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TWO NEW SPECIES OF CONIDIOBOLUS THAT PRODUCE MICROCONIDIA

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TWO NEW SPECIES OF CONIDIOBOLUS THAT PRODUCE MICROCONIDIA[1]

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THE TWO readily culturable fungi herein described as new species of *Conidiobolus* include in their asexual reproduction the simultaneous development of several—usually 5–15—microconidia on short sterigmata borne radially on conidia of the large globose type familiar in many insectivorous members of the Entomophthoraceae. Such multiplicative development was first made known by Costantin (1897) in the original account of his readily culturable *Boudierella coronata*, being there presented as a very distinctive feature requiring the erection of a new genus. When Saccardo and Sydow (1899) took occasion to replace the preëmpted name *Boudierella* with a new generic term, *Delacroixia*, they referred to the microconidia as merely "conidia secundaria." Gallaud (1905) regarded the microconidia (or "spores en couronne") as borne on protuberances of the same category as tht hair-like outgrowths present on the villous resting spores (or "spores échinulées") he found to originate in *D. coronata* through conversion of smooth conidia. Kevorkian (1937) apparently shared this view, and held further that the microconidia of *D. coronata* were equivalent to the secondary conidia produced in the several insectivorous species which Thaxter (1888) assigned to the subgenus *Triplosporium*. In describing another readily culturable entomophthoraceous fungus, which, though given to forming microconidia, produced smooth zygospores instead of villous resting spores, Couch (1939) placed primary emphasis on resemblance in sexual reproduction by bringing it into the genus *Conidiobolus* under the binomial *C. brefeldianus*. He recognized the production of villous resting spores rather than the formation of microconidia as the chief distinguishing character of *Delacroixia*.

Thus the mode of sporulation observed by Costantin has lost esteem as a diagnostic feature. The formation of microconidia now appears of moment less as a developmental oddity than as a multiplicative phase of asexual reproduction homologous with the development of zoospores in the Oomycetes and of sporangiospores in the Mucorales (Drechsler, 1946, 1953b). The homology is sustained by observations on asexual reproduction in the two new species, for here no less than in *Delacroixia coronata* the microconidia develop simultaneously and tend strongly toward uniformity in size irrespective of variations in the dimensions of the parent conidia. Abundant production of sporangiospores in the globose as well as in the elongated conidia of *Basidiobolus meristosporus* Drechsler (1955a) has given further opportunity for confirming the correspondence between the endogenous and exogenous types of multiplicative sporulation found in the Entomophthorales.

The two new species were obtained in cultures that I prepared by canopying Petri plates of maize-meal agar with small quantities of decaying material gathered by me on a trip taken during the third week of November, 1954, through Indiana, Illinois and Wisconsin. Specimens of them have been deposited in the National Fungus Collections, Plant Industry Station, Beltsville, Maryland; and cultures of them have been transmitted to the American Type Culture Collection in Washington, D. C.

1. CONIDIOBOLUS **polytocus** Drechsler, sp. nov.[3]

Mycelium colorless, branched; assimilative hyphae mostly 2–9 μ wide but near origin from a germinated conidium widening to 13–14 μ, soon becoming divided by cross-walls into cells mostly 25–200 μ long which in many places become disjointed and in other places remain connected only by empty portions of membrane; conidiophores colorless, extending 20–30 μ into the air toward the main source of light, in their submerged and procumbent portions commonly 3–7 μ wide, in their aerial portion markedly inflated, usually 5–12 μ wide, mostly unbranched and producing a single conidium but in some instances bifurcate or trifurcate or furnished with 2–4 short branches (sterigmata) and thus bearing plural (2–4) conidia either simultaneously or successively; conidia springing off forcibly, subspherical, 12–25 μ in greatest width, 14–29 μ in length inclusive of a basal papilla commonly 2–6 μ high and 4–7.5 μ wide,

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[3] Mycelium incoloratum, ramosum; hyphis sterilibus plerumque 2–9 μ latis sed prope conidium germinatum usque 13–14 μ latescentibus, mox septatis, postea hic illic disjunctis vel inanitis, in cellulis plerumque 25–200 μ longis constantibus; hyphis fertilibus incoloratis, in aerem 20–30 μ ad lucem protendentibus, in parte infera semper simplicibus et 3–7 μ latis, in parte aeria inflatis, 5–12 μ latis, saepe simplicibus et unum conidium gignantibus sed interdum bifurcis vel trifurcis vel in 2–4 breves ramos (sterigmata) abeuntibus denique 2-4 conidia ferentibus; conidiis violenter absilientibus, incoloratis, globosis, basi papilla 2–6 μ alta et 4–7.5 μ lata praeditis, ex toto 14–29 μ longis, 12–25 μ latis, nunc hypham germinationis emittentibus, nunc aliud conidium gignantibus, nunc aliquot (saepius 2–15) microconidia in apicibus sterigmatum ferentibus; sterigmatibus plerumque 3–7 μ longis, 1.8–3 μ latis; microconidiis sphaeralibus vel elongato-ellipsoideis, basi papilla praeditis, in toto 7–15 μ longis, 6–11 μ latis, quandoque hypham germinationis emittentibus, quandoque aliud microconidium in apice sterigmatis vulgo 2.5–6 μ longi et 1.4–2 μ lati gignantibus.

Habitat in materiis plantarum putrescentibus in Fort Wayne, Indiana, in Chicago, Illinois, et prope Park Falls, Wisconsin.

