Fungi from palms. III. The genus *Pemphidium* Montagne (Ascomycotina)

K. D. Hyde[1]

Plant Pathology Branch, Queensland Department of Primary Industries, Mareeba Q. 4880, Australia

Hyde, K. D. (1993). Fungi from palms. III. The genus *Pemphidium* Montagne (Ascomycotina). – Sydowia 45(1): 5–14.

The genus *Pemphidium* (type species: *P. nitidum*) is described and illustrated. One taxon is added to the genus and the relationship of *Pemphidium* with *Linocarpon* and other related genera is discussed. The placement of *Pemphidium* in the Amphisphaeriaceae is discussed.

Keywords: *Linocarpon*, *Oxydothis*, palm fungi.

The genus *Pemphidium* Montagne (1840) was based on a single species, *P. nitidum* Montagne, occurring on the cortex of rachids of the palm *Maximiliana regia* Martius. Its characteristics included a blackened stroma, fusiform-acicular 8-spored asci and fusiform-acicular hyaline ascospores. Later, six more species of *Pemphidium* were described (Welwitsch & Currey, 1867; Berkeley & Broome, 1870; Cesati, 1879; Karsten, 1973; Hennings, 1903) and four species were transferred from other genera (Saccardo, 1883; Batista & Maia, 1960).

Höhnel (1911) redescribed *P. nitidum* Montagne from the original material and suggested it was related to *Physalospora* Niessl in the Sphaeriaceae. Petrak (1953) reviewed some of the fungi described under *Pemphidium* and proposed it to be monotypic with *P. nitidum* Montagne as the only species. He provided a detailed description in German of *Pemphidium* and *P. nitidum*. *P. opacum* (Berk.) Saccardo, *P. erumpens* (Berk. & Curt.) Saccardo, *P. pini* Karsten, *P. punctoideum* Karsten and *P. bomulense* Hennings were excluded from *Pemphidium* on account of ascoma or ascospore morphology. *Pemphidium* was compared to *Merrilliopeltis* Hennings and *Oxydothis* Penzig & Saccardo as these were thought to be related. *Astrosphaeriella* Sydow, *Merrilliopeltis* Hennings, *Seynesia* Saccardo and *Steganopycnis* Sydow were proposed as synonymous with *Pemphidium* by Arx &

---

1 Present address: Department of Botany, University of Hong Kong, Pokfulam Road, Hong Kong

Müller (1954), but later kept as distinct (Müller & Arx, 1962). In Hawksworth & al. (1983) *Pemphidium* is maintained as distinct with one South American species.

In this paper the genus *Pemphidium* is reviewed with two accepted species, one of which is new. Each species is diagnosed and illustrated and a key to *Pemphidium* is presented.

Pemphidium Montagne, Ann. Sci. nat., sér. 2 (Bot.) 14: 329. 1840.
Type species. – *P. nitidum* Montagne.

On the midrib of palm fronds or *Phenakospermum* petioles, in large or small stromata, ascomata clustered or separate. – Individual ascomata are large (ca. 1 mm diam) and are seen as raised darkened spots on the host surface. – Ascomata are immersed beneath the host epidermis, are cylindrical or ellipsoidal in section and are surrounded by variable stromatic tissue development. – The stroma is composed of host cells filled with darkened fungal hyphae. At the margin between the upper and lower walls of the ascoma, is a wedge-shaped area of vertical brown parallel cells. The upper and lower walls of the ascoma are very thin, comprising 2–3 layers of small flattened brown cells. – The ostiole is periphysate, central, vertical, circular and may or may not be raised. – Paraphyses are embedded in a gelatinous matrix, numerous, hypha-like, septate and branching. – The asci form from the periphery of the ascoma, are long cylindrical, thin-walled, unitunicate, long-pedunculate, apically rounded with a non-amyloid subapical ring-like apparatus. The ring is not easily seen in water mounts, but becomes visible in various stains (e.g. Lactophenol cotton blue; Melzers's reagent). – Ascospores are hyaline, mostly 1-celled, occasionally with a central septum, without refringent bands, eguttulate, cylindrical to fusiform, thin-walled, with polar appendages. The polar appendage can be seen as a mucilaginous drop, but closer examination (x1000) will reveal a hollow cylinder containing mucilage.

