

## A Slender-Spored *Dactylella* Parasitic on *Pythium* Oospores

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### SUMMARY

A mucedinaceous fungus obtained from leaf mold gathered in an oak wood in central Maryland was found actively parasitic on mature oospores in maize-meal-agar plate cultures of *Pythium irregulare* sensu Matthews non Buisman, *P. debaryanum* Hesse, and *P. ultimum* Trow. The fungus is newly described as *Dactylella stenomeces*. The assimilative hyphae intruded into an oospore usually remain indiscernible until the protoplasmic contents have been largely absorbed, though softening of

the spore wall early becomes manifest in undulate deformation of the normally spherical outer contour. Hyphae also invade myxobacterial cysts abundantly by intruding assimilative branches that always remain clearly visible among the degenerating bacteria surrounding them. Conidia, 55-170  $\mu$  long, 2.5-3.2  $\mu$  wide, and divided by 8-22 cross-walls, are borne on conidiophores 10-50  $\mu$  long and 2.5-4  $\mu$  wide.

**INTRODUCTION.**—There is reason to believe that the most important biological agents tending to reduce the longevity of species of *Pythium* and *Phytophthora* in the soil are the mucedinaceous fungi of the sort that often make their appearance spontaneously as destructive parasites of mature oospores in aging petri-plate cultures prepared for the isolation of pathogenic phycomycetes from softened or discolored portions of stems or roots. Fungi of this sort also develop rather consistently, and in a like parasitic role, in maize-meal-agar cultures which after having been overgrown in a pure state by *P. ultimum* Trow, for example, were further inoculated with small portions of plant detritus that had undergone prolonged decay on the ground. Destruction of oospores usually ensues after addition of only 20 or 25 mg of detritus gathered at random in field or forest. Thus, the parasites seem widely and thoroughly distributed. Although a parasitic mycelium may not appear until 1 or 2 weeks after detritus has been added to a plate culture, it spreads slowly for many weeks. Its steady advance is not visibly hindered by pronounced staling and in many instances is not seriously retarded by the presence of alien microorganisms. Such persistent advance in petri-plate cultures might well imply capability for similar parasitic development in the soil, not only during wet intervals, but also during periods of moderate or even deficient rainfall.

Thus, mucedinaceous parasites can be obtained in large quantity and perhaps also in large number, but they are for the most part not readily distinguished. With the exception of the furcate-spored fungus I assigned (2) to *Trinacrium subtile* Riess ex Fres. (6) and of a *Fusarium*-like species I described (2) as *Dactylella spermatophaga*, they produce few conidia. In many sets of petri-plate cultures, the fungus parasites remain sterile. Conidial apparatus, arising from oospore-destroying mycelia, permitted recognition of 5 species: *Trichothecium arrhenopum* (3), *T. polycytonum* (4), *Dactylella helminthodes* (4), *D. anisomeres* (5), and *D. stenocrepis* (5). A descriptive account is given here of another hyphomycete, likewise found

subsisting mainly through the destruction of mature oospores.

**MATERIALS AND METHODS.**—A maize-meal-agar plate culture was inoculated with *P. irregulare* sensu Matthews (7) non Buisman (1) on July 25, 1962; and was completely overgrown with mycelium 2 days later. The culture then was planted with fine detritus sifted from leaf mold newly gathered in an oak (*Quercus* spp.) wood near the Plant Industry Station. On September 20, 1962, destruction of oospores was observed in an extensive region adjoining one of the detritus deposits. In an area of about 10 mm<sup>2</sup>, the mycelium attacking the oospores was found provided with conidiophores and conidia different from any previously noted in a fungus of similar biological relation. During each of the 4 ensuing days, a separate portion of the scanty conidial apparatus was studied under a microscope fitted with an apochromatic water-immersion objective. For ready comparison, all drawings (Fig. 1) were made at a magnification used earlier in dealing with allied species. Conidia were drawn in sufficient number to provide for random selection. Two of the 4 portions of sporulating material then were placed in separate positions on a maize-meal-agar plate culture of *P. ultimum*. The 2 remaining portions were transferred similarly to a maize-meal-agar plate culture of *P. debaryanum* Hesse. All cultures were kept under an inverted battery jar to prevent excessive loss of water.

**RESULTS.**—After 10 days, scattered oospores near each portion of transferred material were found invaded by the mucedinaceous fungus. Expansion of the several areas of attack proceeded steadily during the following 2 months, without, however, any attendant production of conidiophores and conidia. There was no renewed development of conidial apparatus in the petri-plate culture in which the parasite was first observed.

The fungus resembles *Dactylella helminthodes* more closely than any other of the 7 hyphomycetes earlier set forth as habitually parasitizing oospores, but is distinguished from that species by its much longer conidia.