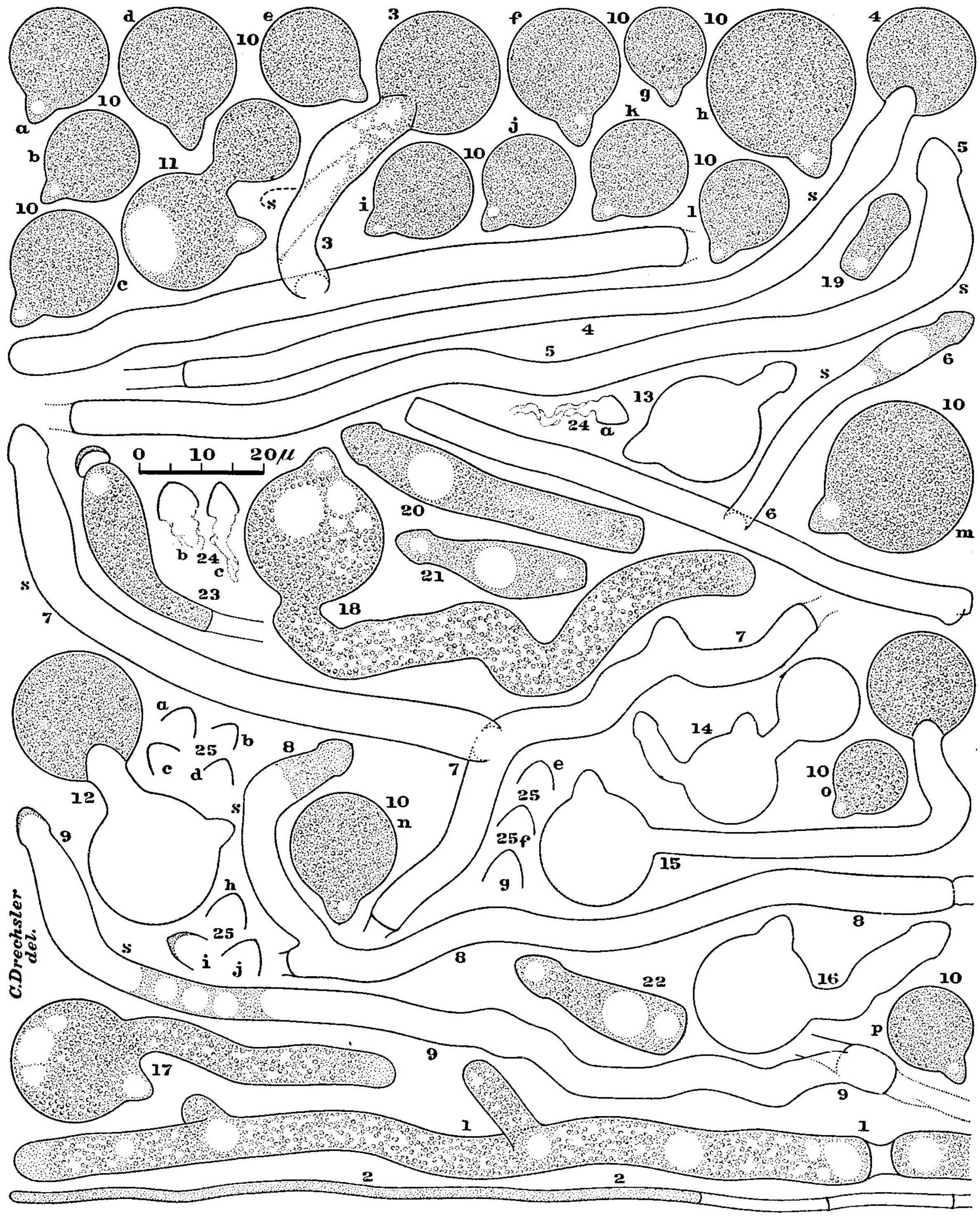

Fig. 1–25. *Conidiobolus polytocus* (Fort Wayne isolation) as found in maize-meal-agar cultures; ×1000.—Fig. 1. Hypha at margin of a growing mycelium.—Fig. 2. Slender hypha in culture 7 days old.—Fig. 3. Conidiophore with partly delimited conidium.—Fig. 4. Fully developed conidiophore.—Fig. 5–9. Denuded conidiophores.—Fig. 10. Newly detached conidia, a–p.—Fig. 11–16. Conidia in different stages of repetitional development.—Fig. 17, 18. Conidia germinating by emission of a germ tube.—Fig. 19–23. Living cells formed in conidiophore terminations.—Fig. 24. Evanescing membranes of conidiophore terminations, a–c.—Fig. 25. Persistent conidiophore caps, a-j, (*s*, surface of substratum.)

