

MYCOLOGY

REVISION OF THE GENUS *OEDOCEPHALUM*  
(FUNGI IMPERFECTI)

BY

J. A. STALPERS

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SUMMARY

The species described in *Oedocephalum* are revised. The genus *Oedocephalum* is redefined as comprising only the imperfect states of ascomycetes; similar imperfect states of basidiomycetes are excluded. The genus *Sphondylocephalum* is proposed for *Oedocephalum verticillatum* Thaxter. A key to the species is provided.

The genus *Oedocephalum* has generally been used for hyphomycetes with blastoconidia formed synchronously on the swollen heads of conidiophores. Since PREUSS (1851) erected the genus *Oedocephalum*, 43 species, 1 subspecies, 1 variety and 1 form have been described. Originally the genus comprised conidial states of Pezizales, but this concept has sometimes been broadened considerably, since species belonging to the Mucorales were intentionally included (MOREAU, 1913). The reverse has also taken place: several ascomycetous species have been described in the zygomycetous genus *Rhopalomyces*, because the conidiogenous cell was more or less areolate. Further, some *Aspergillus*-like species and some conidial states of basidiomycetes have also been placed in *Oedocephalum*.

This study was started in order to find out whether the convergence between the conidial states of ascomycetes and basidiomycetes was as complete as it has been reported to be, and resulted in a revision of all the species described in *Oedocephalum*. No attempt was made to include all known oedocephaloid conidial states in the Pezizales (BERTHET, 1964; PADEN, 1972).

The cultures were grown on neutral malt-agar, the capitalized colour names refer to RIDGWAY (1912). Petri dishes were inoculated at approx. 1 cm from the margin. "Plate covered" means a colony radius of  $7.5 \pm 1$  cm.

The ascomycetous and the basidiomycetous "parts" of *Oedocephalum* proved to be easily distinguishable on the basis of morphological characters.

In the ascomycetous group the conidiophore is septate and usually simple, abruptly swollen into a globose to obovoidal vesicle which is covered all over with conidia and remains warted after conidium secession

(warts 0.2–1.5  $\mu\text{m}$  long). It is in most cases separated by a septum. The conidia are usually coloured in mass. Growth on malt-agar is very rapid to moderately rapid, a petri dish being covered in 1–3 (–4) weeks; on cherry-decoct-agar or acidified malt-agar (pH= 4) no or little growth occurs.

In the basidiomycetous group, in contrast, the conidiophore is often aseptate and branched, widens gradually towards the apex which is denticulate after conidium detachment (denticles 1.5–4 (–7)  $\mu\text{m}$  long). The conidiogenous part is never separated by a septum. The conidia are white in mass. Growth on malt-agar is moderately rapid to slow, a petri dish being covered in (2–)3 to more than 6 weeks; on cherry-agar and acidified malt-agar growth is similar and sometimes even faster.

For these reasons the genus *Oedocephalum* is restricted to ascomycetous species. The genus *Spiniger* is described to accommodate the basidiomycetous species (STALPERS, 1974).

## OEDOCEPHALUM Preuss

*Oedocephalum* Preuss in *Linnaea* 24: 131. 1851.

Type species: *O. elegans* Preuss

Ascigerous state: *Peziza*, *Iodophanus*.

Growth on malt-agar rapid or moderately rapid, colonies covering the petri dish in 1–3(–4) weeks at room temperature. Colonies appressed, hyaline, later locally whitish or with some orange colouration in the cottony aerial mycelium. Conidiophores usually formed after 4–10 days, scattered or dense, at first whitish-hyaline, later usually coloured (Pale Ochraceous, Fawn Colour, Orient Pink, Light Salmon Orange). No distinct odour, reverse not coloured. Submerged hyphae hyaline, usually thin-walled, sometimes with barrel-shaped cells up to 25  $\mu\text{m}$  wide. Conidiophores erect, usually solitary, simple or more rarely branched, hyaline, rarely slightly pigmented, septate (the number of septa depending on the age rather than on the length of the conidiophore), with thin or thickened walls, sometimes tapering towards the apex, terminating in a globose to obovoidal vesicle, often separated by a septum. Vesicle covered with conidia, after conidium detachment warted or minutely denticulate. Conidia one-celled, hyaline, usually coloured in mass, smooth to distinctly warty. In some cultures solitary blastoconidia are rarely formed directly on hyphae.

On the natural substrate the mycelial mat is effused, tufted to densely arranged and mealy.

Substrate: dung, decaying vegetable matter, wood.

Three groups of species can be distinguished within the genus:

### 1. Sectio *Oedocephalum*

Typus: *O. elegans*

Conidia warty, particularly at the base and apex, ochraceous to fawn coloured in mass (not known with certainty in the case of *O. album*). Perfect states in *Peziza*. Species: *O. album*, *O. argillaceum*, *O. elegans* and *O. pallidum*.

2. Sectio **Glomerulosa** sect. nov.

Conidia levia vel minute aspera, agglomerata rosea. Typus: *O. glomerulosum*. Conidia smooth to minutely roughened, pinkish in mass (not known with certainty in the case of *O. macrosporum*). In culture globose to barrel-shaped cells are often found in the agar. Perfect states (only known from *O. glomerulosum*) in *Iodophanus*. Species: *O. glomerulosum*, *O. macrosporum*, *O. nicotianae*.

3. Sectio **Cristallina** sect. nov.

Conidia magna, levia, guttulam magnam continentia. Typus: *O. cristallinum*. Conidia larger, smooth, with a large vacuole, conidiophores rather thick-walled, often pigmented; conidiogenous cell coarsely warted. Perfect state unknown. Species: *O. cristallinum*.

KEY TO THE SPECIES

- |  |                            |
|--|----------------------------|
| 1a. Conidia distinctly warty, especially at the base and apex . . . . .  | 2                          |
| 1b. Conidia smooth or minutely roughened . . . . .   | 5                          |
| 2a. Conidia subglobose to obovoidal, 18-24 × 15-20 μm  | <i>O. album</i> (4)        |
| 2b. Conidia ellipsoidal to cylindrical, up to 7 μm broad . . . . .   | 3                          |
| 3a. Conidia (4-)5.5-7.5(-11) × 3-4 μm; usually on dung. . . . .  | <i>O. pallidum</i> (3)     |
| 3b. Conidia at least 8 μm long; usually on wood . . . . .  | 4                          |
| 4a. Conidia 8-14 × (3-)3.5-5 μm, distinctly warty, but warts never longer than 0.3 μm . . . . .  | <i>O. elegans</i> (1)      |
| 4b. Conidia 13-16.5 × 5-7 μm, warts apically and basally to 2 μm long . . . . .  | <i>O. argillaceum</i> (2)  |
| 5a. Conidia smooth, with a large central vacuole, 34-44 × 16-19 μm; conidiophore after conidium detachment coarsely warted, often somewhat pigmented . . . . . | <i>O. cristallinum</i> (8) |
| 5b. Conidia smooth to minutely roughened, without large vacuole; conidiophore after conidium detachment with small scars, hyaline . . . . .                    | 6                          |
| 6a. Conidia globose to broadly ellipsoidal, 6.3-10 × 6.3-9 μm . . . . .  | <i>O. nicotianae</i> (7)   |
| 6b. Conidia obovoidal to cylindrical, at least 11 μm long . . . . .  | 7                          |
| 7a. Conidia obovoidal to ellipsoidal or subcylindrical, 11-28 μm long; conidiophores up to 500 μm tall . . . . .   | <i>O. glomerulosum</i> (5) |
| 7b. Conidia narrowly ellipsoidal to cylindrical, 27-38(-49) μm long; conidiophores 800-1500 μm tall. . . . .   | <i>O. macrosporum</i> (6)  |

1. *Oedocephalum elegans* Preuss (Fig. 1, e-g; Plate I, 2)

*Oedocephalum elegans* Preuss in *Linnaea* 24: 131. 1851.

