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SCYTALIDIUM CIRCINATUM SP. NOV., A HYPHOMYCETE FROM UTILITY POLES

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A long-term study of fungi involved in the colonization and decay of fumigated and non-fumigated utility poles in the eastern United States by the junior author and her associates yielded over 3000 isolates (**11**, **18**, **19**). The hyphomycete *Scytalidium lignicola* Pesante was one of the more commonly encountered species from pre- and post-fumigated poles (**18**). A second hyphomycete, isolated from only two southern pine and two Douglas-fir poles, resembled *S. lignicola* in producing hyaline arthroconidia and dematiaceous chlamydospores but differed from that species by its fertile hyphae which are distinctly curved, reminiscent of some species of *Malbranchea* Sacc., and by its colonial morphology.

Detailed isolation procedures described in Wang *et al.* (**18**) are briefly summarized. Two increment cores were removed from the groundline zone of each test pole and core positions designated as: 1) outer-treated; 2) inner-treated; 3) treated-untreated interface; and 4) untreated. Three percent male extract agar (MEA) (30 g Difco malt extract, 15 g agar, 1 liter distilled water) containing 50 μg/ml tetracycline was used for isolation of microfungi. The description is based on cultures grown on 2.5% MEA (without antibiotics) and potato dextrose agar (PDA) (Difco), and on slide-culture preparations using 10% Pablum cereal agar (CER) (**13**) and MEA. Colony colors are according to Kornerup and Wanscher (**9**). To test resistance to benomyl and cycloheximide, the strains were grown on modified Melin-Norkrans (MMN) (**10**) and on MMN amended with 2 ppm benomyl, and on Mycosel agar (BBL) containing 400 μg/ml cycloheximide.

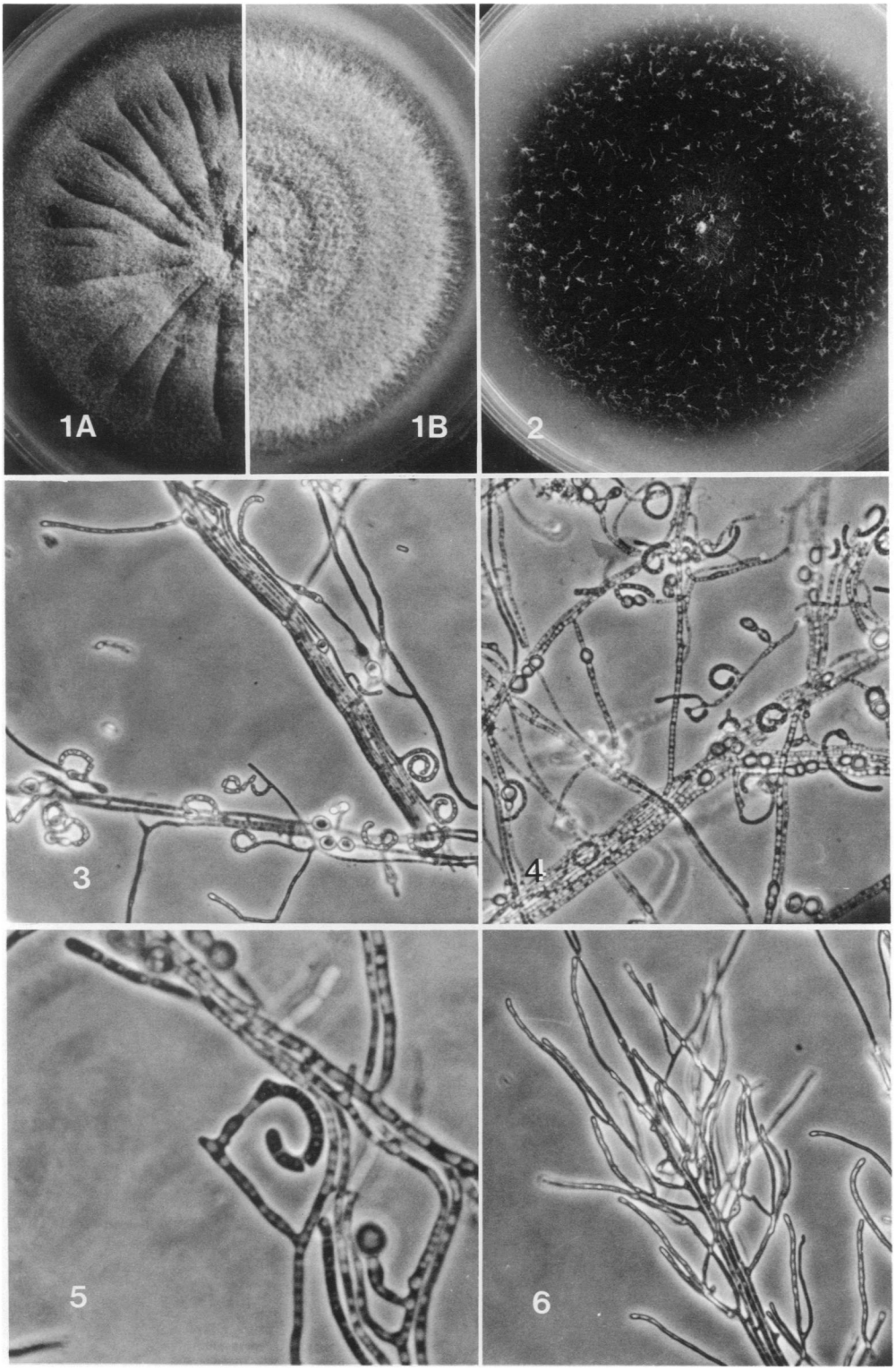
Scytalidium circinatum Sigler *et* Wang, *sp. nov.* FIGS. 1–10

