

RECLASSIFICATION OF *VERTICICLADIELLA* BASED ON CONIDIAL DEVELOPMENT

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The established method of distinguishing *Leptographium*, *Verticicladiella* and *Phialocephala* (the *Leptographium* complex) on the basis of annellidic, sympodial and phialidic conidial development, respectively, is challenged. *Leptographium* and *Verticicladiella* could not be differentiated with confidence using light microscopy whereas *Phialocephala* spp. examined were distinguishable from the latter genera. Scanning electron microscopy (SEM) confirmed that the conidiogenous cells of *Phialocephala* spp. do not elongate when producing a succession of conidia. Using SEM, *Verticicladiella* and *Leptographium* spp. were impossible to separate on the basis of conidial development. This was due to certain *Leptographium* and *Verticicladiella* spp. exhibiting both sympodial and annellidic (percurrent) proliferation on a single conidiophore or conidiogenous cell. The genus *Verticicladiella* is therefore reduced to synonymy with *Leptographium*.

The *Leptographium* complex includes the genera *Leptographium* Lagerberg & Melin, *Verticicladiella* Hughes and *Phialocephala* Kendrick (Kendrick, 1961, 1962). These fungi are characterized by dark, mononematous, penicillately-branched conidiophores with conidia produced in a slimy matrix (Hughes, 1953; Kendrick, 1961, 1962). They commonly occur on the surface of wood and many are associated with wood-infesting insects such as bark beetles (Coleoptera: Scolytidae) and weevils (Coleoptera: Curculionidae) (Goheen & Cobb, 1978; Upadhyay, 1981; Wingfield, 1983).

Leptographium, *Verticicladiella* and *Phialocephala* spp. are commonly recognized anamorphs of the genus *Ceratocystis* Ellis & Halst. sensu lato (De Hoog & Scheffer, 1984; Griffin, 1968; Hunt, 1956; Olchoweki & Reid, 1974; Upadhyay, 1981). The anamorph genera have been separated on the basis of conidial development (Hughes, 1953; Kendrick, 1961, 1962). *Leptographium* spp. are purportedly characterized by having conidiogenous cells which develop annellidically (percurrently). Conidia in *Verticicladiella* spp. develop sympodially whereas those of *Phialocephala* spp. develop phialidically (Hughes, 1953; Kendrick, 1961, 1962).

Using the mode of conidial development as the sole criterion by which to differentiate the three genera has resulted in confusion. Wingfield & Marasas (1983) identified a new species, *Verticicladiella truncata*, in which conidial development appeared to vary between sympodial and annellidic. Whether to assign this species to *Leptographium* or *Verticicladiella* was a problem. Kendrick (1980) emphasized this difficulty and noted that members of the *Leptographium* complex were similar both

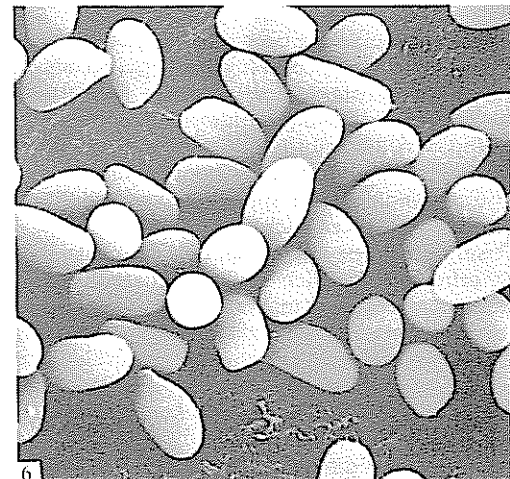
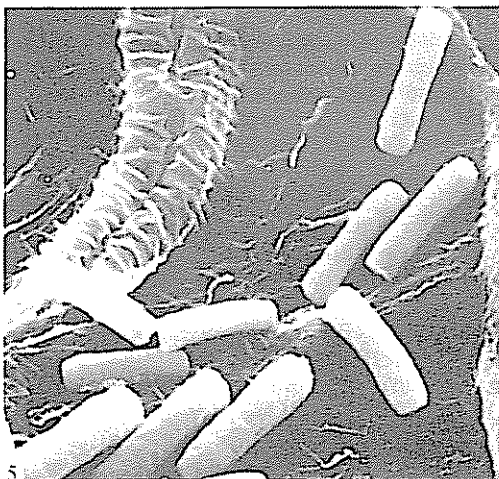
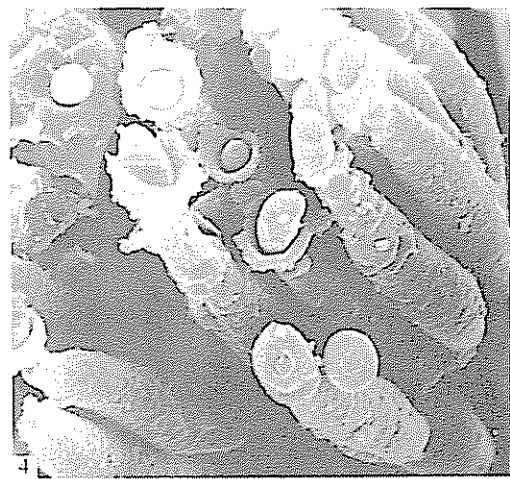
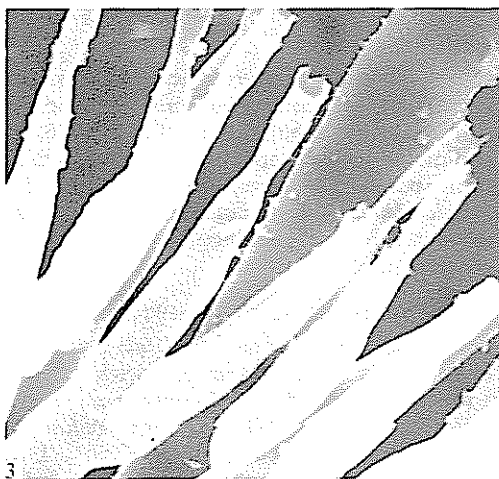
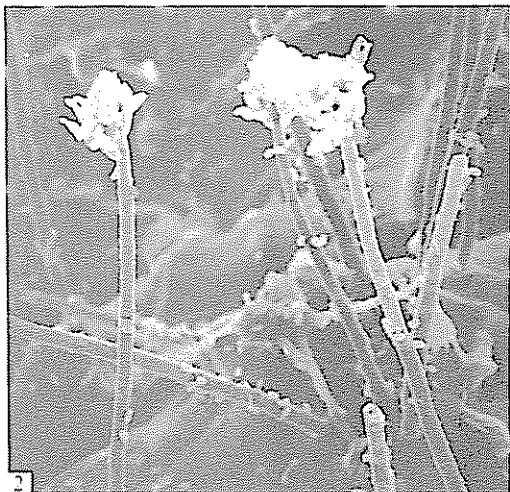
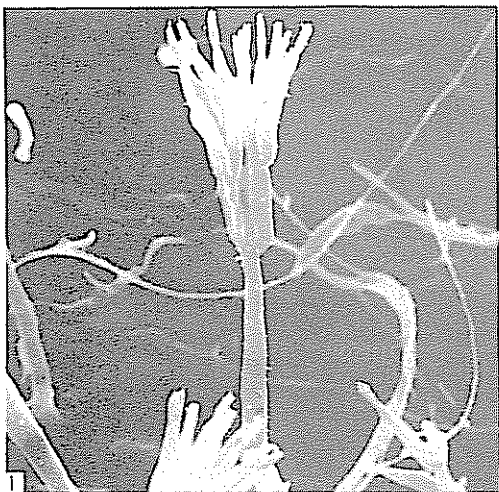
morphologically and ecologically and suggested that the genera required taxonomic revision.