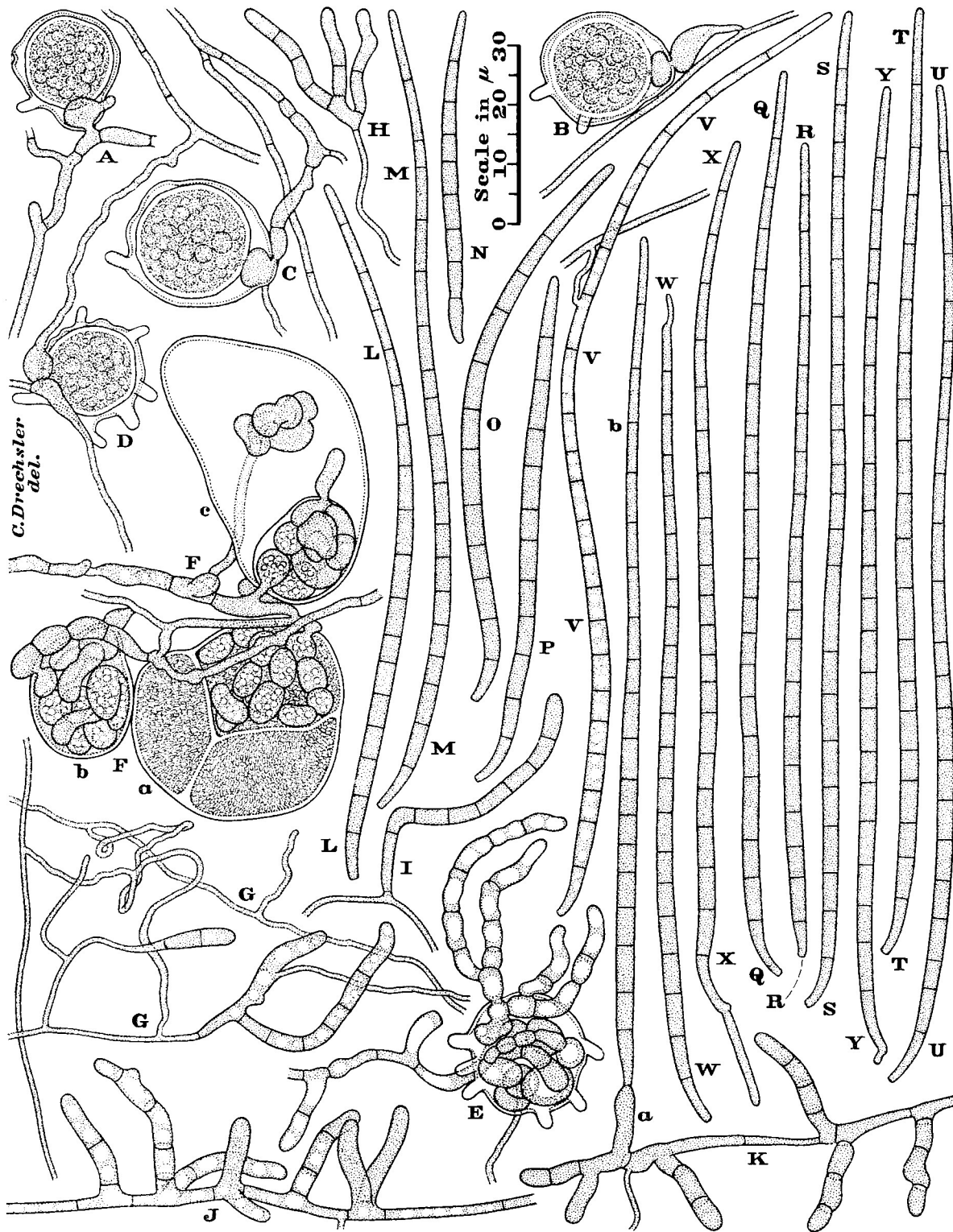


Fig. 1. *Dactylella stenomeces*. ( $\times 1,000$ .) A-D) Portions of mycelium, each with an invaded oospore of *Pythium irregulare* sensu Matthews. E) Infected oospore with emerging conidiophores. F) Three invaded myxobacterial cysts, a-c. G-J) Portions of mycelium with 1 or more conidiophores. K) Prostrate hypha with several conidiophores; a, conidiophore with conidium, b. L-U) Detached conidia. V-Y) Germinating conidia.

Its long conidia together with its relatively short conidiophores distinguish the fungus also from the several species of *Dactylella* subsisting through capture of nematodes and rhizopods. A term meaning "narrow and long" may accordingly serve as an appropriate epithet in describing the fungus as a new member of the genus.

*Dactylella stenomeces* sp. nov.

