

## Canadian and some extralimital *Paraphaeosphaeria* species

R. A. SHOEMAKER AND C. E. BABCOCK

*Mycology Section, Biosystematics Research Institute, Central Experimental Farm, Ottawa, Ont., Canada K1A 0C6*

Received December 4, 1984

SHOEMAKER, R. A., and C. E. BABCOCK. 1985. Canadian and some extralimital *Paraphaeosphaeria* species. *Can. J. Bot.* **63**: 1284–1291.

Six species of *Paraphaeosphaeria* O. Eriksson are redescribed, keyed, and illustrated: *P. castagnei* (Dur. & Mont.) O. Eriksson, *P. glauco-punctata* (Grev.) n. comb. (= *P. rusci* (Wallr.) O. Eriksson), *P. michotii* (West.) O. Eriksson (= *Leptosphaeria iwamotoi* Miyake, = *L. zaeae* Stout, = *Pleospora monilispora* Fuckel), *P. microspora* (Ell. & Ev.) n. comb., *P. obtusispora* (Speg.) Hedjaroude, and *P. vectis* (Berk. & Br.) Hedjaroude. Two species are excluded: *P. longispora* (Wegelin) Crivelli and *P. oblongata* (Niessl) Crivelli.

SHOEMAKER, R. A., et C. E. BABCOCK. 1985. Canadian and some extralimital *Paraphaeosphaeria* species. *Can. J. Bot.* **63**: 1284–1291.

Les auteurs redécrivent six espèces de *Paraphaeosphaeria* O. Eriksson en les illustrant et en proposant une clé. Il s'agit de *P. castagnei* (Dur. & Mont.) O. Eriksson, *P. glauco-punctata* (Grev.) n. comb. (= *P. rusci* (Wallr.) O. Eriksson), *P. michotii* (West.) O. Eriksson (= *Leptosphaeria iwamotoi* Miyake, = *L. zaeae* Stout, = *Pleospora monilispora* Fuckel), *P. microspora* (Ell. & Ev.) n. comb., *P. obtusispora* (Speg.) Hedjaroude, et *P. vectis* (Berk. & Br.) Hedjaroude. Deux espèces sont exclues: *P. longispora* (Wegelin) Crivelli et *P. oblongata* (Niessl) Crivelli.

[Traduit par le journal]

### Introduction

In a continuation of studies of *Leptosphaeria* and allied genera (Shoemaker 1984a, 1984b) the genus *Paraphaeosphaeria* O. Eriksson is treated. The methods and format are as previously described and cover generic description, key to species, species descriptions arranged alphabetically by epithet, excluded species, and general discussion.

### Taxonomy

*Paraphaeosphaeria* O. Eriksson, 1967, p. 405

TYPE: *P. michotii* (Westendorp) O. Eriksson, 1967, p. 405

Ascocarps scattered, intraepidermal or subepidermal, depressed-globose or globose, without a prominent beak. Beak a slightly thickened wall area composed of numerous layers of small wall cells around a thin central disc that opens as a flap and reveals the ostiole without hairs or periphyses. Wall soft,

uniformly thin, of a few layers of globose pseudoparenchyma cells, rarely with some surface scleroplectenchyma, without a detectable external waxy cuticle or crustlike layer. Physes numerous, 2–3  $\mu\text{m}$  wide, septate, not guttulate, rarely coated with gelatinous material, exceeding the asci and appearing to project into the opened ostiole after the cap has been removed. Asci bitunicate, numerous in a broad basal hymenium, cylindrical, short stalked and attached to crozier cells, bearing 8 linearly biseriata ascospores. Ascospores clavate to cylindrical, transversely septate with 2 to 9 septa, first-formed septum regularly well below the middle (0.62–0.65) subtending an enlarged cell, usually echinulate, rarely smooth, guttulate, usually with a thick gelatinous sheath, enlarged cell shorter than wide as are most other intercalary cells, end cells longer and devoid of thin areas (germ pores).

Anamorph where known: *Coniothyrium*.

