

## STUDIES OF COPROPHILOUS ASCOMYCETES

VII. PREUSSIA<sup>1</sup>

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## Abstract

The Plectascales and Perisporiales are both artificial taxa each consisting of a miscellaneous assemblage of unrelated genera. The generic name *Perisporium* is not valid for species of Ascomycota (Ascomycetes). The valid name for those species which produce ascocarps is *Preussia* Fuckel. The ascocarps are non-ostiolate (cleistothecia) and their development is the same as that in the Loculo-ascomycetes (producing a pseudothecium). The ascocarp of *Preussia* is thus a cleistothecial pseudothecium. The genus most closely related to *Preussia* is *Sporormia* and the two may be included in the same family Sporormiaceae. *Preussia* is not included in the Phaeotrichaceae on account of the elongated germinal slit and lack of hairs on the peridium of the ascocarp. Twelve species are included with descriptions and illustrations. The type species of *Preussia* is *P. funiculata* Fuckel. Three species are transferred to this genus from *Perisporium*. These are *P. punctata* (Auersw.) Sacc., *P. typharum* Sacc., and *P. vulgare* Corda. One species is transferred from each of the following genera: *Sporormia* (*Sp. fleischhakkii* Auersw.), *Muellerella* (*M. nigra* Routien), *Pycnidio-phora* (*P. dispersa* Clum), *Anixiopsis* (*A. multispora* Saito and Minoura), and *Thielavia* (*T. indica* Chattop. and Das Gupta). The following three species are described as new: *P. isomera*, *P. terricola*, and *P. purpurea*.

## Introduction

The genus *Preussia* was published by Fuckel, who gave a valid diagnosis on the label of his exsiccatum, Fungi rhenan. Suppl., Fasc. III, No. 1750. issued in 1866. It runs as follows:

"*Preussia* Fckl.

Perithecium hyphopodio delicatulo floccoso spurio suffultum, carbonaceum, astomum, dein irregulariter ruptum secedensque. Asci clavati, longe pedunculati, 8 spori paraphysibus nullis. Sporidia oblongo-cylindracea, demum in articulos quatuor ovatos angulatosque, simplices, atro-fuscos secendentia."

And further:

"1750. *Preussia funiculata* Fckl. Syn. *Perisporium* f. Prss. Linn. 24. no. 145. Ad lignum quercinum putridum, rarissime. Hieme. Ca. Hostrichiam."

It is apparent that the genus *Preussia* is distinct from *Perisporium*, a genus first validly published by Fries (1825). The following is a complete transcript of the discussion there:

"182 *Perisporium*\* (Cb<sup>3</sup>). Peridium innato-superficiale, intus carnosogelatinosum, sporidiiferum. *Punctiforme, nullis fibris impositum, in plantis vivis parasiticum.*

"Frequenter occurrunt hujus formae 1. species, praecipue in supina foliorum pagina, glan- /p. 162/ dulas referentes. Hujus loci *Sclerot. speireum* S. M.,

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*Scl. Caladii* &c. Evidenter prioribus affine; fatendum tamen est me sporangiola nulla vidisse.—Haec tandem est Gasteromycetum forma maxime elementaris."

The "prioribus" in the next to the last sentence appears to refer to the other genera of "Trib. iv. Perisporii", which includes, in order, *Erysiphe*, *Podosphaeria*, *Lasiobotrys*, and *Perisporium*. Since Fries says, in italics, "in plantis vivis parasiticum", the genus *Perisporium* was established for species entirely unrelated to the group here included under *Preussia*. The type species of *Perisporium* appears to be *P. speireum* described by Fries (1815, p. 185; 1822, p. 261) as *Sclerotium speireum*. It was redescribed by Fries (1829, p. 250). The other original species, *Scl. Caladii*, was so published by Schweinitz (1822) and republished by Fries (1822, p. 261), but omitted by Fries (1829) from his later treatment of *Perisporium*.

*P. speireum* was distributed in *Scl. Suec. exs.* 206. I have examined a slide of this made from the material at Uppsala and it consists of pycnidia only. It is an Imperfect fungus as are many of the other species included in *Perisporium*. At least one specimen identified as a *Perisporium* is the spermogonial stage of a rust fungus.

*Sporormia fleischhakii* was described by Auerswald on the label of Rabenhorst, *Fung. eur.* No. 921 issued about 1866. Auerswald (1866 and 1868) republished the description twice. For this species the same author (1869) published the new genus *Fleischhakia* with a new specific epithet *F. laevis* Auersw. I have examined the specimen referred to above (in BPI) and consider that it is not conspecific with the one studied by Fuckel as *Preussia funiculata* but that the two are congeneric. Since *Preussia* was validly published prior to *Fleischhakia* it is the correct generic name to use and the latter genus must be treated as a synonym. However, *Preussia fleischhakii* is regarded as a valid species distinct from *P. funiculata*. In the same publication, Auerswald (1869, p. 2) included a second new species, *Fleischhakia punctata*. This is distinct from the other two species mentioned above.

The generic name *Fleischhakia* was used by Rabenhorst (1878) for an entirely different fungus (Discomycete).

### Relationship

*Preussia* is similar to *Sporormia* as indicated by Munk (1957) and the two have frequently been confused. The former is distinguished by the lack of ostiole, the more superficial position of the ascocarp, and the broader, nondehiscent asci. The early stages in the development of the ascocarps are similar in both genera. Spermogonia are produced by at least one species of *Preussia* as well as some of *Sporormia*.

For the most of the species of *Preussia* no adequate means of delimitation is available. Furthermore they are scattered throughout various genera, some of which have been assigned to the unrelated family Aspergillaceae. The most reliable characteristics appear to be the size and relative shapes of the ascospore segments as well as pigment formation in culture. Within the genus there is a great range of variation with respect to the shape of the asci, the length of the stipe, and the arrangement of the asci within the ascocarp. At the one extreme are species such as *P. funiculata* with elongated

asci arranged in a parallel layer very much as in the genus *Sporormia*. At the other extreme, the asci are small, subglobose, and irregularly disposed in the ascocarp. There are, however, many intergradations in these features such that no generic separations can be made. Indeed, it is very difficult to determine where one species ends and the next begins. Most of the species included here in *Preussia* have been studied in culture but much remains to be done with respect to adequate species descriptions and delimitations. In view of the extensive confusion that exists in the literature concerning this genus, it appears desirable to place on record the information and conclusions so far available.

The order Plectascales is not a natural one. As it is now used it contains a miscellaneous group of entirely unrelated genera. *Preussia* has no close affinity with any of the other genera included in either the Plectascales or Perisporiaceae. In its development and morphological structures it belongs with the Loculoascomycetes in spite of the different ascus structure associated with its nondehiscent nature. This has evolved by reduction. The only family available for cleistothecial, saprophytic species belonging in the Loculoascomycetes is the Phaeotrichaceae. On account of the linear germinal slit and lack of hairs, *Preussia* does not belong in this family. There is considerable doubt as to whether the lack of an ostiole and the shape, arrangement, and nondehiscence of the asci are characters of any value in classification at the family level. It seems preferable, for the present, to include *Preussia* in the family Sporormiaceae.

From the time of Auerswald (1866), most authors have recognized the affinity between *Preussia* and *Sporormia*, but the species delimitation and generic position have been in a continual state of doubt and confusion.

### Descriptions

*Preussia* Fuckel (Sporormiaceae, Loculoascomycetes), Fungi rhenan. Suppl., Fasc. III, No. 1750, issued in 1866

Saprophytic; ascocarps superficial, cleistocarpous, unilocular, stromatic, black, shining, glabrous, globose to subglobose, with thin, carbonaceous-membranaceous peridium, with no definite cleavage areas. Asci 8-spored, broadly clavate and arranged in a parallel fascicle or subglobose and irregularly disposed, short to long stipitate, with crozier at base, without pore or thickening in apex and without special means of dehiscence, rarely exhibiting a bitunicate characteristic type of elongation, fairly thick walled and persistent in a water mount while still immature but becoming very fragile and evanescent at the time of maturity of ascospores. Paraphyses usually present in early stages of development but disappearing at maturity except in abnormal ascocarps containing few asci. Ascospores lying parallel in a fascicle or irregularly disposed in a subglobose mass, with three transverse septa, deeply constricted; segments readily separable at maturity (or in some species, as soon as visible), dark brown and opaque with thick wall and elongated germinal slit extending full length of each cell.

Spermogonia have been found in one species only, *P. dispersa*. Similar spermogonia have been found by the author in a few species of *Sporormia*.

The cultural characteristics and development of the ascocarps in species of *Preussia* and *Sporormia* are very similar.

*Preussia* was republished by Fuckel (1870).

*Type species.*—*Preussia funiculata* Fuckel.

#### KEY TO THE SPECIES

1. Ascospores with obliquely transverse septa and with cells nearly equal in size and shape ..... 1. *P. funiculata*
1. Ascospores with transverse septa not oblique, with cells equal or unequal ..... 2
2. Asci large with more distinctly elongated stipe (except in *P. fleischhakkii*). Ascospores more than 5  $\mu$  broad ..... 3
2. Asci smaller, shorter, with short stipe. Ascospores less than 5  $\mu$  broad ..... 7
3. Ascospores 22–37  $\times$  10–14(17)  $\mu$  ..... 2. *P. punctata*
3. Ascospores less than 9  $\mu$  in width ..... 4
4. Mid-cells broader than long, distinctly shorter than end-cells ..... 3. *P. typharum*
4. Mid-cells and end-cells about equal in width, with end-cells only slightly longer than mid-cells ..... 5
5. Ascospore segments over 6  $\mu$  in width, stipe very short ..... 4. *P. fleischhakkii*
5. Ascospore segments less than 6  $\mu$  in width, stipe longer ..... 6
6. Asci over 75  $\mu$  in length, with spores extended out in several series at different levels ..... 5. *P. terricola*
6. Asci less than 75  $\mu$  in length, with spores in more-compact bundle ..... 6. *P. vulgare*
7. Ascospore segments remaining attached together until near maturity, measuring 7–9  $\times$  4.0–4.5  $\mu$  ..... 7. *P. isomera*
7. Ascospore segments separating at a very early stage, smaller ..... 8
8. Asci clavate, 30–40  $\mu$  long ..... 8. *P. nigra*
8. Asci subglobose, less than 30  $\mu$  long ..... 9
9. Spermogonia present ..... 9. *P. dispersa*
9. Spermogonia absent ..... 10
10. Colony with violet or purple coloration ..... 12. *P. purpurea*
10. Colony without violet or purple coloration ..... 11
11. Ascospores rarely with fewer than 3 septa ..... 10. *P. multisporea*
11. Ascospores frequently with fewer than 3 septa ..... 11. *P. indica*

1. *Preussia funiculata* (Preuss) Fuckel, Fungi rhenan. Suppl., Fasc. III, No. 1750, 1866. (Figs. 1–12)

≡ *Perisporium funiculatum* Preuss, Linnaea, **24**, 143 (1851).

Ascocarps scattered or loosely aggregated, superficial, subglobose, slightly depressed from above, 250–550  $\mu$  in diameter, black, shining, smooth, glabrous, nonostiolate. Peridium of ascocarp thin, carbonaceous-membranaceous to slightly coriaceous when young and fresh, becoming very fragile and brittle when dry, splitting irregularly, without definite cleavage areas, composed of nearly isodiametric cells measuring 5–10  $\mu$  in diameter. Asci eight-spored, broadly clavate, 75–200  $\times$  20–28  $\mu$  (spore-bearing portion 45–80  $\times$  20–28  $\mu$ ), broadest part above middle, narrowed toward apex, no apical structure visible, gradually narrowed below to a long or very long, slender, nearly cylindrical stipe varying in length from 30 to 60  $\mu$  (in culture up to 130  $\mu$ ), lying in a parallel layer attached at base of ascocarp, with crozier at base, with a thick, firm, persistent wall when young but evanescent at maturity. Asci in some collections with irregular number of abortive ascospores fairly frequent and then only three- to seven-spored. Paraphyses mixed with asci in a parallel layer, filiform, septate with cylindrical or swollen cells 3–8  $\mu$  in diameter, sometimes abundant in young ascocarps produced in culture, usually disappearing at maturity. Ascospores crowded in partially overlapping fascicle lying parallel with ascus, nearly cylindrical, 24–38  $\times$  5.0–7.5  $\mu$  (mostly

28–32  $\times$  6.0–7.0  $\mu$ ), four-celled, deeply constricted, very obliquely septate, segments easily separable at maturity, straight or slightly curved, the smooth ascospore wall thick, hyaline at first, then yellow and finally very dark brown and opaque at maturity. Germinal slit longitudinal, extending obliquely entire length of each segment, very distinct. Upper end cell of ascospore 9.0–11  $\mu$  long and 6.0–7.0  $\mu$  wide, conspicuously narrowed toward end, somewhat conical. End-cells 9.0–11  $\times$  6.0–7.0  $\mu$ , only slightly narrowed toward end and broadly rounded. Mid-cells 6.5–7.5  $\mu$  long and 6.5–7.0  $\mu$  wide, equal in size and shape, only slightly broader and slightly shorter than end-cells. Ascospores rarely with one (end), two (end), or all three septa lacking. One-celled ascospores 30–33  $\times$  8–10  $\mu$ , half ascospore (double segment) 16–19  $\times$  6.5–7.5  $\mu$ . No conidia and no spermogonia.

*Collections examined.*—EUROPE: Fuckel, Fungi rhenani 1750, on decaying oak wood, Hostrichiam, Austria (BPI, FH, NY, TRTC). Rabenhorst, Fungi europaei 1433, on damp, decaying fire-hose, coll. Fleischhak (BPI, FH). Krieger, Fungi saxonici 426, on old beehive, Augustusberg, Saxony (BPI, TRTC), 1164, on old bag, Königstein (BPI, NY, TRTC). Petrak, Flora Bohemiae & Moraviae exs. 625, auf Schilfdecke, Mähr-Weisskirchen (BPI, FH). Rehm, Ascomyceten 1044, on dog dung, Gohrau-Worlitz, leg. Staritz, March 1890, as *Perisporium laeve* Auersw. (NY). Thümen, Mycoth. Univ. 161, on straw, Arnstadt, Thüringen, coll. Auerswald, as *Perisporium laeve* Auersw. (in part *Preussia typharum*) (NY, BPI). Zopf, Flora Islebiensis, on rye straw, near Eisleben, April 1873 (in part *Preussia typharum*) (NY). On decayed wood, Smolensk, U.S.S.R., 1895, Jaczewski (BPI). On old sacking, Boolsham Common, Surrey, England, June 22, 1947, (in part *Preussia typharum*) (IMI 16006a) (TRTC 32084, cultured at Toronto, June 1956). On plank lying on ground, Bolton Percy, Yorkshire, England, March 21, 1940, W. G. Bromley (FH, TRTC 32085). On rabbit dung, Brandenburg, Germany, May 10, 1910, O. Jaap (TRTC 34636). QUEBEC: On horse dung, Percé, Gaspé (TRTC). MANITOBA: Culture from tomato seed, April 25, 1940, J. W. Groves, 1-5-1256 B (TRTC 34638). ONTARIO: On dung of rabbit and porcupine. Purbrook, Muskoka, 32428. Lake Timagami, 34635, 34640, 34642, 34643, 34644. Lion's Head, 34641. Burford, Brant, 34637. Singhampton, Grey, 34635. (TRTC.) Gravenhurst, Muskoka, 34639. Penetanguishene, Simcoe, 34634.

In culture the fungus grows fairly rapidly producing white, aerial mycelium with indefinite margin on the colony. Ascocarps are fairly numerous on Leonian's + Y but less abundant on V-8 agar. They are superficial on the agar embedded in the aerial mycelium and normal in appearance except for the size, which is slightly larger than when growing on normal substrata. Ascocarps produced in culture frequently become filled with abundant paraphyses and contain few asci. After a few transfers of the culture there is frequently a progressive decrease in the number of asci with a corresponding increase in the quantity of paraphyses.