This paper presents results of an examination of conidiogenous cell and conidial development in some species of *Leptographium*, *Verticicladiella* and *Phialocephala*. The acceptability of using conidial development to distinguish the genera is considered.

MATERIALS AND METHODS

The following isolates of *Phialocephala*, were examined: *P. bactrospora* Kendrick (Kendrick, 1961) ATCC44606; *P. dimorphospora* Kendrick (Kendrick, 1961) DAOM165556A; *P. fusca* Kendrick (Kendrick, 1963) DAOM67995, DAOM74598; *P. humicola* Jong & Davis (Jong & Davis, 1972) ATCC38881.

Isolates of *Leptographium* examined included the *Leptographium* anamorph of *Ceratocystis brevicollis* Davidson (Davidson, 1958) isolate COLO465 supplied by T. E. Hinds, U.S. Forest Service, Fort Collins, CO80526. U.S.A.; *L. lundbergii* Lagerberg & Melin (Lagerberg, Lundberg & Melin, 1927) ATCC2235, CBS352.29, DAOM75265; *L. pyrimum* Davidson (Davidson, 1978) ATCC34943; *L. reconditum* Jooste (Jooste, 1978) isolate 1244 supplied by Dr W. Jooste, Potchefstroom University for C.H.E., Potchefstroom 2520, South Africa; *L. terebrantis* Barras & Perry (Barras & Perry, 1971) two isolates, CMW9 and CMW11 (author's culture collection) from a previous study (Wingfield, 1983) and one isolate, CMW47 supplied by Dr T. C. Harrington, Department of Plant Pathology, University of New Hampshire, Durham, NH 03824, U.S.A.



The following *Verticicladiella* spp. were examined: *V. abietina* (Pk) Hughes (Hughes, 1953) DAOM37980 and isolate C13189 supplied by Dr T. C. Harrington; *V. antibiotica* Kendrick (Kendrick, 1962) DAOM84338; *Verticicladiella* anamorph of *Ceratocystis aureum* (Robis.-Jeff. & Davidson) Upadhyay (Robison-Jeffrey & Davidson, 1968; Upadhyay, 1981) ATCC16936; *V. brachiata* Kendrick (Kendrick, 1962) DAOM34360; *Verticicladiella* anamorph of *Ceratocystiopsis crassivaginata* (Griffin) Upadhyay (Griffin, 1968; Upadhyay, 1981) isolates COLO486 and COLO498 supplied by T. E. Hinds; *V. dryocoetidis* Kendrick & Molnar (Kendrick & Molnar, 1965) isolate COLO565 supplied by T. E. Hinds; the *Verticicladiella* anamorph of *Ceratocystis huntii* Robis.-Jeff. (Robison-Jeffrey & Grinchenko, 1964) isolate COLO468 supplied by T. E. Hinds; *V. penicillata* (Gros.) Kendrick (Kendrick, 1962) CBS140.36, DAOM63691; *V. procera* Kendrick (Kendrick, 1962) isolate CMW3 supplied by A. Lackner, North Carolina State University, Raleigh NC 27607, U.S.A.; CMW10 from a previous study (Wingfield, 1983) PREM45701, 45704 also examined by Wingfield & Marasas (1983) and DAOM33940; *Verticicladiella* anamorph of *Ceratocystis robusta* (Robis.-Jeff. & Davidson) Upadhyay (Robison-Jeffrey & Davidson, 1968; Upadhyay, 1981) isolate COLO452 supplied by T. E. Hinds; *V. serpens* (Goid.) Kendrick (Goidanich, 1936; Kendrick, 1962; Wingfield & Marasas, 1981) CBS141.36, CBS641.76, DAOM17660; PREM45442; *V. truncata* Wingfield & Marasas (Wingfield & Marasas, 1983) PREM45677, PREM45696, PREM45700, PREM45896; *V. wagneri* Kendrick (Harrington, 1982; Kendrick, 1962) isolates CAD-46, CAS-3, CAS-15 supplied by Dr T. C. Harrington.

In addition to general examination of the fungi listed above, a number of species in each of the genera were selected for more critical examination. These included *L. lundbergii* (ATCC2235); *L. pyrinum* (ATCC 34943); *L. terebrantis* CMW9; the *Verticicladiella* anamorph of *Ceratocystis huntii* (isolate COLO468); *V. procera* DAOM33940; *V. truncata* (PREM45698); *P. fusca* (DAOM74598) and *P. bactrospora* (ATCC44606). Cultures were maintained at 24 °C on 2% malt extract agar (20 g Difco malt extract; 20 g Difco Bacto agar; 1000 ml water) in Petri dishes.

Fungi were examined using light and scanning electron microscopy (SEM). Agar discs bearing

conidiophores were fixed in 2.5% glutaraldehyde and osmium tetroxide in a 0.1 M phosphate buffer, dehydrated in a graded acetone series, critical point dried, coated with gold palladium and examined using a Phillips scanning electron microscope.

