
A synopsis of and a key to *Diplococcium* species, based on the literature, with a description of a new species

Teik-Khiang Goh* and Kevin D. Hyde

Fungal Diversity Research Project, Department of Ecology and Biodiversity, The University of Hong Kong, Pokfulam Road, Hong Kong; * email: tkgoh@hkucc.hku.hk

Goh, T.K. and Hyde, K.D. (1998). A synopsis of and a key to *Diplococcium* species, based on the literature, with a description of a new species. *Fungal Diversity* 1: 65-83.

The genus *Diplococcium* is reviewed, together with a synopsis of 21 accepted species and a composite diagram of their conidial morphology. A further 11 species which have either been synonymised, transferred to other genera, or are questionably placed in *Diplococcium*, are discussed. Probable teleomorphic states in the genera *Helminthosphaeria* and *Othia* are briefly discussed. *Diplococcium varieseptatum* sp. nov. is proposed for the presumed anamorph of *Helminthosphaeria corticiorum*. A key to accepted species is provided.

Introduction

The hyphomycete genera *Spadicoides* S. Hughes and *Diplococcium* Grove produce conidia from polytretic conidiogenous cells (Ellis, 1971b; Holubová-Jechová, 1982). When conidia detach, pores are clearly visible on the conidiogenous cells. Both genera produce conidia which are unicellular or have up to 7-eusepta. In many species, the septa are thick and darkly pigmented. The generic concepts of these genera have been revised by Sinclair, Eicker and Bhat (1985), and branching of conidiophores is not considered an important criterion separating them. Catenation of conidia is currently the sole diagnostic character separating *Diplococcium* from *Spadicoides*.

There are presently thirty binomial names in *Diplococcium* (Hughes, 1953, 1958; Ellis, 1963, 1971a, 1971b, 1976; Pirozynski, 1972; Sutton, 1973; Holubová-Jechová, 1982; Wang and Sutton, 1982; Sinclair *et al.*, 1985; Subramanian and Sekar, 1989; Castañeda Ruíz and Kendrick, 1991; Matsushima, 1993; Goh, Hyde and Umali, 1998), some of which have been transferred to other genera (Hughes, 1958; Ellis, 1971b, 1976; Sinclair *et al.*, 1985). The genus *Spadicoides* has been reviewed by Goh and Hyde (1996). In the present paper, we present a bibliographic reflection on the genus *Diplococcium*. Brief notes are provided with respect to the validity in nomenclature, current taxonomic status, outstanding features, and geographical

distribution of each of the 30 *Diplococcium* names. We also examined isotype material of *Diplococcium asperum* Piroz. (DAOM 133941c) and *D. capitatum* Piroz. (DAOM 133945), and their taxonomic status are discussed. Authentic material of *Diplococcium* species in association with *Helminthosphaeria* species (Herb. BPI) were examined, and the presumed anamorph-teleomorph connections of these fungi (Samuels, Candoussau and Magni, 1997) are briefly discussed. Based on the literature and examination of available authentic material, we consider 21 species as acceptable in *Diplococcium*, while 6 species are regarded as doubtful because of insufficient information. To facilitate identification, some diagnostic characters of the accepted species are presented in Table 1, their conidia are illustrated (Figs. 1-21), and a key is provided.