In many collections there is a tendency to produce some asci with fewer than eight ascospores. This is due to the disintegration of some of the ascospores while these are still small and hyaline. The remaining normal ascospores

are similar in size and shape to those found in eight-spored asci. These abnormal asci are more abundant in some collections than others.

As with most species of *Preussia*, one, two, or even three of the septa fail to develop in the ascospores. An ascus usually contains some normally septate ascospores along with others with a variable number of missing septa. For example, an ascus may contain seven normal spores and one with only a single septum. If one septum remains, it is the one at the middle, thus producing a spore with two double segments. In the other type of abnormal spore, there is one double segment at one end and two ordinary cells at the other.

Asci have a rather thick, firm wall which in young asci (up to the time of maturity of the ascospores) remains intact when crushed out of the ascocarps in a water mount.

This species can be recognized by means of the obliquely septate ascospores which have four cells nearly equal in size and shape.

2. *Preussia punctata* (Auersw.) Cain comb. nov. (Fig. 31)

≡ *Fleischhakea punctata* Auersw., Hedwigia, **8**, 2 (1869).

≡ *Perisporium punctatum* (Auersw.) Sacc., Syll. Fung. **1**, 56 (1882).

Ascocarps superficial, scattered, 500–1500  $\mu$  in diameter, black, punctate, nonostiolate. Peridium membranous, becoming brittle and fragile on drying with upper part readily breaking off. Cells of peridium dark brown, opaque, and indistinct with wall minutely punctate. Asci four- to six-spored, clavate-ovoid, 200–300  $\times$  25–35  $\mu$ , with a very long stipe, evanescent at maturity. Paraphyses numerous, filiform. Ascospores obliquely in several series, four-celled, cylindrical-oval, dark brownish-black, 22–37  $\times$  10–14  $\mu$ , partially constricted at the septa and readily separating at maturity. Mid-cells 7–10  $\times$  10–14 (rarely 17)  $\mu$ , short barrel-shaped, unequal. End-cells subspherical with a flattened end (next to mid-cell), 7–9  $\times$  7.5–10  $\mu$ , slightly narrower than mid-cells. Germinal slit extending entire length of each cell, very distinct, extending lengthwise, nearly parallel with ascospore or oblique.

*Collections examined.*—EUROPE: On decaying wood of *Quercus*, Arnstadt, Thuringia, Dr. Fleischhak, **type** (FH). UNITED STATES: on wood in old disused greenhouse, West Roxbury, Mass., Dec. 1900, Piquet (FH).

Easily recognized by means of the large size of the asci and ascospores. The ascospores are broader in proportion to the length than in any of the other species of *Preussia* and furthermore the ascospores are not as deeply constricted at the septa.

3. *Preussia typharum* (Sacc.) Cain comb. nov. (Figs. 25–30)

≡ *Perisporium typharum* Sacc., Atti soc. venet. trent. sci. nat. **2**, 92 (1873).

Culture on Leonian's + yeast extract agar; hyphae forming a moderately thick, dense, cottony layer, white at first, soon changing to gray and then darker, with production of black layer on surface of agar, hyphae turning brown with production of ascocarps, agar turning dark reddish-brown to nearly black, subcultures soon becoming nonfruiting and remaining white; on V-8 vegetable juice agar, less growth with fewer ascocarps, distinct red coloration in agar, with less tendency to go sterile. Ascocarps scattered

or loosely aggregated on natural substrata, often densely clustered on agar in culture, superficial, subglobose, slightly depressed from above, 250–530  $\mu$  in diameter, black, shining, smooth, glabrous, in culture covered with a dense layer of light brown hyphae forming a continuous and uniform mat, non-ostiolate. Asci eight-spored (sometimes with fewer than eight, and rarely some of ascospores remaining hyaline), broadly clavate, 80–130  $\times$  18–24  $\mu$  (spore-bearing portion 50–80  $\times$  18–28  $\mu$ ), broadest part near apex, slightly narrowed toward apex, no apical structure visible, gradually narrowed below into a long or very long, slender stipe varying in length from 30 to 100  $\mu$ , and about 3–4  $\mu$  in width, lying in a parallel layer attached at base of ascocarp, with crozier at base, with thick, firm, persistent wall when young, not elongating in water at maturity, evanescent after drying when mature. Asci in young ascocarps mixed with few, swollen, hyaline cells which disappear at maturity. Sterile ascocarps (in culture) become filled with large, swollen, hyaline cells but no asci. Ascospores crowded in a partially overlapping fascicle lying parallel with ascus, fusiform-cylindrical, (22)26–35(40)  $\times$  7.0–8.0(10)  $\mu$ , four-celled, deeply constricted, septa transverse, or rarely slightly oblique, segments easily separable at maturity, straight or rarely slightly curved, the smooth ascospore wall thick, hyaline at first, then yellow and finally very dark brown and opaque at maturity. Germinal slit longitudinal, extending obliquely entire length of each segment, very distinct. Mid-cells (5)6–7(9)  $\mu$  long and 8–10  $\mu$  wide, width distinctly greater than length, short barrel-shaped. End-cells (8)10–13(16)  $\mu$  long and 6–8  $\mu$  wide, subconical, distinctly longer and narrower than mid-cells. Ascospores rarely with one (end), two (end), or all three septa lacking. One-celled ascospores about 28  $\times$  8  $\mu$ , fusiform-cylindrical, half ascospores about 13–18  $\times$  8.5  $\mu$ , subconical. No conidia and no spermogonia.

*Collections examined.*—EUROPE: Petrak, Flora Bohemiae et Moraviae exs. 963, auf einer Bastdecke, Mähr-Weisskirchen; Schuttplatz, Oct. 1913, F. Petrak (PR 166306). Thümen, Mycoth. Univ. 161 (in part *P. funiculata*) (NY, BPI). Sydow, Mycotheca Marchica 2830, on old basket, Schoeneberg bei Berlin (NY). Zopf, Flora Islebiensis bei Eisleben, on rye straw, April 1873 (with *P. funiculata*) (NY). Rabenhorst, Fungi eur. 1338, on decaying straw, Arnstadia, 1868, leg. Fleischhak, as *Perisporium Fleischhakii* (BPI, FH), on old sacking, Boolsham Common, Surrey, England, June 22, 1947, S. J. Hughes (IMI 16006a, TRTC 32086) (in part *P. funiculata*). On old sacking, Forge Valley, Yorkshire, England, S. J. Hughes (IMI 13767a, TRTC 32085) cultured, Toronto, 1956. On cow dung, Tamsel, Germany, P. Vogel (TRTC 34630). U.S.A.: Griffiths, West American Fungi 178 as *Perisporium vulgare*, Aberdeen, South Dakota (BPI). On rabbit dung, April 1893, R. Thaxter 1286 B (FH). ONTARIO: On rabbit dung, New Durham, Brant, developed in moist chamber (TRTC 34633). On bird pellets, New Durham, Brant, developed in moist chamber (TRTC 34632). SASKATCHEWAN: On rabbit dung, Beaver Creek, developed in moist chamber (TRTC 34629). On rabbit dung, Saskatoon, developed in moist chamber (TRTC 34631).

One ascus in IMI 13767a had six ascospores one of which was three-septate and the remaining five one-septate with one cell slightly longer than the

other in each case. One ascospore in TRTC 32085 had two cells, one of which measured  $18.5 \times 8.5 \mu$  and the other  $16.5 \times 8.5 \mu$ .

*Preussia typharum* can be separated from *P. fleischhakkii* by the shape and size of the cells in the ascospores. In the former species there is a greater difference between the size and shape of the end- and mid-cells, the end-cells being slightly longer and the mid-cells distinctly broader and shorter.

4. *Preussia fleischhakkii* (Auersw.) Cain comb. nov. (Figs. 13–24)

*Sporormia fleischhakkii* Auersw., in Rabenh. Fung. eur. 921 (1866) and Hedwigia, 7, 66 (1868).

*Fleischhakkia laevis* Auersw., Hedwigia, 8, 2 (1869).

Ascocarps scattered or loosely aggregated, superficial, subglobose, slightly depressed from above, 300–450  $\mu$  in diameter, black, shining, smooth, glabrous, nonostiolate. Peridium of ascocarp thin, carbonaceous-membranaceous to slightly coriaceous when young and fresh, becoming very fragile and brittle when dry, splitting irregularly, without definite cleavage areas, composed of nearly isodiametric, angular, four to six straight-sided cells measuring 5–8  $\mu$  in diameter. Asci eight-spored, subglobose to very broadly clavate,  $43\text{--}60 \times 20\text{--}28 \mu$  including the very short stipe measuring 10–14  $\mu$  in length, broadest near middle, narrowed above and below, broadly rounded at apex, no apical structure visible, lying in a parallel layer attached at base of ascocarp, with crozier at base, with a thick, firm, persistent wall when young but evanescent at maturity. Paraphyses mixed with asci in parallel layer, septate with cylindrical to subglobose cells 3–9  $\mu$  in diameter, sometimes abundant in young ascocarps produced in culture, usually disappearing at maturity. Ascospores crowded in fascicle lying parallel with ascus and overlapping most of their length, nearly cylindrical,  $26\text{--}35 \times 6.0\text{--}7.5 \mu$ , four-celled, deeply constricted, transversely septate, segments easily separable at maturity, straight or slightly curved, the smooth ascospore wall thick, hyaline at first, then yellow and finally very dark brown and opaque at maturity. Germinal slit longitudinal, slightly oblique, extending entire length of each segment. End-cells of ascospore  $8\text{--}10 \times 6.0\text{--}7.0 \mu$ , nearly equal in size and shape. Mid-cells  $5.5\text{--}7.5 \times 6.0\text{--}7.5 \mu$ , longitudinal measurement about equal to width, slightly shorter than end-cells but otherwise similar, ascospores rarely with one septum lacking. No conidia.

*Collections examined.*—EUROPE: Rabenhorst Fungi europaei 921, on partially decayed wood, Wallendorf, Hungary, coll. Kalchbrenner. ONTARIO: On sheep dung, New Durham, Brant, developed in moist chamber (TRTC 34627). On dung, Nashville, York, developed in moist chamber (TRTC 31723). QUEBEC: On partridge dung, Duchesnay (TRTC 34626).

In culture (TRTC 31723) the fungus grows fairly rapidly producing woolly aerial mycelium with an indefinite margin; white at first but becoming pinkish. Color diffuses into the agar so that Leonian's + yeast extract becomes slightly reddish and V-8 becomes a much darker red. Ascocarps with mature ascospores are produced on both media.

This species can be distinguished from *P. funiculata*, with which it has usually been confused, by means of the ascospore septa which are transverse and not oblique, or rarely only slightly so, and by the broader asci which have a much shorter stipe. In *P. fleischhakkii* the four cells of the ascospore are



nearly alike in size and shape. The mid-cells have the length about equal to the width and the germ slit only slightly oblique. The end-cells have a width about equal to that of the median cells but a longitudinal measurement about two microns greater and a germinal slit which is more strongly oblique.

***Preussia terricola*** Cain sp. nov. (Figs. 72-83)

Coloniis in agaro Leonian et yeast extract post quindecim dies circiter 2 cm diam., atro-canis et margine pallido praeditis, strato aliquantulum crasso et denso hypharum aeriaram ornatis. Colonia conversa valde rubido-atra. Ascocarpis crescere incipientibus. Coloniis in agaro YpSs post quindecim dies circiter 2 cm diam., aeriis hyphis rarioribus praeditis, quam ob rem coloniis rubidis, conversis atro-rubidis. Coloniis in agaro V-8 vegetable juice intermediis visu et ascocarpis plus auctis ornatis. Ascocarpis post quindecim dies in cultura maturescentibus. Hyphis in agaro qualicumque submersis rubido-brunneis.

Ascocarpis globosis vel subglobosis, 150-350  $\mu$  diam., minoribus et numerosis, in agaro superficialibus, in strato hypharum canarum et aeriaram omnino immersis. Hyphis circum ascocarpos situs pallido-brunneis. Peridio ascocarpi tenui, membranaceo, structura valde obscura praedito, ex duobus stratis composito. Cellulis strati exterioris ascocarpi brunneis, 3-6  $\mu$  diam., multis lateribus ornatis, haud translucidis, valde indistinctis, maculis irregularibus, haud translucidis, incrassatis ornatis et fibris hypharum stratum crassum 10-15  $\mu$  formantium tectis. Cellulis peridii interioris hyalinis, multis lateribus ornatis, leviter complanatis, 4-10  $\mu$  diam., stratum crassum circiter 12-20  $\mu$  formantibus. Ascis plerumque octosporis (raro minoribus sporis quam octo ornatis), prolatis et clavatis, in parallelo fasciculo ad basem ascocarpi alligato dispositis, 75-120  $\times$  12-22  $\mu$  (parte sporas ferente longa 55-90  $\mu$ ), latissimis prope apicem, superne late rotundatis, sine structura incrassata in parte apicali parietis, in stipitem parem longitudine parti sporas ferenti inferne paulatim attenuatis, basi croca praeditis. Paraphysibus numerosis in ascocarpis novellis, filiformibus, septatis, ramosis, 2-3  $\mu$  diam., cum ascis novellis mixtis. Ascosporis in ascis circiter 20  $\times$  3  $\mu$  primum spectabilibus, tribus septis ornatis, ad septa non constrictis, cylindraceutis, hyalinis et globulis paucis et minimis ornatis. Ascosporis ad septa postea alte constrictis, globulis numerosis, minimis, hyalinis ornatis, deinde olivaceo-brunneis et postremo atro-brunneis. Segmentis ascosporarum novellarum ad septa omnino separatis. Tota ascospora 26-32  $\times$  5.0-5.5  $\mu$ , multiseriata et asco parallela, sine vagina gelatinosa, septis transversis non obliquis praedita. Hilo germinali in longitududinem prolato, ascosporae parallelo vel leviter obliquo, indistincto in segmentis pallido-brunneis. Omnibus segmentis ascosporae plerumque paribus amplitudine et forma, 6.5-8.0  $\times$  5.0-5.5  $\mu$ , vel cellulis terminalibus leviter longioribus quam cellulis medianis et leviter attenuatis praeditis. Ascosporis plerumque sic dispositis: quinque in superiore asci, duabus in fasciculo in parte inferne, singula ascospora in parte inferiore. Ascosporis minoribus segmentis quam quattuor raro praeditis.

Colonies on Leonian + yeast extract agar, at age of 2 weeks, extending to about 2 cm in diameter, dark gray with light margin, with fairly thick compact layer of aerial hyphae. Reverse of colony dark reddish-black. Ascocarps just beginning to develop. On YpSs agar colonies at 2 weeks extending

to about 2 cm in diameter, with less-extensive growth of aerial hyphae so that colonies appear reddish, dark red in reverse. On V-8 vegetable juice agar, appearance of colonies is intermediate between that on other two media and the ascocarps are more advanced. In culture at 2 weeks, ascocarps are just reaching maturity. Hyphae submerged in agar in all media are reddish-brown in color.