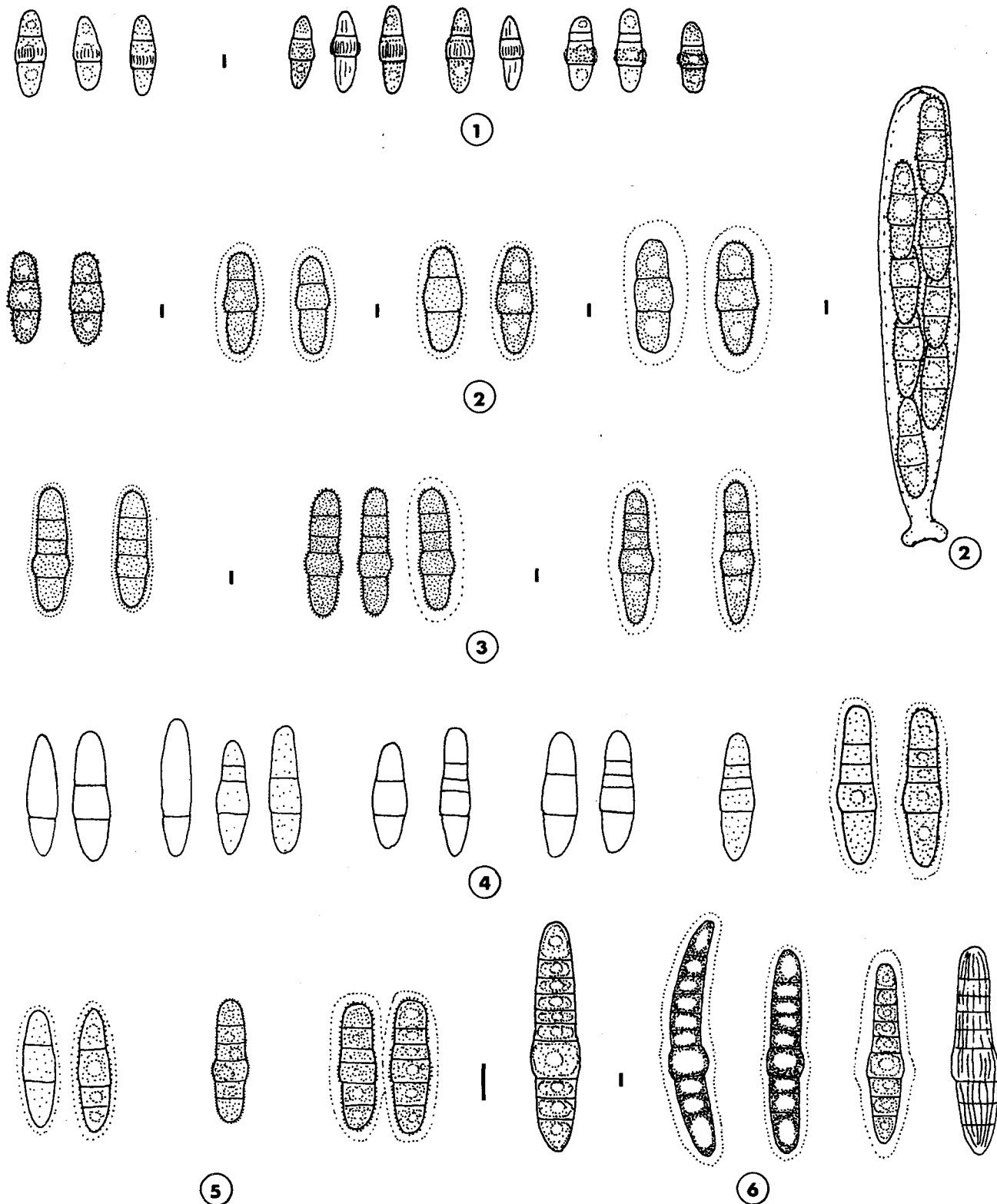
### Key to species

- |  |                        |
|--|------------------------|
| 1a. Ascospores 2-septate (see 1b–1d) ..... | 2                      |
| 2a. Ascospores echinulate, red–brown ..... | <i>michotii</i>        |
| 2b. Ascospores smooth, pale yellow .....   | <i>microspora</i>      |
| 1b. Ascospores 4-septate (see 1c–1d) ..... | 3                      |
| 3a. Ascospores echinulate, red–brown ..... | <i>glauco-punctata</i> |
| 3b. Ascospores smooth, pale yellow .....   | <i>vectis</i>          |
| 1c. Ascospores 5-septate .....             | <i>obtusispora</i>     |
| 1d. Ascospores 9-septate .....             | <i>castagnei</i>       |

*Paraphaeosphaeria castagnei* (Durieu & Montagne) O. Eriksson, 1967, p. 405 Figs. 6, 12, 14, 23, 34, 35  
= *Sphaeria castagnei* Durieu & Montagne in Durieu de Maisonneuve 1848 (1849), p. 528

Ascocarps scattered, intraepidermal, immersed, globose with a flattened base, 300–500  $\mu\text{m}$  wide, 200–250  $\mu\text{m}$  high. Beak barely erumpent, central, terete, 0–10  $\mu\text{m}$  long, 40–50  $\mu\text{m}$

wide, composed of numerous small wall cells around a 20 to 30  $\mu\text{m}$  diam. ostiole. Ascocarp wall surface a *textura angularis*, lateral wall in longitudinal section 55–65  $\mu\text{m}$  thick of 3–5 layers of oblong brown 10–13  $\times$  4–6  $\mu\text{m}$  pseudoparenchyma cells, not thinner at base, not thickened at basal margin, without an external crust. Physes 2.5–3.5  $\mu\text{m}$  wide, with thin septa at 10- to 20- $\mu\text{m}$  intervals, without slime coating. Asci numerous in a broad hymenium, cylindrical, 120–



FIGS. 1-6. Ascospores of *Paraphaeosphaeria* species.  $\times 1000$ . Fig. 1. *P. microspora*, 188529, 184014. Fig. 2. *P. michotii*, 189243, 189453, 115542, 115675, and 189855 entire ascus with biserial spores simulating moniliosporous form. Fig. 3. *P. glauco-punctata*, 188513, 97972, 184012. Fig. 4. *P. vectis*, 189246 developmental stages. Fig. 5. *P. obtusispora*, 188515. Fig. 6. *P. castagnei*, 126610, 26322 including representation of fine surface structure.

$140 \times 16-19 \mu\text{m}$ , short stalked, with 8 overlapping linearly biserial ascospores. Ascospores cylindrical,  $33-39 \times 7-9 \mu\text{m}$ , 9(10) septate in sequence 7:6:5:4:3:2:1:6:7:(8), seventh cell from apex short and enlarged towards base, first septum

submedian (0.65), reddish brown, with large oval guttules, sometimes wrinkled, not echinulate, with sheath.

This species develops fruit bodies within the epidermis originating, at least sometimes, beneath a stoma. The thick outer

wall layer of the epidermis is raised around the ostiole and appears as a white disc as in *P. glauco-punctata* (Grev.) Shoemaker & Babcock. The fungus is readily recognized by the regularly 9-septate ascospores with short central cells and long terminal cells. The spores have a broad sheath and thick walls but are not echinulate. In some mounting media thin longitudinal lines were evident on the outer surface. The basal spore in the ascus is the smallest and may have only 7 septa. The spores have more septa than found in other species of *Paraphaeosphaeria*.

A pycnidial anamorph, *Coniothyrium castagnei* (Fuckel) Sacc., with reddish brown conidia about  $7 \times 5 \mu\text{m}$  was noted.

COLLECTIONS EXAMINED: GERMANY: 26322 and 126610, *Jasminum fruticans* L., Reichartshausen, Fuckel, hieme, Herbarium Fuckel 1894, Fungi rh. 917 (sub. *Sph. Jasmini*), Herb. Barbey-Boissier 355, as *Leptosphaeria castagnei* (Dur. & M.) Sacc.; 188512, *J[asminum] fruticans* L., pr. Reichartshausen, Fuckel, vere, ex Rab. F. eur. 736, as *Sphaeria jasmini* Castagne Cat. Mars. 1845 (non Schw.).