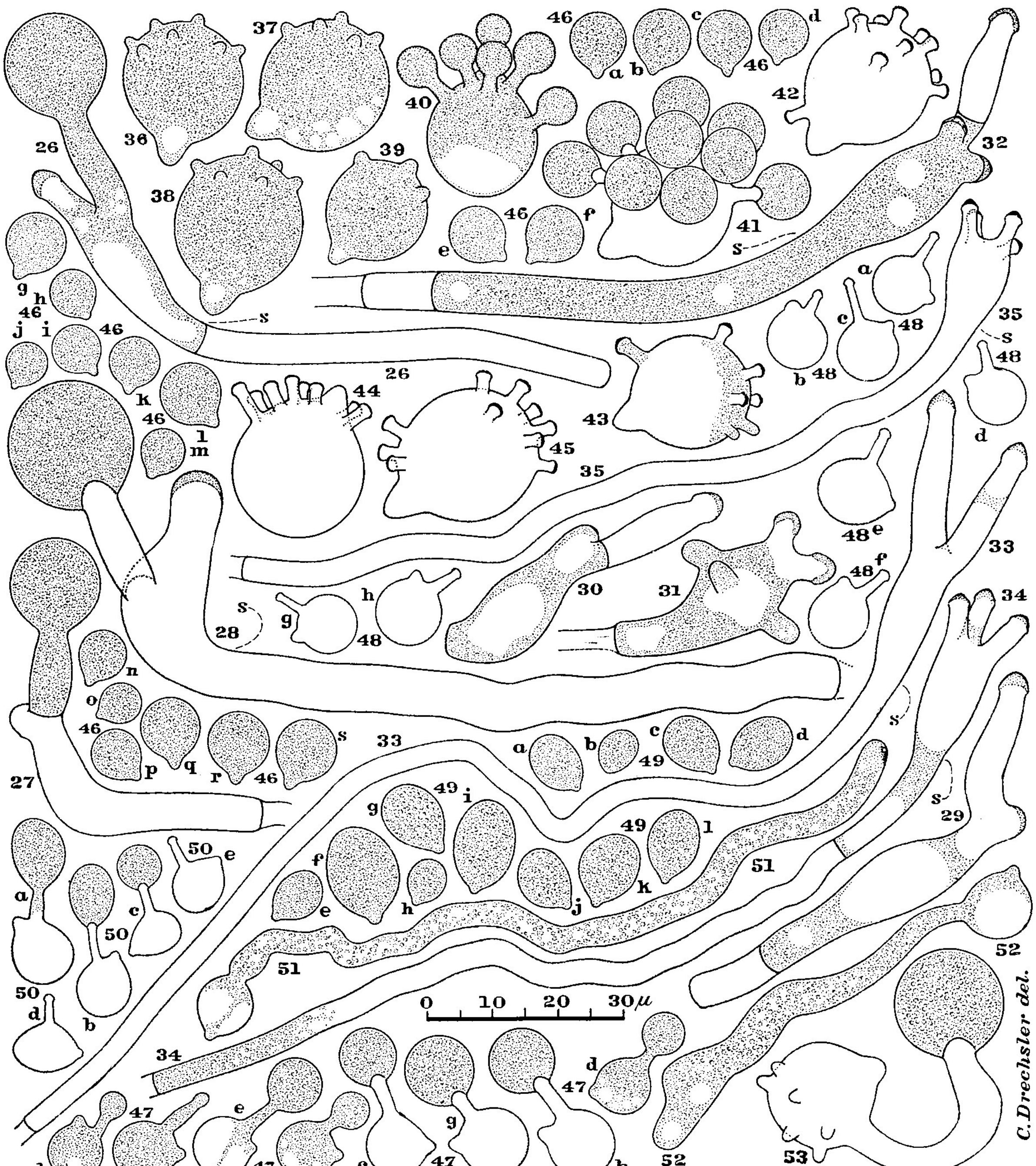

Fig. 26–53. *Conidiobolus polytocus* (Fort Wayne isolation) as found in Lima-bean-agar cultures; ×1000.—Fig. 26, 27. Conidiophore terminations, each producing a second conidium.—Fig. 28. Conidiophore empty after producing a second conidium.—Fig. 29–31. Conidiophore terminations, each retaining some protoplasm after producing 2 conidia.—Fig. 32. Conidiophore retaining much protoplasm after bearing 3 conidia.—Fig. 33. Denuded bifurcate conidiophore.—Fig. 34. Denuded trifurcate conidiophore.—Fig. 35. Conidiophore with 4 denuded branches.—Fig. 36–39. Conidia beginning to form microconidia.—Fig. 40. Conidium bearing 6 young microconidia.—Fig. 41. Conidium bearing 9 microconidia.—Fig. 42–45. Conidia with denuded sterigmata.—Fig. 46. Detached microconidia, a–s, of globose shape.—Fig. 47. Various stages, a–h, in repetitional development of globose microconidia.—Fig. 48. Empty microconidia, a–h, each with a denuded sterigma.—Fig. 49. Somewhat elongated microconidia, a–l.—Fig. 50. Elongated microconidia, a–e, showing various stages of repetitional development.—Fig. 51, 52. Microconidia germinating by emission of a germ tube.—Fig. 53. Conidium that after initiating microspore development produced a secondary conidium. (*s*, surface of agar substratum.)

some germinating by emission of a germ hypha, others producing another globose conidium on a broad cylindrical outgrowth, and still others giving rise to several (2–15) microconidia on the tips of radially projecting sterigmata; sterigmata colorless, usually 3–7 μ long and 1.8–3 μ wide; microconidia subspherical or elongate ellipsoidal, minutely papillate at the base, mostly 7–15 μ long, 6–11 μ wide, germinating by a germ hypha or giving rise to another microconidium on a sterigma commonly 2.5–6 μ long and 1.4–2 μ wide.

Isolated from decaying plant material collected in Fort Wayne, Indiana, on November 21, 1954, as well as from similar material collected in Chicago, Illinois, on November 16, 1954, and near Park Falls, Wisconsin, on November 18, 1954.

In comparison with other members of its genus *Conidiobolus polytocus* seems a species of approximately median dimensions. Usually the hyphae (fig. 1) at the advancing margin of a mycelium actively growing in a Petri plate of maize-meal agar measure 6–7 μ in width. Several hundred microns backward many hyphal segments are 6–9 μ in transverse diameter. Lateral branches, as in related forms, are generally narrower, while hyphae constained to grow in substratum that has long been occupied by mycelium of the fungus may measure only 2 μ in width (fig. 2).

Conidiophores usually develop early and abundantly in cultures of *Conidiobolus polytocus*. Whether they arise from hyphal segments near the surface (fig. 3) or from more deeply submerged segments (fig. 4–9), their phototropic aerial terminations are generally short and noticeably inflated. After the full-grown conidium has become delimited proximally by a dome-shaped partition (fig. 4) it springs off forcibly through sudden eversion of its basal membrane. Soon numerous detached conidia are found strewn about on the substratum, some of them in their unchanged papillate form (fig. 10, a–p), others with a short (fig. 11–14) or a somewhat longer (fig. 15, 16) outgrowth by means of which production of a secondary conidium is being (fig. 11) or has been (fig. 12–16) accomplished, and still others actively germinating by emission of an assimilative hypha (fig. 17, 18).