Mycelium aliquid exiguum, inconspicuum; hyphae steriles ramosae, modice septatae, vulgo 0.8-3 $\mu$  latae, ex parte maxima incoloratae sed prope bases hypharum fertilius saepe aliquantulum fumagineae, hic illic appressoria ad oogonia et oosporas Pythiorum vel ad alia corpora perdurantia apponentes, tum ramos assumentes intus evolventes; appressoria clavata vel globosa, saepius 3-7 $\mu$  crassa; rami assumentes in nonnullis cellulis globosis vel ellipsoideis, plerumque 3-12 $\mu$  longis et 2-7 $\mu$  latis, vulgo constantes. Hyphae fertiles erectae vel acclivae, rectae vel saepius pravae, vulgo aliquanto fumagineae, primo saepe simplices et interdum continuatae sed postea vulgo septatae et plus minusve ramosae, plerumque 10-50 $\mu$  longae et 2.5-4 $\mu$  latae. Conidia incolorata vel interdum forsitan dilutissime fumaginea, filiformia, vulgo plus minusve curvata, saepius 25-40 $\mu$  super basin crassissima, sursum et deorsum leniter attenuata, basi rotundo-truncata, apice rotundata, plerumque 8-22 septata, 55-170 $\mu$  longa, 2.5-3.2 $\mu$  lata.

Oosporas Pythiorum (*P. ultimi*, *P. debaryani*, *P. irregularis* sensu Matthews) atque corpora perdurantia myxobacterialia (forsitan speciei *Polyangii*) enecans habitat in foliis arborum putrescentibus prope Beltsville, Maryland. Typus: Figura 1.

Mycelium somewhat scanty, inconspicuous; sterile hyphae branched, moderately septate, mostly 0.8-3 $\mu$  wide, largely colorless, but near the bases of conidiophores often somewhat smoky, here and there forming appressoria in contact with oogonia and oospores of *Pythium* species or with other durable bodies and inside them producing assimilative branches; appressoria club-shaped or globose, mostly 3-7 $\mu$  wide; assimilative branches commonly composed of several globose or ellipsoidal cells that are mostly 3-12 $\mu$  long and 2-7 $\mu$  wide. Conidiophores erect or sloping, straight or crooked, commonly somewhat smoky, at first often simple and sometimes continuous, but later commonly septate and branched in varying measure, mostly 10-50 $\mu$  long and 2.5-4 $\mu$  wide. Conidia colorless or of a faint smoky tinge, filiform, commonly more or less curved, often widest 25-40 $\mu$  above the base, thence gradually tapering upward and downward, slightly rounded at the base and fully rounded at the tip, mostly containing 8-22 cross-walls, 55-170 $\mu$  long and 2.5-3.2 $\mu$  in greatest width.

DISCUSSION.—The hyphae formed by *Dactylella stenomeces* on or very near the surface of a maize-meal-agar plate culture are mostly 1-3 $\mu$  wide, whereas submerged hyphae commonly are 0.8-1 $\mu$ . When one of the stouter hyphae encounters a *Pythium* oogonium containing a mature oospore, it often pushes an infection-tube through the oogonial envelope without under-

going much outward modification (Fig. 1-A). The more delicate submerged hyphae usually form a recognizable appressorium before they penetrate (Fig. 1-B). An expanded lobe is ordinarily produced within the oogonial chamber before penetration of the oospore wall takes place (Fig. 1-A-C). The assimilative branches, soon intruded into the oospore, are at first invisible under bright-field illumination, though some obvious effects of invasion become manifest in a disorderly globuliferous texture of the spore contents as well as in an irregularly undulous deformation of the softened wall (Fig. 1-A-D). After the oospore has been largely expropriated of its digestible substance, the cellular make-up of the assimilative branches becomes visible (Fig. 1-E).

By way of contrast, the assimilative branches intruded by *D. stenomeces* into myxobacterial cysts, often abundantly present in cultures earlier planted with leaf mold, are always distinctly visible as invasion proceeds (Fig. 1-F. a). During early stages of development, their component cells show a variable number of globules distributed through otherwise nearly homogeneous protoplasm. After the bacteria in an invaded cyst chamber have faded from sight, the globules gradually disappear. With continued withdrawal of fungus materials into the external mycelium, the contents of the assimilative segments become more and more attenuated (Fig. 1-F, b, c).

The rather short conidiophores of *D. stenomeces* arise haphazardly, sometimes from an assimilative branch (Fig. 1-E), but more often from mycelial hyphae (Fig. 1-G-K). They are, on the whole, vaguely demarcated from the underlying mycelium. In respect to coarseness, coloration, and posture, many of them merge gradually with the prostrate hyphae from which they have originated. They give rise at the tip (Fig. 1-K, a) to a single conidium (Fig. 1-K, b). Geniculation of the longer conidiophores suggests production of plural conidia following successive elongation. Detached conidia (Fig. 1-L-U) may germinate, on moist agar substratum, by germ tubes from middle (Fig. 1-V), apical (Fig. 1-W), or basal segments (Fig. 1-X, Y). As in related oospore-destroying fungi, germ tubes readily anastomose with mycelial hyphae (Fig. 1-V).

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