*Oedocephalum griseobrunneum* Jaap in *Verh. bot. Ver. Prov. Brandenb.* 58: 36. 1916.

Ascigerous state: *Peziza echinospora* Karst. (= *P. anthracophila* Dennis).

Colonies growing rapidly on malt-agar, covering the petri dish in 2 weeks at room temperature, appressed, later with some cottony white aerial mycelium locally. Submerged hyphae hyaline, thin-walled, to 10  $\mu\text{m}$  wide, septate, cells shorter than 100  $\mu\text{m}$ . Conidiophores arising on immersed mycelium and aerial mycelium, erect, solitary (or rarely with 2 originating from the same cell), simple or rarely branched, hyaline, septate, to 320  $\mu\text{m}$  tall and 6–10  $\mu\text{m}$  wide, often somewhat tapering towards the apex, usually terminating in a subglobose to obovoidal vesicle, 18–30  $\mu\text{m}$  wide, rarely proliferating apically and forming a new conidiogenous vesicle or vesicles. Conidia ellipsoidal to subcylindrical, hyaline, ochraceous to brownish in mass, warty, warts largest at the ends, (6–)7–13  $\times$  3.5–4.5(–5)  $\mu\text{m}$ .

Colonies on the natural substrate effuse, later forming a dense mat, pulverulent, at first whitish to cream, becoming ochraceous to yellowish brown to greyish brown. Sterile hyphae 6–15  $\mu\text{m}$  wide, cells 15–60  $\mu\text{m}$  long. Conidiophores 9–15  $\mu\text{m}$  wide, conidiogenous vesicle 25–40  $\mu\text{m}$  wide, bearing more than 100 conidia, collapsing after conidium detachment. Conidia 8–12(–14)  $\times$  (3–)3.5–5  $\mu\text{m}$ .

*Substrate*: decorticated, often burnt wood.

*Material examined*:

Herbarium specimens.

*Oedocephalum elegans*, holotype, on decorticated branch of *Malus*, Hoyerswerda; leg. G. T. Preuss (B).

*Oedocephalum griseobrunneum*, holotype, on decayed burnt branch of *Betula alba*, Triglitz, Germany, 15-III-1915; leg. O. Jaap (B).

Living strains:

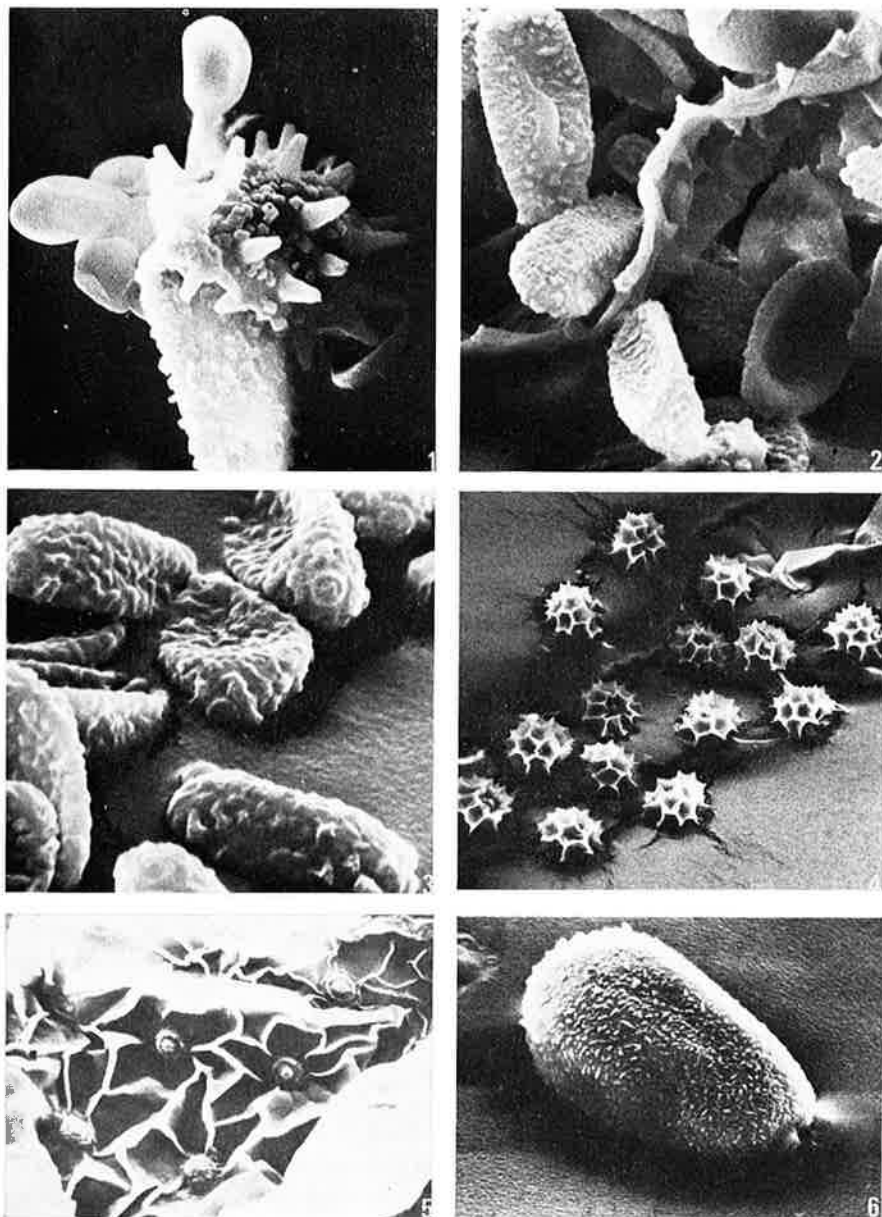
CBS 266.64=IMI 104,308 as conidial state of *Peziza anthracophila* from burnt soil, isolated by J. Webster.

*Discussion*

*O. elegans*, the first of the three species originally described by PREUSS, is generally accepted as the type of the genus. HARZ (1871), SACCARDO (1886) and CLEMENTS and SHEAR (1931) regarded it as a synonym of *Sporocephalum glomerulosum* which therefore became the type species. Only THAXTER (1891) doubted this synonymy and a study of the type specimen confirmed his suspicion.

*Peziza echinospora* Karst. is the perfect state of *O. elegans*. The

PLATE I



1, *Spiniger meineckellus*, conidiogenous structure. 2, *Oedocephalum elegans*, conidiogenous structures and conidia. 3, *Oedocephalum pallidum*, conidia. 4, *Sphondylocephalum verticillatum*, conidia. 5, *Oedocephalum glomerulosum*, conidiogenous warts. 6, *Oedocephalum glomerulosum*, conidium. All scanning micrographs, 3300 $\times$ , except 3 (6600 $\times$ ).

descriptions given by BERTHET (1964) and WEBSTER et al. (1964) of the conidial state of *P. echinospora* agree with *O. elegans*. WEBSTER's ascospore culture is still fertile and has been utilized in the above description. WEBSTER found the conidial state of *P. echinospora* on charred wood in a field and gave a similar description. *P. praetervisa* Bres., which in the perfect state is clearly distinct from *P. echinospora*, has similar conidia, but they are, however, somewhat narrower (3.5–4  $\mu\text{m}$ ), only slightly roughened, and contain one or two guttules (absent in the conidia of *P. echinospora*) (BERTHET, 1964).