The reproductive apparatus of *Conidiobolus polytocus* rather commonly shows certain peculiarities reminiscent of *C. firmipilleus* Drechsler (1953b). Even when the fungus is grown on a culture medium low in nutrients many of its conidiophores will retain some protoplasm after the conidium has sprung off (fig. 6, 8, 9). The remnant of granular material usually collects in the terminal portion of the conidiophore, which then is delimited proximally to form a segment of bizarre shape (fig. 19–23). In instances where no protoplasm is retained the empty membrane of the conidiophore soon begins to evanesce (fig. 24, a–c), except for the distal wall, which, as in *C. firmipilleus*, commonly remains visible for days (fig. 25, a–j).

On rich substrata many conidiophores after producing a first conidium may grow out laterally to produce a second (fig. 26–28). A considerable quantity of protoplasm may remain in the terminations of some richly nourished conidiophores even after two (fig. 29–31) or three (fig. 32) conidia have sprung off. Instead of taking place successively plural development of conidia may proceed simultaneously on conidiophores that from the beginning were bifurcate (fig. 33) or trifurcate (fig. 34) or terminated in four short branches (fig. 35). Rather similar plural production of conidia was observed by Couch in *C. brefeldianus*.

All my isolations of *Conidiobolus polytocus* have produced microconidia far more promptly and more abundantly than any isolation of *Delacroixia coronata*, *C. brefeldianus* or *C. chlamydosporus* I have hitherto examined; the specific epithet given to the fungus—from πολυτοκος meaning "bringing forth many young ones"—being intended to signalize its unusual prolificness. In an early stage of multiplicative sporulation the parent condium shows several warty protuberances (fig. 36–39). Each protuberance, after elongating a few microns, forms a terminal swelling (fig. 40) that continues to expand until the conidium has been depleted of protoplasmic contents. A dome-shaped wall then is laid down to delimit the terminal enlargement (fig. 41), which thereupon springs off as a papillate microconidium through sudden eversion of its basal membrane. The empty conidial envelope with its bristling sterigmata (fig. 42–45) usually collapses soon afterwards.

Many of the microconidia borne directly on conidia of *Conidiobolus polytocus* are of subspherical shape and have an average diameter of about 8.5 μ (fig. 41). However, a random assortment of microconidia (fig. 46, a–s) in a culture several day old will ordinarily include more than a few noticeably smaller specimens. These mostly result from repetitional development wherein an individual microconidium puts forth a narrow sterigma (fig. 47, a) on which is produced a secondary microconidium (fig. 47, b–h) that after being delimited proximally by a dome-shaped partition springs off through eversion of its basal wall, leaving behind the empty envelope of its parent (fig. 48, a–h). Somewhat elongated microconidia (fig. 49, a–l) intermingled with the subspherical ones in varying proportion display similar readiness for repetitional development (fig. 50, a–e). On the moist surface of a newly poured agar plate microconidia commonly germinate by putting forth a vegetative hypha (fig. 51, 52) capable of growing into an extensive mycelium.

The reasons why some detached conidia embark on repetitional development while others nearby engage in multiplicative sporulation have not been