Anamorph. – Unknown.

Mode of Life. – Saprobic.

Habitat. – On dead rachids of palms or similarly structured material [e.g. *Phenakospermum* sp. (Strelitziaceae)].

Pemphidium is a genus occurring on palms and other plants with a similar type of tissue structure (e.g. *Phenakospermum* sp.). The ascomata occur under a stroma and may be individual, but are usually clustered. The ascomata resemble those of *Linocarpon* H. Sydow & P. Sydow (Hyde, 1992), but the form of the ascus and ascospores are different. Asci are similar to those of *Oxydothis* (Hyde & Nakagiri, 1989), being long cylindrical with a subapical ring, but this is non amyloid.

In *Linocarpon* the asci are much shorter and the ring is refractive. The ascospores of all three genera are distinct. In *Pemphidium* they are usually cylindrical, one-celled, with polar appendages (Fig. 19b), in *Oxydothis* they taper from the centre to pointed or spine-like processes (Fig. 19c), while in *Linocarpon* they are filiform, with refringent bands and with or without appendages (mucilaginous pads) at the poles (Fig. 19a).

Pemphidium differs quite considerably from *Linocarpon* in ascus, ascospore and paraphysis morphology. Hyde (1992) proposed that *Linocarpon* be included in the Lasiosphaeriaceae. Wehmeyer (1975) placed *Pemphidium* in the Amphisphaeriaceae and his decision has been accepted by Eriksson & Hawksworth (1991). The asci, very similar to those of *Oxydothis*, but with a non-amyloid apical ring, might exclude *Pemphidium* from the Amphisphaeriaceae; on the other hand characteristics (ie. ascus, paraphyses) suggest that it can be included here. *Oxydothis* was placed in the Xylariales, Hyponectriaceae by Barr (1990) and since *Pemphidium* is closely related to *Oxydothis* it should occur alongside this genus in any scheme.

Key to species of *Pemphidium*

Ascomata developing within a darkened stroma lacking a distinct outer margin, spores 47–69 x 4–6.5 µm ..... *P. nitidum.*
Ascomata developing within a darkened stroma, with a distinct outer margin,ascospores 60–94 x 3.5–4.5 µm ..... *P. zonatum.*

Pemphidium nitidum Montagne, Ann. Sc. nat. sér. 2 (Bot.), 14: 326. 1840. – Figs. 1–8.

A s c o m a t a on the midrib of palm fronds, gregarious, in oval darkened areas up to 5.5 cm long and 2.0 cm wide (Fig. 5). Individual fruiting bodies occur as blackened raised shiny spots on the host surface, are up to 1040 µm in diameter and have a central slightly raised ostiolar dot (Fig. 8). Ascomata are immersed, up to 880 µm in diam and 120 µm high, in section cylindrical, ellipsoidal or lenticular, under a stroma which darkens the entire host surface around numerous ascomata (Figs. 1,2). Variable stromatic tissue is found at the base of the ostiole (Fig. 1) and at the extreme periphery of the ascoma (Fig. 2). – T h e s t r o m a is blackened, occupies 2–4 upper host cells, is pigmented and the host cells are filled with numerous hyphae (Fig. 2). At the margin between the upper and lower walls of the ascoma is a wedge-shaped area of vertical brown parallel cells (Fig. 2). The upper and lower walls of the ascoma are extremely thin, of 2–3 layers of small flattened cells. – T h e o s t i o l e is periphysate, weakly raised and circular. – P a r a p h y s e s are embedded in a gelatinous matrix, nu-

merous, hypha-like, septate and branched. – The asci form from the periphery of the ascoma, while paraphyses form from the periphery and base, particularly in the centre which may be slightly raised. Asci 195–270 x 8–10 µm, 8–spored, long-cylindrical, thin-walled, unitunicate, long–pedunculate, apically rounded with a ring-like subapical apparatus (Fig. 3). The ring cannot be easily seen in water mounts, it becomes visible in Lactophenol cotton blue or Melzer's reagents, but is non amyloid. – Ascospores 47–69 x 4–6.5 µm, hyaline, overlapping 3–4–seriate, 1–celled, without refringent bands, cylindrical to fusiform, thin–walled, eguttulate, with polar appendages (Fig. 4). The polar appendages appear to be composed of a hollow cylinder containing mucilage (Figs. 6, 7).