RESULTS

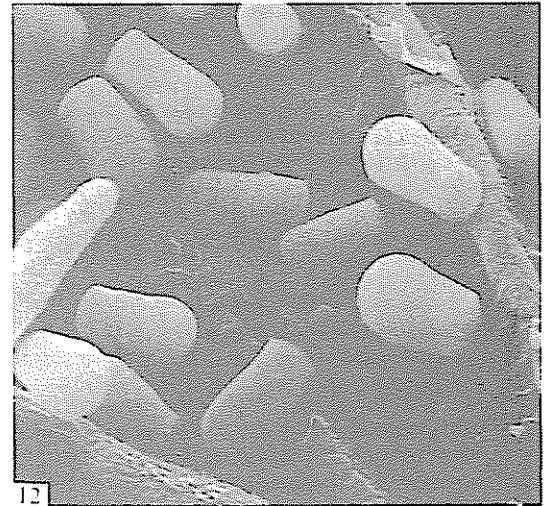
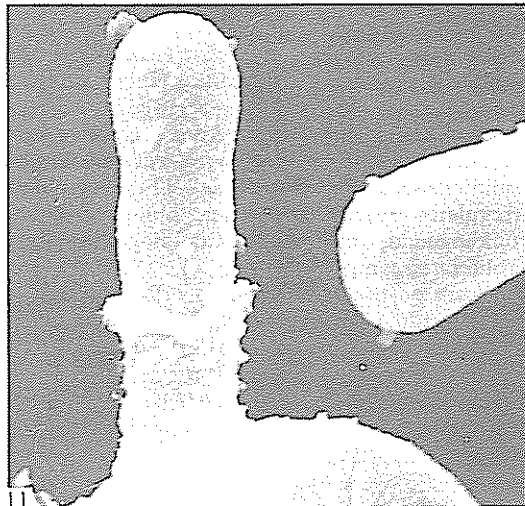
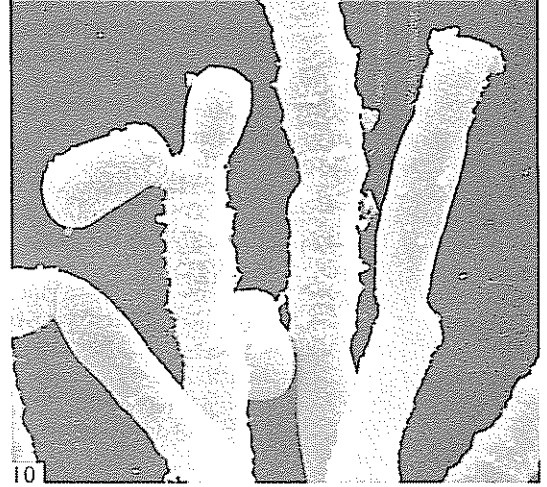
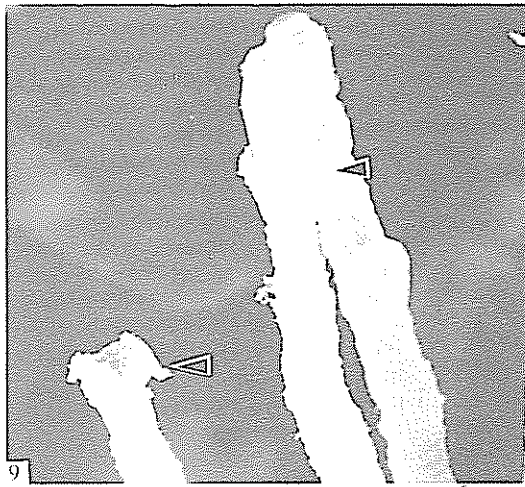
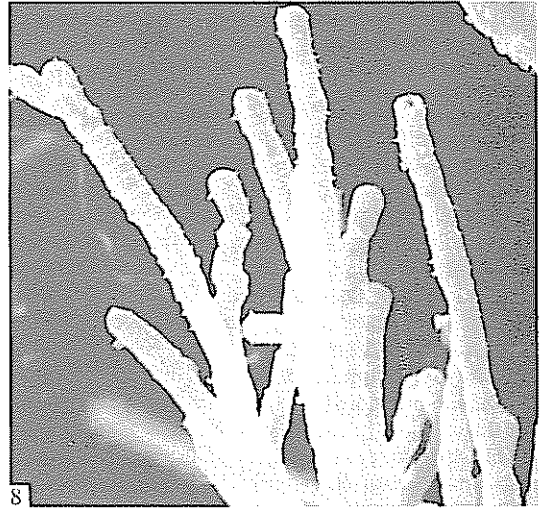
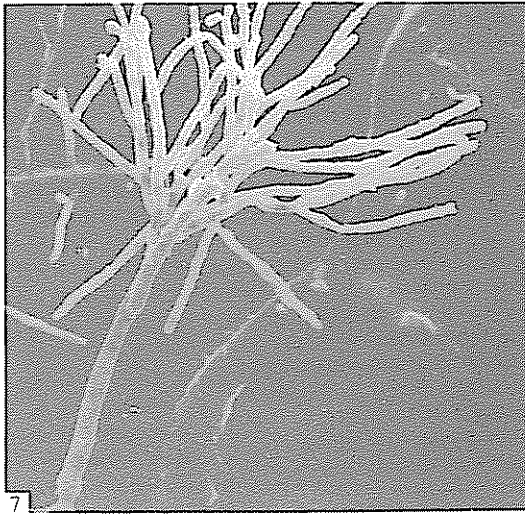
Using SEM, conidiogenous cells in *P. bactrospora* and *P. fusca* were phialidic with well-developed collarettes (Figs 1-4). Conidia were elongate with parallel walls and only slightly constricted at the point of attachment in *P. bactrospora* (Fig. 5), and pyriform with distinctly constricted points of attachment in *P. fusca* (Fig. 6).

Conidiogenous cells in *L. lundbergii* had proliferated, extending in length during successive production of conidia (Figs 7-11). Progressive development of conidia resulted in scars encircling the conidiogenous cells suggesting that the proliferation was percurrent. Some conidiogenous cells appeared to have resumed vegetative growth after production of a series of conidia (Figs 9-11). This sometimes resulted in displaced fungus wall tissue similar to a collarette below the point of resumed growth (Figs 10-11). In addition to the presence of encircling scars, apparent sympodial proliferation was observed in some conidiogenous cells (Figs 8, 10). Conidia in *L. lundbergii* were broadly truncate (Fig. 12).

Ceratocystis huntii and *L. terebrantis* both had distinct encircling scars on the conidiogenous cells and were similar to each other (Figs 13-15, 18-20). Sympodial conidiogenous cell development with conidia produced successively on alternate sides of the conidiogenous cells (Figs 14, 19) was also apparent. In some cases, development resulted in the presence of 'collarettes' similar to those observed in *L. lundbergii* at the apices of conidiogenous cells (Figs 15, 20). Conidia in *C. huntii* and *L. terebrantis* were obtuse, had points of attachment less broadly truncate than those in *L. lundbergii* and were often observed to be budding (Figs 16, 17, 20, 22).

Encircling scars resulting from successive production of conidia in *L. pyrinum* were evident on conidiogenous cells (Figs 23, 24). These scars were irregularly spaced and often oblique on the conidiogenous cell walls. Conidiogenous cells proliferated sympodially (Figs 24, 25) and many of the scars on the conidiogenous cells appeared to have resulted from secession of successively

Figs. 1-6. *Phialocephala fusca* and *P. bactrospora*. Figs 1, 3, 5, Conidiophores ($\times 730$), conidiogenous cells ($\times 3300$) and conidia ($\times 5600$) of *P. bactrospora*. Figs 2, 4, 6, Conidiophores ($\times 730$), conidiogenous cells ($\times 5600$) and conidia ($\times 5600$) of *P. fusca*.



produced conidia (Fig. 24). Conidia in *L. pyrinum* were more broadly truncate than those in *C. huntii* and *L. terebrantis* and most similar in size and shape to those in *L. lundbergii* (Fig. 26).