## 2. *Oedocephalum argillaceum* Malençon (Fig. 2, h)

*Oedocephalum argillaceum* Malençon in Bull. Soc. Hist. nat. Afr. Nord 44: 140. 1953 [as "*argilaceum*"].

Ascigerous state: unknown.

On the natural substrate forming a continuous mat, somewhat mealy, Ochraceous Buff to Cinnamon Buff. Sterile hyphae hyaline, thin-walled, septate, to 10  $\mu\text{m}$  wide, easily collapsing, septa sometimes with a central thickening. Conidiophores erect, solitary, thin-walled, simple, with 4–7 septa, 450–800  $\mu\text{m}$  tall, 10–15  $\mu\text{m}$  wide at the base, often tapering towards the terminal vesicle. Conidiogenous vesicle obovoidal, rarely globose, 40–60  $\times$  35–52  $\mu\text{m}$ , not separated by a septum, bearing more than 100 conidia; after conidium detachment distinctly warty, warts to 1.5  $\mu\text{m}$  long. Conidia hyaline, covered with brownish granules which are distinctly larger at the ends (to 2  $\mu\text{m}$  long), ochraceous to brownish in mass, narrowly ellipsoidal, 12.5–15(–16)  $\times$  5.3–6.3(–6.5)  $\mu\text{m}$ .

Substrate: dead and living wood.

### *Material examined:*

*Oedocephalum argillaceum*, holotype, on not decayed branch, Moyen Atlas, Marocco; nr. 2370, leg. G. Malençon, April 1951.

Other collections: On *Paenonia*, Marocco, nr. 2704, leg. G. Malençon, 9-V-1954; on decayed plant material, Djebel Hebbri, Moyen Atlas, 1900 m, Marocco, nr. 4738, leg. G. Malençon, 2-IV-1963; all Herb. Crypt. Malençon.

### *Discussion*

*O. argillaceum* is distinguished from the other *Oedocephalum* species by the absence of a septum under the conidiogenous vesicle and the large size of the warts at the base and apex. It seems to be most closely related to *O. elegans*. Herbarium specimen nr. 4738 has the indication "Typus" on the packet but this is certainly incorrect because the specimen was collected 10 years after the publication of the diagnosis. The only specimen collected before 1954 is nr. 2370.

### 3. *Oedocephalum pallidum* (Berk. & Br.) Cost. (Fig. 1, a-d; Plate I, 3)

- Rhopalomyces pallidus* Berk. & Br. in Ann. Mag. nat. Hist., Ser. 2, 7: 96. 1851.  
 — *Oedocephalum pallidum* (Berk. & Br.) Cost. in Bull. Soc. bot. Fr. 33: 492. 1886.  
*Rhopalomyces candidus* Berk. & Br. in Ann. Mag. nat. Hist., Ser. 2, 7: 96. 1851.  
*Haplotrichum fimetarium* Riess apud Fres., Beitr. Mykol.: 105. 1863. —  
*Oedocephalum fimetarium* (Riess) Sacc. in Syll. Fung. 4: 48. 1886.  
*Rhopalomyces cervinus* Cooke in Grevillea 12: 27. 1883.  
*Oedocephalum vuilleminii* Sacc. in Syll. Fung. 11: 590. 1895.  
 ? *Oedocephalum ochraceum* Masee & Salmon in Ann. Bot. 16: 80. 1902.

Ascigerous state: *Peziza vesiculosa* Bull. ex St. Amans, Flore Agenaise: 534. 1821.

Colonies growing rapidly on malt-agar, covering the plate in 2 weeks at room temperature, appressed, hyaline, later with white, cottony aerial mycelium locally. After one week conidiophores are formed from the immersed hyphae as well as from the aerial mycelium, at first white, becoming Light Salmon Orange. Submerged hyphae hyaline, thin-walled, 1.5-4(-6)  $\mu\text{m}$  wide, cells 45-90  $\mu\text{m}$  long. Conidiophores erect, mostly solitary, hyaline, thin-walled, septate, 7-14  $\mu\text{m}$  wide and up to 200  $\mu\text{m}$  tall, terminating in a globose or subglobose vesicle, 17-25  $\mu\text{m}$  diam., usually bearing more than 100 conidia. Conidia hyaline, Light Salmon Pink in mass, warty, especially at the ends, ellipsoidal to subcylindrical, 5.5-7(-9.5)  $\times$  3-4  $\mu\text{m}$ . In the aerial mycelium intercalary swellings are sometimes formed on which a few conidia (up to 10) may originate. These are usually larger and less distinctly roughened than the typical conidia, 7.5-9.5  $\times$  3.5-4  $\mu\text{m}$ .

Colonies on the natural substrate effuse or forming a mealy mat, at first white, becoming Pale Ochraceous Buff to Pinkish Cinnamon to Fawn. Sterile hyphae thin- to somewhat thick-walled, 2-4  $\mu\text{m}$  wide. Conidiophores 6-13(-17)  $\mu\text{m}$  wide at the base, to 420  $\mu\text{m}$  tall, with 2-9 septa. Conidigenous vesicle 18-27  $\mu\text{m}$  wide, bearing more than 100 conidia. Conidia hyaline, Ochraceous Buff to Fawn in mass, ellipsoidal to subcylindrical, rarely obovoidal, (4-)5.5-7.5(-11)  $\times$  3-4  $\mu\text{m}$ .

Substrate: dung of various animals and decaying vegetable matter.

#### *Material examined:*

Herbarium specimens:

*Rhopalomyces pallidus*, holotype, on decayed Russian matting, Kings Cliff, England, 10-II-1848 (K).

*Rhopalomyces candidus*, holotype, on mixture of dung, earth and hops, Kings Cliff, England, 10-II-1848 (K).

*Haplotrichum fimetarium*, on horse dung, Leipzig, Germany, March 1875; leg. G. Winter (B).

*Rhopalomyces cervinus*, holotype, on cow dung; leg. M. C. Cooke (K).

*Oedocephalum fimetarium*, on matting, Geneva, New York, U.S.A., Juli 1927; leg. Y. K. Charles; ex herb. Petrak (M).