Coloniae in agaro ad 25 C, post 21 dies 68–80 mm attingentes, planae vel sulcatae, glabrae cum cristis albis sparsisque vel similes coacti vel lanosae, griseolae vel theobrominae, pars reversa theobromina vel atra. Incrementum tardum ad 37 C. Hyphae septatae, hyalinae vel subhyalinae, conidiophora absunt. Hyphae fertiles arcuatae vel circinatae vel rectae, 1.5–2.5 μm crassae, hyalinae, septa in basipetalo ex ordine occurrentia. Arthroconidia hyalina, non-septata, schizolytica, dehiscentia, in basipetalo ex ordine vel temere occurrentia; ex hyphis curvatis quadrata vel curvata, 2.2–4 × 1.5–2.5 μm, ex hyphis rectis cylindrica, 3–9.5 × 1.5–2.5 μm. Chlamydosporae magnitudine et forma variae, primum pallidae postea brunneae, solitariae vel catenulas intercalares formantes, omnis cellula 4–9 longa × 3–9 μm lata, saepe in limo brunneo. Teleomorphosis ignota est.

HOLOTYPUS: Colonia exsiccata ex UAMH 6380, isolata e parte extrinsecus tractata partis internae incrementi stipitis creosoto-tractati pinus, 54 annos aetate, Chester, New Jersey, C. J. K. Wang, VIII-85.

The type specimen, the ex-type culture and other isolates are deposited in the University of Alberta Microfungus Collection and Herbarium (UAMH). An isotype specimen and living culture are deposited in the National Mycological Herbarium (DAOM 211379), and living subcultures deposited at ATCC (66464) and CBS (654.89).

Colonies on PDA and MEA (FIGS. 1, 2) reaching 68–80 mm diam in 21 days at 25 C; on PDA flat with scarcely distinct zones, or sulcate, felty or lanose, pale to dark grey (5C1-6D/E3) or dark brown (6F8); reverse dark brown (6F8) to black; on MEA flat with sparse white tufts of aerial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mycelium; surface mycelium dark chocolate brown (6F8) to black; no diffusing pigment. Growth at 37 C on PDA restricted with strains attaining 6–23 mm diam by 21 days. All strains sensitive to benomyl at 2 ppm and to cycloheximide at 400 μg/ml.

Hyphae septate, hyaline to subhyaline, 2–4 μm wide. Conidiophores lacking. Conidiogenous cells in the form of smooth, hyaline, fertile hyphae, irregularly arising from the main hyphae, usually curved but also straight, becoming septate in basipetal succession, and later producing arthroconidia by schizolytic dehiscence in basipetal order or randomly (FIGS. 3–7). Arthroconidia hyaline, non-septate, square or short-cylindrical and often slightly curved when formed from the curved hyphae, 2.2–4 × 1.5–2.5 μm; cylindrical when formed from straight hyphae, 3–9 × 1.5–2.5 μm, without connectives or disjunctors. Regions of the vegetative hyphae becoming thick-walled, up to 1 μm thick, and enlarging to form globose, lobed or irregularly shaped brown cells, solitary or in chains, mostly intercalary, individual cells measuring 4–9 μm × 3–9 μm, often surrounded by brown slime in old cultures (FIGS. 8–10).