Mode of Life. – Saprobic. Irregular cavities were evident in the wood beneath the ascomata and indicate the *Pemphidium nitidum* may digest lignocellulose.

Habitat. – Palm rachids.

Distribution. – Brazil, Guyana.

Holotype. – Guyana, in petiole of *Maximiliana regia* Martius, 1837, Leprieux, P.

Other material examined. – Brazil, Amazonia, 0–3 km S of central portion of Serra Araca and 8 km E of Rio Jauari, 60m, 00°49'N; 63°19'W, 1–5 and 12–13 Mar 1984, G.J. Samuels 706 (NY).

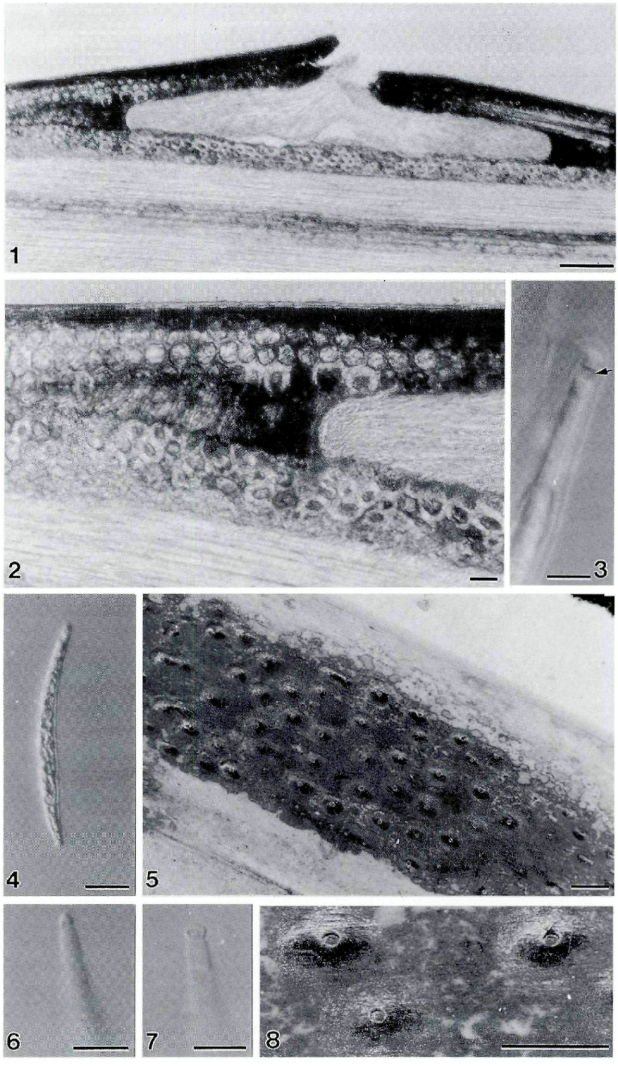
Other specimens with ascospores of different dimensions to *P. nitidum* had smaller groups of ascomata and an outer zonate margin and did not agree with the type material in all aspects. These specimens are placed under *P. zonatum*.

Pemphidium zonatum Hyde, sp. nov. – Figs. 9–18.

Pemphidio nitiduo Montagne similis sed ascosporis 60–94 x 3.5–4.5 µm magnitudine differt.

Etymology. – In reference to the black outer darkened margin around the ascomata.