Taxonomy

Species accepted in Diplococcium

Key to accepted species of *Diplococcium*

1. Conidia verrucose, ellipsoidal to obclavate, 1-septate, 15-20 × 6-7 μm; conidiophores unbranched; on decaying palm rachides *D. asperum*
1. Conidia smooth..... 2
2. Conidia versicolored, with one or more cells distinctly darker than the other 3
2. Conidia concolorous, with all the cells of the same color 11
3. Conidiophores branched..... 4
3. Conidiophores unbranched..... 7
4. Mature conidia nonseptate, ovate to obpyriform, 8.5-13 × 5.5-8 μm; conidiophores 3-6 μm wide *D. parcum*
4. Mature conidia uniseptate, ellipsoidal, clavate, obclavate or lageniform, 4-6 μm wide; conidiophores 2.5-4 μm wide 5
5. Conidiophores dichotomously branched; conidia ellipsoidal, obovoid or clavate, 9-16.5 × 4.5-6 μm *D. lawrencei*
5. Conidiophores irregularly branched; conidia pyriform, obclavate, or lageniform 6
6. Conidia obclavate to lageniform, septum closer to the apex, not constricted at the septum, basal cell darker than apical cell, 11-20 × 4.5-5 μm *D. bicolor*

6. Conidia pyriform to ellipsoidal, septum closer to the base, constricted at the septum, apical cell darker than the basal cell, 5-13 × 4-5 μm *D. aquaticum*
7. Mature conidia 1-septate, 11-15 × 3-4.5 μm; on dead grass culms *D. graminearum*
7. Mature conidia 2- or 3-septate, 9.5-40 μm long, 7-13 μm wide; on dead leaves or rotten wood 8
8. Conidiophores 3-4 μm wide; mature conidia 2-septate, constricted at septa, subellipsoidal, central cell larger and darker than end cells, 17-25 × 7-9 μm, borne in acropetal chains; occurring on dead leaves *D. laxusporum*
8. Conidiophores 3.5-8 μm wide; mature conidia 2- or 3-septate, of other shapes or combination of conidial characters not as above; occurring on rotten wood 9
9. Mature conidia 2-septate, base broader than the apex (broadly obclavate, cylindric-obclavate, ovate or ellipsoidal) *D. insolitum*
9. Mature conidia mostly 3-septate, apex broader than the base (clavate or obovoidal)..... 10
10. Conidiophores 6-7.5 μm wide; conidia 20-40 × 8-10 μm, constricted at the septa *D. constrictum*
10. Conidiophores 3.5-6 μm wide; conidia 16-26 × 8-13 μm, not constricted or rarely slightly constricted at the septa *D. grovei*
11. Conidiophores branched..... 12
11. Conidiophores simple..... 17
12. Mature conidia clavate, obclavate, ellipsoidal or subcylindrical, 5.6-15 μm wide; occurring on fruit bodies of Basidiomycetes 13
12. Mature conidia, oblong, elliptical or cylindrical, 3-7.5 μm; occurring on wood or leaves..... 15
13. Mature conidia 0-1-septate, 13-29 × 6-9 μm; overgrowing carpophores of Clavariaceae *D. clavariarum*
13. Mature conidia with 2-3 or more septa; overgrowing carpophores of Corticiaceae..... 14

14. Conidia (11-)19-42(-55) × (5-)7-11(-15) μm, with 1-5 septa, cylindrical to ellipsoidal *D. varieseptatum*
14. Conidia 16-32 × 5.6-9 μm mostly 3-septate, ellipsoidal, obclavate or subcylindrical *D. clarkii*
15. Mature conidia mostly 0-septate, occasionally 1-3-septate, 8-40 × 4.5-6 μm; occurring on living leaves of *Pandanus* *D. pandani*
15. Mature conidia mostly 1-septate, occurring on rotten wood 16
16. Conidia 6-9 × 3-4 μm *D. spicatum*
16. Conidia 12-30 × 5-7.5 μm *D. pulneyense*
17. Occurring on stromata of *Diatrype*; conidiophores 3-3.5 μm wide; conidia 0-1-septate; 4.5-10 × 2.5-4 μm *D. heterosporum*
17. Occurring on bamboo culms or palm material; conidiophores 3.5-9 μm wide 18
18. Mature conidia 0-septate, 7.5-12 × 2.5-5.5 μm; conidiophores 3.5-4 μm wide, with conidiogenous pores confined to swollen terminal cell *D. capitatum*
18. Mature conidia 1-7-septate, 12-34 × 6-10.5 μm; conidiophores 4-9 μm wide, conidiogenous pores not as above 19
19. Mature conidia (1-2-)3-7-septate, constricted, not darkly pigmented at the septa, cylindro-obclavate, 14-33 × 6-9 μm *D. stoveri*
19. Mature conidia 1(-2)-septate, not constricted, darkly pigmented at the septa, oblong, ellipsoidal, broadly fusiform or ovate 20
20. Conidiophores subulate, 7.5-12 μm wide; mature conidia oblong or ellipsoidal, 12-22 × 6-9 μm; occurring on decaying bamboo culms *D. dendrocalami*
20. Conidiophores cylindrical, 4-6 μm wide; mature conidia broadly fusiform or ovate, 12-34 × 7-10.5 μm; occurring on rotten palm petioles *D. peruamazonicum*
1. *Diplococcium aquaticum* Goh, K.D. Hyde and Umali, Mycologia 90: 514 (1998). (Fig. 1)