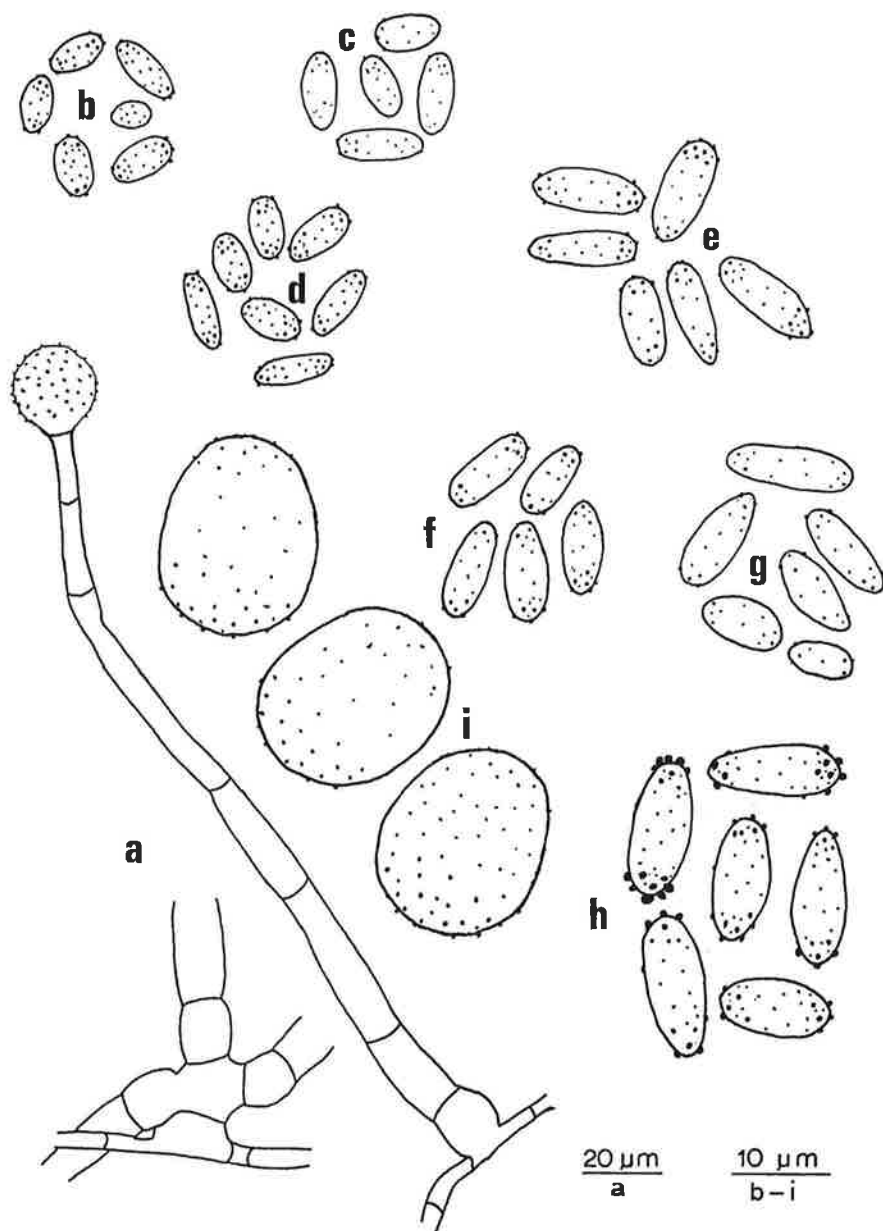


Fig. 1. Sectio *Oedocephalum*. a-d, *O. pallidum*; a, conidiogenous structures; b-d, conidia (b, coll. Y. K. Charles; c, type; d, CBS 748.68). e-g, *O. elegans*; conidia (e, type; f, type of *O. griseobrunneum*; g, CBS 748.68); h, *O. argillaceum*, conidia (type); i, *O. album*, conidia (type).

*Oedocephalum fimetarium*, on hare dung, Naardermeer, Netherlands, 17-V-1956; leg. C. Bas (L); on dung of horses and pigs, Bruxelles, Belgium; leg. É. Marchal (K).  
*Oedocephalum pallidum*, 3440 m, Laguna Negra, Venezuela, 1-VIII-1958; leg. R. W. G. Dennis (K).



*Oedocephalum spec.*, on paper on sheep dung, Elspeet, Netherlands, 31-III-1958;  
on sheep dung, Elspeet, Netherlands, 24-IV-1958; leg. J. van Brummelen (L).

Living strains:

CBS 748.68, isolated from deer dung by H. A. van der Aa.

CBS 884.68, isolated from soil by G. J. Bollen.

### Discussion

The type specimens of *Rhopalomyces candidus* and *R. cervinus* fall within *O. pallidum*. The type specimen of *O. ochraceum* was not available for study. The conidia are, according to the description, too small (i.e.  $4-5 \times 2 \mu\text{m}$ ) but in the remaining characters the "species" falls well within *O. pallidum*. MASSEE and SALMON (1902) state as another difference that the conidiophores of *O. pallidum* are distinctly narrowed towards the vesicle whilst those of *O. ochraceum* are not, but this character is variable within *O. pallidum* and little importance can consequently be attached to it. VUILLEMIN (1886) described the conidial state of *Aleuria asterigma*, a synonym of *Peziza vesiculosa*, and SACCARDO (1895) named it *O. vuilleminii*. *Peziza vesiculosa* is generally considered as the perfect state of *O. pallidum* (STEWART, 1927). In monospore cultures of *Peziza vesiculosa* a conidial state was obtained which agreed perfectly with *O. pallidum*. BREFELD (1891) described a conidial state of *P. cerea* Sow. ex Mérat which he stated to be indistinguishable from that of *P. vesiculosa*. BERTHET (1964), on the contrary, describes the conidia of *P. cerea* as smooth and mentions the conidial state of *P. echinospora* as the most closely related to it (see also under *O. elegans*).

The conidial state of *Peziza vesiculosa* (BREFELD, 1891; BERTHET, 1964) is very similar to those of *P. echinospora* and *P. praetervisa* and, to a lesser extent, to those of *P. micropus* with pyriform warty conidia, *P. violacea* with pyriform echinulate conidia and *P. cerea* with smooth ellipsoidal conidia (BERTHET, 1964; WEBSTER et al., 1964).

#### 4. *Oedocephalum album* Preuss (Fig. 1, i).

*Oedocephalum album* Preuss in *Linnaea* 24: 132. 1851.

Ascigerous state: unknown.

On the natural substrate whitish, effuse. Sterile hyphae thin-walled, hyaline, septate, much branched, short-celled. Conidiophores erect, solitary, simple, hyaline, thin-walled, septate, to  $300 \mu\text{m}$  tall and  $6-9 \mu\text{m}$  wide, terminating in a globose to ovoidal vesicle on which 20-50 conidia originate; vesicle finely warted after conidium detachment,  $28-43 \mu\text{m}$  wide. Conidia subglobose to slightly obovoidal, thin-walled, warty, warts at the apical (and sometimes also at the basal) end larger,  $18-24 \times 15-20 \mu\text{m}$ .

Substrate: decayed wood of *Pinus sylvestris*.

*Material examined:*

*Oedocephalum album*, type, on decayed wood of *Pinus sylvestris*, Hoyerswerda, Germany; leg. G. T. Preuss, nr. 1406 (B).

*Discussion*

The type specimen is in a rather poor condition, overgrown by a species of the Mucorales, and few conidiophores could be found. No other collection was traced. This species is characterized by its large, globose, and warty conidia. It is doubtful whether the colonies are always white. HARZ (1871) erroneously considered *O. album* to be a synonym of *O. glomerulosum*.

5. ***Oedocephalum glomerulosum*** (Bull. ex Chev.) Sacc. (Fig. 2, a-d; Plate I, 5-6).

*Mucor glomerulosus* Bull., Herb. Fr., p. 101. 1790. — *Botrytis glomerulosa* (Bull.) DC., Fl. Franç. 2: 71. 1805. — *Sporocephalum glomerulosum* (Bull.) ex Chev., Fl. Envir. Paris 1: 60. 1826. — *Botrytis glomerulosa* (Bull. ex Chev.) Fr., Syst. mycol. 3: 395. 1832. — *Oedocephalum glomerulosum* (Bull. ex Chev.) Sacc. in Syll. Fung. 4: 47. 1886.

*Oedocephalum roseum* Cooke in Grevillea 1: 184. 1873.

*Oedocephalum coprophilum* Kobayasi in Nagaoa 1: 8. 1952.

*Rhopalomyces minor* Windisch in Zentbl. Bakt. ParasitKde, Abt. 2, 113: 686. 1960.