Stromata on the midrib of palm fronds, solitary or gregarious, in oval darkened areas up to 9 mm long and 5 mm wide with an outer darkened margin (Fig. 10), or linear, some with little stromatic development. Individual fruiting bodies occur as blackened raised shiny spots on the host surface, are up to 1040 µm in diameter, and have a central weakly raised ostiolar dot. The outer edge of the stroma has a distinct blackened margin (Fig. 10) and this is found at the sides and base of the colonised wood area (ventral zone). Small but variable stromatic tissue is found at the base and sides of the ascomata. The



Figs. 1–8. – *Pemphidium nitidum* from Holotype, P. – 1–4 and 6, 7. Interference contrast light micrographs. – 1, 2. Section through ascoma. The ascomata develop under a stroma, are cylindrical with a central ostiole. Note the wedge of parallel cells at the periphery (in 2). – 3. Apex of ascus with subapical ring-like structure (arrowed). – 4. Ascospore with appendages at each end. – 5. Stroma on frond surface. – 6, 7. Ascospore appendages which comprise a cylinder containing mucilage. – 8. Surface view of three ascomata with central ostiolar dots. Bars: 1, 2 = 100 µm; 3–4, 6, 7 = 10 µm; 5,8 = 1 mm.

stroma is composed of host cells packed with darkened fungal hyphae and beneath this is a layer of radially arranged brown septate hyphae. – Ascomata are immersed, up to 900 µm in diameter and 160 µm high, lenticular in section, under a darkened stroma which covers the entire host surface around one to several ascomata (Fig. 9). At the margin between the upper and lower walls of the ascoma is a wedge-shaped area of vertical brown angular parallel cells. The upper and lower walls of the ascoma are thin, comprising 2–3 layers of hyaline elongate thin-walled cells. – The ostiole is periphysate, central, weakly raised and circular. – Paraphyses are embedded in a gelatinous matrix, filamentous, numerous, septate, thin, up to 2 µm thick (Fig. 18). The asci form from the periphery of the ascoma, while paraphyses form from the base, particularly in the centre which may be weakly raised. In one section a wad of vertically arranged hyphae formed a dome in the centre of the ascoma. Asci 210–260 x 8–12 µm, long-cylindrical, thin-walled, unitunicate, long pedunculate, apically rounded with a small sub-apical ring-like apparatus (Figs. 12, 17). – Ascospores 60–94 x 3.5–4.5 µm, hyaline, 4–5 seriate, 1-celled, rarely 2-celled, without refringent bands, cylindrical to fusiform, thin-walled, eguttulate, weakly tapering towards the polar appendages (Figs. 13, 14). The polar appendages or end chambers are 2.0–2.4 µm wide x 1.6–2.0 µm long and contain mucilage (Figs. 15, 16).

Mode of Life. – Saprobic. Irregular cavities were evident in the wood beneath the ascomata (Fig. 11) and indicate that this taxon is capable of digesting lignocellulose.

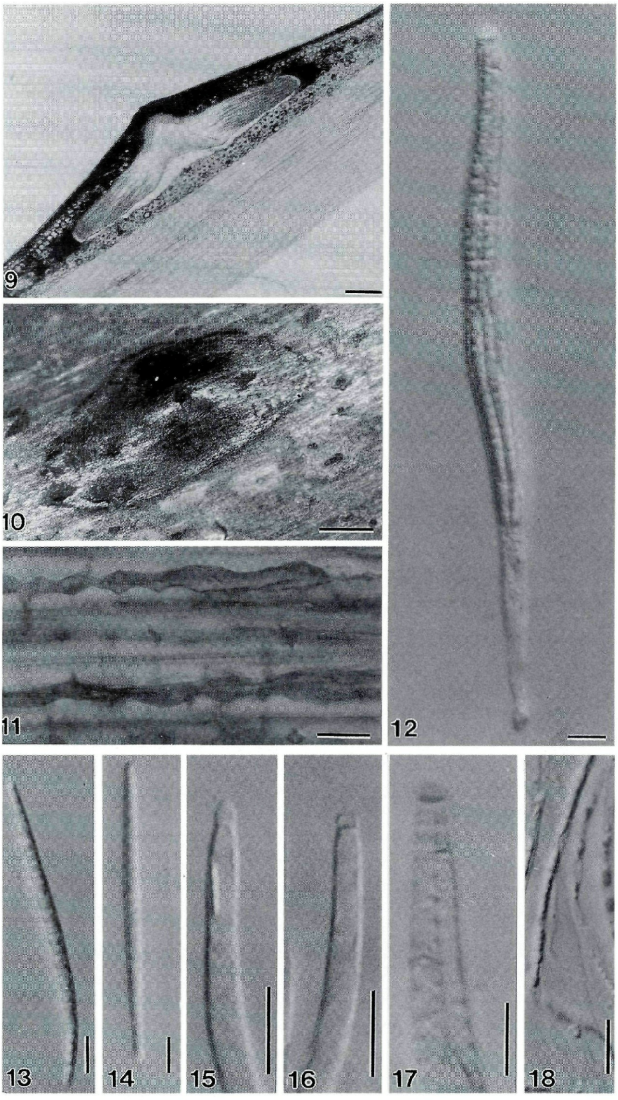
Habitat. – Palm rachids.