Ascocarps globose to subglobose, 150–350  $\mu$  in diameter, rather small and numerous, superficial on agar, completely embedded in layer of gray aerial hyphae. Hyphae surrounding ascocarps appear light brown in microscope. Peridium of ascocarp thin, membranaceous with very obscure structure, consisting of two layers. Cells of outer layer of ascocarp brown, 3–6  $\mu$  in diameter, polyhedral, opaque, very obscure, with irregular, opaque thickened spots and covered with hyphal filaments, forming a layer 10–15  $\mu$  in thickness. Cells of inner peridium hyaline, polyhedral, somewhat flattened, 4–10  $\mu$  in diameter, forming a layer about 12–20  $\mu$  in thickness. Asci usually eight-spored (rarely fewer than eight), elongate-clavate, arranged in parallel fascicle attached at base of ascocarp, 75–120  $\times$  12–22  $\mu$  (spore-bearing part 55–90  $\mu$  in length), broadest near apex, broadly rounded above, without thickened structure in apical portion of wall, gradually tapering below into stipe equal to spore-bearing part in length, with crozier at base. Paraphyses abundant in young ascocarps, filiform, septate, branching, 2–3  $\mu$  in diameter, mixed with young asci. Ascospores when first visible in asci measuring about 20  $\times$  3  $\mu$ , three-septate, not constricted at septa, cylindrical, hyaline with few minute globules. Ascospores later becoming deeply constricted at septa, with numerous, minute, hyaline globules, changing to olivaceous brown and finally dark brown. Segments of ascospores separating completely at septa at an early stage of development. Complete ascospore measuring 26–32  $\times$  5.0–5.5  $\mu$ , lying in several series parallel to ascus, with no gelatinous sheath, with transverse septa not oblique. Germinal slit longitudinal, parallel to ascospore or slightly oblique, faint in light-brown segments. Segments of ascospore all about equal in size and shape, 6.5–8.0  $\times$  5.0–5.5  $\mu$ , or with end-cells slightly longer than median and slightly pointed. Ascospores usually arranged with five overlapping at slightly different levels in upper part of ascus, with two below and a separate one in lower part. Ascospores rarely with fewer than four segments.

In culture from banana rhizosphere soil, Omonita Farm, Honduras, July 1958, R. D. Goos 217. (TRTC 36955, **type**.)

One ascus was observed in which four of the ascospores had one septum each and four had three septa each so that there were 8 double segments and 16 single ones. Another ascus contained only four ascospores. These had three septa each but were about double the normal size.

This species differs from *P. funiculata* in having smaller ascospores and transverse instead of oblique septa. It differs from *P. fleischhakkii* and *P. isomera* in having a longer stipe on the ascus.

6. *Preussia vulgare* (Corda) Cain comb. nov.

$\equiv$  *Perisporium vulgare* Corda, Icon. Fung. 2, 27 (1838).

Perithecia globose superficial. Asci broadly clavate, about 40–70  $\times$  20  $\mu$ ,

lying parallel, with a short stipe measuring about  $20\ \mu$  in length. Ascospores cylindrical,  $26\text{--}31 \times 5\ \mu$ , lying longitudinally parallel with ascus. Cells all equal or end-cell rarely slightly longer. Germinal slit parallel to long axis of spore.

This species is intermediate between *P. fleischhakkii* and *P. terricola*. It is well illustrated by Corda in *Icones Fungorum*, Plate 13. I have examined the specimens of *Perisporium* on loan from the National Museum, Prague, but have been unable to find the collection from which the illustration was made. A slide of a collection made by N. Lundqvist, Uppsala, was sent on loan. This agrees fairly closely with the illustration by Corda. This is the only collection of this species that has been seen.

7. *Preussia isomera* Cain sp. nov. (Figs. 32–38)

Ascocarpis dense congregatis, saepe constipatis et in stratis compluribus coacervatis, plerumque superficialibus sed nonnullis in agar omnino immersis, vel globosis vel aligantulum prolatis vel leviter depressis,  $100\text{--}350\ \mu$  diam., nigris, nitentibus, levibus, glabris non ostiolatis. Peridio ascocarpi tenui, membranaceo. Cellulis peridii in stratis externis brunneis, angulatis, constantibus, in strato uno,  $5\text{--}9\ \mu$  diam.; cellulis peridii in stratis interioribus hyalinis, turgidis. Ascis octosporis, late clavatis vel subellipsoideis,  $43\text{--}55 \times 15\text{--}18\ \mu$ , plerumque latissimis prope medium, superne subtruncatis, ad apicem neque perforatis, neque incrassatis, basin versus in stipitem  $5\text{--}10\ \mu$  longum abrupte attenuatis, in fasciculis irregulariter dispositis, novellis pariete crasso, firmo pertinaci, maturis evanescentibus. Sine paraphysibus. Ascosporis primum hyalinis, tribus septis celeriter praeditis, et profunde constrictis, postremo pallido-brunneis,  $30\text{--}33 \times 4.0\text{--}4.5\ \mu$  diam., in fasciculis parallelis cum asco dispositis. Segementis ascosporarum maturis facile sejunctis, raro extra ascos in perpetuum alligatis, cylindraco-ovalibus, a utroque termino late rotundatis,  $7.0\text{--}9.0 \times 4.0\text{--}4.5\ \mu$ , pari amplitudine et forma ferme praeditis, vel aliquando cellulis terminalibus et mediis paulo longioribus, cellulis terminalibus aliquando paulo angustioribus. Hilo germinali pari longitudine cellulis ascosporum, in longitudinem disposito, leviter curvato, vix spectabili.

Ascocarps densely aggregated, often crowded and several layers in depth, mostly superficial but some completely immersed in agar, globose or somewhat elongated or slightly depressed from above,  $100\text{--}350\ \mu$  in diameter, black, shining, smooth, glabrous, nonostiolate, abundantly produced (but in part without ascospores) on Leonian's + yeast extract agar, less abundant but normal on V-8 vegetable juice agar, maturing in 2-week-old culture. Peridium of ascocarp thin, membranous, consisting of an outer single layer of distinct, rather uniform cells and an inner layer of hyaline, swollen cells. Cells of outer peridium brown, angular, with slightly thickened walls and measuring  $5\text{--}9\ \mu$  in diameter. Asci eight-spored, broadly clavate to subelliptical,  $43\text{--}55 \times 15\text{--}18\ \mu$ , usually broadest near middle, broadly rounded with no apical structure visible, rather abruptly narrowed to a very short stipe, measuring  $5\text{--}10\ \mu$  in length, with crozier at base, irregularly disposed in branching fascicles from short ascogenous cells, with a thick, firm, persistent wall, especially when young but evanescent at maturity, rarely outer wall ruptures below an

apical thimble-shaped portion and inner membrane elongates and then disintegrates. No paraphyses observed. Ascospores at first hyaline, rapidly becoming three-septate and deeply constricted and finally light brown,  $30-33 \times 4.0-4.5 \mu$ , forming a fascicle parallel with ascus. Ascospore segments readily separating at maturity, rarely remaining attached outside asci, cylindrical-oval, with broadly rounded ends  $7.0-9.0 \times 4.0-4.5 \mu$ , about equal in size and shape, or sometimes end-cells and sometimes mid-cells slightly longer, end-cells sometimes slightly more narrowed. Germinal slit extending entire length of ascospore cells, longitudinal, slightly curved, not very distinct.

Culture from dung, collected near Tallahassee, Florida, U.S.A., S. L. Meyer, March 1952, developed in moist chamber, Toronto. (**type**, TRTC 32089.) On rabbit dung from Chapel Hill, North Carolina, W. C. Coker, developed in moist chamber, Toronto (TRTC 34628).

The ascocarp develops from a short, swollen cell in a hypha. Septa form in different planes resulting in a subglobose mass of pseudoparenchymatous cells.

This species occupies a somewhat intermediate position in the genus in respect to the size and shape of the asci as well as their arrangement, the size and shape of the ascospores, the ease with which the ascospore segments separate, and the appearance of the germinal slit.

*P. isomera* can be separated from *P. nigra* by means of the larger size of the asci and ascospores as well as the tendency for the ascospore cells to remain attached together for a longer period of development.

8. *Preussia nigra* (Routien) Cain comb. nov. (Figs. 84-96)

*Muellerella nigra* Routien, Bull. Torrey Botan. Club, **83**, 403 (1956).

Aerial hyphae flesh-gray, sparse, occasionally agglutinated to form a few scattered ropes, finally forming a black layer on surface of agar. Ascocarps scattered or densely aggregated, superficial to partially embedded in substratum or in aerial mycelium, subglobose, slightly depressed from above,  $250-500 \mu$  in diameter, black, shining, smooth, glabrous, nonostiolate. Peridium of ascocarp thin, membranaceous, consisting of an outer layer of brown cells and an inner layer of hyaline flattened cells. Asci eight-spored, clavate,  $30-41 \times 10-11 \mu$ , broadest part near apex, broadly rounded with no apical structure visible, rather abruptly narrowed below into a stipe up to  $10 \mu$  in length and constricted to  $2 \mu$  in middle portion, lying in a somewhat irregular layer extending inward from the base and sides of ascocarp, with crozier at base, with a thick, firm, persistent wall, especially when young, at maturity outer wall ruptures below an apical thimble-shaped portion and inner membrane elongates and then disintegrates. Paraphyses fairly abundant when young, extending inward from upper part of ascocarp, filiform, branching, septate, with elongated cells,  $2-3 \mu$  in diameter with a few cells swollen to  $6 \mu$ ; usually disappearing at maturity. Ascospores at first hyaline, one-celled, linear, forming a bundle parallel with ascus, indistinct, rapidly becoming one- and then three-septate, constricted at the septa and immediately separating and becoming irregularly disposed in the ascus and turning brown. Ascospore segments brown, ellipsoid,  $4.0-5.2 \times 2.4-3.0 \mu$ , germ slit or pore not visible.

Mature ascospores rarely with only one (mid) septum developed and very rarely with no septa. No conidia.

One ascus observed with a single mature ascospore (the other seven having nearly disintegrated) with the four brown segments still attached together.

*Collection examined.*—Type culture isolated from soil from Bondville, Kentucky, J. B. Routien 17M48 (TRTC).

The development of the ascocarp is typical of the Loculoascomycetes such as *Sporormia*. A short cell in a hypha becomes swollen and, as it enlarges, septa are formed in various directions to produce a mass of brown pseudo-parenchymatic cells.

*P. nigra* differs from *P. multispora* in having more-elongated asci and slightly broader ascospore segments. *P. isomera* can be separated by means of the larger asci and ascospore segments.

9. *Preussia dispersa* (Clum) Cain comb. nov. (Figs. 39–49, 62–71)

≡ *Pycnidophora dispersa* Clum, *Mycologia*, **47**, 900 (1955).

Colony white to gray, thin, appressed, with sparse aerial hyphae, developing a slimy appearance due to conidia and turning dark with ascocarp production. Hyphae hyaline, branching, up to 6  $\mu$  in diameter, anastomosing frequently in region of spermogonia and ascocarps. Ascocarps scattered or densely aggregated, globose or slightly depressed from above, 100–700  $\mu$  (mostly 200–250  $\mu$ ) in diameter, black, shining, smooth, glabrous, nonostiolate. Peridium of ascocarp with outer single layer of dark-brown, thick-walled, angular cells measuring 4–7  $\mu$  in diameter, and inner thicker layer of hyaline, swollen cells. Asci eight-spored, globose or subglobose, 15–18  $\times$  12–15  $\mu$ , no apical structure visible, abruptly narrowed below into a very short, broad stipe with crozier at base, irregularly disposed in branching clusters, with a thick, firm, persistent wall, especially when young but evanescent at maturity. Paraphyses a few swollen, hyaline cells, disappearing at maturity. Ascospores at first hyaline, septate when first visible with three transverse septa, deeply constricted, irregularly disposed around a large central vacuole, rapidly enlarging and separating at the septa. Ascospore segments 32, ellipsoid, light brown, 3.0–5.0  $\times$  2.0–2.6  $\mu$ , with two oil globules, irregularly crowded in ascus. Rarely with end septa lacking and then double ascospore segment measuring about 6–10  $\times$  2.0–2.5  $\mu$ ; very rarely with no septa developing and then ascospore measuring about 16  $\times$  2.5  $\mu$ . Spermogonia globose or somewhat irregular in shape, up to 160  $\mu$  in diameter (mostly about 80  $\mu$ ), on surface of agar or on aerial hyphae, smooth, glabrous, with circular ostiole measuring about 18–20  $\mu$  in diameter. Peridial cells of spermogonium very light brown and thin-walled except around slightly papillate ostiole where they are darker and thicker-walled. Spermata (phialospores) ellipsoid, hyaline, 3.0–4.5  $\times$  2.4–2.6  $\mu$ , with a single refractive oil globule, produced on short phialides which line the inner peridium and exude in large numbers through the ostiole.

*Collections examined.*—Type culture isolated from a seedling of *Phlox drummondii* Hook., grown at East Lansing, Mich., from a packet of seed supplied by Northrup King and Company, F. M. Clum 27 (TRTC). Culture isolated from soil sample taken from garden, Westport, Pretoria, South

Africa, and sent by Dr. B. J. Sloan. Cultures isolated by Wm. Bridge Cooke from Lytle Creek, Ohio, water and sediment from pool at station 4.2 (No. 1168), bank soil at station 2.8 (No. 1444), and water sample at station 7.6 (No. 1486). Culture isolated from seed by C. T. Rogerson (No. SD 53-54-7). Culture from soil, Dacca, Pakistan, 1956, Q. A. Ahmed (NB. 15), received from IMI (62762) Feb. 1960.

This species is very similar to *P. multispora* except for the production of spermogonia.

10. *Preussia multispora* (Saito and Minoura) Cain comb. nov. (Figs. 50-61)  
 = *Anixiopsis multispora* Saito and Minoura, J. Fermentation Technol. **26**, 3 (1948).

= *Pseudeurotium multisporum* (Saito and Minoura) Stolk, Antonie van Leeuwenhoek, **21**, 71-73 (1955).

Colony gray, thin, appressed, with sparse aerial hyphae, spreading rapidly; submerged layer ochraceous-salmon; becoming dark with ascocarp production. Ascocarps scattered or densely aggregated and abundant, globose or slightly depressed from above, 100-400  $\mu$  in diameter, black, shining, smooth, glabrous, nonostiolate. Peridium of ascocarp with outer single layer of dark-brown, angular cells with outer and side walls thickened, measuring 4-7  $\mu$  in diameter, and inner thicker layer of hyaline, swollen cells. Asci eight-spored, globose or subglobose, rarely more elongated and somewhat clavate, 18-30  $\times$  9-16  $\mu$ , no apical structure visible, abruptly narrowed below into a short, broad stipe with crozier at base, irregularly disposed in branching clusters, with a thick, firm, persistent wall, especially when young but evanescent at maturity. Paraphyses a few swollen, hyaline cells, disappearing at maturity. Ascospores at first hyaline, septate when first visible with three transverse septa, deeply constricted, irregularly disposed around a large central vacuole, rapidly enlarging and separating at the septa. Ascospore segments 32, ellipsoid or somewhat flattened on one side, light brown, 4.0-5.5  $\times$  2.5-3.5  $\mu$ , with two oil globules, irregularly crowded in ascus. Rarely with end septa lacking and then double ascospore segment measuring about 8-10  $\times$  3.0-4.0  $\mu$ , slightly curved to allantoid, very rarely with no septa developing and then ascospore measuring about 13-16  $\times$  3.0-4.0  $\mu$ , allantoid, broadly rounded at ends. No spermogonia or conidia observed.

Culture (Nagao Institute, Japan, 2003) received from Centraalbureau voor Schimmelcultures, Baarn, Netherlands.

*Validating Latin description.*—Ascocarpis dispersis vel dense aggregatis, globosis vel leviter depressis, 100-400  $\mu$  diam., nigris, nitentibus, levibus, glabris, non ostiolatis. Cellulis peridii in stratis externis brunneis, angulatis, in strato uno, 4-7  $\mu$  diam.; cellulis peridii in stratis interioribus hyalinis, turgidis. Ascis octospori, globosis vel subglobosis, 18-30  $\times$  9-16  $\mu$ , ad apicem neque perforatis, neque incrassatis, basin versus in stipitem brevitem abrupte attenuatis, in fasciculis irregulariter dispositis, novellis pariete crasso, firmo pertinaci, maturis evanescentibus. Paraphysibus in ascocarpis novellis, hyalinis, ventricosis, paucis, evanescentibus. Ascosporis primum hyalinis, tribus septis celeriter praeditis, et profunde constrictis, postremo pallido-brunneis. Segmentis ascospororum facile sejunctis, ellipsoideis, pallido-

brunneis,  $4.0-5.5 \times 2.5-3.5 \mu$ , biguttulatis.