***Paraphaeosphaeria glauco-punctata* (Greville) n. comb.**

Figs. 3, 7, 8, 15, 20, 28, 29

= *Cryptosphaeria glauco-punctata* Greville, 1824, pp. 362–363

= *Sphaeria rusci* Wallroth, 1833, p. 776

= *Leptosphaeria rusci* (Wallroth) Saccardo, 1883, p. 74

Ascocarps scattered, intraepidermal, immersed, globose to depressed, 200–300  $\mu\text{m}$  wide, 150–250  $\mu\text{m}$  high. Beak not erumpent, central, terete, 0–10  $\mu\text{m}$  long, 30–40  $\mu\text{m}$  wide, composed of small wall cells around a 20 to 25  $\mu\text{m}$  diam. ostiole. Ascocarp wall surface a *textura angularis*, lateral wall in longitudinal section 20–30  $\mu\text{m}$  thick of 5–7 layers of polygonal brown 6–9  $\times$  4–6  $\mu\text{m}$  pseudoparenchyma cells, not thinner at base, not thickened at basal margin. Physes 2–3  $\mu\text{m}$  wide, with thin septa at 10- to 20- $\mu\text{m}$  intervals, without slime coating. Asci numerous in a broad hymenium, cylindrical, 70–85  $\times$  14–16  $\mu\text{m}$ , short stalked, with 8 overlapping linearly biseriolate ascospores. Ascospores cylindrical, 20–24  $\times$  4–5  $\mu\text{m}$ , 4 septate in sequence 3:2:3:1, fourth cell from apex short and enlarged towards base, first septum submedian (0.64), yellowish brown, with small guttules, echinulate, with a sheath.

This species occurs on cladophylls of *Ruscus*. The ascocarps are formed within the epidermis and raise a white disc of host tissue around the central ostiole. The fungus is readily distinguished by its regularly 4-septate echinulate ascospores that have a broad gelatinous sheath.

Although *Sphaeria rusci* Wallroth and *Cryptosphaeria glauco-punctata* Greville were recognized as synonymous by Berlese (1892, p. 72) for example, the earlier epithet was not adopted. A new combination is proposed here.

A *Coniothyrium* anamorph was reported by Müller and Tomašević (1957). Dennis (1978, p. 446) gave the anamorph as *Haplosporella ruscigena* Bubák. The generic name is often spelled *Aplosporella*.

COLLECTIONS EXAMINED: GERMANY: 188513, Dresden, hieme 1871/72, ex Rab. F. eur. 1727, as *Sphaeria rusci* Wallr. SOVIET UNION: 121668, *Ruscus synaglossum*, Leningrad, L. A. Lebedeva, 15.XII.1922, as *Leptosphaeria ruscicola* Karst. SWITZERLAND: 123614, Waadt, Carrières, Hügel von St. Triphon, W. Koch, 28.6.1939, ex ZT; 123542, Kt. Tessin, Vico-Morcote, D. Badertscher, 2.6.1949, ex ZT;

123617, *Ruscus* spec., Kt. Zürich, Wädenswil, Garten der Versuchsanstalt, E. Müller, 6.3.1950, ex ZT. UNITED KINGDOM: ENGLAND: 97972, Lyndhurst Hill, Lyndhurst, Hants., G. F. Laundon, 4.V.1962, ex Herb IMI 94853; 121667, Hadzor, Worcestershire, P. G. M. Rhodes 4454, 11/3/1930; SCOTLAND: 184012, W. Edinburgh (Script.?), Greville Collection, August, ex E. Greville Collection, as *Sphaeria, Cryptosphaeria glauco-punctata* Grev. YUGOSLAVIA: 36850, St. Vitum et monte Belvedere ad Flumen, Voss et Wettstein, Fl. Exs. Austro-Hungarica 1578. All collections as *Leptosphaeria rusci* (Wallr.) Sacc. on *Ruscus aculeatus* L. unless otherwise noted.

*Paraphaeosphaeria michotii* (Westendorp) O. Eriksson, 1967, p. 406 Figs. 2, 10, 19, 26, 27

= *Leptosphaeria michotii* Westendorp, 1859, p. 87

= *Leptosphaeria iwamotoi* Miyake, 1910, p. 247

= *Leptosphaeria zae* Stout, 1930, p. 277

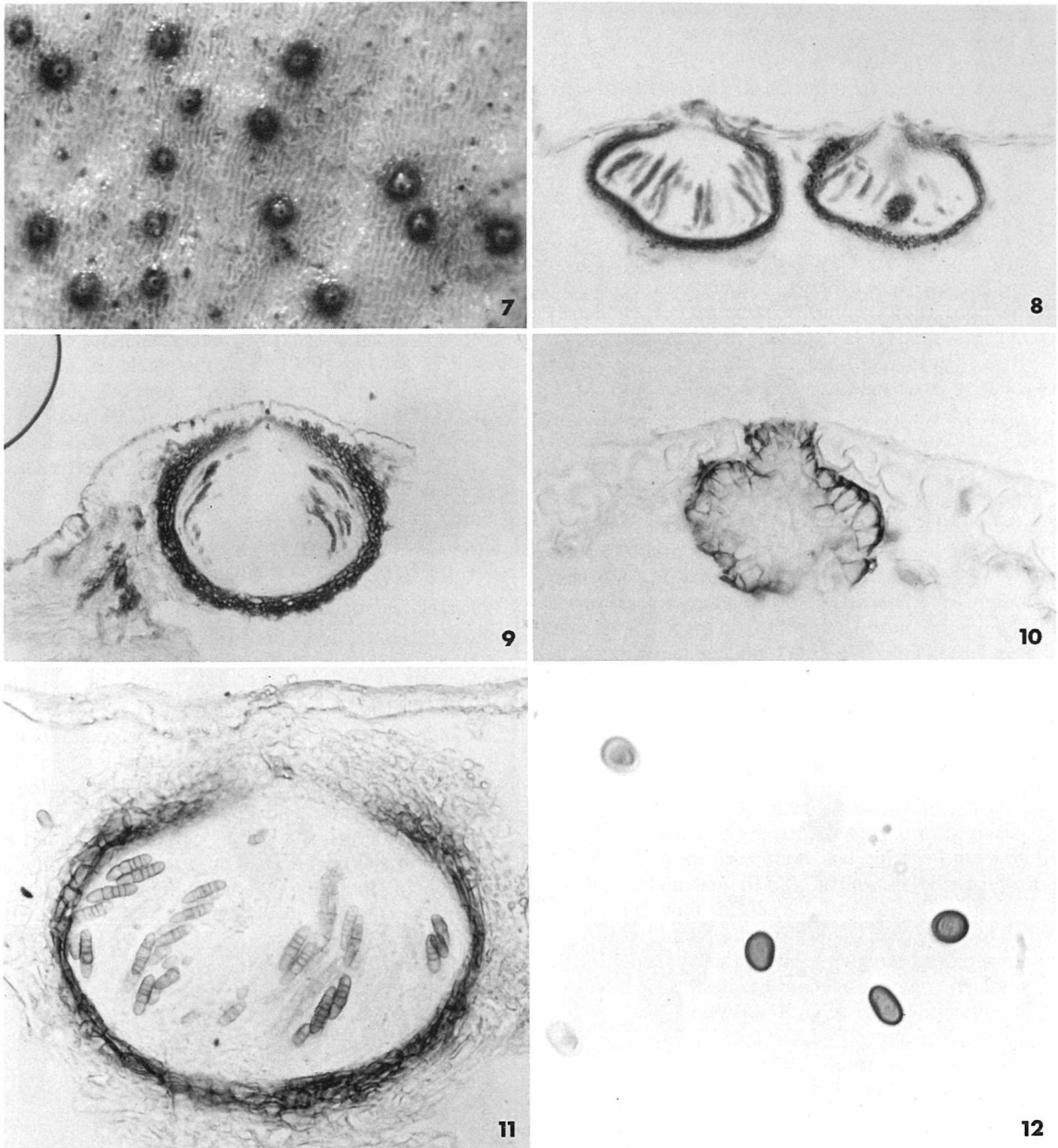
= *Pleospora monilisporea* Fuckel, 1869 (1870), p. 138