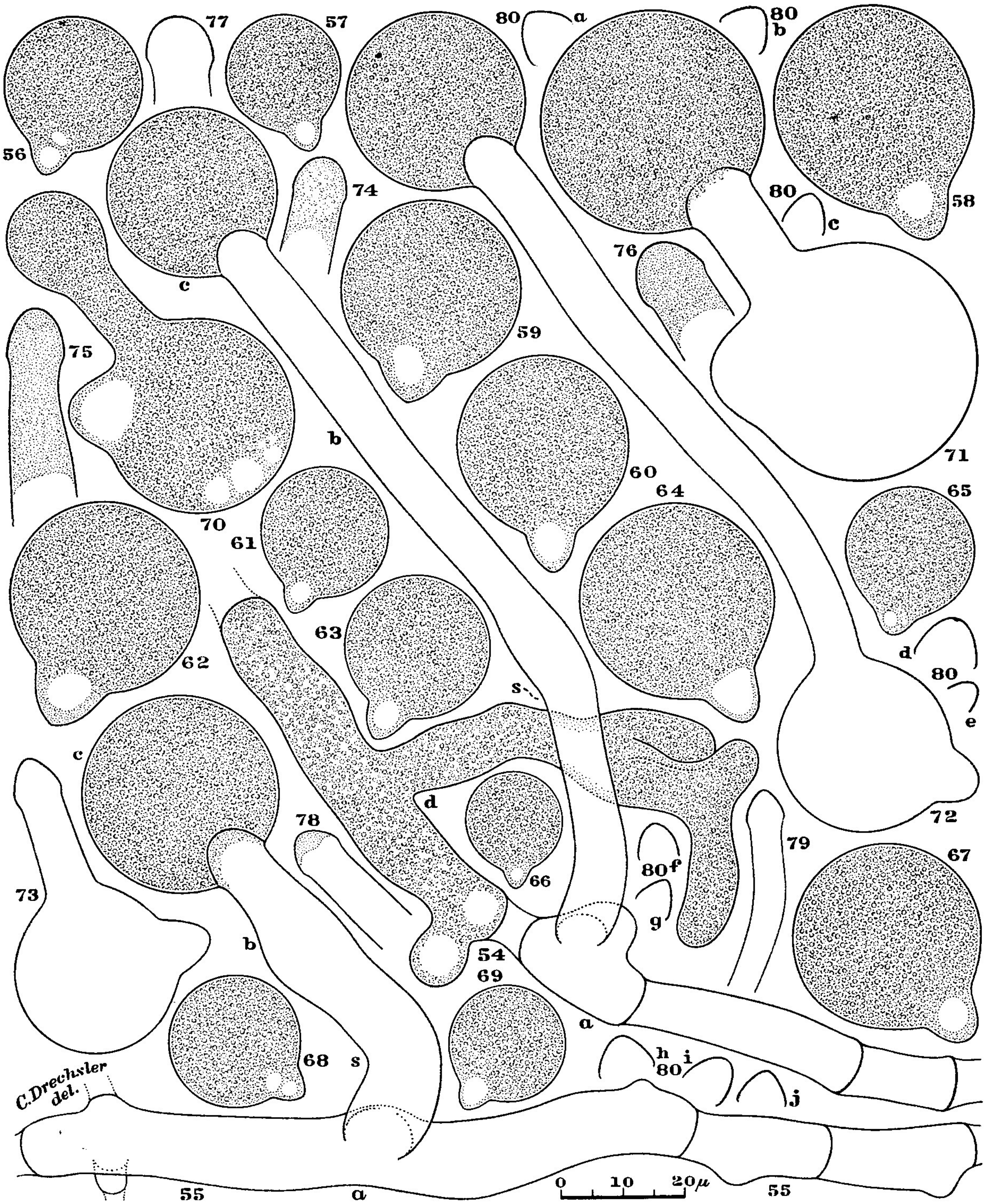

Fig. 54–80. *Conidiobolus chlamydosporus* as found in maize-meal-agar cultures; ×1000.—Fig. 54. Empty hyphal segment, *a*, with conidiophore, *b*, bearing a conidium, *c*; *d*, branched neighboring hyphal segment.—Fig. 55. Empty hyphal segment, *a*, with conidiophore, *b*, bearing a conidium *c*.—Fig.56–69. Detached conidia showing usual variations in size and shape.—Fig. 70–73. Conidia showing stages in repetitional development.—Fig. 74–76. Denuded conidiophore terminations retaining some protoplasm.—Fig. 77–79. Empty conidiophore terminations.—Fig. 80. Persistent conidiophore caps, a–j. (*s*, surface of agar substratum.)

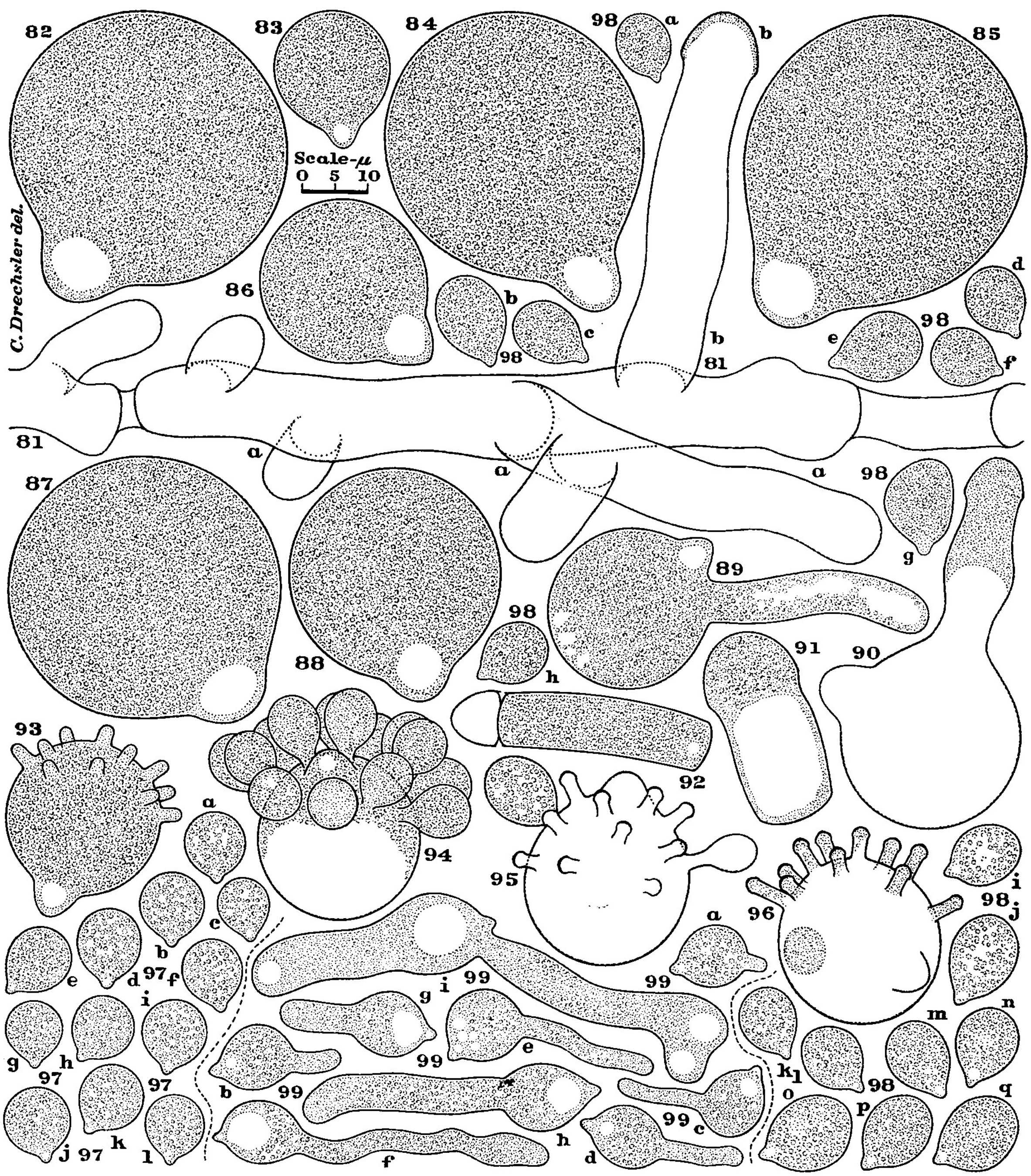

Fig. 81–99. *Conidiobolus chlamydosporus* as found in Lima-bean-agar plate cultures; ×1000.—Fig. 81. Empty hyphal segment, *a*, with empty denuded conidiophore, *b*.—Fig. 82–38. Detached conidia showing variations in size and shape.—Fig. 89. Conidium germinating by emission of a germ tube.—Fig. 90. Empty conidium that has produced a secondary conidium.—Fig. 91, 92. Conidiophore terminations with residual protoplasm collected in a terminal and a substerminal cell, respectively.—Fig. 93. Conidium in early stage of multiplicative development.—Fig. 94. Conidium with 14 young microconidia.—Fig. 95. Empty conidial envelope with 9 denuded sterigmata and a tenth sterigma still supporting a microconidium.—Fig. 96. Conidial envelope with 11 denuded sterigmata.—Fig. 97. Detached microconidia, a–l, of globose shape.—Fig. 98. Detached microconidia, a–q, of somewhat elongated form.—Fig. 99. Microconidia, a–i, germinating by emission of one or two germ tubes.