The ascocarp develops from a short, enlarged intercalary cell in a hypha. This cell enlarges and becomes divided by septa which form in various planes so that a brown, pseudoparenchymatous mass is developed. This is subglobose or somewhat elongated. The development of the ascocarp is similar to that found in other species of *Preussia* and various species of *Sporormia*.

The ascospore segments do not become very dark in color and hence an elongated germ slit or germ pore has not been observed. When the segments germinate, however, a single germ tube originates from the side. This type of germination is typical of different species of *Sporormia*.

The failure in the development of one, two, or three of the septa in the ascospores is also typical of many species of *Sporormia*.

The original diagnosis by Saito and Minoura (1948) is in Japanese and without a Latin description.

11. *Preussia indica* (Chattop. & Das Gupta) Cain comb. nov.

≡ *Thielavia indica* Chattop. and Das Gupta, Trans. Brit. Mycol. Soc. **40**, 277 (1957).

≡ *Pseudoeurotium indicum* (Chattop. & Das Gupta) Chattopadhyay, Trans. Brit. Mycol. Soc. **40**, 460 (1957).

Ascocarps subglobose, up to  $650 \times 400 \mu$ , black, smooth, superficial on agar, immersed in dense layer of aerial mycelium. Peridium membranaceous, with one to three layers of cells. Cells of peridium distinct, irregular in shape,  $5-8 \mu$  in diameter, with wall variably thickened. Asci oval to pyriform,  $15-20 \times 11-18 \mu$  nonstipitate, evanescent, deliquescing at maturity, with 16 ascospore segments (according to original description). Ascospore segments irregularly arranged, ellipsoid, oval to irregularly oblong, smooth, dark brown, without visible germinal slit,  $5.0-7.0 \times 3.6-4.2 \mu$ . Double segments (due to failure in formation of one septum) fairly numerous,  $9-12 \times 3.8-4.0 \mu$ , slightly curved. A few larger, more-curved compound segments measuring  $14-17 \times 3.8-4.0 \mu$ .

Culture from soil of paddy fields in State Agricultural Farm, Chinsurah, West Bengal, India, dried culture received from IMI 57849.

*P. indica* is very close to *P. multispora* but has larger ascospore segments. There is also a greater tendency for the ascospores to develop one septum only instead of the normal three septa. This accounts for the 16 segments in the ascus referred to in the original description as ascospores.

A dried culture of *P. indica* was kindly loaned by the Commonwealth Mycological Institute. Unfortunately, the material is overmature and asci could not be found. Attempts were made to revive the culture but there was no growth.

12. *Preussia purpurea* Cain sp. nov.

Coloniis in agaro YpSs et Leonian + yeast extract strato aliquantum violaceo, crasso et denso hypharum aeriaram ornatis. Colonia conversa valde brunneo-atra. Hyphis in agaro qualicumque submersis rubido-brunneis.

Ascocarpis globosis,  $150-600 \mu$  diam., nigris, nitentibus in agaro superficialibus, in strato hypharum violaceo-canarum et aeriaram omnino immersis,

non ostiolatis. Peridio ascocarpi tenui, membranaceo, ex duobus stratis composito. Cellulis strati exterioris ascocarpi brunneis, angulatis. Cellulis peridii interioris hyalinis, turgidis. Asci octosporis, globosis vel subglobosis,  $15-22 \times 12-16 \mu$ , sine structura incrassata in parte apicali parietis, basin versus in stipitem brevitem abrupte attenuatis, irregulariter dispositis, novellis pariete crasso, firmo, maturis evanescentibus. Paraphysibus hyalinis, turgidis, evanescentibus. Ascosporis primum hyalinis, tribus septis celeriter praeditis, profunde constrictis, postremo pallido-brunneis. Segmentis ascosporarum novellarum ad septa omnino separatis, 32, ellipsoideis, pallide olivaceo-brunneis,  $4.0-5.5 \times 2.8-3.4 \mu$ , biguttulatis, irregulariter dispositis. Ascosporis raro uniseptatis, segmentis  $7.0-8.0 \times 2.8-3.0 \mu$  praeditis.

Colonies on YpSs agar and Leonian + yeast extract agar fairly slow-growing with fairly dense, cottony, aerial layer, lilac colored at first, becoming violet to purplish, margin indefinite, somewhat radiately wrinkled. Reverse rapidly becoming brownish and then black. Brownish pigment diffusing slowly into agar. Colonies on V-8 vegetable juice agar similar but deeper violet in color. On malt agar more brownish and radiately wrinkled. Submerged mycelium dark reddish-brown on all media.

Ascocarps globose,  $150-600 \mu$  in diameter, black, shining, smooth, superficial on agar, completely embedded in layer of light violaceous aerial mycelium, without ostiole. Peridium of ascocarp thin, membranaceous, semitransparent, with outer single layer of light olivaceous-brown, thin-walled, very distinct, angular cells measuring  $4-6 \mu$  in diameter and inner thicker layer of hyaline, swollen cells. Asci eight-spored, globose or subglobose, rarely more elongated and oval,  $15-22 \times 12-16 \mu$ , no apical structure visible, abruptly narrowed below into a very short, broad stipe with crozier at base, irregularly disposed in branching clusters, with a thick, firm, persistent wall when young, but very evanescent at maturity. Paraphyses a few hyaline, swollen cells, disappearing at maturity. Ascospores at first hyaline, septate when first visible, with three transverse septa, deeply constricted, irregularly disposed around a large central vacuole, rapidly enlarging and separating at septa. Ascospore segments 32, ellipsoid, light olivaceous-brown,  $4.0-5.5 \times 2.8-3.4 \mu$ , with two prominent oil globules, irregularly crowded in ascus. Rarely with end septa lacking and then double ascospore segments measuring about  $7.0-8.0 \times 2.8-3.0 \mu$ , slightly curved, with four oil globules. No spermogonia or conidia observed.

Culture isolated from soil, Iowa City, Iowa, 1956, R. D. Goos, No. 202. (TRTC 36956, **type**.)

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## EXPLANATION OF FIGURES

FIGS. 1-12. *Preussia funiculata*. All  $\times 1200$ . FIG. 1. Rehm, Ascomyceten 1044. FIG. 2. Zopf, Flora islebiensis 1873. FIGS. 3, 4. TRTC 34645. FIG. 5. Petrak, Flora Bohemiae and Moraviae exs. 625. FIG. 6. Fuckel, Fungi rhenani 1750. One ascospore is without septa. FIG. 7. Jaczewski, Smolensk 1895. One ascospore is without septa, two are uniseptate, and one is biseptate. FIG. 8. Thümen, Mycoth. Univ. 161. FIG. 9. Krieger, Fungi saxonici 426. One ascospore is without septa. FIG. 10. Krieger, Fungi saxonici 1164. FIG. 11. TRTC 34645. FIG. 12. TRTC 34639.  
 FIGS. 13-24. *Preussia fleischhakkii*. All  $\times 1200$ . FIG. 13. Cells of peridium. TRTC 31723. FIG. 14. Ascus with outline of ascospores. Ascus on left showing all eight ascospores. The same ascus is shown on right with lower four ascospores complete and parts of upper four omitted. TRTC 31723. FIG. 15. Paraphyses taken from a normal-sized ascocarp which contained very few asci. TRTC 31723. FIG. 16. Two asci with outline of ascospores. TRTC 31723. FIG. 17. Transverse view of an ascus taken at three different levels. The one at the left shows the four end-cells of four ascospores nearest the apex of the ascus. The middle view shows the second cell of these four ascospores and the upper cell of the next two. The view on the right side is taken through the next lower series of cells, namely, the third cell of four ascospores, the second cell of two ascospores, and the upper cell of the last two ascospores. TRTC 31723. FIG. 18. Cells of peridium. Rabenh. Fungi eur. 921. FIG. 19. Ascus, left view showing complete outline of upper four ascospores and right view showing lower four. Rabenh. 921. FIG. 20. Ascus with outline of ascospores, two being omitted and two others only partially shown. Rabenh. 921. FIG. 21. Ascus with outline of all eight ascospores. Rabenh. 921. FIG. 22. Same ascus as shown in FIG. 21. The left view shows complete outline of lower three ascospores and the right view the upper five. Rabenh. 921. FIG. 23. Mature ascospores showing germinal slits. Six are shown stippled, three in outline only. The ascospore on the left has the upper septum lacking. The one second from left has the lower septum lacking. Rabenh. 921. FIG. 24. Outline of ascospores, those on the left have separated or partially separated into spore segments. TRTC 31723.  
 FIGS. 25-30. *Preussia typharum*. All  $\times 1200$ . FIG. 25. Asci and ascospores, all except three in outline only. Note the ascospore on the left side has only the mid-septum; the upper and lower septa are lacking. The ascospore near the figure 25 has the lower septum lacking. TRTC 32085. FIG. 26. Three asci with outline of ascospores. Eight ascospores and eight segments partially separated. TRTC 31724. FIG. 27. Three ascospores and 11 ascospore segments. Sydow, Mycoth. March. 2830. FIG. 28. Two asci and three ascospores. The ascus on the left is mature with eight dark ascospores, shown in outline only. The ascus on the right is immature with eight, hyaline ascospores just barely visible. Thümen, Myc. Univ. 161. FIG. 29. Two asci, ascospores, and segments of ascospores. The ascus on the left is immature with eight, hyaline ascospores just barely visible. Note that each ascospore is already three-septate. The ascus on the right is mature but contains only six dark ascospores, shown in outline only. Only one of the ascospores is normal with three septa. The remaining five have only one septum each; the two end septa are lacking. A similar two-celled ascospore is shown at the bottom of the page. Beside it is another ascospore with all three septa lacking. IMI 13767. FIG. 30. Ascospore. Rabenh. Fungi Eur. 1338.  
 FIG. 31. *Preussia punctata*  $\times 1200$ . Ascospores and ascospore segments; Fleischhakk, Thuringia.

FIGS. 32-38. *Preussia isomera*. All  $\times 1200$ . TRTC 32089, cultures. FIG. 32. Early stages in development of ascocarps. FIG. 33. Cells of peridium. FIG. 34. Asci in lactophenol. The inner membrane has separated from the outer wall. Croziers are shown at base of asci. FIG. 35. Young asci developing with croziers at base. FIG. 36. Lower part of outer wall of ascus. The upper cap has dehisced in a manner typical of the Loculoascomycetes. FIG. 37. Four mature ascospores [before separation into segments] and ascospore segments. FIG. 38. Mature asci with dark ascospores, shown in outline only. The three illustrations at the lower left represent the same ascus. The figure at the left shows all eight ascospores in outline. The second from the left has the upper four omitted and the third from the left has the lower four omitted.

FIGS. 39-49. *Preussia dispersa*. All  $\times 1200$ , unless marked otherwise. Rogerson SD 53-54-7. FIGS. 39-41. Early stages in the development of ascocarps or spermogonia. Abundant hyphal fusions are shown in FIG. 40. FIGS. 42, 43. Later stages in development of ascocarps. FIG. 44. Two spermogonia showing prominent ostioles.  $\times 120$ . FIG. 45. Upper part of spermogonium showing ostiole surrounded by thick-walled peridial cells. FIG. 46. Same as Fig. 45. FIG. 47. Hyaline conidia, each with a single oil globule. FIG. 48. Asci, all except one immature. FIG. 49. Light-brown ascospore segments, each with two oil globules.

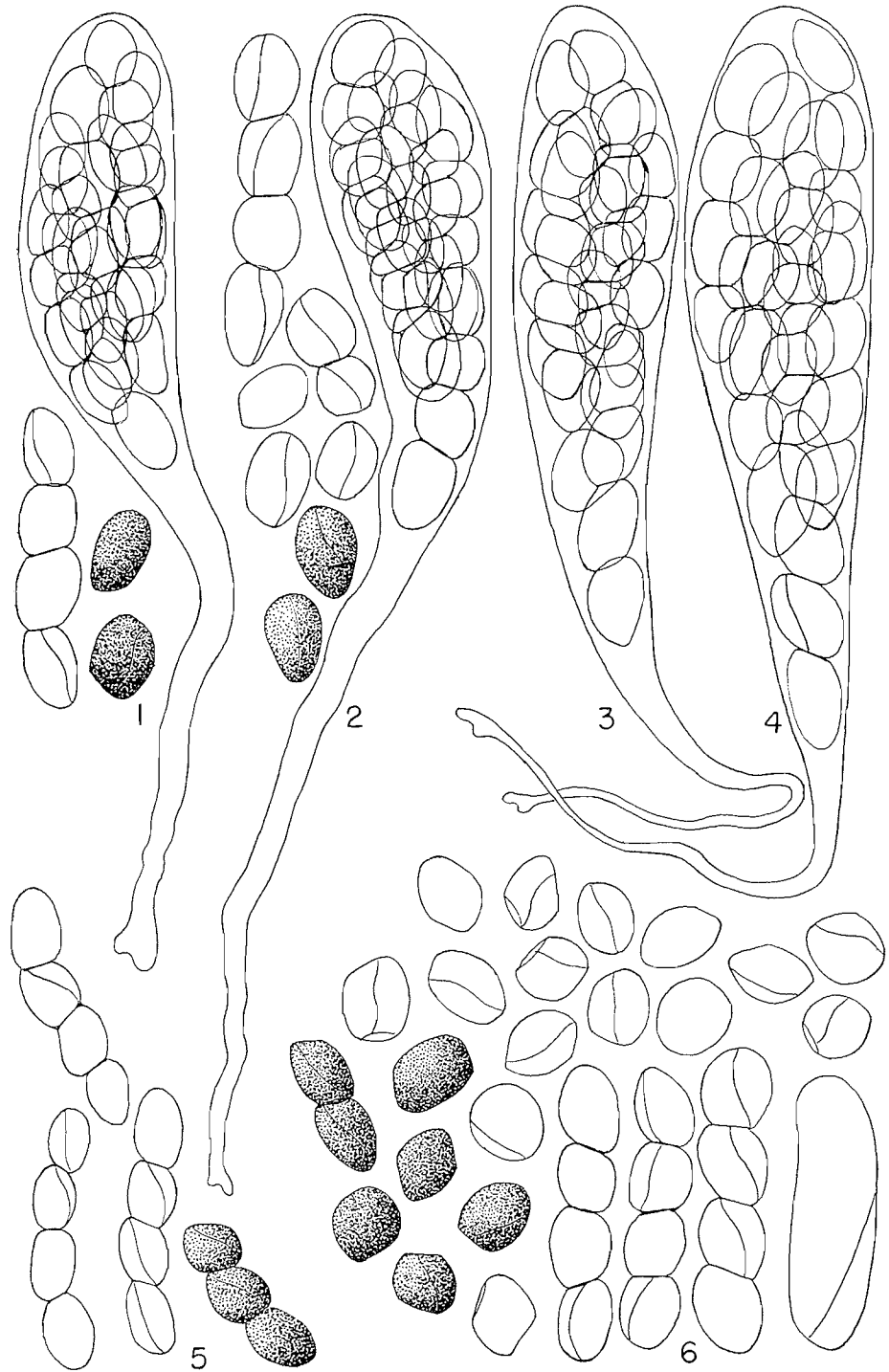
FIGS. 50-61. *Preussia multispora*. All  $\times 1200$ . Baarn culture. FIG. 50. Ascogenous hyphae with very young asci with croziers. FIGS. 51, 52. Young asci shortly after formation of ascospores. FIG. 53. Swollen cells of paraphyses. FIG. 54. Young asci with ascospores just barely visible; with four segments attached end to end. FIG. 55. Mature ascus with 32 separate ascospore segments. FIG. 56. Mature ascus with 8 one-celled ascospores; septa having failed to develop. FIG. 57. Mature ascus with 8 one-celled ascospores (4 in side view, 4 in end view). FIG. 58. Mature ascus with 8 one-celled ascospores. In FIGS. 55-58 the brown ascospores are shown in outline only. FIG. 59. Normal, brown ascospore segments each with two oil globules, four having separated from each ascospore. FIG. 60. Double ascospore segments, each with four oil globules, two having separated from each uniseptate ascospore. FIG. 61. Six nonseptate ascospores, some of the larger oil globules representing two or more normal globules.