?*Oedocephalum guadalcanalense* Matsushima, Microf. Solomon Is., Papua N. Guinea, p. 41. 1971.

Ascigerous state: *Iodophanus testaceus* (Mougeot ex Fr.) Korf *apud* Kimbrough & Korf in Am. J. Bot. 54: 19. 1967.

Colonies growing rapidly to very rapidly on malt-agar, covering a petri dish within 2 weeks at room temperature, appressed, hyaline or Light Salmon Orange, later sometimes forming small patches of whitish aerial mycelium. After 4-5 days conidiophores are formed, at first whitish, becoming Orient Pink after the maturation of the conidia. Odour and coloured reverse absent, but the colour of mycelium may shine through. Submerged hyphae hyaline, thin-walled, often somewhat constricted at the septa, 2.5-5(-7)  $\mu\text{m}$  wide, with short cells (10-50  $\mu\text{m}$  long). Numerous subglobose to barrel-shaped cells are usually present, often in chains, with thin or thickened walls, to 25  $\times$  18  $\mu\text{m}$ ; after 3 weeks these cells can be found free in the agar. Conidiophores erect, mostly solitary and simple, hyaline, thin-walled or basally somewhat thickened, septate, cylindrical or somewhat tapered towards the obovoidal vesicle, 150-500  $\mu\text{m}$  tall and 6-12  $\mu\text{m}$  wide at the base. Conidiogenous vesicle separated by a septum, 15-30  $\times$  18-32  $\mu\text{m}$ , covered with 50-100 conidia. Conidia thin-walled, hyaline, Orient Pink in mass, obovoidal to broadly ellipsoidal, 11-20  $\times$  (7-)9-13(-15.5)  $\mu\text{m}$ ; point of attachment distinct or not.

Colonies on the natural substrate effuse or more frequently in irregular

patches, at first white, becoming Orient Pink to Salmon Pink, occasionally yellowish to light ochraceous. Sterile hyphae 3–6  $\mu\text{m}$  wide, sometimes with thickened septa. Hyphal swellings absent to rather numerous, to 15  $\mu\text{m}$  wide. Conidiophores 90–400  $\mu\text{m}$  tall, 7–13  $\mu\text{m}$  wide at the base, with (1–)3–9(13) septa. Conidiogenous vesicle 17–45  $\mu\text{m}$  wide, bearing 40–100 conidia, slightly warted after conidium detachment, sometimes areolate. Conidia smooth to slightly roughened, obovoidal to ellipsoidal to subcylindrical, rarely pyriform, (13–)15–24(–28)  $\times$  8.5–18  $\mu\text{m}$ .

Some aberrations of the normal type were found several times: after conidium detachment a new hypha grows out from the old stalk, breaks through the old vesicle (often branching) and forms new conidiogenous vesicles (proliferating conidiophores). Sometimes conidia originate directly on the creeping hyphae and are attached by a broad base. Their size is often larger than the average for this species. Similar conidia are well known from other members of the Pezizales (PADEN, 1972).

Substrate: dung of various animals, old paper, rags, compost and decaying vegetable matter, but not known on wood. The record of SACCARDO (1886) on perithecia of *Sphaeropsis visci* is an error, the species involved being *Gonatobotrys simplex*.

#### *Material examined:*

##### Herbarium specimens:

- Oedocephalum roseum*, holotype, on old paper, Millfield Lane, Kew, England; leg. M. C. Cooke, 1872.  
*Oedocephalum glomerulosum*, on old paper and dung, New Haven, Connecticut, U.S.A., leg. R. Thaxter, 1888.  
*Oedocephalum glomerulosum*, on compost, Soest, Netherlands; leg. H. A. van der Aa, 1971.  
*Oedocephalum glomerulosum*, on decaying leaves and paper, Baarn, Netherlands, J.A.S. 354, leg. J. A. Stalpers, 1973.

##### Living strains:

- CBS 333.52, isolated by H. J. Swart, Utrecht, Netherlands.  
 CBS 301.63, isolated from sheep dung by I. Gamundl, Argentina.  
 CBS 236.56, isolated from dung of *Sus leuostyax* by K. Tubaki, Japan (as *O. coprophilum*).  
 CBS 516.68, isolated from air by J. J. van Gogh, Netherlands (as *O. coprophilum*).  
 CBS 959.68, *Rhopalomyces minor*, type strain, and CBS 255.72, isolated from air by S. Windisch, Berlin, Germany.  
 CBS 255.73 (=IMI 140,796), isolated from plant pot by G. Stidson (as *O. roseum*).

#### *Discussion*

The type specimen of *O. glomerulosum* has not been preserved, but all authors agree as to its identity. This species is closely related to *O. macrosporum* and *O. nicotianae*, which differ mainly in the dimensions of the conidia and conidiophores.

THAXTER (1891) already suspected the synonymy of *O. roseum* and

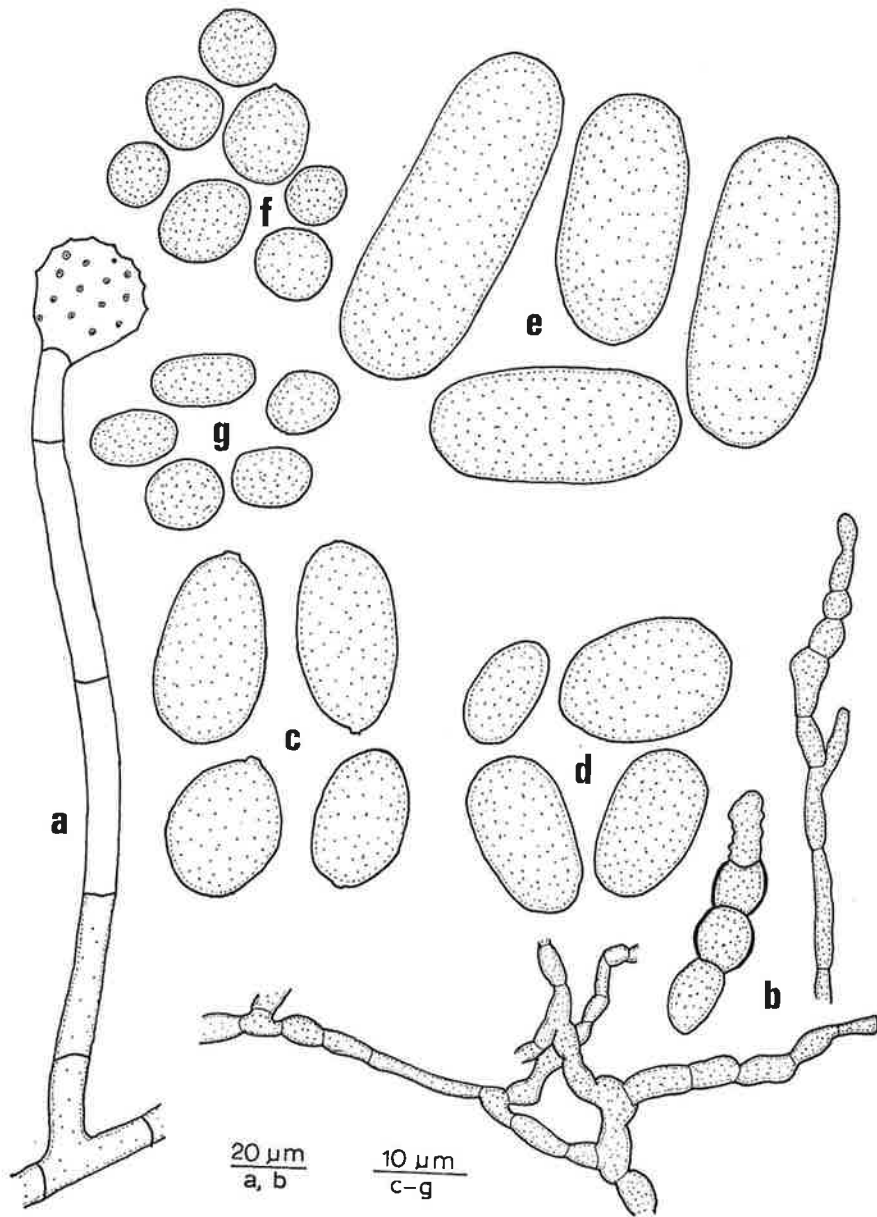


Fig. 2. Sectio *Glomerulosa*. a-d, *O. glomerulosum*; a, conidiogenous structures; b, submerged hyphae (CBS 333.52); c-d, conidia (c, coll. Thaxter; d, CBS 333.52). e, *O. macrosporum*, conidia (type); f-g, *O. nicotianae*, conidia (f, neotype; g, CBS 159.74).