Conidial development in *V. truncata* (Figs 27–30) was most like that observed in *Leptographium* spp. Conidiogenous cells commonly had encircling scars (Figs 27–30). However, sympodial proliferation of the conidiogenous cells was also observed (Figs 30, 31). In some cases conidiogenous cells appeared to proliferate vegetatively before resumption of continuous conidial production (Figs 29, 30). Conidia in *V. truncata* were broadly truncate and commonly observed to be budding (Figs 31, 32).

In *V. procera*, proliferation of the conidiogenous cells was less pronounced than in *V. truncata* or the *Leptographium* spp. examined (Figs 33–35). Conidiogenous cells appeared to proliferate sympodially with less proliferation than that observed in conidiogenous cells of *V. truncata* (Fig. 30). This apparently resulted in tightly packed scars remaining after conidial secession (Fig. 35). Conidia in *V. procera* were less strongly truncate than those of *V. truncata* or *Leptographium* spp. (Fig. 36).

When these fungi were examined using light microscopy, *Phialocephala* spp. were easily recognizable from other members of the *Leptographium* complex due to the presence of well-developed collarettes and the absence of extensive proliferation of the conidiogenous cells (Figs 36, 37). The means of conidiogenous cell development following conidial production in *Leptographium* spp. and *Verticicladiella* spp. were more difficult to determine (Figs 38–41). In species such as *V. truncata*, conidiogenous loci appeared to be distinctly sympodial in some conidiogenous cells and progressively percurrent in others. In all *Verticicladiella* spp. and *Leptographium* spp. conidiogenous cells elongated during progressive development. This elongation due to proliferation was, however, least obvious in *V. procera*.

DISCUSSION

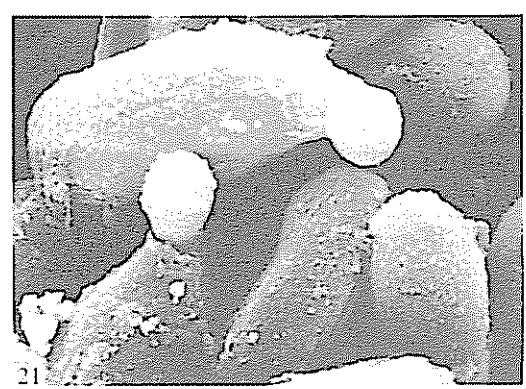
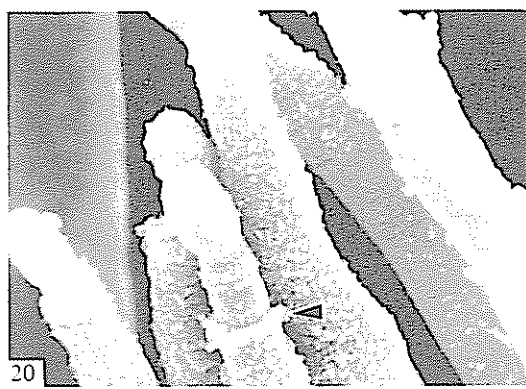
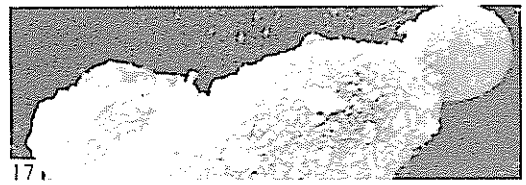
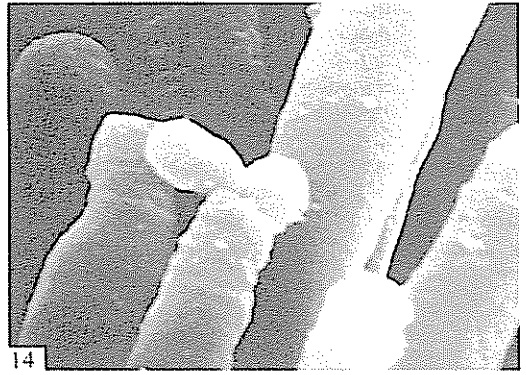
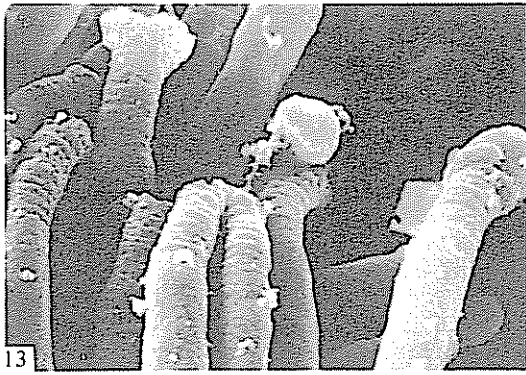
Previously experienced difficulties in distinguishing between *Leptographium* and *Verticicladiella* based on their alleged annellidic and sympodial 'conidial development' (Wingfield & Marasas, 1983) were reaffirmed here. By definition, *L. lundbergii*, the type species of the genus (Lagerberg *et al.*, 1927)