Distribution. – Brazil, Guyana.

Holotype. – Brazil, East Berbice, Corentyne region VI; Subregion VI–5: Canje River, north half of Cow Savanna, 05°37'N; 57°35'W, on midrib of recently dead palm frond, 14 Apr 1987, G. Samuels, J. Pipoly, G. Gharbarran, G. Bacchus 5462 (NY).

Other material examined. – BRAZIL: Amazonia, base of west facing talus slope of Serra Araca, near central portion of Serra, about 45 min. walk from lower airstrip, tall moist igapò forest with palms, 60m; on palm litter, 10–13 Mar 1984, G.J. Samuels 831 (NY); on palm, 1–5 and 12–13 Mar 1984, G.J. Samuels 874 (NY); on palm, 1 & 5 & 12–13 Mar 1984, G.J. Samuels 645 (NY); on palm, 13 Mar 1984, G.J. Samuels 892 (NY); petiole of *Phenakospermum guianense* Endl. (Strelitziaceae), Feb 1984, G.J. Samuels 386 (NY); East Berbice–Corentyne Region VI; Subregion VI–5, Canje River, 05°36'N, 57°35'W, on dead *Mauritia* (Palmae) frond, 12–15 Apr 1987, G.J. Samuels, J. Pipoly, G. Gharbarran, G. Bacchus 5445 (NY); Guyana, Demerara–Mahaica Region, IV; Mahaica subregion, IV–1, Yarowcabra Forestry Station, 06°30'N, 58°15'W, on palm frond, 26, 27 Apr 1987, G.J. Samuels and J. Pipoly 5554 (NY).

P. zonatum differs from *P. nitidum* in two important aspects. The dimensions of the ascospores differ greatly (60–94 x 3.5–4.5 vs. 47–69



Figs. 9–18. *Pemphidium zonatum*. – 9 and 11–18. Interference contrast light micrographs. – 9. Section through ascoma. – 10. Stroma and ascoma on host surface. Note the blackened margin. – 11. Irregular cavities in wood beneath ascomata. – 12. Long cylindrical ascus. – 13, 14. Ascospores. – 15, 16. Appendages of ascospores. – 17. Ascus apex with subapical ring. – 18. Paraphyses. Bars: 9 = 100 µm; 10 = 1 mm; 11–18 = 10 µm.

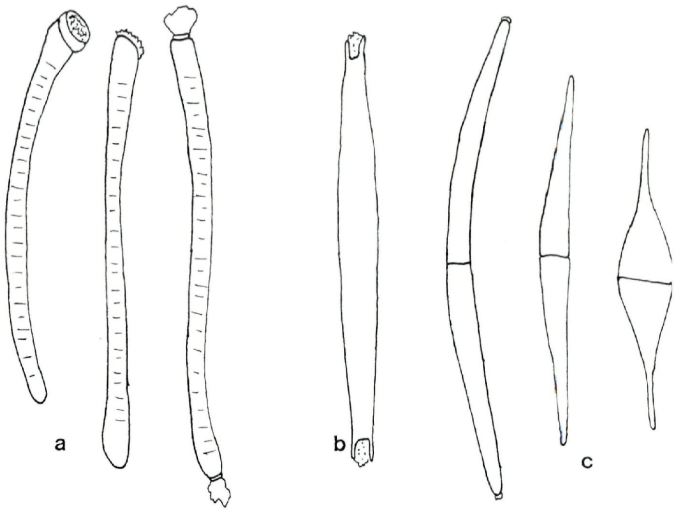


Fig. 19. – Diagrammatic representation of ascospores and ascospore appendages in *Linocarpon* (a), *Pemphidium* (b) and *Oxydothis* (c).