This species is unique in the genus in having slender (2.5-3 μm wide) conidiophores and pyriform conidia. It is comparable to *D. graminearum* which

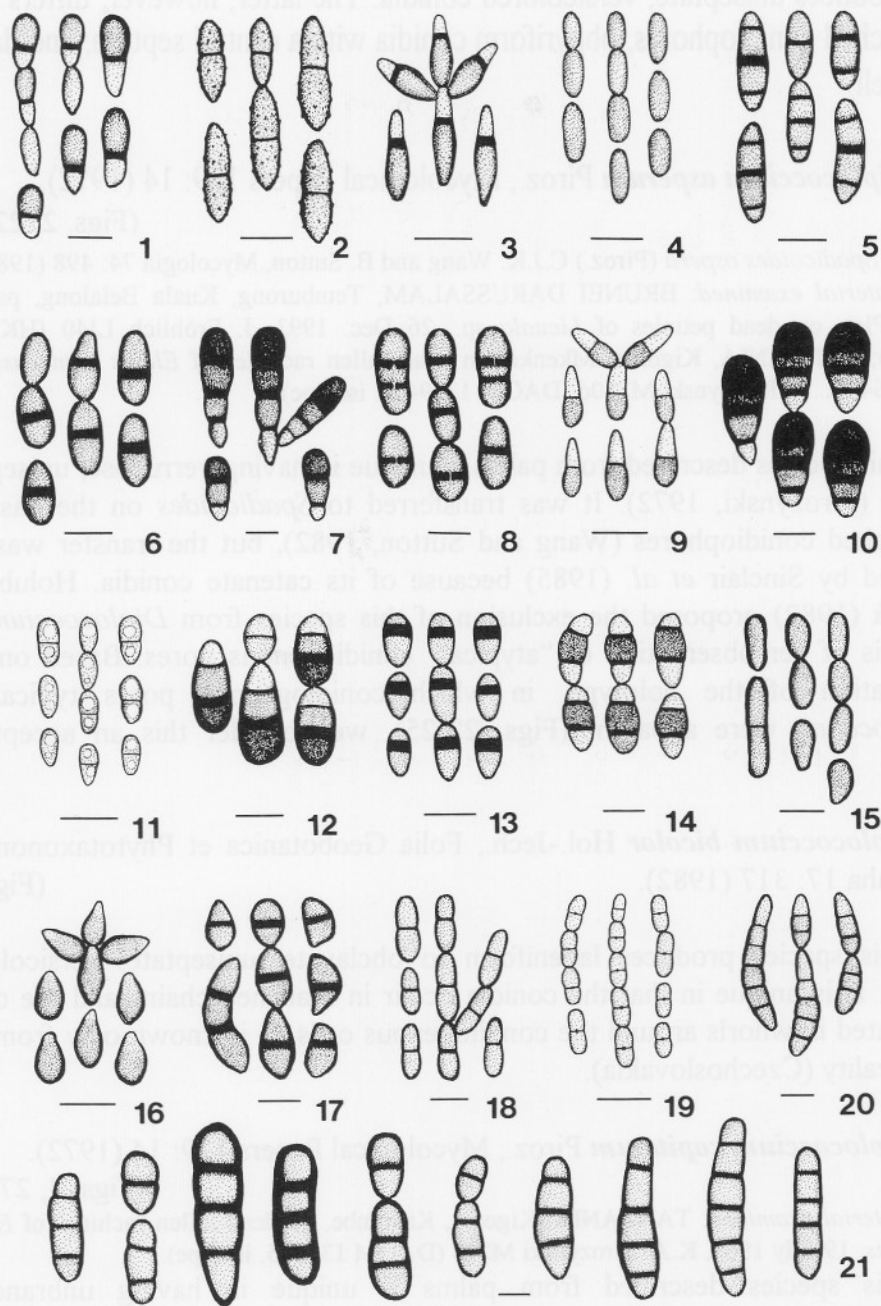
Table 1. Synopsis of accepted species of *Diplococcium*.