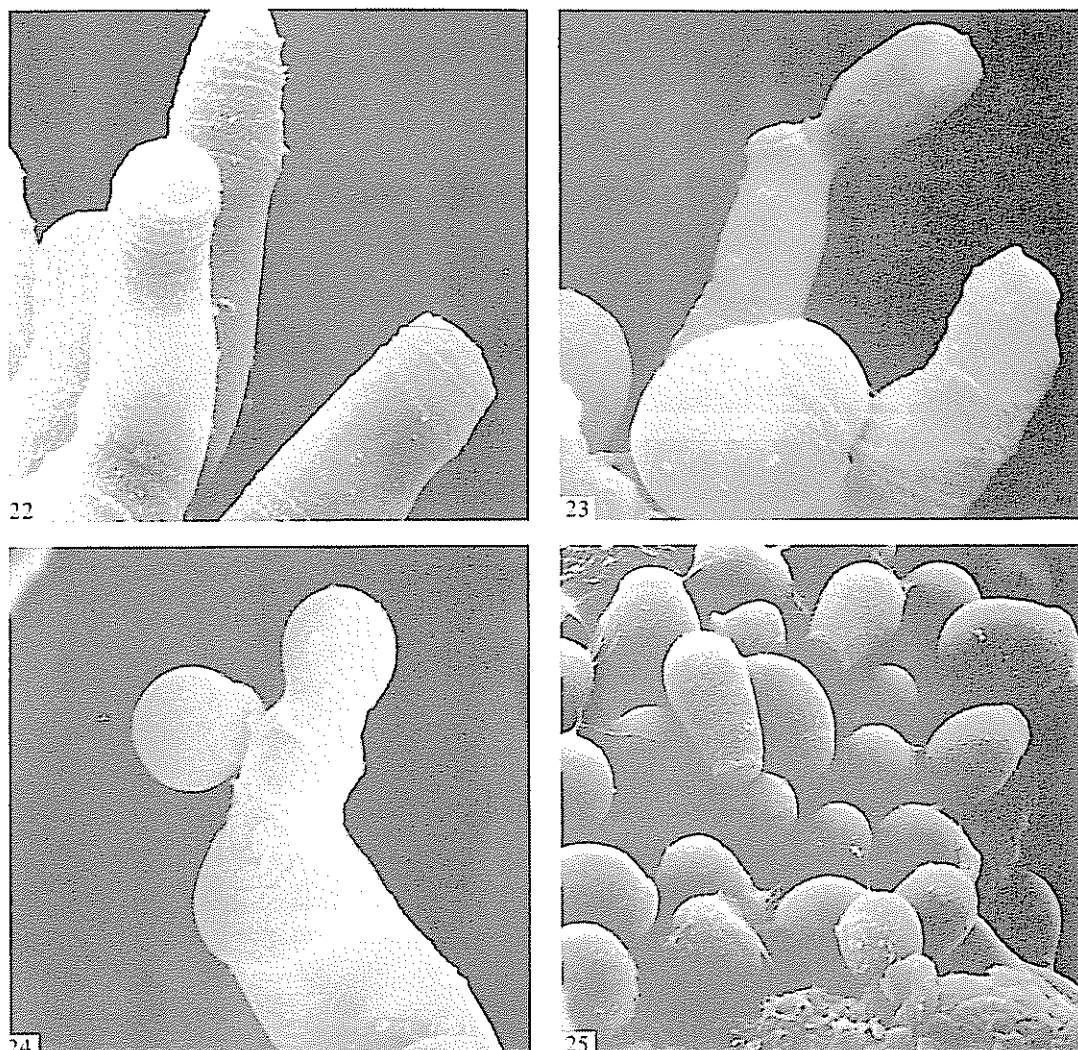
should have distinctly annellidic conidiogenous cells with ring-like encircling scars (remains of the outer conidiogenous cell wall) left at the apex of the conidiogenous cell after secession (Hughes, 1953). Scanning electron micrographs of conidiogenous cells in *L. lundbergii* show, however, that sympodial proliferation resulting in geniculate conidiogenous cells as well as percurrent proliferation of conidiogenous cells occur in this fungus. Examination of other *Leptographium* spp. (*L. terebrantis*, *L. pyrinum* and *C. huntii*) also suggest that conidial development in these species is associated with percurrent as well as sympodial conidiogenous cells. Ultrastructural studies on the development of the conidia are necessary to determine unequivocally that both enteroblastic and holoblastic proliferation of the conidiogenous cells occur in these genera.

Although sympodial proliferation of conidiogenous cells in *V. truncata* appeared to be more common than in *Leptographium* spp., evidence of percurrent proliferation in this fungus was however also apparent. Proliferation of conidiogenous cells in *V. procera* was apparently sympodial, however, without as much extension in length of the conidiogenous cells as was observed in *V. truncata* or *Leptographium* spp.

Because both sympodial and percurrent development occurred in species of *Leptographium* and *Verticicladiella*, it must be concluded that separation of these genera solely on this basis is impossible. Other genera have also been reported to exhibit both annellidic and sympodial ontogeny. Some of these include the coelomycetes *Seimatosporium kriegegerianum* (Bresadola) Morgan-Jones & Sutton (Sutton, 1964) and *Ajrekarella polychaetriae* Kamat & Kalani (Sutton, 1967), and some anamorphs of the Ascomycete genera *Diatrype* Fr., *Diatrypella* (Ces. & de Not.) Sacc., *Eutypa* Tul. (Glawe & Rogers, 1982a, b) and *Monographella* Petrak (Samuels & Hallett, 1983). Many anamorphs of the Rhytismataceae also exhibit variation between sympodial, annellidic and phialidic development (D. Minter, pers. comm.). In contrast, however, Zhang, Kendrick & Brubacher (1983) emphasized the stability of annellidic and sympodial proliferation as taxonomic characters in *Sporidesmiella* Kirk although Kirk (1982) had considered the taxa concerned to be varieties of the same species. Minter, Kirk & Sutton (1982, 1983) have provided a new view of Deuteromycete development which predicts that species proliferating both