CULTURES STUDIED: UAMH 6377 (EP-84), from the inner-treated zone of an increment core, taken about 15 cm below groundline, of a creosote-treated, 45-year-old southern pine pole, Vestal, Broome Co., New York, VII-85; UAMH 6378 (ED-162), from outer-treated position of an increment core, taken about 15 cm below groundline, of a chromated copper arsenate (CCA)-treated, 10-year-old Douglas-fir pole (#146), Ithaca, Tompkins Co., New York, VII-85; UAMH 6379 (ED-174), from inner-untreated portion of the same increment core as above pole (#146) (= ATCC 66463 = CBS 655.89); UAMH 6380 (P-1013), 6381 (P-1014), 6382 (P-1018), from the outer-treated position of an increment core collected at groundline zone of a creosote-treated, 54-year-old southern pine pole (fumigated with Vapam in 1979), Chester, New Jersey, VII-85; ED-187, from outer zone of an increment core, taken about 15 cm below groundline, of a badly decayed, CCA-treated Douglas-fir pole (#149), Ithaca, Tompkins Co., New York, VII-85.

These cultures were isolated mostly from the outer treated zone of increment cores from poles at the groundline or below the groundline. Data from previous research (**18**, **20**) suggest that *S. circinatum* is a soil fungus. Its soft rot capabilities are being tested.

Pesante (**14**) established *Scytalidium* for the single species, *S. lignicola* [as *lignicolum*], growing together with *Haplaria ochracea* Pesante on decaying *Platanus* wood. On the wood, *S. lignicola* grew predominantly in the form of dematiaceous intercalary conidia, but on agar media formed conidia of two types: dematiaceous intercalary conidia which Pesante called chlamydoconidia and bacilliform hyaline conidia which he called conidia vera. As defined by Pesante, the form-genus *Scytalidium* was based on two synanamorphs, and it is noteworthy that he accommodated the genus in the Dematiaceae. Two other species microscopically identical to *S. lignicola* are *S. album* Beyer & Kingstrom and *S. aurantiacum* Klingstrom & Beyer (**8**). Like *S. lignicola,* these species occur commonly on utility poles or pulpwood and have been differentiated on the basis of thermotolerance and colonial pigmentation. Independent investigations by us of a large number of isolates have shown that these distinctions are not well supported and that both species should be treated as synonyms of *S. lignicola.*

Because the form-genus *Scytalidium* was based on the co-occurrence of two anamorphs, there have been some conflicting interpretations of which morph is most representative. Sigler and Carmichael (**15**, **16**) added several species which differed from *S. lignicola* in producing only dematiaceous arthroconidia. They based their decision in part on Ellis's (**4**) description and illustration, and in part on examination of the ex-type culture (UAMH 1502) and one other isolate of *S. lignicola* in which the dematiaceous intercalary conidia were a prominent feature. Subsequent examination of a larger sample of *S. lignicola* isolates has shown that the hyaline arthroconidial synanamorph is the most distinct and stable. Production of the dematiaceous conidia is variable in different strains and on different agar media.