Species	Conidiophores branching/size ^a	Conidia				size ^a	Habitat
		shape	wall	colour	septation		
<i>D. aquaticum</i>	√ / 80-140 × 2.5-3	ellipsoid, pyriform	smooth	versi-	1, constricted, banded	5-13 × 4-5	submerged wood
<i>D. asperum</i>	X / -250 × 4-5	ellipsoid, obclavate	rough	con-	1, constricted, not banded	15-20 × 5.5-7	rotten palm rachides
<i>D. bicolor</i>	√ / 90-400 × 2.5-4	obclavate, lageniform	smooth	versi-	1, not constricted, banded	11-20 × 4-5.5	rotten wood
<i>D. capitatum</i>	X / -180 × 3.5-4	short cylindrical, broadly ellipsoid	smooth	con-	0	7.5-12 × 2.5-5.5	rotten palm rachides
<i>D. clarkii</i>	√ / 70-200 × 4-8	ellipsoid, subcylindric, obclavate	smooth	con-	1-3, not constricted, banded	16-32 × 5.6-9	basidiomata (Stereales)
<i>D. clavariarum</i>	√ / 50-120 × 3-5	ellipsoid, clavate, obclavate	smooth	con-	0-1, not constricted, banded	13-29 × 6-9	basidiomata (<i>Clavaria</i>)
<i>D. constrictum</i>	X / 100-360 × 6-7.5	obovoid, clavate	smooth	versi-	2-3, constricted, banded	20-40 × 8-10	rotten wood
<i>D. dendrocalami</i>	X / 120-280 × 7.5-12	oblong, ellipsoid	smooth	con-	1-2, not constricted, banded	12-17 × 6-9	rotten bamboo culms
<i>D. graminearum</i>	X / -300 × 3-4	narrowly obpyriform, obclavate	smooth	versi-	1, constricted, not banded	11-15 × 3-4.5	dead grass stem
<i>D. grovei</i>	X / -350 × 3.5-6	obovate, clavate	smooth	versi-	3, not constricted, banded	16-26 × 8-13	rotten wood
<i>D. heterosporum</i>	X / 150-200 × 3-3.5	elliptical, obovate	smooth	con-	0-1, constricted, not banded	4.5-10 × 2.5-4	stromata of <i>Diatrype</i>
<i>D. insolitum</i>	X / 40-120 × 3.5-8	broadly obclavate, ellipsoid	smooth	versi-	2, not constricted, banded	9.5-22 × 8-11	rotten wood
<i>D. lawrencei</i>	√ / 120-320 × 2-3.5	ellipsoid, clavate	smooth	versi-	1, not constricted, banded	9-16.5 × 4.5-6	rotten wood

Table 1. (continued).