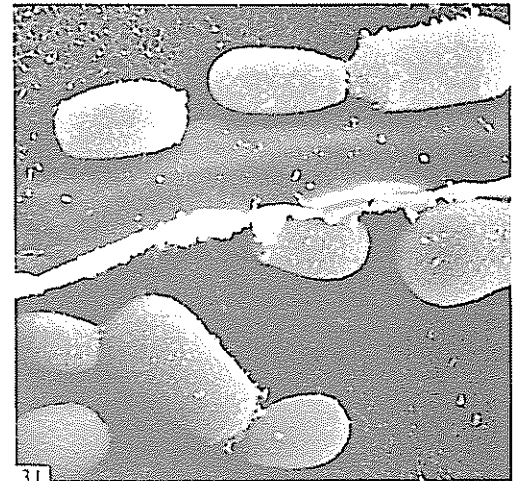
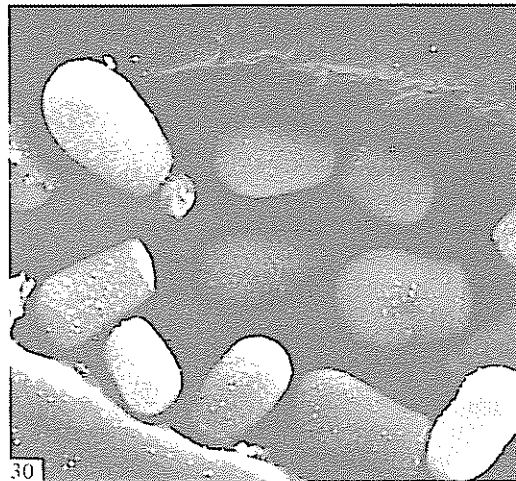
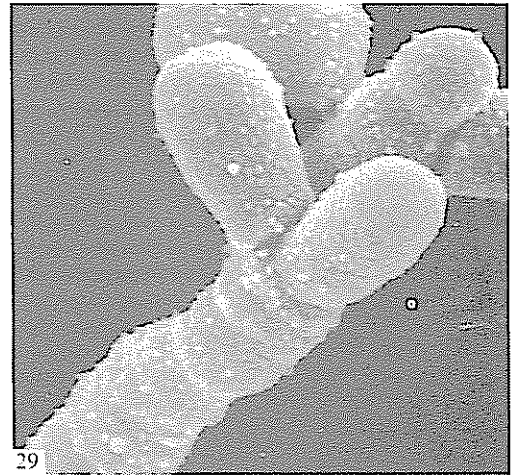
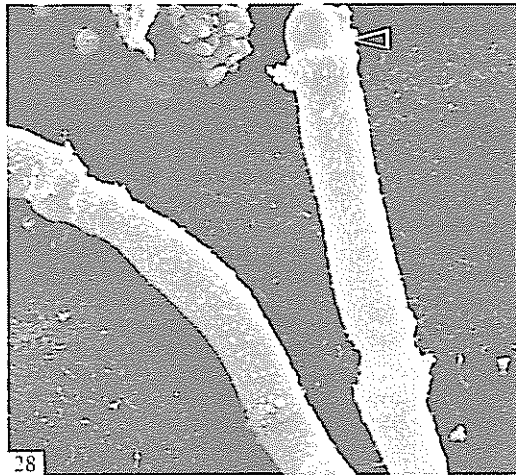
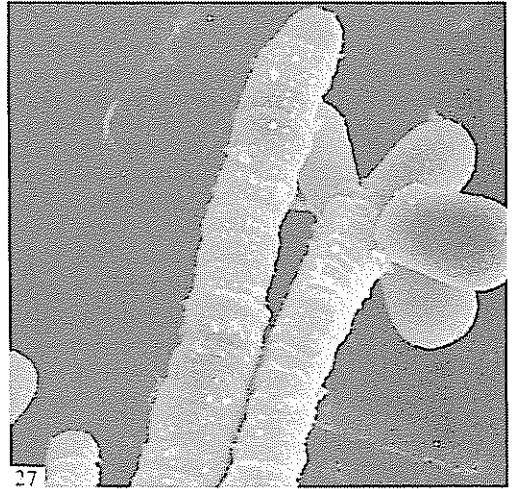
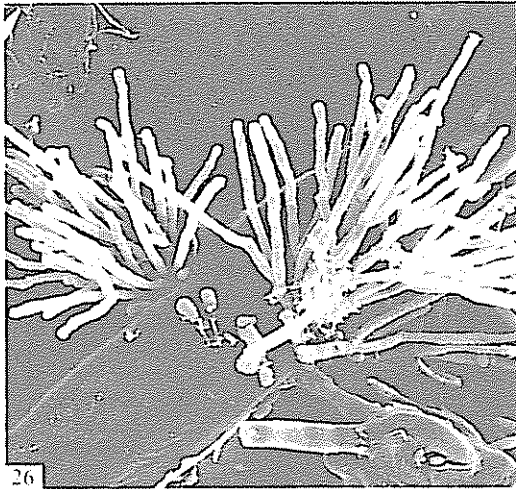
Figs 7–12. *Leptographium lundbergii*. Fig. 7. Conidiophores showing extensive proliferation of conidiogenous cells ($\times 730$). Fig. 8. Conidiogenous cells with percurrent and sympodial proliferation ($\times 3300$). Fig. 9. Displacement of outer cell wall layers to form collarettes (arrow) on conidiogenous cells ($\times 5600$). Fig. 10. Sympodial proliferation of conidiogenous cells ($\times 5600$). Fig. 11. Extension of conidiogenous cell after period of successive conidium production ($\times 11300$). Fig. 12. Conidia with truncate bases ($\times 5600$).

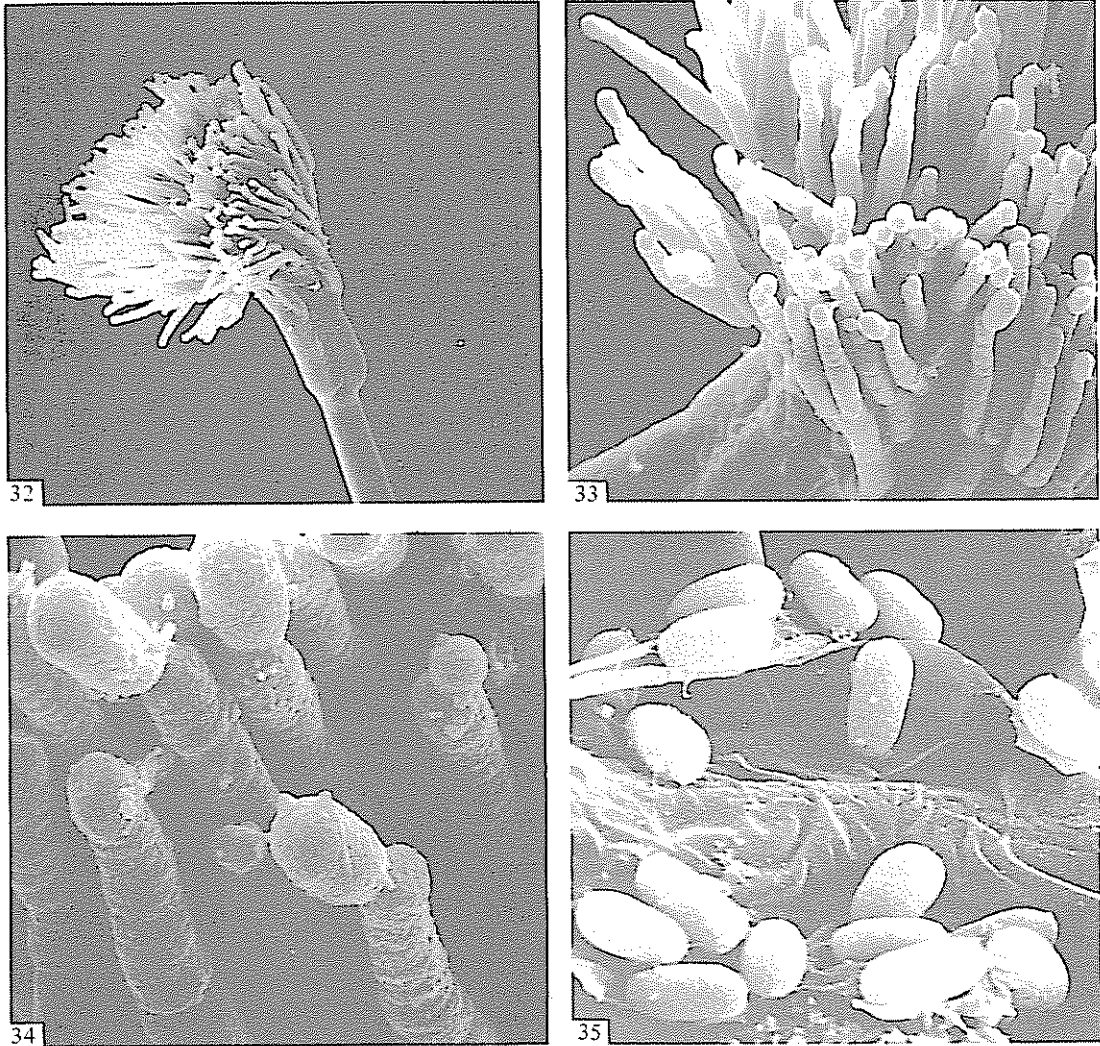




Figs 22–25. *Leptographium pyrimum*. Fig. 22. Ring-like encircling scars on conidiogenous cells ($\times 5600$). Fig. 23. Conidial secession showing scars on outer wall layer and sympodial development of conidiogenous cell ($\times 5600$). Fig. 24. Sympodial proliferation of conidiogenous cell ($\times 5600$). Fig. 25. Conidia with broadly truncate bases ($\times 3600$).