FIGS. 62-71. *Preussia dispersa*. All  $\times 1200$ . Cooke 1168. FIG. 62. Spermogonium showing ostiole. FIG. 63. Hyaline conidia each with a single oil globule. FIG. 64. Double ascospore segment, representing half of a uniseptate ascospore. FIGS. 65, 66. Normal ascospore segments, four having separated from each ascospore. FIG. 67. End view of mature ascus with only 22 of the 32 ascospore segments visible and shown in outline. FIG. 68. Very young ascus before ascospore formation. FIG. 69. Ascus with two of the ascospores nonseptate. FIG. 70. Two young asci with ascospores just barely visible. FIG. 71. Very young ascus with single large globule and before ascospore formation.

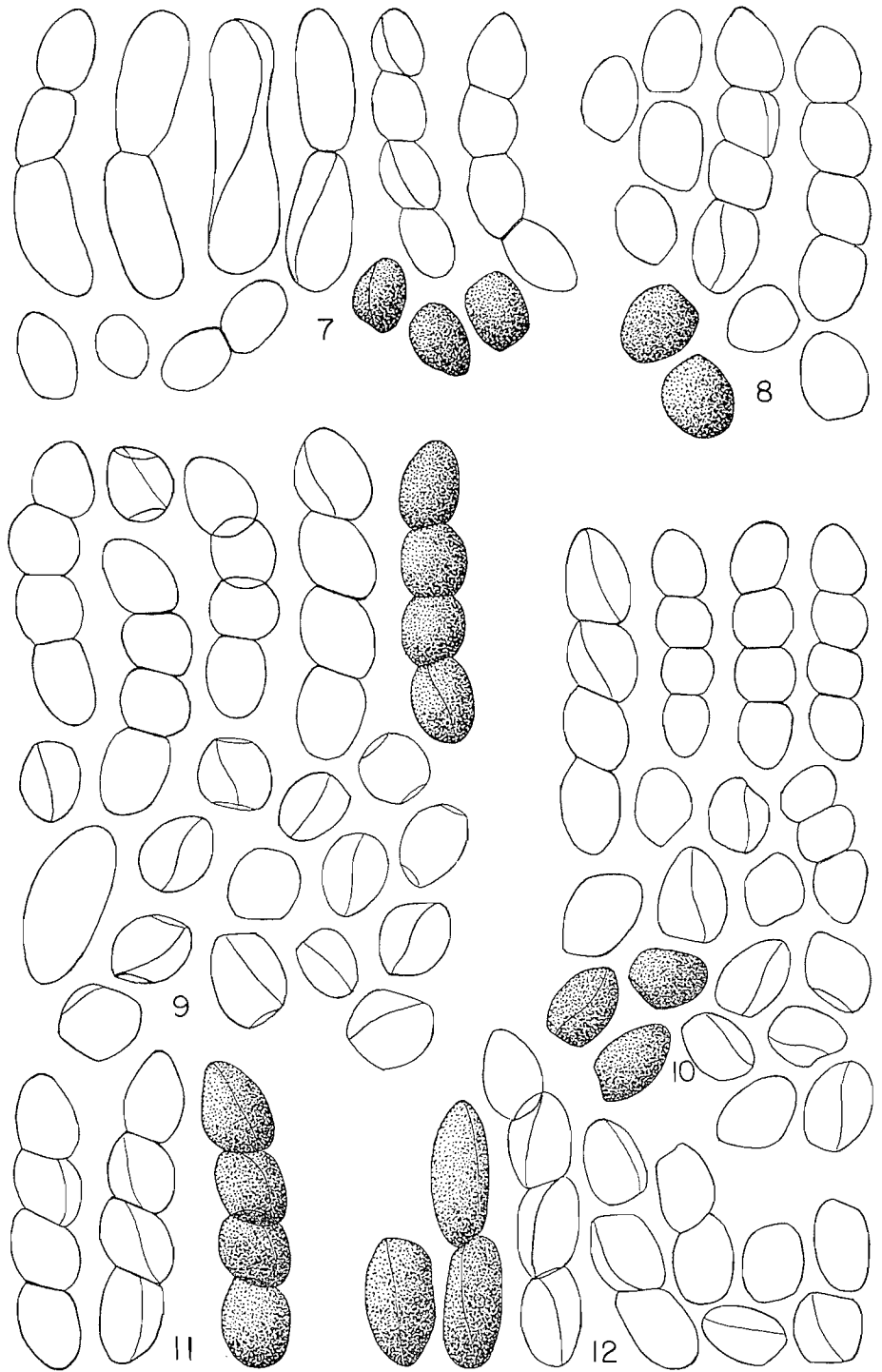
FIGS. 72-83. *Preussia terricola*. Goos 217. FIG. 72. Section of three ascocarps on surface of agar and embedded in dense layer of aerial hyphae. The layer below the ascocarps represents the zone of reddish brown hyphae submerged in agar. The thin peridium of the ascocarp consists of a dark brown outer layer in which the cells are very obscure and an inner hyaline layer.  $\times 175$ . FIG. 73. Section of peridium of very young ascocarp.  $\times 1200$ . FIG. 74. Surface view of peridium showing very obscure, small, angular cells with characteristic opaque, irregular, thickened spots.  $\times 1200$ . FIG. 75. Ascospores and separated ascospore segments.  $\times 1750$ . FIG. 76. Asci with paraphyses in various stages of development.  $\times 1200$ . FIG. 77. Two asci with ascospores nearly mature.  $\times 1200$ . FIG. 78. Mature ascus containing only four giant four-celled brown ascospores.  $\times 1750$ . FIG. 79. Two young asci with ascospores still hyaline. The ascus on the right still contains a large globule.  $\times 1200$ . FIG. 80. Mature ascus containing about 8 double segments (four ascospores), and 16 single segments (four ascospores).  $\times 1200$ . FIG. 81. Mature ascus with 32 single ascospore segments which have separated, shown in outline only.  $\times 1200$ . FIG. 82. Apical portion of ruptured ascus.  $\times 1200$ . FIG. 83. Ascospore and ascospore segments showing germinal slits.  $\times 1200$ .

FIGS. 84-95. *Preussia nigra*. All  $\times 1200$  (except Fig. 84). Routien, 17M48. FIG. 84. Ascocarp, crushed under cover slip, with asci extruding.  $\times 125$ . FIG. 85. Surface view of peridium of mature ascocarp showing very distinct cells. FIGS. 86-88. Young asci with croziers at base, before ascospore formation. FIG. 89. Ascus, nearly mature but ascospores still hyaline. FIG. 90. Early stages in development of ascocarp. Swollen cell in hypha divides to form a mass of cells. FIG. 91. Young asci, before ascospore formation, and paraphyses. FIG. 92. Young asci containing hyaline ascospores, in various stages of development. FIG. 93. Mature asci with brown ascospore segments separated (shown in outline only). FIG. 94. Mature asci, end view. FIG. 95. Mature ascus with ascospore segments separated (in lactophenol). FIG. 96. Separated ascospore segments.

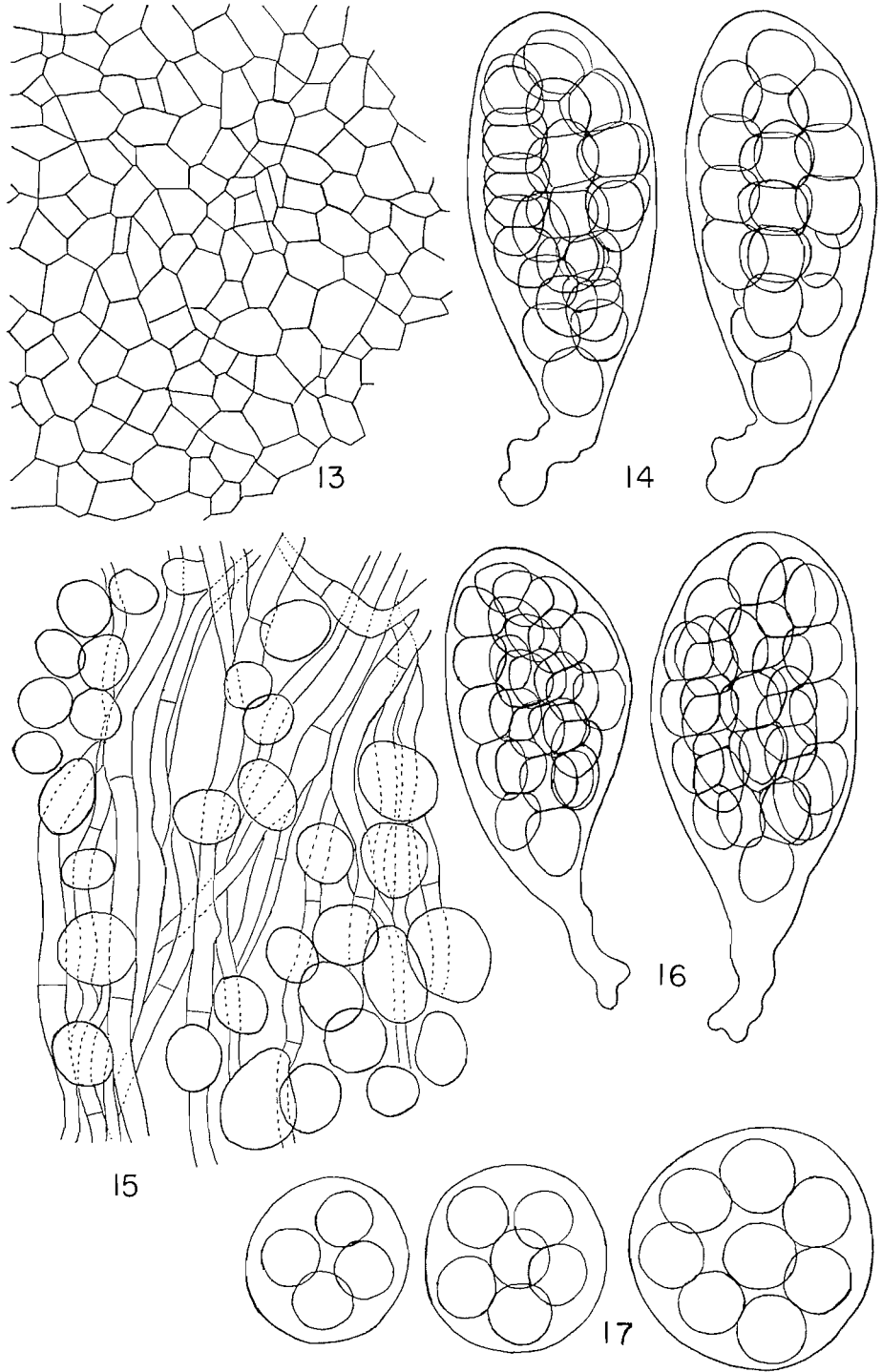
NOTE: Figures 1-96 follow.



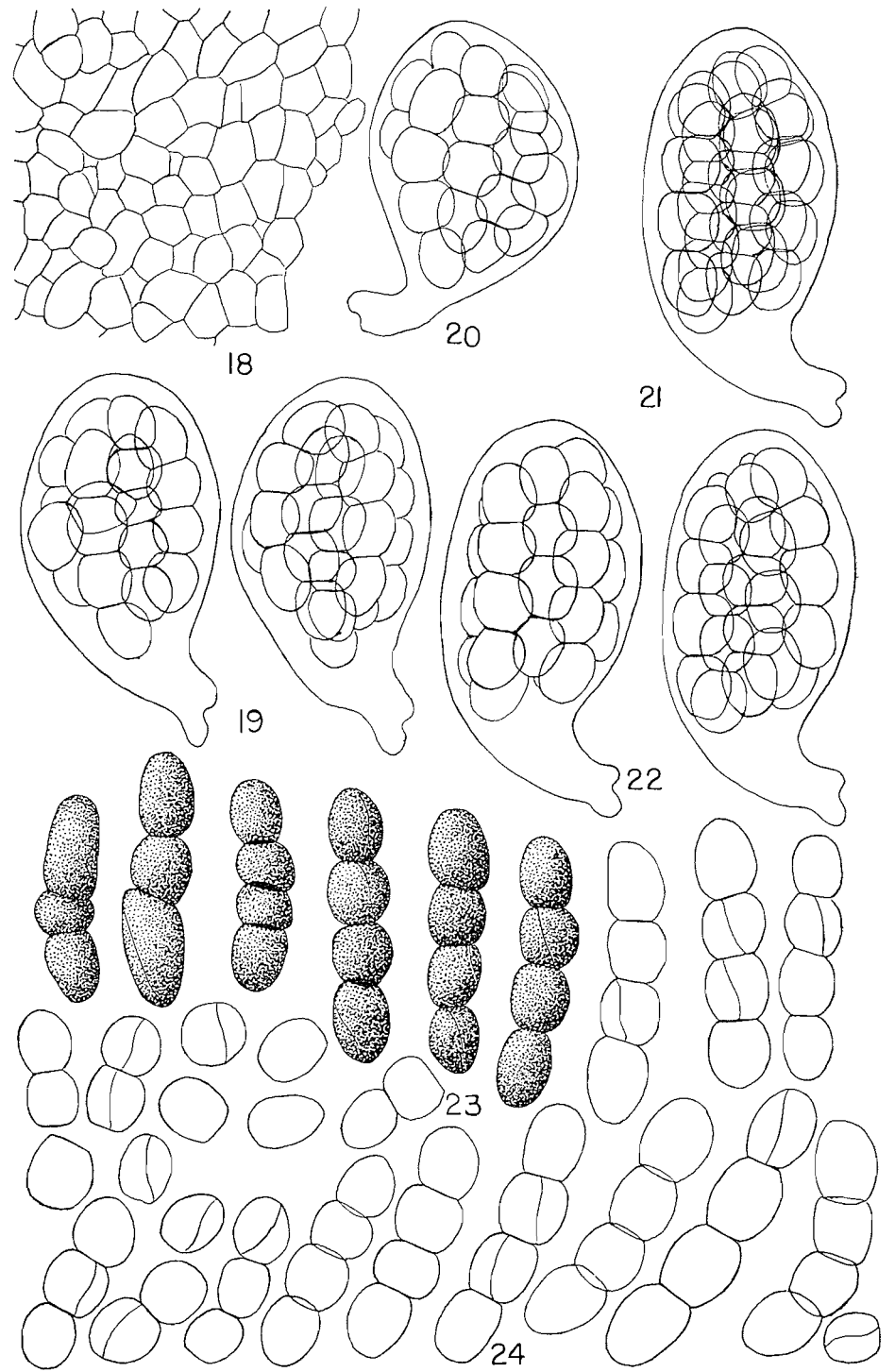
*Preussia funiculata* (Figs. 1-6)