the examination of the type specimen proved him right. The type culture of *O. coprophilum* has been lost (TUBAKI, 1954), but the diagnosis falls within this species-concept and a culture identified by TUBAKI as *O. coprophilum* is identical with *O. glomerulosum*. The type of

*O. guadalcanalense* was not available for study, but the description agrees exactly with *O. glomerulosum*.

SCHMIDT (1910) first described the perfect state and identified it as *Pyronema omphalodes* (Bull. ex St. Amans) Fuckel. This is apparently a misidentification, as SCHMIDT himself mentions the amyloid reaction of the asci. KORF (1958) reported an *Oedocephalum* conidial state of *Iodophanus testaceus*. GAMUNDÌ and RANALLI (1964) proved in pure culture that *O. glomerulosum* was connected with *Ascophanus carneus*. According to KIMBROUGH et al. (1969) this was a misidentification of *Iodophanus testaceus*.

#### 6. *Oedocephalum macrosporum* Penzig & Sacc. (Fig. 2, e)

*Oedocephalum macrosporum* Penzig & Sacc. in *Malpighia* 15: 242. 1901.

Ascigerous state: unknown.

Colonies on the natural substrate effuse, whitish. Sterile hyphae hyaline, thin- to somewhat thick-walled, septate, 2.5–6  $\mu\text{m}$  wide, somewhat constricted at the septa, cells to 50  $\mu\text{m}$  long. Swollen barrel-shaped cells present, to 10  $\mu\text{m}$  wide. Conidiophores erect, solitary, simple, hyaline, 5–9-septate, 18–37  $\mu\text{m}$  wide, 800–1500  $\mu\text{m}$  tall, with thin or basally somewhat thickened walls, tapering towards the conidiogenous cell. Conidiogenous vesicle (according to the original description; not present in the specimen examined) globose to subglobose, warted, 90–110  $\mu\text{m}$  in diam., bearing about 100 conidia. Conidia hyaline, thin-walled, smooth or minutely roughened, narrowly ellipsoidal to cylindrical, 27–38(–49)  $\times$  12–16(–20)  $\mu\text{m}$ , not or inconspicuously apiculate.

Substrate: rotten wood.

#### *Material examined:*

*Oedocephalum macrosporum*, holotype, no. 255, Java (PAD).

#### *Discussion*

*O. macrosporum* is closely related to *O. glomerulosum*; it differs only in the dimensions of the conidia and conidiophores. The type specimen is in rather bad condition, only sterile hyphae, conidia and pieces of conidiophores could be found and conidiogenous cells were absent.

#### 7. *Oedocephalum nicotianae* Oudem. (Fig. 2, f–g)

*Oedocephalum nicotianae* Oudem. in *Ned. kruidk. Archief*, Ser. 3, 2: 906. 1903.

Ascigerous state: unknown.

Colonies growing moderately rapidly on malt-agar, covering the petri dish in 3 weeks at room temperature, appressed, hyaline or Light Salmon Orange, later with some whitish to Salmon Buff cottony aerial mycelium locally. After 4–6 days conidiophores are formed on the immersed hyphae and later in the aerial mycelium, at first white, becoming Orient Pink to Salmon Pink after maturation of the conidia. Reverse uncoloured, but the salmon colour shining through. Odourless. Submerged hyphae hyaline, thin-walled, septate, 3–8(–12)  $\mu\text{m}$  wide, cells 15–45(–70)  $\mu\text{m}$  long; subglobose to barrel-shaped swellings usually present, to 25  $\mu\text{m}$  wide, often with granular contents, sometimes cyanophilous, more abundant in old cultures, later often free. Conidiophores erect, usually solitary, simple or branched (the latter more frequently in the aerial mycelium), hyaline, septate, 7–15  $\mu\text{m}$  wide at the base, 60–200  $\mu\text{m}$  tall, with thin to somewhat thickened walls, often tapering towards the obovoidal to ellipsoidal conidiogenous vesicle. Vesicle 15–24  $\mu\text{m}$  wide, bearing 15–40 conidia. Conidia hyaline, pinkish in mass, smooth to minutely roughened, globose to broadly ellipsoidal, (6.3–)7–10  $\times$  (6.3–)6.8–9  $\mu\text{m}$ .

Substrate: dead leaves, compost and soil.

*Material examined:*

CBS 160.74, isolated from soil by A. von Klopotek, Giessen, Germany; neotype. CBS 159.74, isolated from compost by K. H. Domsch, Braunschweig, Germany.

*Discussion*

OUDEMANS' original material of this fungus has not been preserved, only the published description and drawing supporting the retention of this name. The strain CBS 160.74 agrees exactly with OUDEMANS' description and is designated as neotype for this name here. Another strain, CBS 159.74 agrees in most respects, but differs somewhat both in the shape of the conidia which are ellipsoidal, rarely subglobose, (7.5–)8–10(–11)  $\times$  5.5–7(–7.5)  $\mu\text{m}$  and in the conidiophores which sometimes proliferate. *O. nicotianae* is closely allied to *O. glomerulosum*.

8. *Oedocephalum cristallinum* Ces. (Fig. 3)

*Oedocephalum cristallinum* Ces. in Bot. Ztg 13: 299. 1885 [mostly cited as "cristallinum"].

Ascigerous state: unknown.

Colonies on the natural substrate effuse, whitish to ochraceous. Sterile hyphae hyaline, thin-walled, septate, 3–4  $\mu\text{m}$  wide, short-celled (cells to 50  $\mu\text{m}$  long). Conidiophores erect, generally solitary, simple, hyaline to slightly yellowish, thin- to basally thick-walled (to 2  $\mu\text{m}$ ), 4–14-septate,

septa often thickened. Conidiophores 500–800  $\mu\text{m}$  tall, 20–25  $\mu\text{m}$  wide at the base, tapering to 13–18  $\mu\text{m}$ , often somewhat constricted at the septa, with a globose to subglobose terminal vesicle, 35–50  $\mu\text{m}$  wide. Conidiogenous vesicle bearing 30–50 conidia. Conidia thin-walled, hyaline to slightly yellowish, smooth, ellipsoidal to subcylindrical, 34–44  $\times$  16–19  $\mu\text{m}$ , with a large central vacuole, not or indistinctly apiculate. After conidium detachment the conidiogenous cell is coarsely warted.

Substrate: wood.