Figs 13–21. *Ceratocystis huntii* and *Leptographium terebrantis*. Figs 13–17. *Ceratocystis huntii* Fig. 13. Conidiogenous cells showing ring like encircling scars ($\times 5600$). Fig. 14. Conidiogenous cells with apparent sympodial development ($\times 5600$). Fig. 15. Displaced outer wall tissue (arrows) of conidiogenous cells ($\times 5600$). Fig. 16. Conidia ($\times 5600$). Fig. 17. Conidia budding ($\times 5600$). Figs 18–21. *L. terebrantis*. Fig. 18. Conidiogenous cells with encircling scars ($\times 5600$). Fig. 19. Sympodial proliferation of conidiogenous cell ($\times 5600$). Fig. 20. Displacement of outer cell wall tissue (arrow) during proliferation of conidiogenous cell ($\times 5600$). Fig. 20. Budding conidia ($\times 5600$).



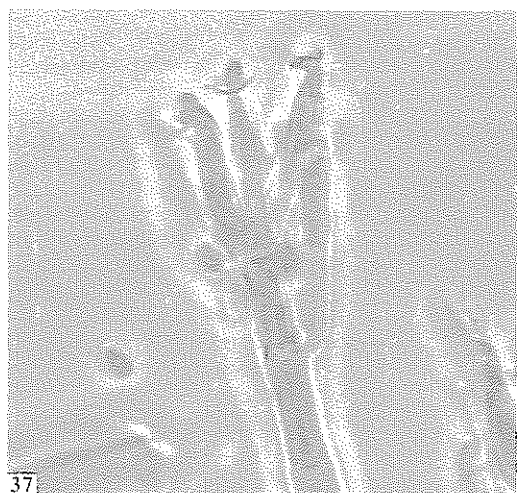


Figs 32–36. *Verticicladiella procera*. Fig. 32. Conidiophore showing restricted elongation during conidiogenesis ($\times 730$). Fig. 33. Sympodial development of conidiogenous cells ($\times 5600$). Fig. 34. Conidiogenous cells showing sympodial proliferation and scars marking areas of conidium development ($\times 11300$). Fig. 35. Conidia ($\times 5600$).

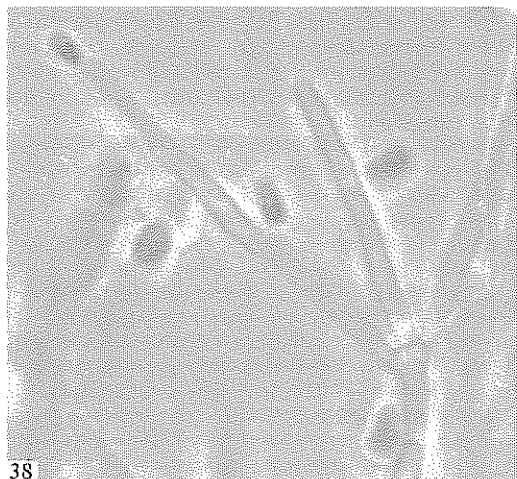
Figs 26–31. *Verticicladiella truncata*. Fig. 26. Conidiophores ($\times 3300$). Fig. 27. Conidiogenous cells with scars left after secession of conidia ($\times 5600$). Fig. 28. Elongating conidiogenous cell showing displacement (arrow) of outer wall tissue ($\times 5600$). Fig. 29. Apparent sympodial development of conidiogenous cell ($\times 11300$). Fig. 30. Conidia with truncate bases ($\times 5600$). Fig. 31. Budding conidia ($\times 5600$).



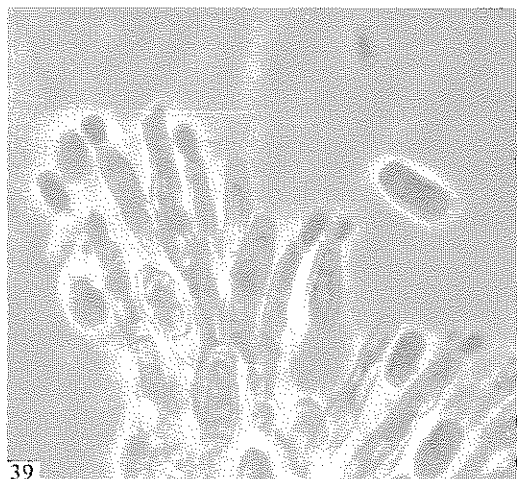
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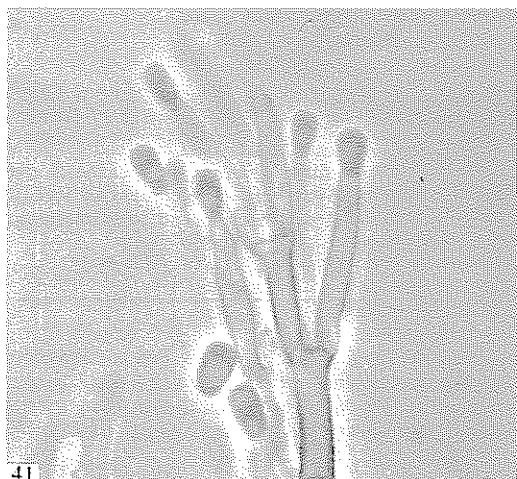
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enteroblastically and holoblastically (sympodially and percurrently), are more common than was previously thought. The present work confirms this prediction.

Conidial development in *Leptographium* spp. and *Verticicladiella* spp. could be described in terms of the five developmental stages suggested by Minter *et al.* (1982) in the following way. The first conidium is produced holoblastically and delimited by a septum (conidium ontogeny and conidium delimitation). Thereafter the conidium secedes (secession) and the conidiogenous cell proliferates enteroblastically percurrently or holoblastically sympodially (proliferation). The second conidium is formed holoblastically involving all walls of the adjacent proliferation (regeneration).

Conidial development in *V. procera* was different from that observed in *V. truncata* and *Leptographium* spp. Conidiogenous cells appeared to have proliferated sympodially although the resulting geniculate conidiogenous cell was not as obvious as some of those observed in *V. truncata* and *Leptographium* spp. This was apparently due to a more limited proliferation of the conidiogenous cells in *V. procera*. The extent of proliferation of conidiogenous cells in species of *Verticicladiella* and *Leptographium* may become a useful taxonomic character at the species level.