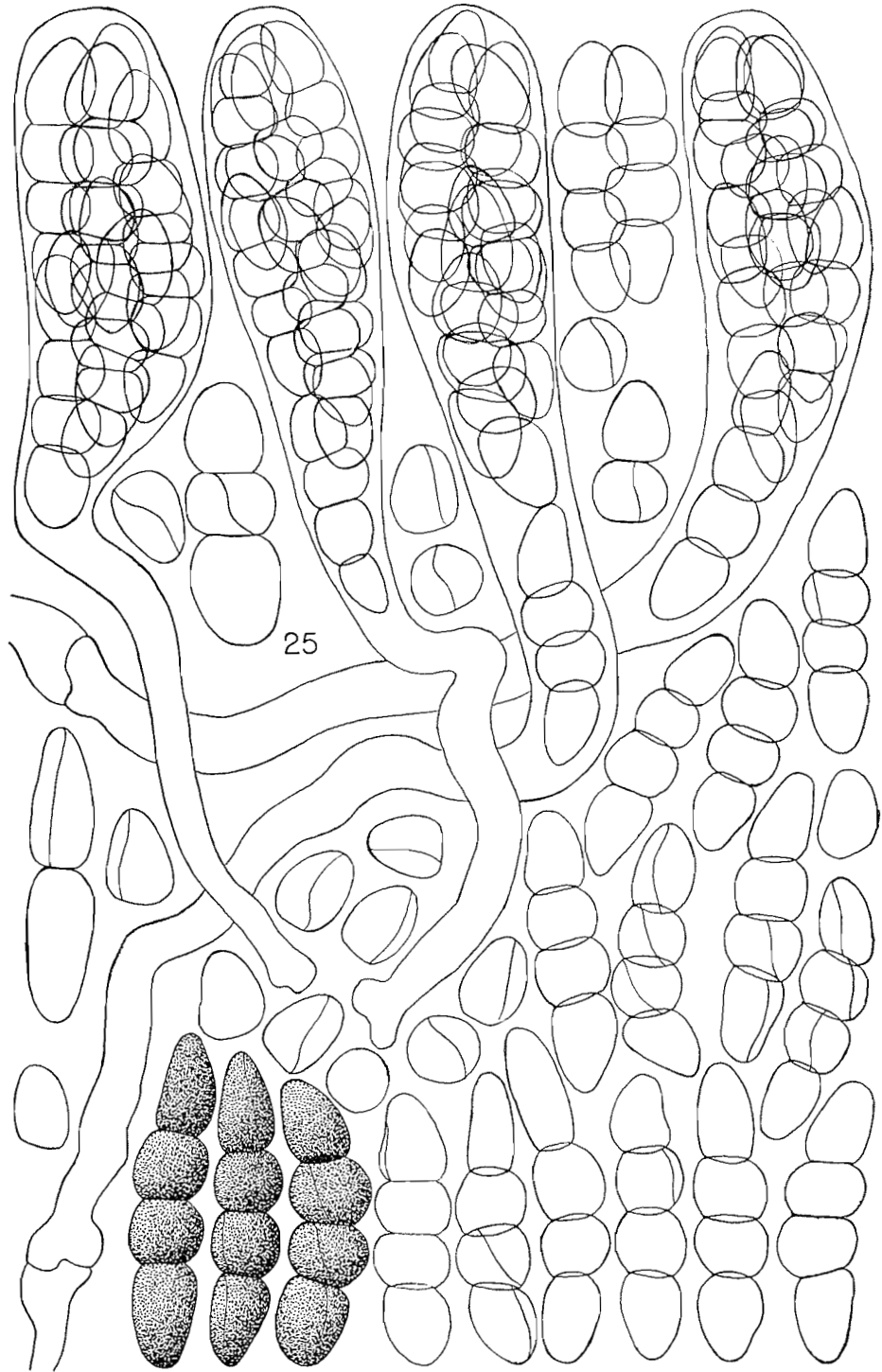
*Preussia funiculata* (Figs. 7-12)



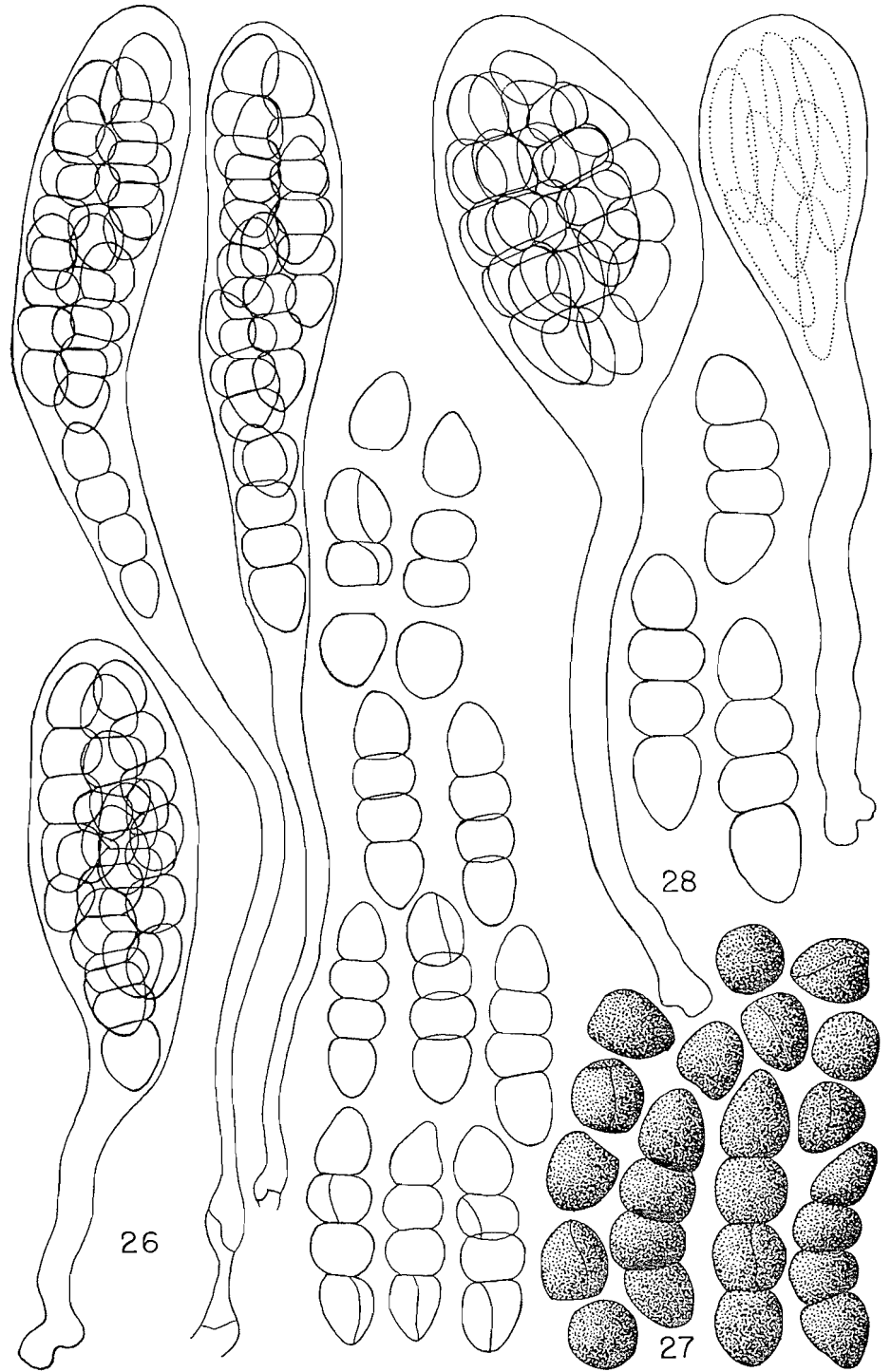
*Preussia fleischhakkii* (Figs. 13-17)



*Preussia fleischhakkii* (Figs. 18-24)

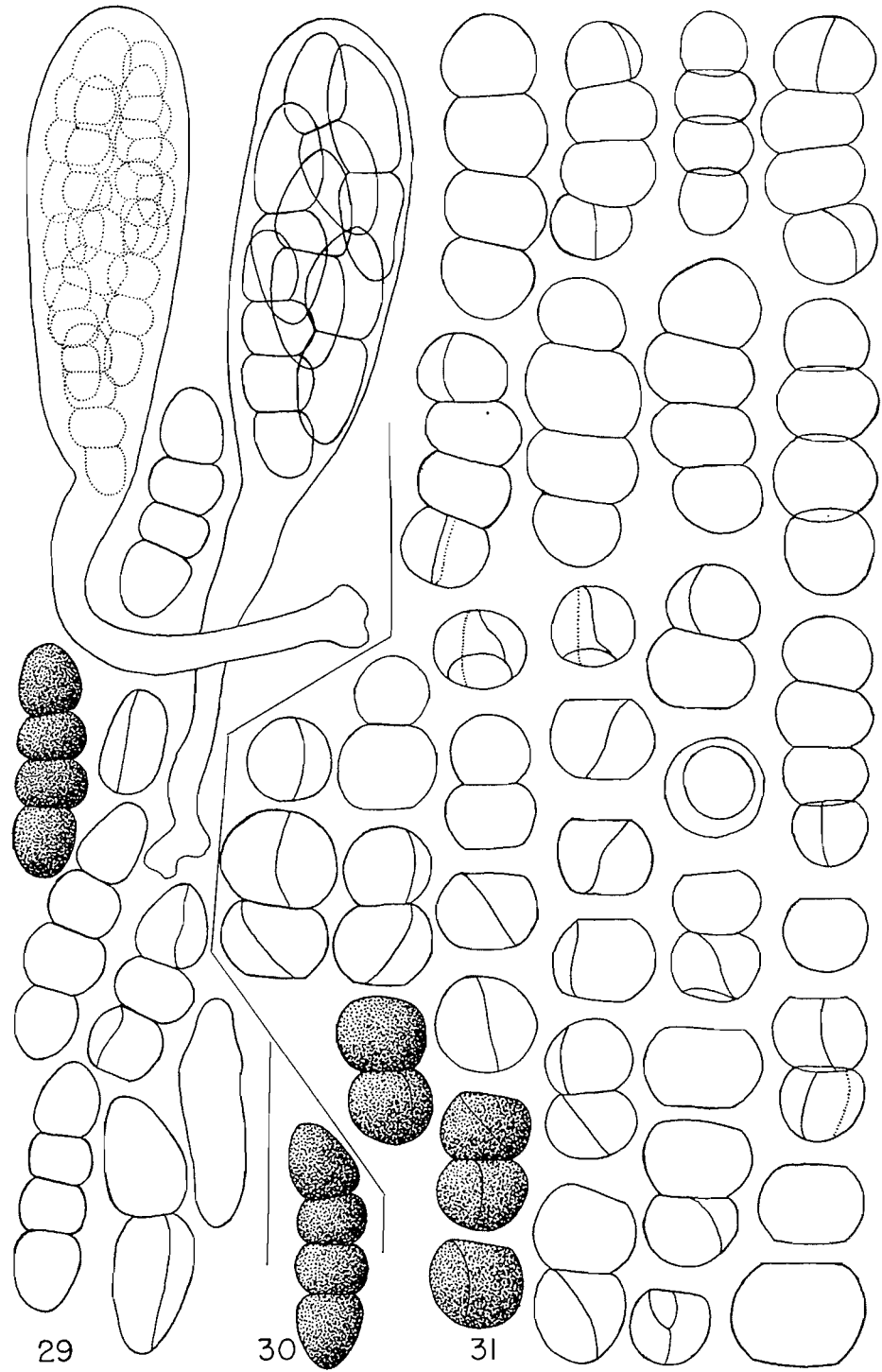


*Preussia typharum* (Fig. 25)



*Preussia typharum* (Figs. 26-28)