x 4–6.5 µm) and the stroma in *P. zonatum* has a distinct darkened outer margin (Fig. 10). I have identified many collections as *P. zonatum* and many of these have a distinct blackened margin. However, in some specimens it was not possible to locate an outer margin, while the specimen on *Phenakospermum guianense* (386 NY) comprised individual ascomata under a small clypeus. In all specimens included under *P. zonatum* the ascospores were of similar dimensions and with our present state of knowledge I feel it is unwise to differentiate new species on stromatic development alone.

Seven taxa have at one time been described or transferred to *Pemphidium*, but these were all excluded by Petrak (1953). Petrak (1953) excluded *P. opacum* because the ascospores, although similar in form to those of the type species, were two-celled and the ascomata lacked an ostiole. In fact, *P. opacum* is a good *Oxydothis* Penzig & Saccardo (Hyde, unpublished). *Pemphidium erumpens* was also excluded by Petrak (1953) and Hawksworth (1985) since the ascomata were asteroid and the ascospores small (28 x 7 µm) brown and 2-cel-

led. In the holotype of *Micropeltis erumpens* Berk. & Curt. (Fungi Cubenses Wrightiana No. 745 K!) I could find no ascospores or asci, but the ascomata were superficially reminiscent of *Astrosphaeriella* H. Sydow & P. Sydow. Hawksworth (1985) examined syntypes of this taxon. He found unitunicate asci with a cylindrical J+ apical apparatus and retained the taxon in *Seynesia* Saccardo. In *Pemphidium pini* asci are fusoid–clavate, short, and the ascospores very small, 9 x 2 µm. *Pemphidium punctoideum* is found on *Rubus* and is a fungus of temperate regions. Its ascospores are small, light-yellow and the asci are fusoid-clavate and also small. In *P. bomulense* the ascospores are also small and the fungus is a superficial leaf parasite (Petrak, 1953).

Five species not dealt with by Petrak are *Pemphidium palustre* (Berk. & Broome) Batista & Maia, *P. rubicola* (Ellis & Everhart) Batista & Maia (1960), *Pemphidium dilatatum* Berkeley & Broome (1870), *Pemphidium coffeinum* Cesati (1879) and *Pemphidium nobile* Welwitsch & Currey (1867). *P. palustre* has light-brown ascospores, which are ellipsoidal or fusoid, 1–septate and small, 20–22 x 5.5–7 µm, with polar conical cap–like mucilaginous appendages. Asci are also provided with an amyloid apical ring (*Seynesia palustris* (Berk. & Broome) Petrak, Niederdonau, Wien, on *Carex pendula,* 1943, Petrak 281, K!). Moreover, its host is *Carex* and this taxon was kept in *Ceriophora palustris* (Berk. & Broome) Höhnel by Müller & Arx (1962). In *P. rubicola* the ascomata are superficial, globose and clustered in small rings, while the ascospores are also light–brown, 1-septate, ellipsoidal and small (12.5–15 x 6–7.5 µm; Batista & Maia, 1960). The host is *Rubus* and this taxon was transferred to *Colerea rubicola* (Ellis & Everhart) Müller (Müller & Arx, 1962) and to *Hormotheca rubicola* (Ellis & Everhart) Corlett & Barr (1986). The ascospores of *P. dilatatum* are broadly oval and brown the fungus and was transferred to *Anthostomella* by Petch (1916). *P. coffeinum* was transferred to *Myiocopron* by Saccardo (1883), while *P. nobile* has dark brown oblong ascospores and was transferred to *Seynesia* Saccardo by Saccardo (1883). The taxon was later made synonymous with *Seynesia erumpens* (Berk. & Curtis) Petrak (Müller & Arx, 1962).