determined. In some instances a conidium that had put forth warty protuberances preparatory to production of microconidia later changed its course of development and gave rise instead to a secondary conidium (fig. 53). The difference in environal conditions whereby the production of conidia is favored here and the production of microconidia is favored there is perhaps not well displayed in the non-porous substance of a shallow Petri-plate culture. From their resemblance to the homologous small primary conidia of the nematode parasite *Meristacrum asterospermum* Drechsler (1940) it seems probable that the microspores serve mainly in disseminating the fungus through the innumerable interstices in deposits of decaying plant materials, while the more forcibly propelled conidia serve better to spread the fungus on the roomy surfaces.

Conidiobolus polytocus differs from *C. firmipilleus* in its generally smaller dimensions. In *C. polytocus* the projecting phototropic portion of conidiophore is short and markedly inflated, while in *C. firmipilleus* the corresponding portion is relatively long and without pronounced enlargement. As no strain of *C. polytocus* has so far been found to produce zygospores or other durable resting spores the species seems readily distinguishable from *C. brefeldianus,* which nearly always forms zygospores in abundance.

2. Conidiobolus **chlamydosporus** Drechsler sp. nov.[4]

Inconspicuous when growing on substrata poor in nutrients, but on rich substrata forming somewhat copious aerial growth conspicuous to the naked eye; mycelium colorless, assimilative hyphae branched, 2–20 μ (mostly 6–12 μ) wide, early divided by cross-walls, here and there soon becoming disjointed or emptied, the resulting segments mostly 20–125 μ long, but the terminal segment commonly 125–500 μ long; conidiophores colorless, extending 40–500 μ or more into the air toward the main source of light, 4–13 μ wide, commonly bearing a single conidium; conidia colorless, globose, mostly 15–45 μ in greatest width, 18–50 μ in length inclusive of a basal papilla 3–8 μ high and 4–13 μ wide, in some instances producing 2–20 microconidia on radially projecting sterigmata; sterigmata mostly 3–7 μ long, 1.7–2.3 μ wide, microconidia colorless, globose or elongate ellipsoidal, 8–11 μ in greatest width, 10–16 μ in length inclusive of a basal papilla 1–2 μ high; chlamydospores colorless, formed intercalarily in segments of assimilative hyphae and rather rarely in denuded conidiophores, mostly subspherical or elongate ellipsoidal or barrel-shaped, commonly 15–35 μ long and 8–29 μ wide.

Isolated from decaying plant material collected near Park Falls, Wisconsin, on November 18, 1954.

Conidiobolus chlamydosporus is a robust fungus rather similar in its large dimensions to *Delacroixia coronata.* In Petri-plate cultures about one day old the conidiophores (fig. 54, b; 55, b; 81, b) arising singly from individual hyphal segments (fig. 54, a; 55, a; 81, a) at the center of a young mycelium commonly extend only 40–100 μ into the air. As the mycelium expands over a rich substratum like lima-bean agar the conidiophores pushed up near the advancing margin are likewise relatively short, but those produced in the older sporulating region grow to increasingly greater heights before forming conidia. Accordingly after 5 days a large central area may be covered with a whitish mantle composed of conidiophores 100–500 μ long or even longer. Such conspicuous aerial development is not often observed in cultures of related species. Under the microscope the conidiophores appear commonly of cylindrical shape without pronounced outward modification, thereby resembling more especially the conidiophores of *C. firmipilleus* and *D. coronata.*

Shortly after they have been delimited from the conidiophores by a dome-shaped partition, the globose conidia (fig. 54, c; 55, c) spring off through eversion of the basal membrane. In their generally subspherical shape as also in the hemispherical or conoid shape of the basal papilla (fig. 56–69, 82–88) they resemble the conidia of *Conidiobolus polytocus* and *C. firmipilleus,* but they usually attain greater size. On the moist surface of a fresh agar substratum they germinate readily by putting forth a vegetative hypha (fig. 89). Under somewhat drier conditions they commonly extend a broad aerial conidiophorous outgrowth (fig. 70–72) that gives rise terminally to a secondary globose conidum. After the secondary conidium has sprung off, the denuded outgrowth (fig. 73, 90), like the denuded conidiophore of mycelial origin (fig. 74–79; 81, b), shows a distinctive profile in which the junction between convex distal wall and tubular membrane appears smoothly rounded rather than abruptly angular. In many instances denuded conidiophorous outgrowths (fig. 90) or denuded conidiophores

[4] In materiis macris saepius vix visibilis sed in materiis feracibus vulgo in aerem aliquid copiose crescens itaque oculo nudo conspicuus; mycelio incolorato; hyphis sterilibus ramosis, 2–20 μ (plerumque 6–12 μ) latis, mox septatis, postea hic illic disjunctis vel inanitis, cellulis eorum plerumque 20–125 μ longis sed cellula terminali vulgo 125–500 μ longa; hyphis fertilibus incoloratis, 4–13 μ crassis, in aerem 40–500 μ ad lucem protendentibus, globosis sed basi papilla 3–8 μ alta et 4–13 μ lata praeditis, ex toto plerumque 18–50 μ longis, 15–45 μ latis, nunc hypham germinationis emittentibus nunc aliud conidium gignantibus nunc 2–20 microconidia in apicibus sterigmatum ferentibus; sterigmatibus plerumque 3–7 μ longis, 1.7–2.3 μ latis; microconidiis incoloratis, globosis vel elongato-ellipsoideis, basi papilla 1–2 μ alta praeditis, ex toto plerumque 10–16 μ longis, 8–11 μ latis; chlamydosporis in hyphis mycelii rarius in hyphis fertilibus oriundis, incoloratis, vulgo intercalaribus, plerumque globosis vel elongato-ellipsoideis vel dolioformibus, 15–35 μ longis, 8–29 μ latis.