= *Leptosphaeria monilisporea* (Fuckel) Saccardo, 1883, p. 79

Ascocarps scattered, subepidermal, depressed–globose, 200–250  $\mu\text{m}$  wide, 150–190  $\mu\text{m}$  high. Beak barely erumpent, central, terete, short, 30–60  $\mu\text{m}$  long, 30–40  $\mu\text{m}$  wide, composed of small wall cells around a 10 to 20  $\mu\text{m}$  diam. ostiole. Ascocarp wall surface a *textura angularis*, lateral wall in longitudinal section 10–20  $\mu\text{m}$  thick of 3–5 layers of oblong, yellow, 6–8  $\times$  3–4  $\mu\text{m}$  pseudoparenchyma cells, not thinner at base, not thickened at basal margin. Physes 2–3  $\mu\text{m}$  wide, with thin septa at 10- to 15- $\mu\text{m}$  intervals, with slime coating. Asci numerous in a broad hymenium, cylindrical, 60–80  $\times$  12–18  $\mu\text{m}$ , short stalked, with 8 overlapping linearly biseriolate ascospores. Ascospores clavate, 16–24  $\times$  4–5  $\mu\text{m}$ , 2 septate in sequence 2:1, central cell short and enlarged towards base, first septum submedian (0.65), yellowish brown, with small guttules, echinulate, with sheath when young.

The anamorph is *Coniothyrium scirpi* Trail (Webster 1955; Sivanesan 1984). The pycnidial fungus, *Coniothyrium zae* Stout (1930, p. 273), to judge from the description and illustration, is a synonym.

This species occurs on monocots, mainly grasses. It is quite distinctive in having 2-septate, echinulate ascospores with a sheath visible on young spores. A detailed description and synonymy were given by Shoemaker and Eriksson (1967). Only additional synonyms are cited here. *Leptosphaeria iwamotoi* is included on the basis of the original description and illustration, and from our study of a collection by Hara on *Oryza sativa*, Kohoma, 21.XI.1910, ex Herb. Sydow, S. Sivanesan (1984) cited it as a synonym. *Leptosphaeria zae* Stout on *Zea mays* L. from Illinois, U.S.A., is clearly a synonym. *Pleospora monilisporea* Fuckel has been an enigma since its description. On the type from G we found good material of *P. michotii*. It seems probable to us that Fuckel saw rows of three or four 2-septate spores, each spore with an enlarged central cell and with apparent constrictions at the ends of the touching spores in a row, giving rise to the choice of epithet “monilisporea.” A row of 4 mature spores would be 11 “septate” and three spores would appear 8 “septate,” whereas Fuckel gave 8 to 10 septate. He did state the asci were 8 spored, but our surmise implies only two rows of 3 or 4 spores giving the appearance of only two moniliform spores per ascus. Otherwise the original description can apply quite well to *P. michotii*.