Scytalidium circinatum resembles *S. lignicola*

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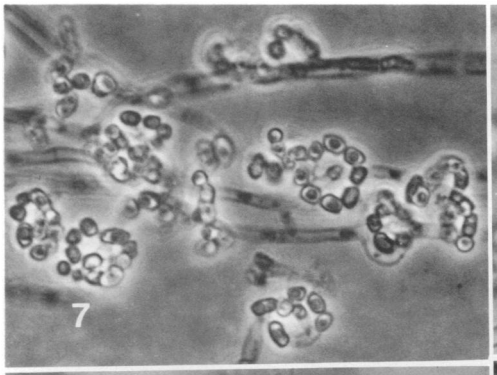
FIGS. 1–6. *Scytalidium circinatum.* (1A, UAMH 6381; 1B, 2, 6379; 3–6, 6380.) 1, 2. Three-week-old colonies at 25 C; A, B on PDA; 2 on MEA; all ×1.0. 3–6. Vegetative hyphae bearing curved and straight fertile hyphae and forming terminal and intercalary, irregularly shaped, dematiaceous chlamydospores. 3, 4, 6, ×460; 5, ×1120.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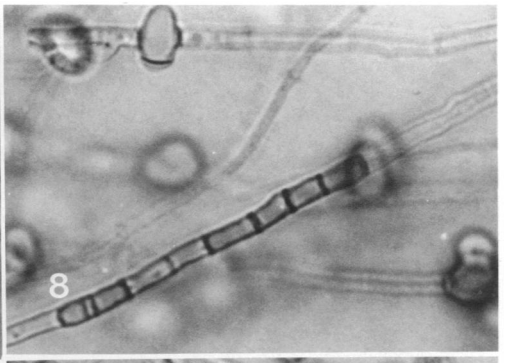
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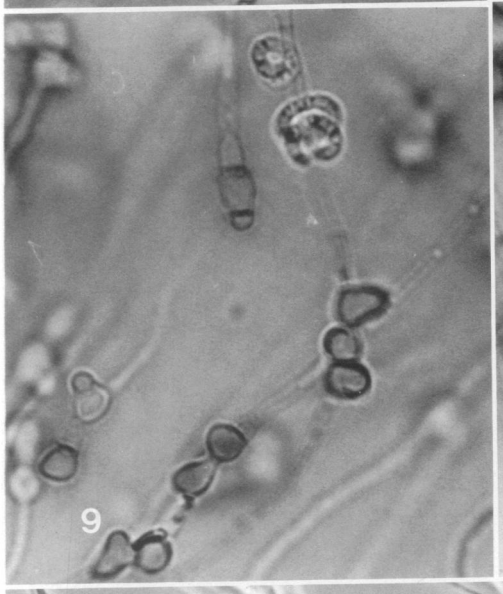
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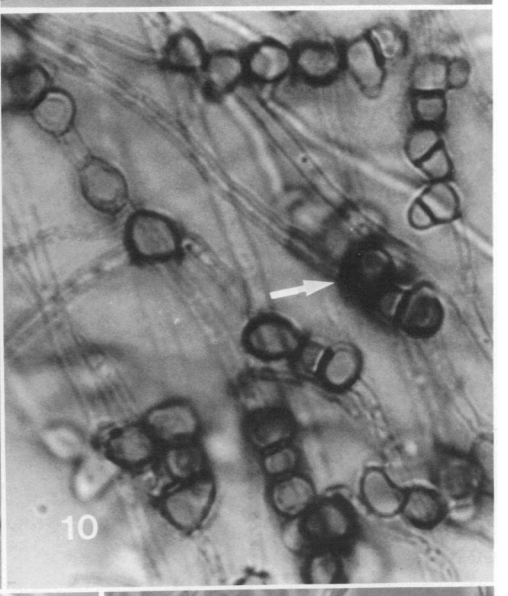
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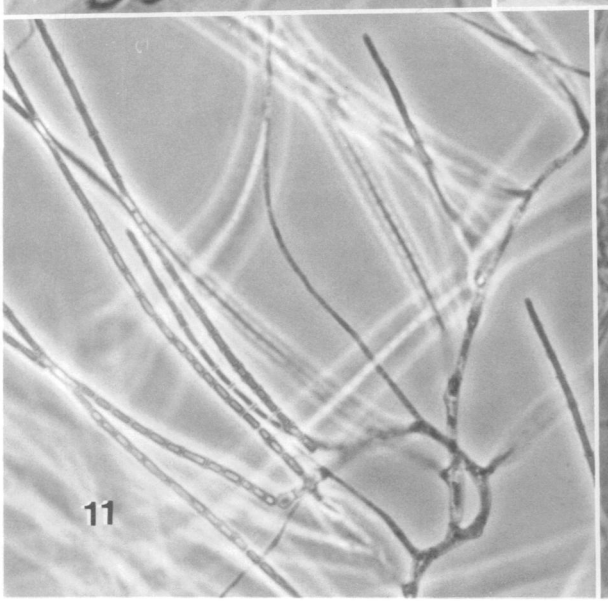
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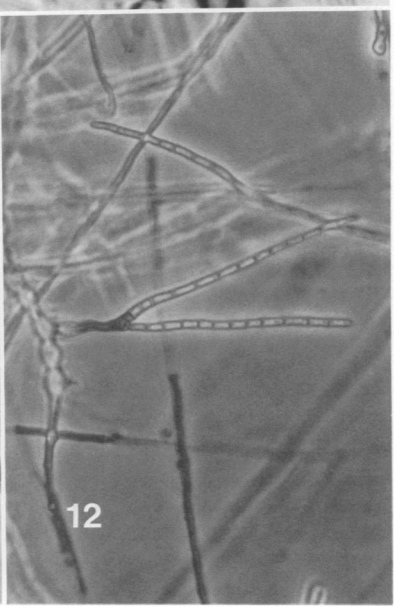
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in its habitat on wood, especially on wood treated with preservatives, and in its conidium development, but can be distinguished by the curved fertile hyphae and the colonial morphology. Colonies of *S. circinatum* are dark grey to chocolate brown on all media within 3 weeks and lack diffusing pigment (FIGS. 1, 2). Depending upon the abundance of dematiaceous conidia produced, colonies of *S. lignicola* vary from dark grey or black to off-white, dull to greyish yellow or light grey (3B3/4). Most isolates produce an intense yellow diffusing pigment but production of the pigment varies from medium to medium. In both species, the hyaline arthroconidia are borne from narrow, usually unbranched, fertile hyphae which arise as lateral branches directly from the vegetative mycelium. The main distinguishing feature is the propensity of the fertile hyphae to become curved in *S. circinatum* (FIGS. 3–5), whereas the fertile hyphae of *S. lignicola* are straight, usually unbranched (FIG. 11), and occasionally arise from a short conidiophore (FIG. 12).