Habitat in materiis plantarum putrescentibus prope Park Falls, Wisconsin.

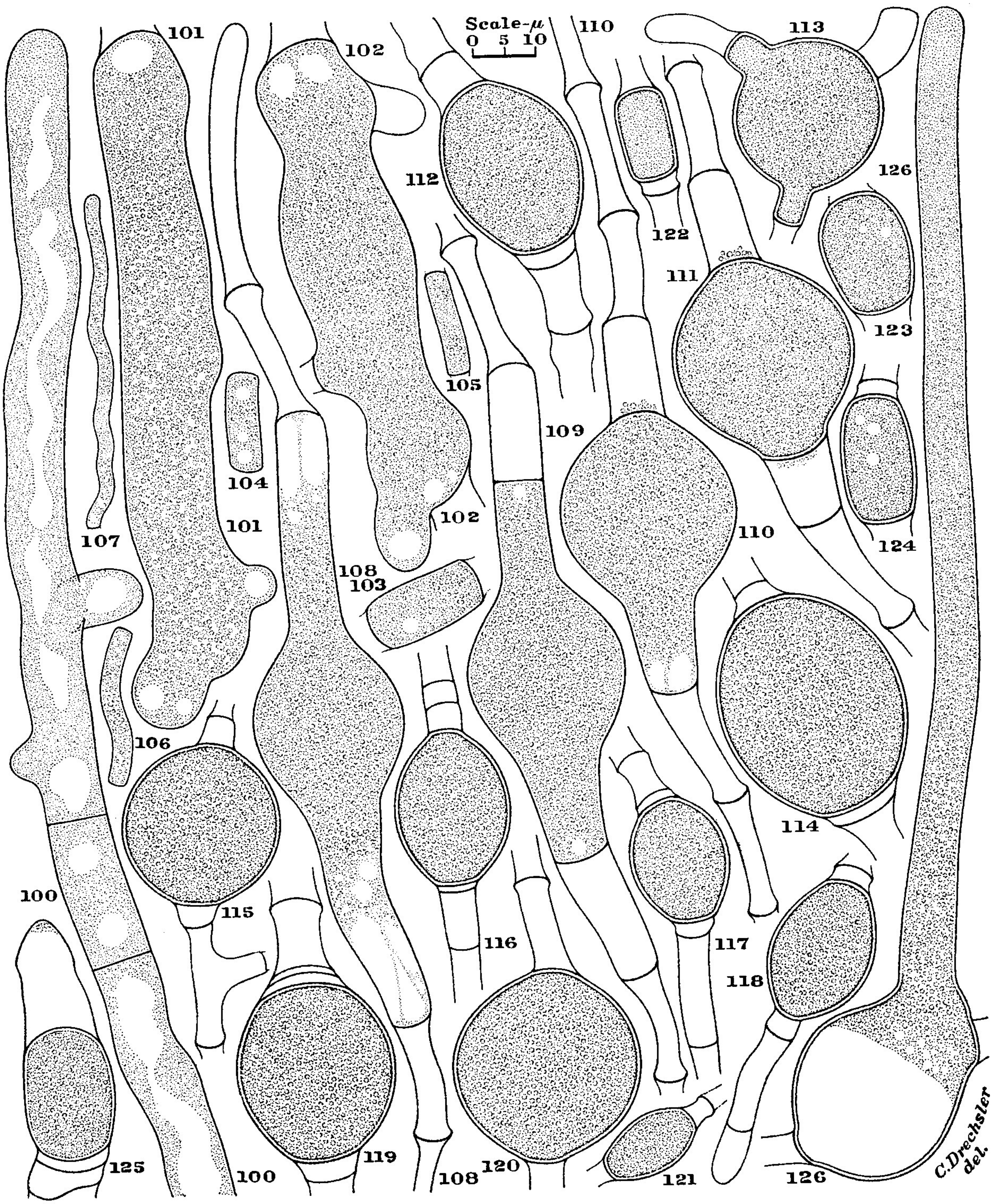

Fig. 100–126. *Conidiobolus chlamydosporus* as found in maize-meal-agar cultures; ×1000.—Fig. 100. Terminal portion of hypha at margin of an actively growing mycelium.—Fig. 101, 102. Wide intercalary hyphal segments.—Fig. 103–107. Relatively small hyphal segments.—Fig. 108–111. Successive stages observed in formation of a chlamydospore.—Fig. 112–124. Chlamydospores with contiguous portions of parent hyphal segments, showing usual variations in size and shape.—Fig. 125. Chlamydospore formed in a denuded conidiophore termination.—Fig. 126. Chlamydospore extending a broad germ hypha in a culture 15 days old.

(fig. 74–76) retain some protoplasmic contents. Very commonly this residual protoplasm, just as in *C. polytocus* and *C. firmipilleus,* becomes walled off to form a terminal (fig. 91) or subterminal cell (fig. 92). The tubular envelopes of empty conidiophores usually soon collapse and evanesce except for the dome-shaped distal wall, which, again as in *C. polytocus* and *C. firmipilleus,* generally remains visible for days as a hemispherical or conoidal cap (fig. 80, a–j).