In the wood beneath sections of ascomata of *Pemphidium nitidum* and *P. zonatum* (Fig. 11) irregular cavities were found, similar to those described by Mouzouras (1986). These cavities are characteristic of soft rot decay of wood within the S_2 cell wall region (Eaton, 1986).

Acknowledgments

Thanks are extended to curators of the Herbaria K, NY, B, H, and BPI for loan of material used in this study. Dr John L. Alcorn is thanked for his comments on the manuscript.

References

Arx, J. A. von & E. Müller (1954). Die Gattungen der amerosporen Pyrenomyceten. – Beitr. Kryptogamenfl. Schweiz 11: 1–434.

Barr, M. E. (1990). Prodromus to nonlichenized, pyrenomycetous members of Class Hymenoascomycetes. – Mycotaxon 39: 43–184.

Batista, A. C. & D. S. Maia (1960). Revisaõ e ilustracaõ de alguns ascomycetes herbarizados 1. – Saccardoa 1: 81–93.

Berkeley, M. & J. & C. E. Broome (1870). The fungi of Ceylon. – Reading.

Cesati, V. (1879). Mycetum in itinere Borneensi lectorum a cl. Od. Beccari. – Neapoli.

Corlett, M. & M. E. Barr (1986). *Hormotheca* for species of *Coleroa* with hemisphaerical ascomata. – Mycotaxon 25: 255–257.

Eaton, R. A. (1986). Preservation of wood in the sea. In: Moss S. T. (ed.). The Biology of Marine Fungi. – Cambridge University Press, pp. 355–365.

Eriksson, O. E. & D. L. Hawksworth (1991). Outline of the ascomycetes – 1990. – Systema Ascomycetum 9: 39–271.

Hawksworth, D. L. (1985). A redisposition of the species referred to the ascomycete genus *Microthelia*. – Bull. British Museum (Natural History) Bot. 14: 43–181.

—— , B. C. Sutton & G. C. Ainsworth (1983). Ainsworth & Bisby's Dictionary of the fungi. – Commonwealth Mycological Institute. Kew, London, 445 pp.

Hennings, P. (1903). Fungi Africae orientalis. III. – Engl. Bot. Jahrb. 34: 39–57.

Höhnel, F. (1911). Fragmente zur Mykologie XIII. Aus den Sitzungsberichten der kaiserl. Akademie der Wissenschaften in Wien. – Mathem.-naturw. Klasse 120: 379–484.

Hyde, K. D. (1992). Fungi from palms. I. The genus *Linocarpon*, a revision. – Sydowia 44: 32–54.

—— & A. Nakagiri (1989). A new species of *Oxydothis* from the mangrove palm, *Nypa fruticans*. – Trans. Mycol. Soc. Japan 30: 69–75.

Karsten, P. A. (1973). Collected Mycological Papers. Reprint.

Montagne, C. (1840). Seconde centurie de Plantes cellulaires exotiques nouvelles. – Ann. Sci. nat., sér 2, (Bot.) 14: 321–350.

Mouzouras, R. (1986). Patterns of timber decay caused by marine fungi. In: Moss S. T. (Ed.). The Biology of Marine Fungi. – Cambridge University Press: pp. 341–353.

Müller, E. & J. A. von Arx (1962). Die Gattungen der didymosporen Pyrenomyceten. – Beitr. Kryptogamenfl. Schweiz 11: 1–992.

Petch, T. (1916). Additions to Ceylon fungi. – Annals of the Royal Botanic Gardens, Peradeniya 6: 153–183.

Petrak, F. (1953). Über die Gattung *Pemphidium* Mont. – Sydowia 7: 354–357.

Saccardo, P. A. (1883). Sylloge Fungorum. II. (Pyrenomycetae). – Johnson Reprint Corporation, New York. 813 pp.

Wehmeyer, L.E. (1975). The pyrenomycetous fungi. – Mycologia Memoir 6: 1–250.

Welwitsch, F. & F. Currey (1867). Fungi Angolenses. – London.

(Manuscript accepted 6th October 1992)