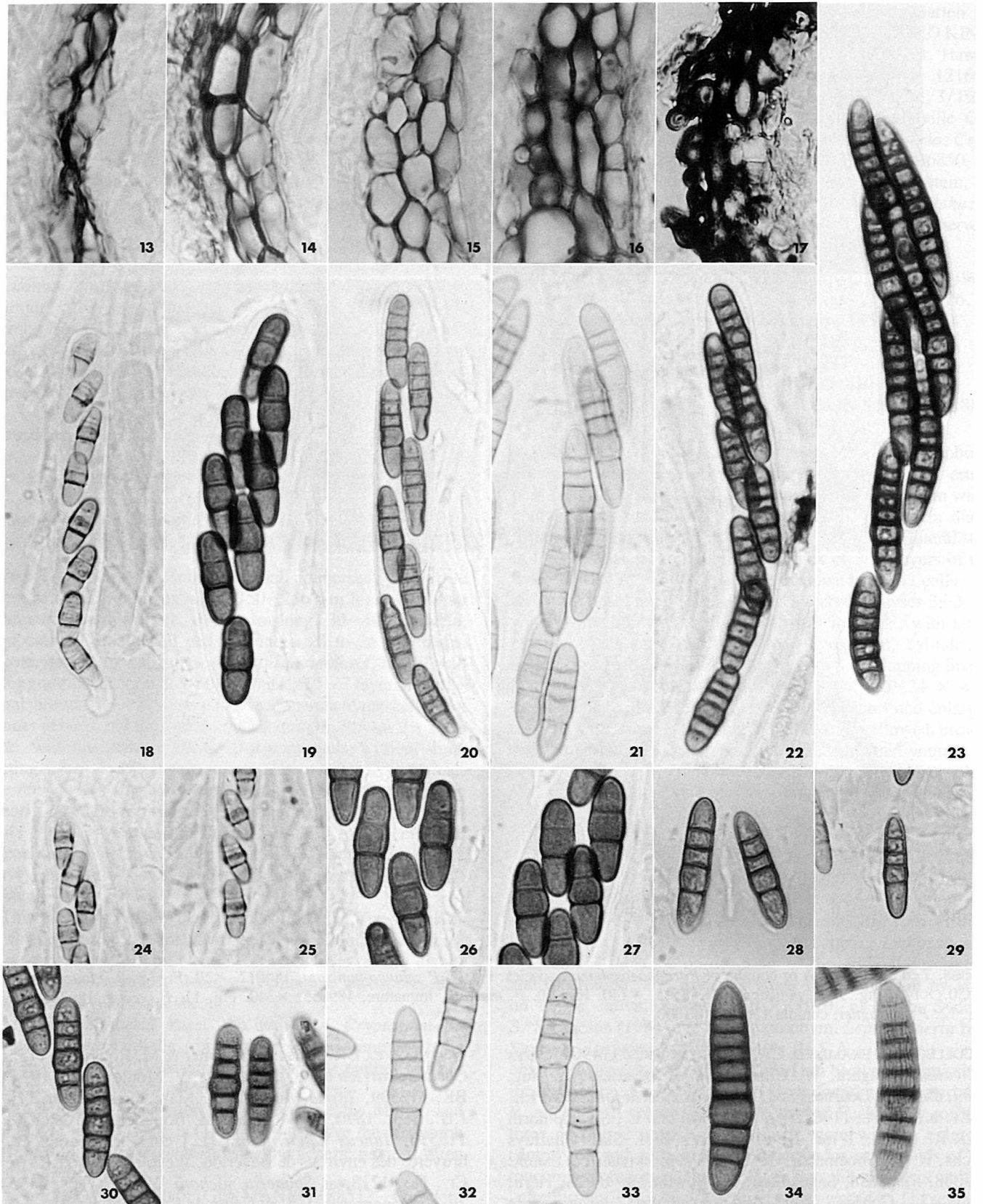


FIGS. 7-12. Ascocarps or conidia of *Paraphaeosphaeria* species. Fig. 7. *P. glauco-punctata*, 184012.  $\times 20$ . Fig. 8. *P. glauco-punctata*, 36850.  $\times 140$ . Fig. 9. *P. obtusispora*, 188515.  $\times 140$ . Fig. 10. *P. michotii*, immature, 189855.  $\times 340$ . Fig. 11. *P. vectis*, 189246.  $\times 340$ . Fig. 12. *P. castagnei*, conidia 126610.  $\times 1000$ .

COLLECTIONS EXAMINED: CANADA: ONTARIO: 114904, *Carex folliculata*, Niagara, W. Chautauqua, J. Dearness, 15 Aug. 1889, ex Herb. Dearness 561, as *Leptosphaeria folliculata* Ell. & Ev. n.s., TYPE; 114672(c), *Typha latifolia* L., Swamp north of R.R. tracks, 1 mi. N. of Queen's Biol. Stat. Chaffeys Locks, R. A. Shoemaker, 10 Sept. 1966; BRITISH COLUMBIA: 165038, *Bambusa*, Saanichton, M. Newton, 9-6-28, Herb. of W. L. Gordon 1660, as *Leptosphaeria? arundinacea* (Sow.) Sacc. AUSTRIA: 115537, *Luzula nemorosa*, Mahr.-Weisskirch: Ungersdorf, Dr. F. Petrak, 5.1914, ex BR, F. Petrak, Flora Bohemiae et Moraviae exsiccata, Lfg. 21. Nr. 1038. BELGIUM: 115541, *Calamagrostis epigeios* [(L.) Roth], Groenendael, Janvier 1889, ex BR, Herb. E. Bommer & M. Rousseau.; 115538, *Calamagrostis*, Groenendael, Jan-

vier 1889, ex BR, Herb. E. Bommer & M. Rousseau; 115542, *Carex sylvat[ica]* Huds., Beaufays, V. Mouton, Acc. 1922, ex BR; 115539, *Typha angustifolia*, Mare, près Dohan, Ch. et J.B., Sept. 1890, ex BR, Herb. E. Bommer & M. Rousseau; 115536, *Juncus squarro[sus]* [L.] dans les marais et les bruyères des environs de Beverloo, West. et W., ex BR, Herb. Cr., No. 1218, as *Sphaeria michotii* West., TYPUS; 115543, *Juncus squarrosus* [L.], au Camp de Beverloo, ex BR, Herbier Westendorp, probably TYPE and part of 115536, as *Sphaeria michotii* West.; 115540, *Scirpus lacustris*, Mare à Dohan, Septembre 1890, ex BR. GERMANY: 126613, *Juncus lamprocarpus*, Oestricher Wald, Fuckel, Autumno, ex Herbier Barbey-Boissier 368, as *Leptosphaeria monilispora* (Fckl.) Sacc; 189855, *Juncus lamprocarpus*, [in Oestricher Wald],





FIGS. 13–35. Ascocarp lateral wall in longitudinal section, asci or ascospores of *Paraphaeosphaeria* species.  $\times 1000$ . Fig. 13. *P. vectis*, 189246. Fig. 14. *P. castagnei*, 188512. Fig. 15. *P. glauco-punctata*, 36850. Fig. 16. *P. obtusispora*, 188515. Fig. 17. *P. microspora*, 184014. Fig. 18. *P. microspora*, 188529. Fig. 19. *P. michotii*, 189855. Fig. 20. *P. glauco-punctata*, 188513. Fig. 21. *P. vectis*, 189242. Fig. 22. *P. obtusispora*, 188515. Fig. 23. *P. castagnei*, 126610. Figs. 24 and 25. *P. microspora*, 188529. Fig. 26. *P. michotii*, 115543. Fig. 27. *P. michotii*, 189855. Figs. 28 and 29. *P. glauco-punctata*, 188513. Figs. 30 and 31. *P. obtusispora*, 188515. Figs. 32 and 33. *P. vectis*, 189246. Fig. 34. *P. castagnei*, 126610. Fig. 35. *P. castagnei*, 26322.