The hyaline, uniformly narrow, fertile hyphae and arthroconidia (2.5 μm or less in width) distinguish these species from the *Scytalidium* anamorph of *Hendersonula toruloidea* in which the hyphae vary greatly in width and color (**12**, **16**). Hyphae range from 2.5–10 μm broad, whereas arthroconidia measure 2.5–7 μm, sometimes rounding up to 10–16 μm, and the color varies from hyaline or subhyaline to brown (**12**, **16**). Further, some of the vegetative hyphae are verrucose to tuberculate, especially in isolates which develop fewer arthroconidia and fail to produce pycnidia in culture (**12**). Despite these differences, Sutton and Dyko (**17**) recently proposed synonymy of *S. lignicola* with the *Scytalidium* anamorph of *H. toruloidea* which they named *S. dimidiatum* (Penz.) Sutton & Dyko. However, they provided no arguments for synonymy, and do not appear to have examined type material or living cultures of *S. lignicola.*

A second feature which distinguishes *S. lignicola* and *S. circinatum* from *S. dimidiatum* and most other species currently accommodated in the genus is the swelling and subsequent melanization of intercalary and terminal regions of the vegetative hyphae (FIGS. 8–10). These dematiaceous structures are not readily detached but detached cells may be found in tease mounts and separation occurs by fracture of the thin-walled adjacent cells. They are solitary or remain connected in short chains and may bear a remnant of wall material from the adjacent cell. While their ontogeny can be considered thallic, their indehiscence suggests that Sigler and Carmichael (**16**) were misguided in considering them to be arthroconidia. Indeed, Pesante (**14**) called them chlamydoconidia. Problems in application of the term chlamydospore have been noted by Hughes (**7**) and El-Ani (**3**), but the term is in widespread use for these types of indehiscent cells, and no alternative term has yet been proposed.

The situation in *Scytalidium* appears analogous to *Verticillium* Nees which accommodates several species having darkly pigmented chlamydosporic synanamorphs. Some of the species had originally been placed in *Diheterospora* Kamyschko based on presence of both the phialidic and chlamydosporic morphs, but current practice is to recognize the phialidic morph as the most stable and prominent (*e.g.*, **2**, **5**). Carmichael (**1**) has argued that anamorph genera should be based on only a single anatomic form. *Scytalidium* now includes forms producing strictly dematiaceous arthroconidia, forms producing strictly hyaline arthroconidia, and forms having two synanamorphs, and is in need of reassessment. Proposals for revision of the genus will be outlined in a second contribution by the senior author.

Oidiodendron scytaloides Gams & Soderstrom (**6**), described as a common species in soil of coniferous forests, differs from *S. circinatum* by its slow growth rate, erect pigmented conidiophores and arthroconidia joined by narrow connectives. Further the pigmented chlamydospores are commonly lateral or terminal rather than predominantly intercalary.

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FIGS. 7–10. *Scytalidium circinatum.* (7, 10, ED-187; 8, 9, UAMH 6377.) 7. Arthroconidia arising by schizolytic dehiscence of curved fertile hyphae, ×1000. 8, 9. Melanization and subsequent enlargement of regions of the vegetative hyphae to form irregularly shaped chlamydospores, ×1000. 10. Chlamydospores often surrounded by brown slime (arrow), ×1000. FIGS. 11, 12. *Scytalidium lignicola.* (11, UAMH 4831; 12, 6292.) Straight, usually unbranched fertile hyphae arising from the vegetative hyphae or from short conidiophores, ×610.

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Key Words: *Scytalidium circinatum, Scytalidium lignicola, Hendersonula toruloidea,* utility poles, arthroconidia, chlamydospores

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