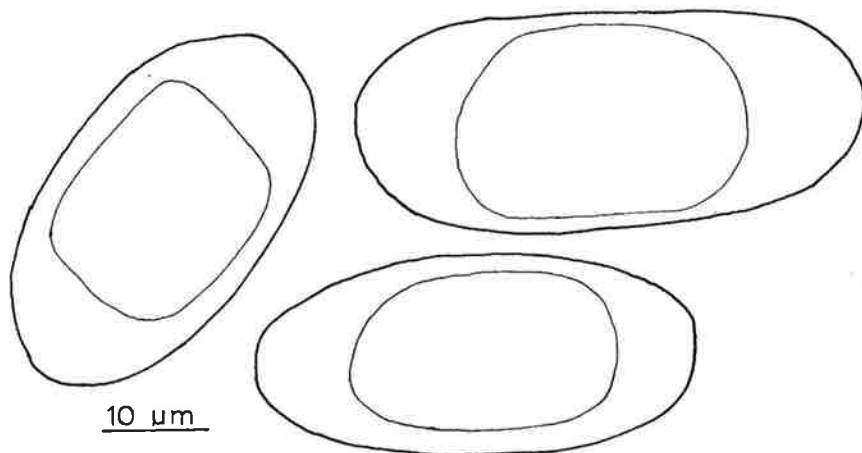


Fig. 3. Sectio *Cristallina*. *O. crystallinum*, conidia (type).

*Material examined:*

*Oedocephalum crystallinum*, isotypes, on *Ulmus cariosa*, Vercelli, Italy; leg. Cesati, January 1853; J. F. Klotzsch et Rabenhorst, Editio I, nr. 1974 (B, L).

*Discussion*

*O. crystallinum* differs from all other species of the genus in its large, smooth, guttulate conidia, the coarsely warted conidiogenous cells and the somewhat pigmented, broad conidiophores.

DOUBTFUL AND EXCLUDED SPECIES

*O. agaricinum* Richon, Catal. rais. Champ. Marne, p. 416. 1889.

Type not extant. The description and drawing give no clue as to the identity of the fungus.

*O. albidum* (Sacc.) Sacc. in Syll. Fung. 4: 48. 1886. – *Haplotrichum albidum* Sacc. in Michelia 2: 288. 1871. – *Cunninghamella albida* Matruchot in Anns mycol. 1: 56. 1903.

A doubtful species of *Cunninghamella*, fide SAMSON (1969).

- O. alienum* Preuss in *Linnaea* 24: 132. 1851.  
The description and drawing point to this being a species of *Oedocephalum*, but no similar fungus could be found in the type material (B).
- O. asperum* Karst. in *Medd. Soc. F. Fl. fenn.* 18: 66. 1891.  
Type specimen is an *Aspergillus*, close to *A. wentii* Wehmer (H).
- O. aurantiacum* Cooke in *Grevillea* 5: 147. 1877.  
Type specimen contains a rust, probably an *Uromyces*. Host indicated as "probably *Loranthus*" (K).
- O. badium* Schulzer von Muggenburg in *Verh. k.k. zool. bot. Ges. Wien*, 24: 292. 1874.  
Type not seen. The description indicates this is an *Aspergillus* of the *A. niger*-series.
- O. bergii* Spig. in *Revta Agron. Veter. La Plata* 1896: 244 (fig. 4, a-b) (LPS). This species is identical with *Oidium tenellum* (Berk. & Curtis) Linder.
- O. bergrothii* Karst. in *Hedwigia* 31: 183. 1892.  
On *Homoeocerus mundus* (insect); belongs to *Aspergillus* (H).
- O. beticola* Oudem. in *Ned. kruidk. Archief*, Ser. 2, 3: 905. 1903.  
Type specimen not preserved. The description and drawing (unpublished, L) suggest *O. pallidum*.
- O. byssinum* (Bon.) Sacc. in *Syll. Fung.* 4: 49. 1886. – *Periconia byssina* Bon., *Abh. Geb. Mykol.* 2: 95. 1870.  
Type not available. Probably belongs to *Aspergillus*.
- O. byssinum* subsp. *herbariorum* Karst. in *Medd. Soc. F. Fl. fenn.* 16: 30. 1888.  
Type specimen contains an *Aspergillus* (H).
- O. clavatum* A. L. Smith in *J. Bot.* 41: 259. 1903.  
Type specimen not available in K. The description and drawing suggest a species identical or closely related to *O. elegans*.
- O. curiosum* (Parm. & Žukov) Donk in *Gorteria* 5: 135. 1971. – *Paulliticorticium curiosum* Parm. & Žukov apud Parm. in *Česká Mykol.* 23: 73. 1969. – *Spiniger curiosus* (Parm. & Žukov) Stalpers in *Proc. Kon. Ned. Akad. Wet.*, Ser. C. 77, 402. 1974.  
Conidial state of *Hyphoderma*, probably *H. populneum* (Peck) Donk (DONK, 1971).
- O. dichotomum* Preuss in *Linnaea* 26: 708. 1852.  
Type not in B. According to the description this is not an *Oedocephalum*.
- O. echinulatum* Thaxter in *Bot. Gazette* 16: 17. 1891. – *Cunninghamella echinulata* (Thaxter) Thaxter in *Rhodora* 5: 98. 1903. For further synonymy see SAMSON (1969).
- O. griseolum* Oudem. in *Ned. kruidk. Archief*, Ser. 2, 3: 761. 1903.  
Type specimen not extant. The drawing may represent a monstrose *Aspergillus*.
- O. hyalinum* (Bon.) Sacc. in *Syll. Fung.* 4: 49. 1886. – *Periconia hyalina* Bon., *Abh. Geb. Mykol.* 2: 95. 1870.



- Type specimen not available. According to the description this species belongs to *Aspergillus*.
- O. indicum* Narayanan in *Sydowia* 16: 82. 1962.  
Type specimen not available. Judging from the description this species belongs in the vicinity of *O. glomerulosum*.
- O. intermixtum* Peck in *Rep. N.Y. St. Mus. nat. Hist.* 50: 116. 1897.  
Type specimen not seen. The description points in the direction of *O. glomerulosum*.
- O. lacrimisporum* Kamyshko in *Bot. Mater.* 14: 22. 1961.  
Type specimen not extant. The description and drawing agree with *Spiniger meineckellus* (A. J. Olson) Stalpers.
- O. laeticolor* Berk. & Br. in *Ann. Mag. nat. Hist.*, Ser. 3, 15: 402. 1865.  
Type specimen not available in K. Probably not an *Oedocephalum*.
- O. lineatum* Bakshi in *Trans. Br. mycol. Soc.* 33: 114. 1952.  
Type specimen contains *Spiniger meineckellus* (BAKSHI, 1954).
- O. longisporum* Moreau in *Bull. Soc. mycol. Fr.* 29: 1. 1913.  
Type specimen not seen. According to the description and drawing the species belongs to the Mucorales and is probably close to *Syncephalis obconica* Indoh.
- O. lunzinense* Szilvinyi in *Zentbl. Bakt. ParasitKde, Abt.* 2, 53: 141. 1941.  
Type specimen not existing. Probably belongs to *Cylindrocarpon* or *Phialophora*.
- O. meineckellum* (A. J. Olson) Donk in *Proc. Kon. Ned. Akad. Wet.*, Ser. C, 74: 7. 1971 (Plate I, 1).  
= *Spiniger meineckellus* (A. J. Olson) Stalpers (Stalpers, 1974).
- O. minutissimum* Karst. in *Hedwigia* 31: 182. 1892.  
Type specimen contains an *Aspergillus* (H).
- O. pyriforme* (Bon.) Sacc. in *Syll. Fung.* 4: 49. 1886. – *Periconia pyriformis* Bon., *Handb. allg. Mykol.*: 113. 1851.  
Type specimen not available for study, probably belongs to *Aspergillus*.
- O. preussii* Sacc. in *Syll. Fung.* 4: 49. 1886. – *Periconia alba* Preuss in *Linnaea* 24: 130. 1851 [non *O. album* Preuss in *Linnaea* 24: 132. 1851].  
Type specimen did not contain the described fungus (B).
- O. sulphureum* Cooke & Masee in *Grevillea* 17: 3. 1888 (as “*sulfureum*”) – *Oidiodendron sulphureum* (Cooke & Masee) Stalpers in *Verh. Kon. Ned. Akad. Wet., Afd. Natuurk.*, Ser. 2, 61: 71. 1973 (fig. 4, e).  
Description of the type specimen (K): Tufts byssoid, somewhat mealy, sulphur-yellow. Conidiophores rather short or absent, to 3.5  $\mu\text{m}$  wide, with a pigmented, sometimes roughened basal part and a hyaline, repeatedly branched upper part. Branches 1.5–2  $\mu\text{m}$  wide, often curved at the ends, during maturation transformed into conidia, usually connected by sterile segments. Arthroconidia ellipsoidal to obovoidal, rarely subglobose, hyaline, sulphur-yellow in mass, rarely brownish, smooth or slightly roughened, thin- or slightly thick-walled, 3.8–5  $\times$  2.5–3.3  $\mu\text{m}$ , the ends often with wall fragments from the sterile portion.