[Fuckel], [in Herbst.], ex G, Fungi rhen. Nr. 1777, as *Pleospora monilispota* Fckl, TYPE. INDIA: 123924, *Cymbopogon iwarencusa* Schult., [5,000 ft., Kathau(?), Kulu, Punjab], W. Koelz 1882, April 19, 1931, as *Leptosphaeria iwamotoi* I. Miyake. ITALY: 184953, *Juncus lamprocarpus*, Baganze bei Parma, G. Passerini, 6.1877, ex S, ex Herb. Sydow 2442, "*Sphaerella lamprocarpi*," as *Leptosphaeria lamprocarpi* (Pass.) Sacc. JAPAN: 184947, *Oryza sativa* L., Kohama, [Shikoku], Hara, 21/XI, 1910, ex S, ex Herb. Sydow, as *Leptosphaeria iwamotoi* Miyake. KENYA: 97981, *Hordeum vulgare*, North Kinangop, E. J. Guthrie, xii.1961, IMI No. 91011. SWEDEN: 115674, *Ammophila arenaria*, Gotland, Tarö par., Vorsta auren, B. & O. Eriksson 2072c, 11.vi.1963, ex UPS; 115675, *Juncus squarrosus* [L.], Halland, Bredared par., Moshult, J. A. Nannfeldt, 4.xi.1929, ex UPS. U.S.A.: ILLINOIS: 189243, *Zea mays* L., Tamaroa, Perry Co., G. L. Stout, 13 October 1933, ex ILLS, Accession No. 23182, as *Leptosphaeria zae* Stout. All collections as *Leptosphaeria michotii* (West.) Sacc. unless otherwise noted.

*Paraphaeosphaeria microspora* (Ellis & Everhart) n. comb.  
Figs. 1, 17, 18, 24, 25  
= *Leptosphaeria microspora* Ellis & Everhart, 1897, p. 461

Ascocarps scattered, immersed, subepidermal, later exposed, globose with a flattened base, 150–200  $\mu\text{m}$  wide, 120–140  $\mu\text{m}$  high. Beak central, terete, truncate-conical 30–40  $\mu\text{m}$  long, 30–40  $\mu\text{m}$  wide, composed of 3–5 layers of brown polygonal 3–4  $\times$  3–4  $\mu\text{m}$  cells around a 15 to 20  $\mu\text{m}$  diam. ostiole. Ascocarp wall surface a *textura angularis*, lateral wall in longitudinal section 15–20  $\mu\text{m}$  thick of 3 or 4 layers of polygonal brown 3–7  $\times$  2–3  $\mu\text{m}$  scleroplectenchyma cells, thinner at base, slightly thickened at basal margin, with a few blunt aseptate setae 10–15  $\times$  2  $\mu\text{m}$ . Physes 1–1.5  $\mu\text{m}$  wide, with thin septa at 8- to 20- $\mu\text{m}$  intervals, with slime coating. Asci numerous in a broad hymenium, cylindrical, 55–60(70)  $\times$  5–7  $\mu\text{m}$ , short stalked, with 8 overlapping linearly biseriate ascospores. Ascospores narrowly fusiform, 12–16  $\times$  3.5–4.5  $\mu\text{m}$ , 2 septate in sequence 2:1 (or rarely 3 septate), central cell enlarged towards base, slightly shorter than end cells, first septum submedian (0.65), yellowish brown, without guttules, smooth, without sheath or appendages.

This species was accurately described by Ellis & Everhart with the exception of spore septation. The spores are regularly 2 septate when mature. This character suggested *Eudarluca caricis* a parasite of rust fungi. Rust is present on the *Lepedeza*, but *P. microspora* is independent of the rust. The spore form differs in that *Eudarluca* ascospores are more acute at the ends and are furnished with terminal globose appendages. *Paraphaeosphaeria microspora* belongs in *Paraphaeosphaeria* and is quite similar to *P. michotii* which has slightly larger and echinulate ascospores and occurs on monocots.

The spores of *P. microspora* very occasionally have a third septum formed close to the second septum. Rarely, a septum divides the basal cell. Such rare occurrences may have prompted the authors to describe the spores as 1–3 septate. The usual condition is 2 septate. A substantial number of spores have a thin refractive zone on both sides of the apical septum, though the majority do not and appear with finely granular cytoplasm filling all cells uniformly except for the central guttule in each cell. There appears to be a thin band around the lower part of

the central cell. The band resembles the wall reinforcement shown for *Phaeosphaeria juncina* (Auersw.) L. Holm, *P. juncicola* (Rehm) L. Holm, and *P. sowerbyi* (Fuckel) L. Holm by Leuchtmann (1984, Figs. 15a, 15b, 15d). In *P. microscopica* the band appears to be on the outer surface and, in views of the upper surface, to consist of about 8 fine vertical ridges. In median optical section of a spore the numerous ridges on the curved lateral wall make the wall appear thickened. Some exceptionally fine lines extend to the ends of the spores, but these lines are so fine that they are difficult to resolve.

COLLECTIONS EXAMINED: CANADA: ONTARIO: 184014, *Lepedeza capitata* [Michx.], Woodland Cem[eter]y, [London], J. Dearness, 9 Aug[ust] 1897, ex Herb. Dearness 2474, part of type; 188529, *Lepedeza capitata* [Michx.], London, J. Dearness, August 1897, ex Ell. & Ev., N.A.F. 3524. Both collections as *Leptosphaeria microspora* Ell. & Ev.