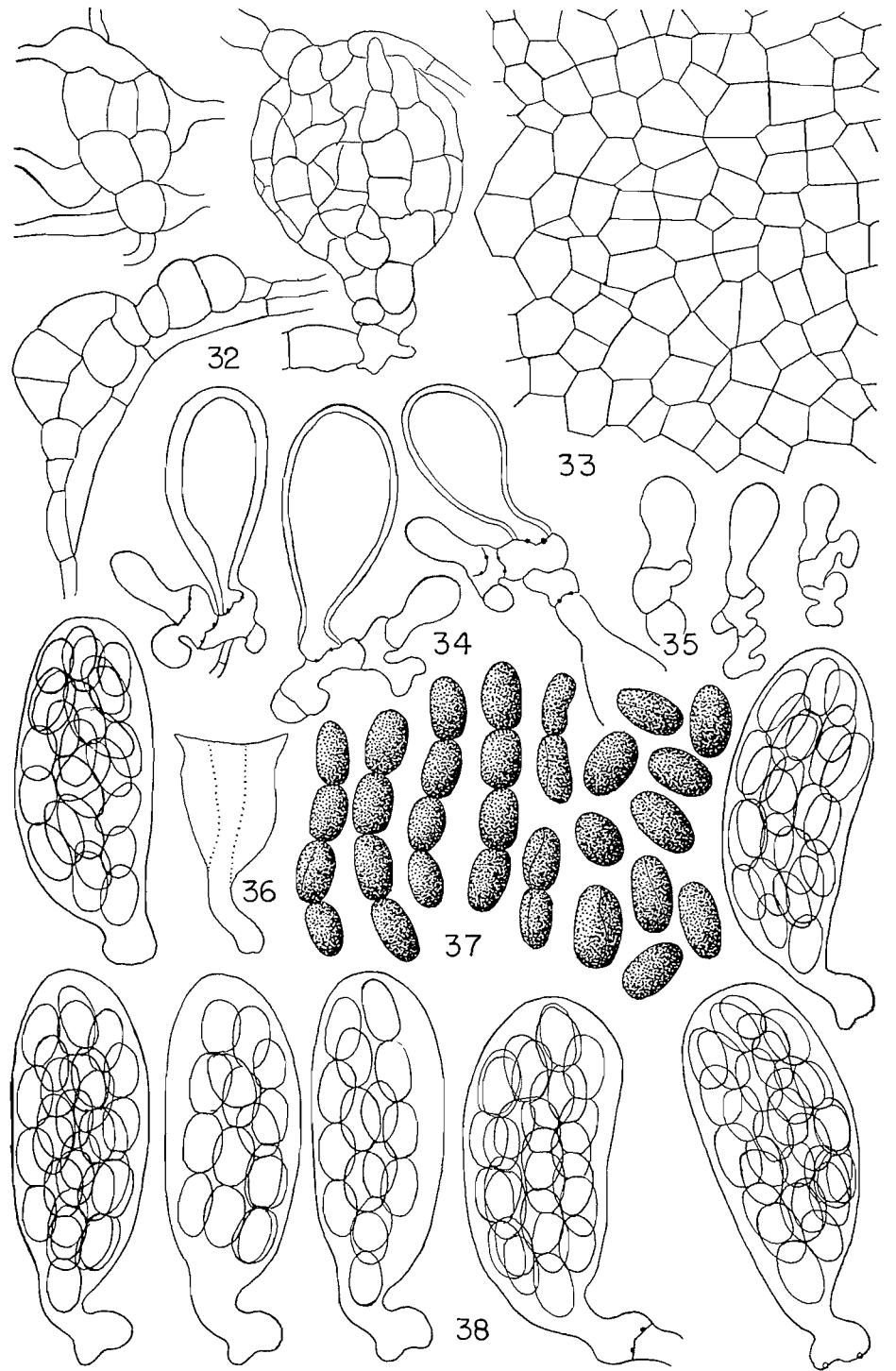


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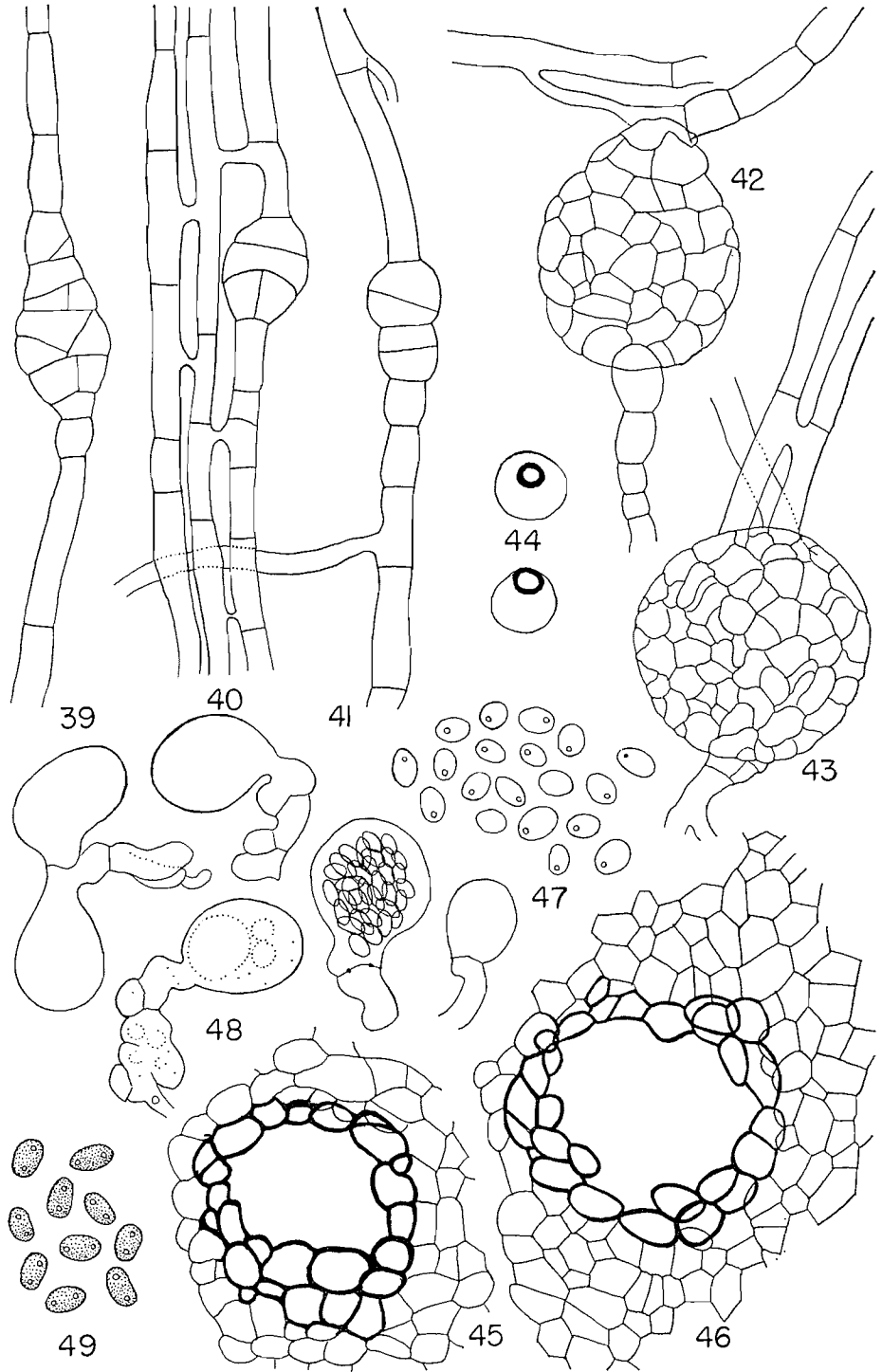
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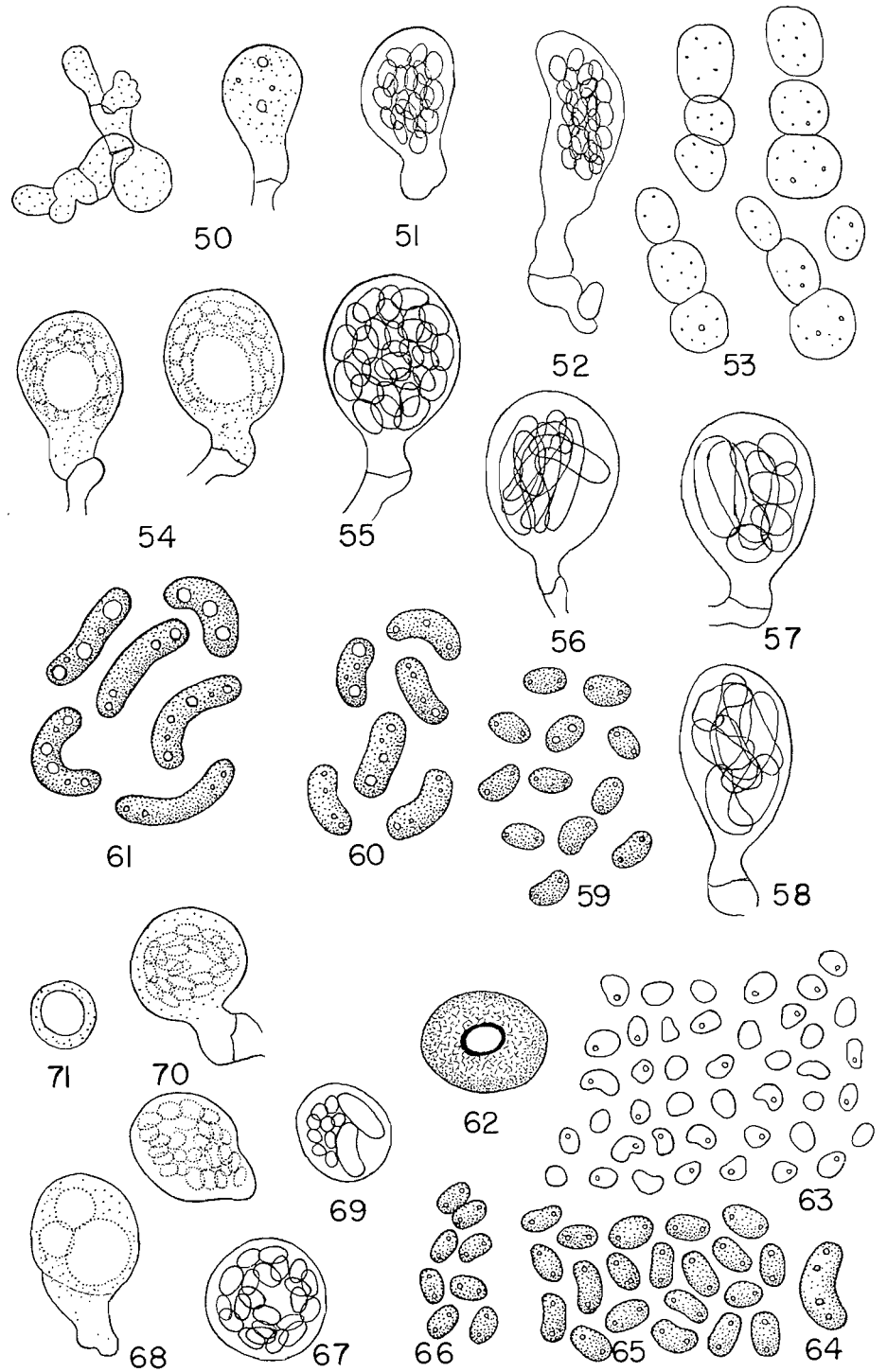
*Preussia typharum* (Figs. 29, 30) and *P. punctata* (Fig. 31)



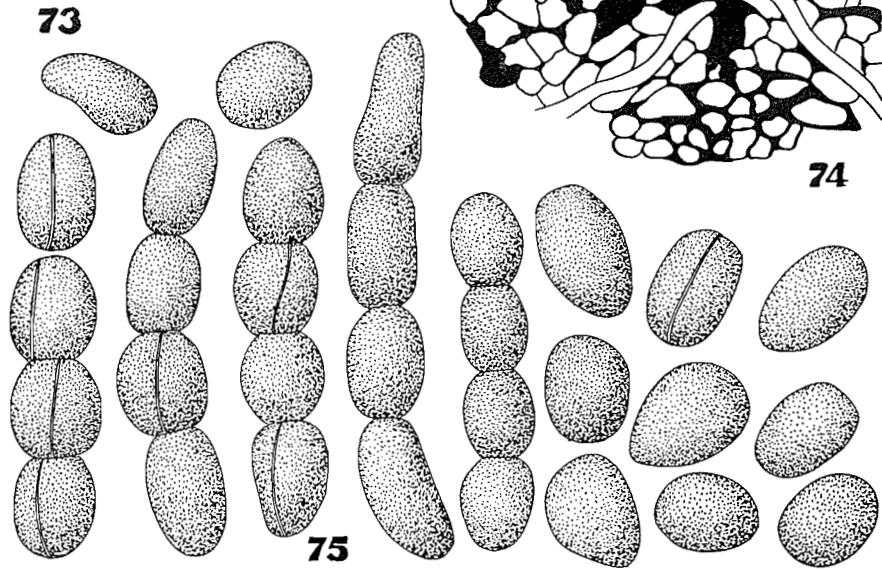
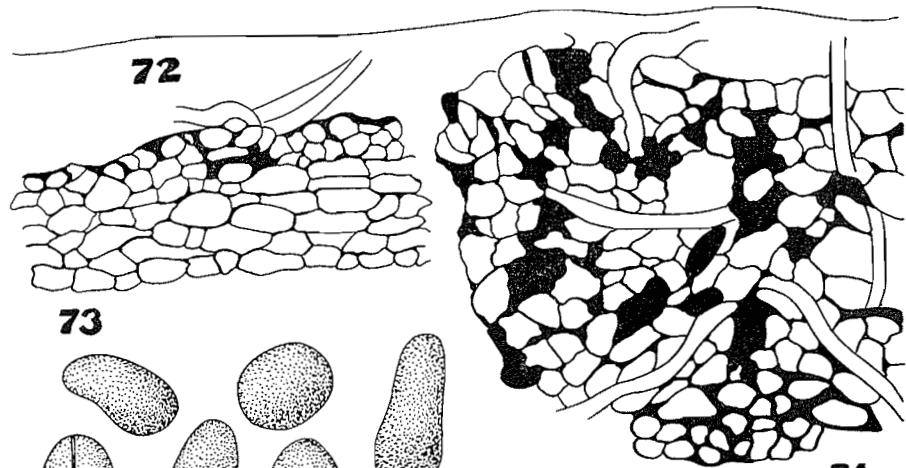
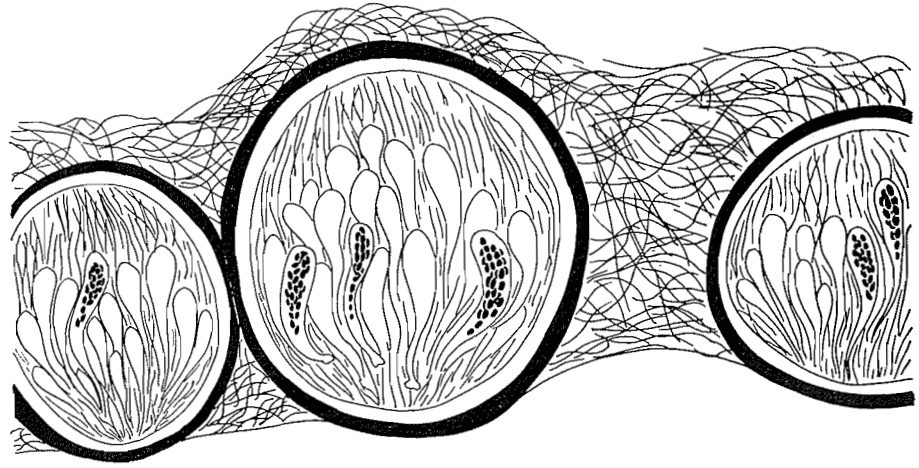
*Preussia isomera* (Figs. 32-38)



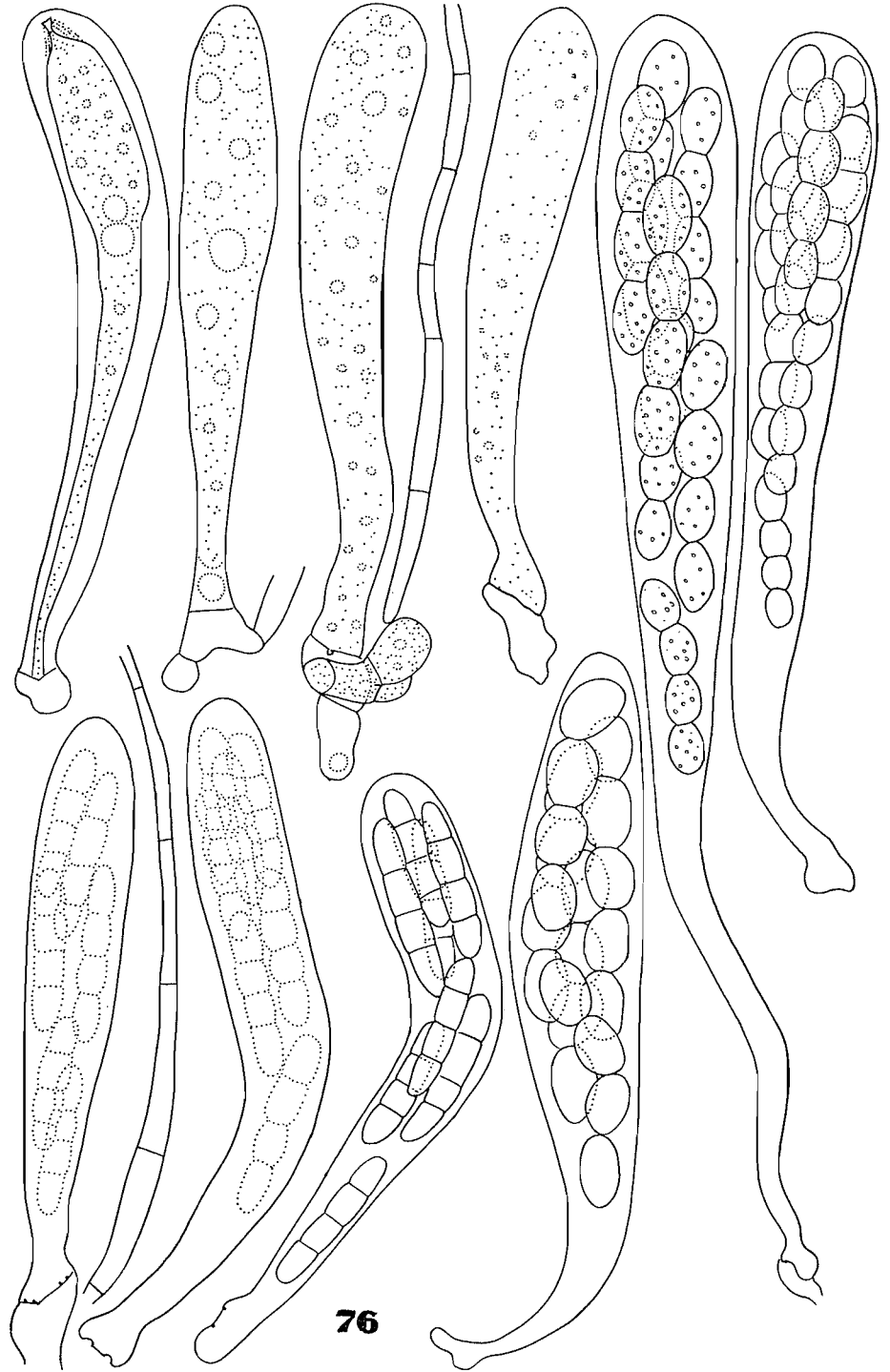
*Preussia dispersa* (Figs. 39-49)