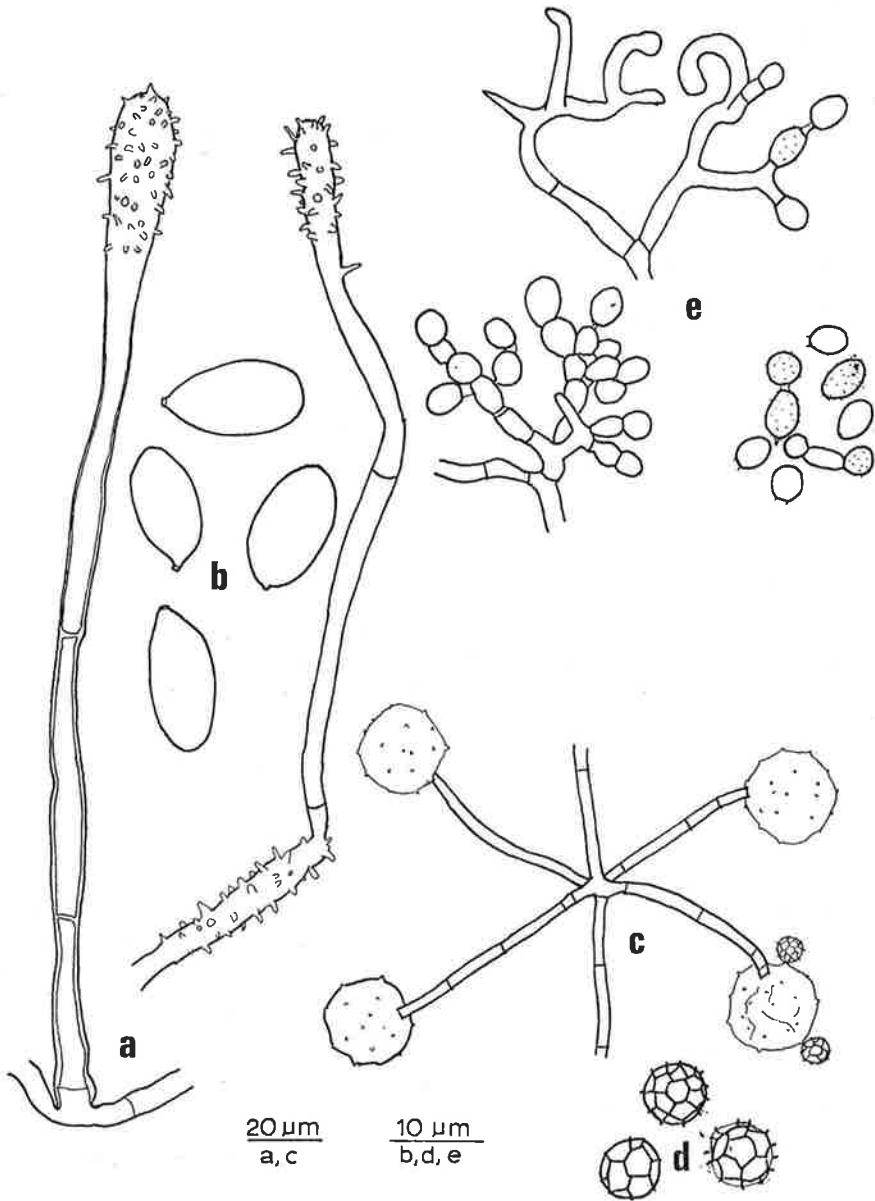


Fig. 4. a-b, *Oidium tenellum*, type specimen of *Oedocephalum bergii*; a, conidiogenous structures; b, conidia (type); c-d, *Sphondylocephalum verticillatum*; c, conidiogenous structures; d, conidia (type); e, *Oidi dendron sulphureum*, conidiogenous structures and conidia (type).

This species is closely related to or identical with *O. flavum* Szilvinyi *emend.* BARRON (1962). The conidial dimensions agree better with those given by VON SZILVINYI (1941) ( $3.4-5.7 \times 2.5-3.4 \mu\text{m}$ ) than with those of the emended description ( $2.5-4.5(-5.5) \times 1.5-2.5 \mu\text{m}$ ); the curved

branches of the conidiophore are mentioned by BARRON, but this character is variable.

*O. verticillatum* Thaxter in Bot. Gazette 16: 18. 1891 (fig. 4, c-d; Plate I, 4).

Description of the type specimen (FH): mycelium scarce, evanescent, whitish to faintly yellowish. Sterile hyphae hyaline, thin-walled, septate, cells usually shorter than 50  $\mu\text{m}$ , branched, with one or two, rarely more, branches from one point forming a right angle with the main branch. Conidiophores single or more usually in whorls of 2-4(-5), hyaline, septate, 2-4.5  $\mu\text{m}$  in diam., abruptly expanded into a globose vesicle, 20-28  $\mu\text{m}$  in diam., covered with 20-40 conidia, remaining minutely warty after conidium detachment. Conidia globose, hyaline, distinctly reticulate, 5.8-7  $\mu\text{m}$  in diam.

The species does not fall within the concept of *Oedocephalum* adopted here, nor in any other described genus, and a new genus is consequently proposed to accommodate it.

### SPHONDYLOCEPHALUM Stalpers *gen. nov.*

Mycelium albidum vel flavidum. Hyphae steriles hyalinae, septatae, emittentes 2-4(-5) hyphas fertiles verticillatas ascendentes ex una cellula. Hyphae fertiles septatae, 2-4.5  $\mu\text{m}$  diam., abrupte dilatatae in vesiculam globosam, tenuissime areolatam, conidiis globosis reticulatis, 5.8-7  $\mu\text{m}$  diam. obtectam.

Typus: *Sphondylocephalum verticillatum* (Thaxter) Stalpers *comb. nov.* — *Oedocephalum verticillatum* Thaxter in Bot. Gazette 16: 18. 1891 (basionym).

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*Centraalbureau voor Schimmelcultures, Baarn*

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