*Paraphaeosphaeria obtusispora* (Spegazzini) Hedjaroude, 1968 (1969), p. 98 Figs. 5, 9, 16, 22, 30, 31  
= *Leptosphaeria obtusispora* Spegazzini, 1881, p. 179

Ascocarps scattered, intraepidermal, depressed globose, 250–350  $\mu\text{m}$  wide, 200–250  $\mu\text{m}$  high. Beak barely erumpent, central, terete, short, 0–10  $\mu\text{m}$  long, 30–40  $\mu\text{m}$  wide, composed of small wall cells around a 10 to 15  $\mu\text{m}$  diam. ostiole. Ascocarp wall surface a *textura angularis*, lateral wall in longitudinal section 17–30  $\mu\text{m}$  thick of 4 or 5 layers of polygonal to oblong dark brown 7–10  $\times$  4–6  $\mu\text{m}$  pseudo-parenchyma cells, not thinner at base, thickened at upper margin. Physes 2–3  $\mu\text{m}$  wide, with thin septa at 10- to 15- $\mu\text{m}$  intervals, with slime coating. Asci numerous in a broad hymenium, cylindrical, 90–110  $\times$  11–13  $\mu\text{m}$ , short stalked, with 8 overlapping linearly biseriate ascospores. Ascospores cylindrical, 17–22  $\times$  5–6  $\mu\text{m}$ , 5 septate in sequence 4:2:4:1:3, fourth cell from apex short and enlarged towards base, first septum submedian (0.62), yellowish brown, with guttules, echinulate, with sheath.

This species was described on *Yucca gloriosa* L. by Spegazzini and is redescribed from material on the same host from Mississippi. It has been reported on other genera of Liliaceae: *Agave*, *Aloë*, *Dracaena*, *Fourcroya*, (Hedjaroude 1968, p. 99). The ascocarps develop within the epidermis and raise a white disc of the outer part of the epidermis around the ostiole. In intermediate stages a strongly developed upper wall is evident and the ascocarp is almost semicircular in outline in longitudinal section. Later the ascocarp may be globose as illustrated by Hedjaroude. The spores are consistently 5 septate, echinulate, and exhibit a gelatinous sheath.

COLLECTION EXAMINED: U.S.A.: MISSISSIPPI: 188515, *Yucca gloriosa* [L.], Starkville; S. M. Tracy, May 1894, ex Ell. & Ev., N.A.F. 3117 as *Leptosphaeria obtusispora* Speg.

*Paraphaeosphaeria vectis* (Berkeley & Broome) Hedjaroude, 1968 (1969), p. 98 Figs. 4, 11, 13, 21, 32, 33  
= *Sphaeria vectis* Berkeley & Broome, 1854, p. 467

Ascocarps clustered, immersed, substomatal, subcuticular, semiglobose, flattened above, 170–220  $\mu\text{m}$  wide, 100–140  $\mu\text{m}$  high. Beak central, a mere papilla, surrounded by a white disc of raised epidermis, 15–20  $\mu\text{m}$  long, 60–80  $\mu\text{m}$  wide, composed of 6–8 layers of brown polygonal 3–5  $\times$  3–5  $\mu\text{m}$  cells around a 25 to 30  $\mu\text{m}$  diam. ostiole, surrounded by extensive mycelium and cells merging with the beak. Ascocarp wall surface a *textura angularis*, lateral wall in longitudinal section

12–16  $\mu\text{m}$  thick of 3–5 layers of polygonal brown 6–8  $\times$  3–5  $\mu\text{m}$  pseudoparenchyma cells, not thinner at base, not thickened at basal margin. Physes 2–3  $\mu\text{m}$  wide, with thin septa at 20- to 30- $\mu\text{m}$  intervals, without slime coating. Asci numerous in a broad hymenium, cylindrical, 75–95  $\times$  12–16  $\mu\text{m}$ , short stalked, with 8 overlapping linearly biseriate ascospores. Ascospores narrowly fusiform, 22–27  $\times$  6–7  $\mu\text{m}$ , 4 septate in sequence 3:2:3:1, first septum at 0.66, fourth cell from apex widest, shorter than wide and enlarged towards base, yellowish brown, with guttules, finely echinulate, with a sheath.

This redescription from the type agrees in many respects with the original description. However, no 5-septate ascospores were found even in very mature ascocarps. The original description and illustrations indicated a fifth septum dividing the basal cell. Dennis (1968, p. 400) redescribed the spores as 4 septate. The pattern of septation is interesting. The first septum 1/3 from the base gives a young spore resembling apiosporous forms. The second septum divides the upper part nearly equally. The next septation is almost simultaneous on both sides of and close to the second septum. The mature spore is 4 septate in *P. vectis*. It is close to *P. obtusispora*, which however, has a fundamental difference in septation sequence, 4:2:4:1:3. In *P. obtusispora* the third septum divides the basal third of the spore. The result is consistently 5-septate ascospores at maturity. In *P. vectis* the basal third is not subdivided and the spores are typically 4 septate. If a fifth septum occurs as originally described, it must be very late and infrequent based on our examination of the type. The ascospores of *P. obtusispora* are hemispheric at both ends as the epithet implies and dark reddish brown and conspicuously echinulate. In *P. vectis* the ascospores are more nearly fusoid, mid yellowish brown, and finely echinulate. The differences between *P. vectis* and *P. glauco-punctata* are that the ascospores of *P. vectis* are yellowish brown, finely echinulate, and 6–7  $\mu\text{m}$  wide, whereas those of *P. glauco-punctata* are dark reddish brown, coarsely echinulate, and 4–5  $\mu\text{m}$  wide.

COLLECTION EXAMINED: UNITED KINGDOM: ENGLAND: 189246, *Iris foetidissima* [L.], I[sle] of W[ight], [Rev.] A. B[loxam] 340, ex K, Herb. Berk. 1879, as *Sphaeria vectis* Berk. & Br., TYPE!