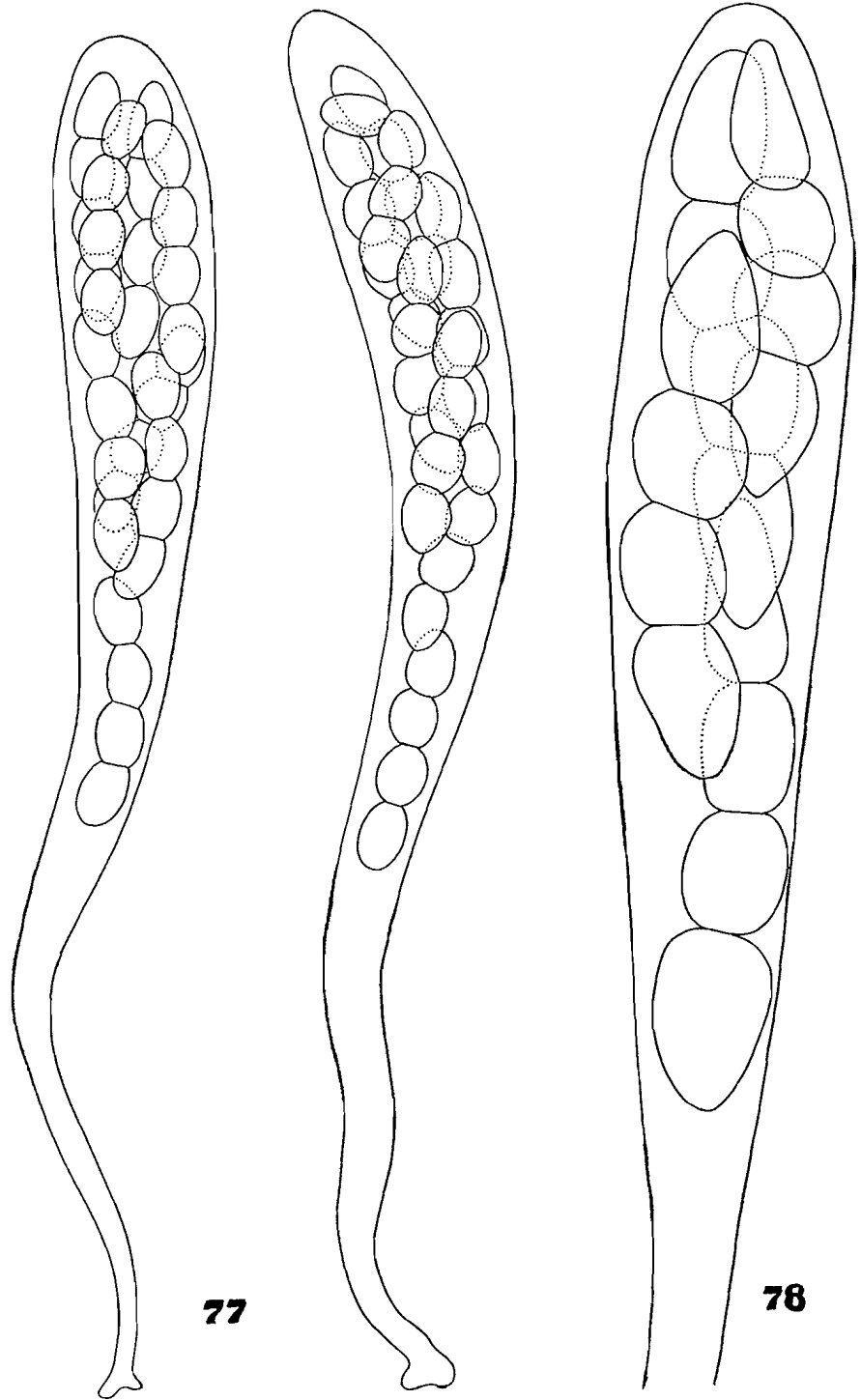
*Preussia multispora* (Figs. 50-61) and *P. dispersa* (Figs. 62-71)



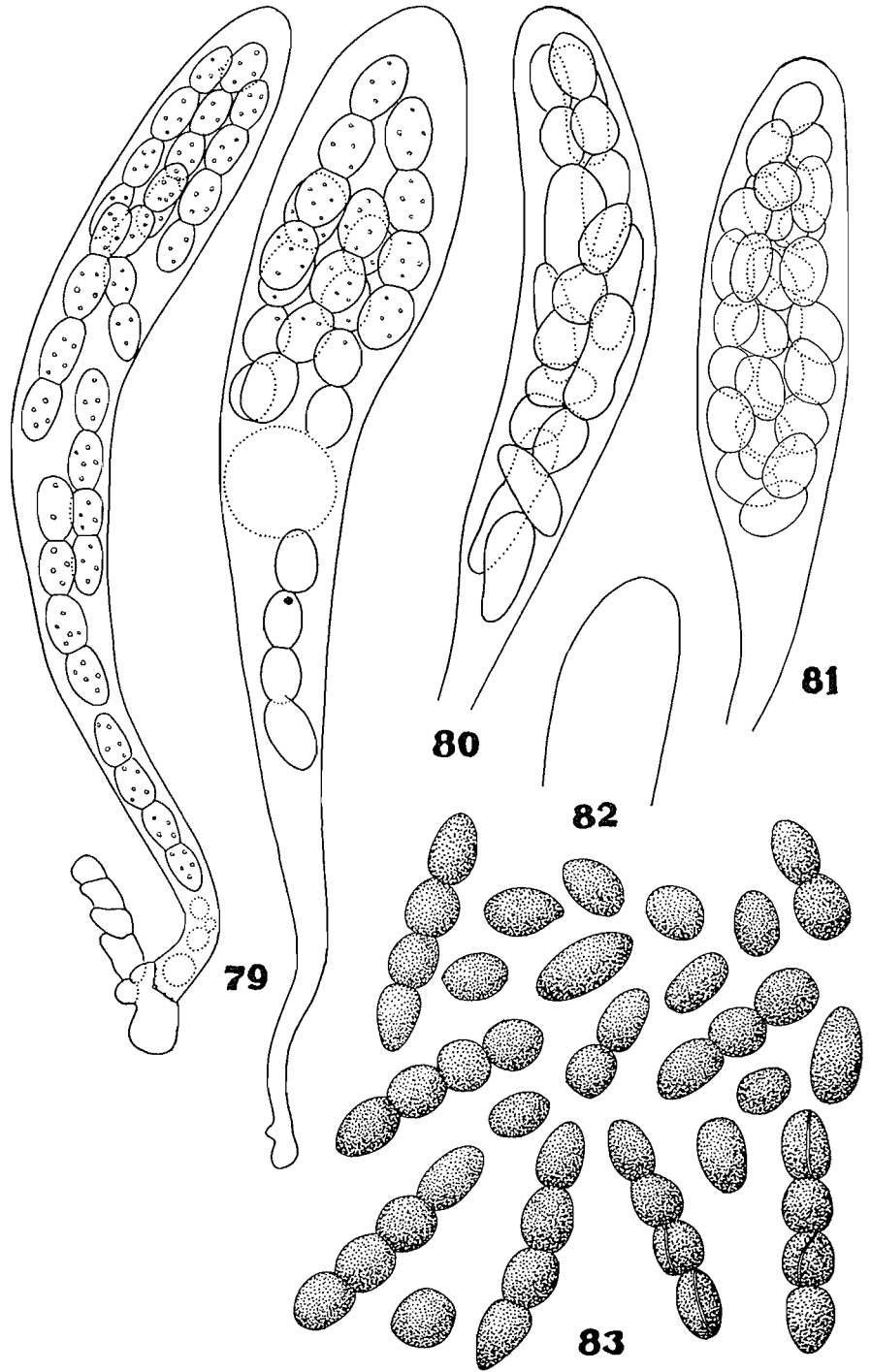
*Preussia terricola* (Figs. 72-75)



*Preussia terricola* (Fig. 76)

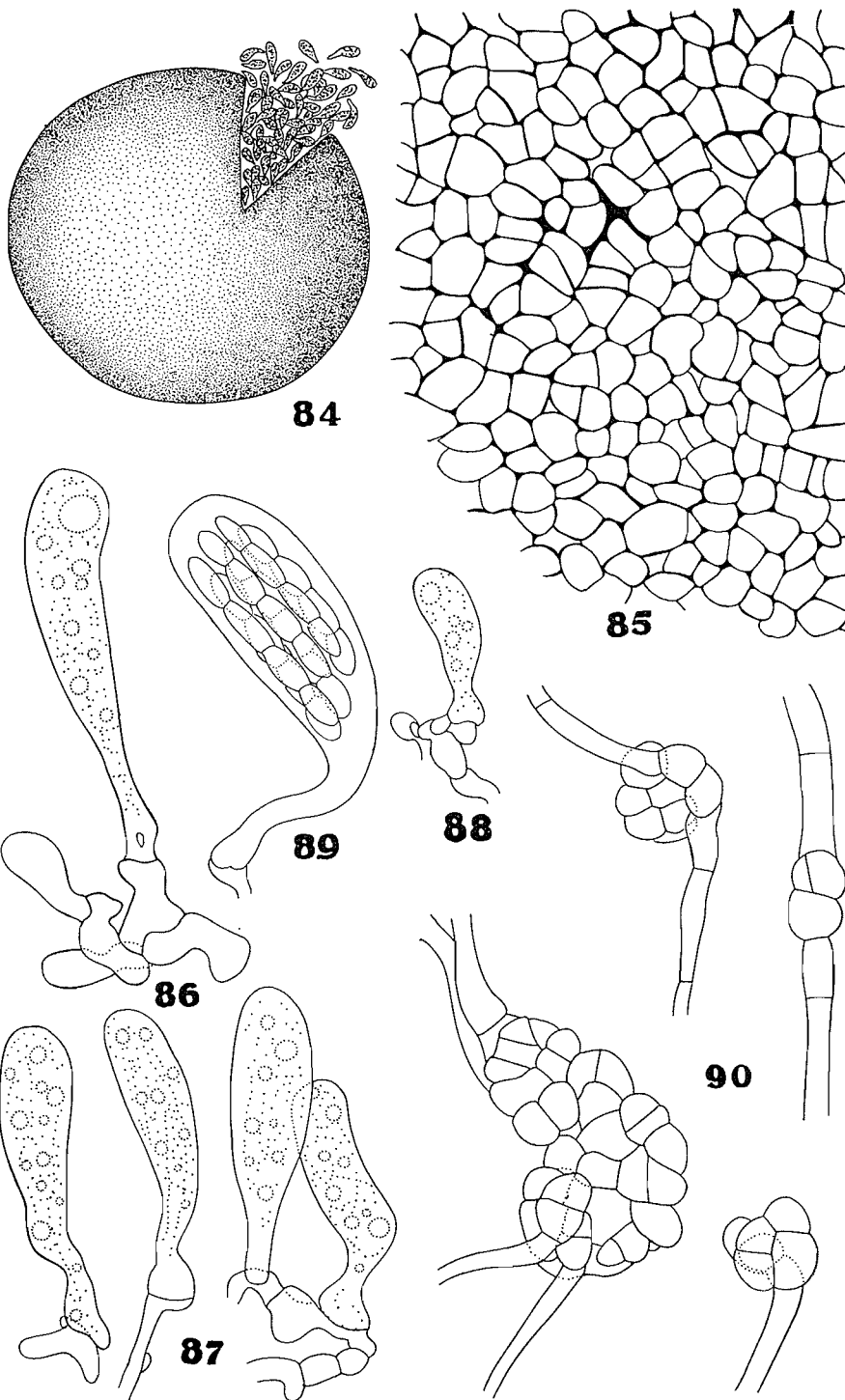


*Preussia terricola* (Figs. 77, 78)

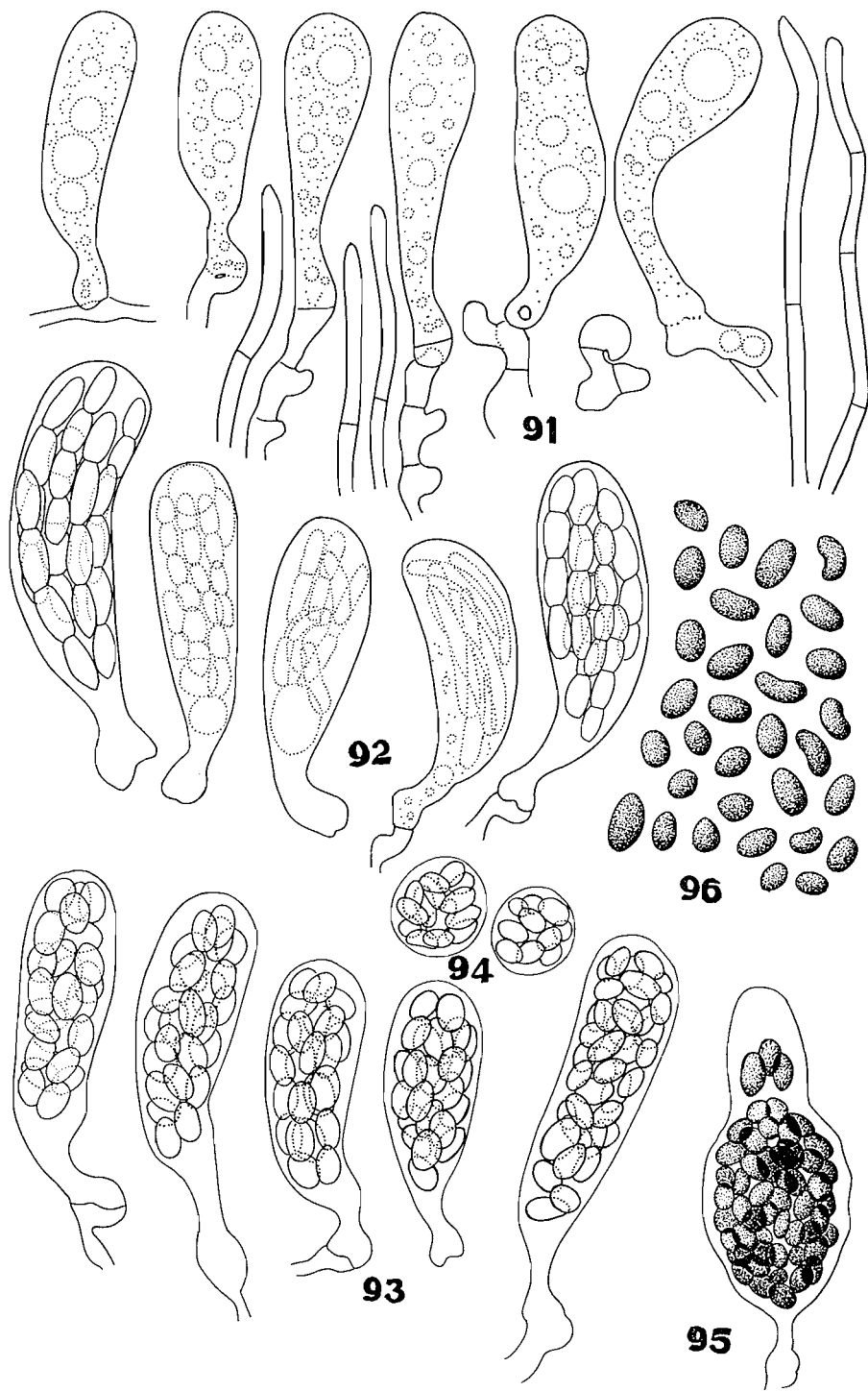


*Preussia terricola* (Figs. 79-83)





*Preussia nigra* (Figs. 84-90)



*Preussia nigra* (Figs. 91-96)