Conidial development and shape in the two *Phialocephala* spp. examined here suggests that this genus is not homogeneous and that *P. bactrospora* is distinctly different (cylindrical conidia with truncate ends and long cylindrical collarettes) from *P. fusca*. *Phialocephala bactrospora* is more similar to a *Chalara* spp. and conidiogenous cells suggest that conidia are being produced by ring wall building (Minter *et al.*, 1983; Minter, pers. comm.). By comparison, the conidia of *P. fusca* in the collarettes suggests that development is by replacement wall building (Minter *et al.*, 1983). *Phialocephala bactrospora* may thus be related to *Ceratocystis* spp. with *Chalara* type anamorphs whereas *P. fusca* is closer to the *Leptographium*/*Verticicladiella* types (Minter, pers. comm.). A more detailed examination of conidial development in *Phialocephala* is required to establish whether this genus should be separated from *Leptographium* and *Verticicladiella*.

The genera *Graphium* Corda, *Pesotum* Crane &

Schoknecht and *Phialographium* Upadhyay & Kendrick, are synnematous homologues of *Leptographium*, *Verticicladiella* and *Phialocephala* respectively (Crane & Schoknecht, 1973; Upadhyay & Kendrick, 1974). Observations on the mononematous species in this study could apply to their synnematous homologues. Conidiogenous cell proliferation in *Graphium* spp. (annelidic) and *Pesotum* spp. (sympodial) might be sufficiently similar to warrant consolidation of these genera.

Kendrick (1980) noted the morphological similarity between *Leptographium*, *Verticicladiella* and *Phialocephala* spp. and questioned whether the separation of these genera based on conidial ontogeny is justified. The results of this study, however, suggest that *Phialocephala* can be distinguished from *Leptographium* and *Verticicladiella* using light microscopy. Although conidial development in many *Phialocephala* spp. may not be conceptually different from conidial ontogeny in *Leptographium* and *Verticicladiella* spp., it is considered reasonable to leave the genus *Phialocephala* intact at present. The separation of *Verticicladiella* spp. and *Leptographium* spp. solely on the basis of sympodial and annelidic conidium development can clearly not be justified. *Verticicladiella* spp. should therefore be assigned to the genus *Leptographium*. The following synonymy is proposed:

LEPTOGRAPHIUM Lagerberg & Melin, *Sv. Skogs-
vardsf. Tidskr.* 25: 257 (1927).

Verticicladiella Hughes, *Can. J. Bot.* 31: 653
(1953).

The generic circumscription of *Leptographium* should be amended to include conidiogenous cells which develop enteroblastically (percurrent, annelidic) and holoblastically (sympodial).

Incorporation of the *Verticicladiella* spp. in *Leptographium* requires a number of new combinations. Of these, five species have been described as *Verticicladiella* anamorphs of *Ceratocystis* spp. after publication of a *Verticicladiella* monograph by Kendrick (1962). These include *V. aurea*, *V. crassivaginata*, *V. grandifoliae* Davidson, *V. huntii* and *V. robusta*. With the exception of *V. grandifoliae*, isolates of all these fungi have been examined. Assignment of the anamorph of *C. grandifoliae* to *Verticicladiella* by Davidson (1976)

Figs 36–41. Light micrographs of conidiogenous cells of *Verticicladiella* spp. *Leptographium* spp. and *Phialocephala* spp. Fig. 36. Phialides of *P. bactrospora* ($\times 1750$). Fig. 37. Phialides of *P. fusca* ($\times 1750$). Fig. 38. Apparent sympodial proliferation in *L. humbergii* ($\times 1750$). Fig. 39. Sympodial and annelidic development in *L. terebrantis* ($\times 1750$). Fig. 40. Sympodial proliferation in *L. pyrinum* ($\times 1750$). Fig. 41. Apparent annelidic development in *V. truncata* ($\times 1750$).

was reconfirmed by Upadhyay (1981). The following species previously in *Verticicladiella* are included in *Leptographium* as amended:

- Leptographium abietinum** (Peck) Wingfield, comb.nov.
Sporocybe abietina Peck, *New York State Museum Rept* 31: 45 (1879).
Verticicladiella abietina (Peck) Hughes, *Can. J. Bot.* 31: 653 (1953).
- Leptographium antibioticum** (Kendrick) Wingfield, comb.nov.
Verticicladiella antibiotica Kendrick, *Can. J. Bot.* 40: 781 (1962).
- Leptographium aureum** (Robis.-Jeff. & Davids.) Wingfield, comb.nov.
Verticicladiella aurea Robis.-Jeff. & Davids., *Can. J. Bot.* 46: 1525 (1968).
- Leptographium brachiatum** (Kendrick) Wingfield, comb.nov.
Verticicladiella brachiata Kendrick, *Can. J. Bot.* 40: 786 (1962).
- Leptographium crassivaginatum** (Griffin) Wingfield, comb.nov.
Verticicladiella crassivaginata Griffin, *Can. J. Bot.* 46: 701 (1968).
- Leptographium dryocoetidis** (Kendrick & Molnar) Wingfield, comb.nov.
Verticicladiella dryocoetidis Kendrick & Molnar, *Can. J. Bot.* 43: 39 (1965).
- Leptographium grandifoliae** (Davidson) Wingfield, comb.nov.
Verticicladiella grandifoliae Davidson, *Mem. New York Bot. Gard.* 28: 45 (1976).
- Leptographium huntii** (Robis.-Jeff.) Wingfield, comb.nov.
Verticicladiella huntii Robis.-Jeff., *Can. J. Bot.* 40: 528 (1964).
- LEPTOGRAPHIUM PENICILLATUM** Grosm., *Zeitschr. f. Parasitenkunde* 3: 94 (1931).
Verticicladiella penicillata (Grosm.) Kendrick, *Can. J. Bot.* 40: 776 (1962).
- Leptographium procerum** (Kendrick) Wingfield, comb.nov.
Verticicladiella procera Kendrick, *Can. J. Bot.* 40: 783 (1962).
- Leptographium robustum** (Robis.-Jeff. & Davids.) Wingfield, comb.nov.
Verticicladiella robusta Robis.-Jeff. & Davids., *Can. J. Bot.* 46: 1525 (1968).
- Leptographium serpens** (Goid.) Wingfield, comb.nov.
Scopularia serpens Goid., *Boll. Staz. Patol. Vegetale* 16: 42 (1936).
- Verticicladiella serpens* (Goid.) Kendrick, *Can. J. Bot.* 40: 781 (1962).
- Leptographium truncatum** (Wingfield & Marasas) Wingfield, comb.nov.
Verticicladiella truncata Wingfield & Marasas, *Trans. Br. Mycol. Soc.* 80: 232 (1983).
- Leptographium wagneri** (Kendrick) Wingfield, comb.nov.
Verticicladiella wagneri Kendrick, *Can. J. Bot.* 40: 793 (1962).

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