### Discussion

*Paraphaeosphaeria* was described by Eriksson (1967, pp. 405–407) for four species and slightly expanded by Hedjaroude (1968 (1969), pp. 94–101). Recently, Leuchtmann (1984, pp. 26–27) provided a key to allied genera. The generic concept in these works is consistent. The ascocarps form below or within the host epidermis, often beginning beneath stomata. They are globose to semiglobose and have at most a slight thickening of the wall in the ostiole region. A conspicuous beak is lacking. The ostiole opens by extrusion of a circular flap of tissue to which some pseudoparaphyses are attached, reminiscent of the ostiolar opening described in *Clathrospora heterospora* (DeNot.) var. *simmonsii* (Wehm.) Wehm. by Corlett (1967). Periphyses and ostiolar hairs are lacking. The ascocarp wall is not highly differentiated, merely a few layers of pseudoparenchyma. The ascospores have the first septum consistently 2/3 from the apex, most are echinulate and bear a broad uniform sheath. The species are distinguished on the number of septa, (2–9), pattern of septation, spore color, and to a degree, by host specialization. The anamorph, where known, is con-

sistently a *Coniothyrium* (Sivanesan 1984). The affinities are closest to *Phaeosphaeria* and in particular to the series of species including *Phaeosphaeria fuckelii* (Niessl) L. Holm.

It is of interest that Crivelli (1983, pp. 179–184) included in the genus two *Pleospora* species (*P. oblongata* Niessl and *P. wegeliniana* E. Müller, = *Strickeria longispora* Wegelin) which have transverse septa like those in ascospores of *P. castagnei* but develop longitudinal septa. However, the beak and wall structure of these two *Pleospora* species are features that exclude these species from *Paraphaeosphaeria* in our opinion, despite the evidence of a developmental sequence in septation of ascospores. We favor the retention of the two species in *Pleospora*. Anamorphs were not reported for either species. Evidence from the anamorph may eventually help resolve a better generic disposition.

An earlier study of *P. michotii* (West.) O. Eriksson indicated a number of synonyms (Shoemaker and Eriksson 1967). Some additional synonyms are included in the present work. The most controversial of these is *Pleospora monilispora* Fuckel (1869 (1870), p. 138) which has been an enigma ever since it was described. Details of the argument are given under *P. michotii*.

### Acknowledgments

Constructive comments were given in reviews by Dr. S. J. Hughes and Dr. M. P. Corlett.

- BERKELEY, M. J., and C. E. BROOME. 1854. Notices of British fungi. XLIII. Ann. Mag. Nat. Hist. Ser. 2, 13: 458–469.
- BERLESE, A. N. 1892. Icones fungorum. Vol. 1. Fasc. 2. E. Pergola, Avellino. pp. 67–90.
- CORLETT, M. 1967. The developmental morphology of *Clathrospora heterospora* var. *simmonsii*. Can. J. Bot. 45: 221–227.
- CRIVELLI, P. G. 1983. Ueber die heterogene Ascomycetengattung *Pleospora* Rabh.; Vorschlag für eine Aufteilung. Dissertation Eidgenössische Technische Hochschule 7318. ADAG Administration & Druck AG, Zürich.
- DENNIS, R. W. G. 1968. British Ascomycetes. 2nd ed. Cramer, Vaduz.
- 1978. British Ascomycetes. 3rd ed. Cramer, Vaduz.
- DURIEU DE MAISONNEUVE, M. C. 1848. Exploration scientifique de l'Algérie. Imprimerie royale, Paris. 1(14): 521–560.
- ELLIS, J. B., and B. M. EVERHART. 1897. New species of fungi from various localities. Bull. Torrey Bot. Club, 24: 457–477.
- ERIKSSON, O. 1967. On graminicolous pyrenomycetes from Fennoscandia. 2. Phragmosporous and scolecosporous species. Ark. Bot. 6(9): 381–440.
- FUCKEL, L. 1869. Symbolae Mycologicae. Jahrb. Nassau. Ver. Naturk. 23, 24: 1–459.
- GREVILLE, R. K. 1824. Flora edinensis: or a description of plants growing near Edinburgh. W. Blackwood, Edinburgh.
- HEDJAROUDE, G. A. 1968. Études taxonomiques sur les *Phaeosphaeria* Miyake et leurs formes voisines (Ascomycètes). Sydowia, 22: 57–107.
- LEUCHTMANN, A. 1984. Ueber *Phaeosphaeria* Miyake und andere bitunicate Ascomyceten mit mehrfach querseptierten Ascosporen. Dissertation Eidgenössische Technische Hochschule 7545. ADAG Administration & Druck AG, Zürich.
- MIYAKE, I. 1910. Studien über die Pilze der Reispflanze in Japan. J. Coll. Agric. Tokyo Imp. Univ. 2(4): 237–256.
- MÜLLER, E., and M. TOMAŠEVIČ. 1957. Kulturversuche mit einigen Arten der gattung *Leptosphaeria* Ces. & DeNot. Phytopathol. Z. 29: 287–294.
- SACCARDO, P. A. 1883. Sylloge Fungorum. 2. Padua.
- SHOEMAKER, R. A. 1984a. Canadian and some extralimital *Leptosphaeria* species. Can. J. Bot. 62: 2688–2729.

- 1984b. Canadian and some extralimital *Nodulosphaeria* and *Entodesmium* species. Can. J. Bot. **62**: 2730–2753.
- SHOEMAKER, R. A., and O. ERIKSSON. 1967. *Paraphaeosphaeria michotii*. Can. J. Bot. **45**: 1605–1608.
- SIVANESAN, A. 1984. The bitunicate Ascomycetes and their anamorphs. Cramer, Vaduz.
- SPEGAZZINI, C. 1881. Fungi Argentini additis nonnullis Brasiliensibus Montevideensibusque. Pugillus IV. Anal. Soc. Cient. Argentina, Buenos Aires, **12**: 174–189.
- STOUT, G. L. 1930. New fungi found on the Indian corn plant in Illinois. Mycologia, **22**: 271–287.
- WALLROTH, F. G. (W). 1833. Flora cryptogamica germanica Pars. II. J. L. Schrag, Noremberg.
- WEBSTER, J. 1955. Graminicolous Pyrenomycetes. V. Conidial states of *Leptosphaeria michotii*, *L. microscopica*, *Pleospora vagans* and the perfect state of *Dinemasporium graminum*. Trans. Br. Mycol. Soc. **38**: 347–365.
- WESTENDORP, G. D. 1859. Sixième notice sur quelques cryptogames inédités ou nouvelles pour la Flore Belge. Bull. Acad. R. Sci., Bruxelles, Ser. 2, **7**(5): 77–94.