Production of microconidia takes place about as sparingly in *Conidiobolus chlamydosporus* as in *Delacroixia coronata.* Conidia from which sterigmata are growing out (fig. 93), or on which microconidia are developing (fig. 94), can usually be found sparsely distributed in cultures 5–10 days old. Empty or nearly empty conidial envelopes bristling with sterigmata mostly (fig. 95) or wholly denuded (fig. 96) are less usually seen in their original globose shape than in a badly collapsed state. Many microconidia are subspherical (fig. 97, a–l) like the parent conidia, but an equal or possibly somewhat larger number are of more elongated conformation (fig. 98, a–q). The globose individuals vary commonly between 9 and 10 μ in transverse diameter, thus appearing about 1 μ broader than those originating directly from conidia of *C. polytocus.* On a moist agar surface they germinate promptly by extending one or two assimilative hyphae (fig. 99, a–i). If the substratum is already occupied by the fungus the germ hyphae usually elongate as narrow unbranched filaments (fig. 99, a–f), whereas on fresh substratum they soon widen out (fig. 99, g-i) to form an extensively branched mycelium.

The elongating hyphae at the forefront of an actively growing mycelium terminate in a segment usually measuring 200–500 μ in length and 7–10 μ in width, although here and there distal segments only 125 μ long (fig. 100) can be found. Segments mostly 50–125 μ long that are cut off proximally from the terminal cell may later widen rather markedly (fig. 101, 102) and, in addition, may put forth one or more short branches (fig. 54, d; 81, a). In older cultures some short narrow cells (fig. 103–106) are formed from remnants of protoplasm apparently left isolated in branches given off by axial segments. Aging cultures further contain numerous segments only about 2.5 μ wide (fig. 107) which have originated mostly as germ hyphae extended from conidia or microconidia into substratum already occupied by mycelium of the fungus.

While many of the larger hyphal segments soon yield up their granular contents in giving rise to single conidiophores and conidia, many others withdraw their protoplasm progressively from both ends to form a chlamydospore near the middle (fig. 108–111). As the movement of granular material proceeds, retaining walls are laid down at intervals to mark successive stages in the evacuation of the tubular parts. Chlamydospores formed in relatively young mycelium are usually of subspherical or elongated ellipsoidal shape (fig. 111–121). Those formed in older hyphal segments (fig. 122–124) or from cells originating from protoplasm left in denuded conidiophores (fig. 125) include commonly a considerable proportion of cylindrical and barrel-shaped individuals. In my cultures most chlamydospores germinated within 15 days after they were formed, each extending straightforward a rather wide unbranched filamentous hypha (fig. 126), which in many instances elongated slopingly to the surface of the agar and then grew slantwise several hundred microns into the air.

Although the chlamydospores here show little distinctiveness of outward form or internal organization, their early and abundant production at temperatures near 20° C. ordinarily prevailing in laboratories is a feature so unusual among the readily cultivable Entomophthoraceae that the epithet applied to the species would seem appropriately descriptive. Chlamydospores are produced also by *Conidiobolus adiaeretus* Drechsler (1953a) but in that species their development proceeds slowly and preferably at low temperatures. In *C. lachnodes* Drechsler (1955b) rather small chlamydospores are formed at usual indoor temperatures, though only somewhat tardily and sparingly. Chlamydospores of even smaller size appear very tardily in some cultures of *C. rhysosporus* Drechsler (1954), their development evidently not supplanting sexual reproduction, as zygospores are formed early and abundantly in that species.

SUMMARY

Two readily cultivable entomophthoraceous fungi isolated from plant materials undergoing slow decay in contact with the moist ground are described as new species of *Conidiobolus. Conidiobolus polytocus,* a species of moderate dimensions obtained from Indiana, Illinois and Wisconsin, is distinguished especially by early and abundant production of microconidia on sterigmata borne radially on its globose conidia. *Conidiobolus chlamydosporus,* a more robust form from northern Wisconsin, likewise gives rise to microconidia. It further appears notable for its somewhat conspicuous aerial development when growing on rich substrata, and for its copious production of chlamydospores. The microconidia of both new species are considered homologous with zoospores of the Oomycetes and with sporangiospores of the Mucorales.

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LITERATURE CITED

Costantin, J. 1897. Sur une Entomophthorée nouvelle. Bull. Soc. Mycol. France 13: 38–43.

Couch, J. N. 1939. A new *Conidiobolus* with sexual reproduction. Amer. Jour. Bot. 26: 119–130.

Drechsler, C. 1940. Three fungi destructive to free-living terricolous nematodes. Jour. Washington (D.C.) Acad. Sci. 30: 240–254.

———. 1946. A nematode-destroying phycomycete forming immotile spores in aerial evacuation tubes. Bull. Torrey Bot. Club 73: 1–17.

———. 1953a. Three new species of *Conidiobolus* isolated from leaf mold. Jour. Washington (D.C.) Acad. Sci. 43: 29–43.

———. 1953b. Two new species of *Conidiobolus* occurring in leaf mold. Amer. Jour. Bot. 40: 104–115.

———. 1954. Two species of *Conidiobolus* with minutely ridged zygospores. Amer. Jour. Bot. 41: 567–575.

———. 1955a. A southern *Basidiobolus* forming many sporangia from globose and from elongated adhesive conidia. Jour. Washington (D.C.) Acad. Sci. 45: 49–56.

———. 1955b. Three new species of *Conidiobolus* isolated from decaying plant detritus. Amer. Jour. Bot. 42: 437–443.

Gallaud, I. 1905. Études sur une Entomophthorée saprophyte. Ann. Sci. Nat. Bot. IX. 1: 101–134.

Kevorkian, A. G. 1937. Studies in the Entomophthoraceae. Jour. Agric. Univ. Puerto Rico 21: 191–200.

Saccardo, P. A., and P. Sydow. 1899. *Delacroixia* Sacc. et Syd. Sylloge Fungorum 14: 457. Patavii.

Thaxter, R. 1888. The Entomophthoraceae of the United States. Mem. Boston Soc. Nat. Hist. 4: 133–201.