Species	Conidiophores branching/size ^a	Conidia				Habitat	
		shape	wall	colour	septation		size ^a
<i>D. laxusporum</i>	X / 170-250 × 3-4	subellipsoid	smooth	versi-	2, constricted, banded	17-25 × 7-9	dead leaves
<i>D. pandani</i>	√ / -400 × 4-5	ellipsoid, cylindric	smooth	con-	0, occasionally 1-3	8-40 × 4.5-6	living <i>Pandanus</i> leaves
<i>D. parcum</i>	√ / 70-300 × 3-6	ovate, ellipsoid, obpyriform	smooth	versi-	0	8.5-13 × 5.5-8	rotten wood
<i>D. peramazonicum</i>	X / 130-500 × 4-6	broadly fusiform, ovate	smooth	con-	1-2, not constricted, banded	12-34 × 7-10.5	dead palm petiole
<i>D. pulneyense</i>	√ / -300 × 3-5.5	elliptic, subcylindric	smooth	con-	1-2, constricted, not banded	12-30 × 5-7.5	dead wood
<i>D. spicatum</i>	√ / 200-400 × 2.5-4	oblong, ends rounded	smooth	con-	1, constricted, not banded	6-9 × 3-4	rotten wood
<i>D. stoveri</i>	X / -550 × 5-8	cylindric, obclavate	smooth	con-	1-7, constricted, not banded	14-33 × 6-9	living <i>Elaeis</i> leaves
<i>D. varieseptatum</i>	√ / -250 × 4-6	cylindric, ellipsoid	smooth	con-	1-5, constricted, banded	11-55 × 5-15	basidiomata (Corticiaceae)

√ = branched; X = unbranched; versi- = conidial cells differ in pigmentation; con- = conidial cells of the same pigmentation; ^a = Measurements in μm.



Figs. 1-21. Conidia of *Diplococcium* spp. 1. *D. aquaticum*. 2. *D. asperum*. 3. *D. bicolor*. 4. *D. capitatum*. 5. *D. clarkii*. 6. *D. clavariarum*. 7. *D. constrictum*. 8. *D. dendrocalami*. 9. *D. graminearum*. 10. *D. grovei*. 11. *D. heterosporum*. 12. *D. insolitum*. 13. *D. lawrencei*. 14. *D. laxusporum*. 15. *D. pandani*. 16. *D. parcum*. 17. *D. peruamazonicum*. 18. *D. pulneyense*. 19. *D. spicatum*. 20. *D. stoveri*. 21. *D. varieseptatum*. Bars = 10 μ m.

also produces uniseptate, versicolored conidia. The latter, however, differs in its unbranched conidiophores, obpyriform conidia with a central septum, and darker basal cell.

2. *Diplococcium asperum* Piroz., Mycological Papers 129: 14 (1972).
(Figs. 2, 22-26)

≡ *Spadicoides aspera* (Piroz.) C.J.K. Wang and B. Sutton, Mycologia 74: 498 (1982).

Material examined: BRUNEI DARUSSALAM, Temburong, Kuala Belalong, path to Ruth's Plot, on dead petioles of *Licuala* sp., 26 Dec. 1993, J. Fröhlich LI40 (HKU(M) JL/LI40); TANZANIA, Kigoma, Mkenke, on dead fallen rachides of *Elaeis guineensis*, 13 Mar. 1964, K. A. Pirozynski M780d (DAOM 133941c, isotype).

This species described from palms is unique in having verrucose, uniseptate conidia (Pirozynski, 1972). It was transferred to *Spadicoides* on the basis of unbranched conidiophores (Wang and Sutton, 1982), but the transfer was not accepted by Sinclair *et al.* (1985) because of its catenate conidia. Holubová-Jechová (1982) proposed the exclusion of this species from *Diplococcium* on the basis of her observation of "atypical" conidiogenous pores. Based on our examination of the holotype, in which conidiogenous pores typical of *Diplococcium* were apparent (Figs. 23-25), we consider this an acceptable species.

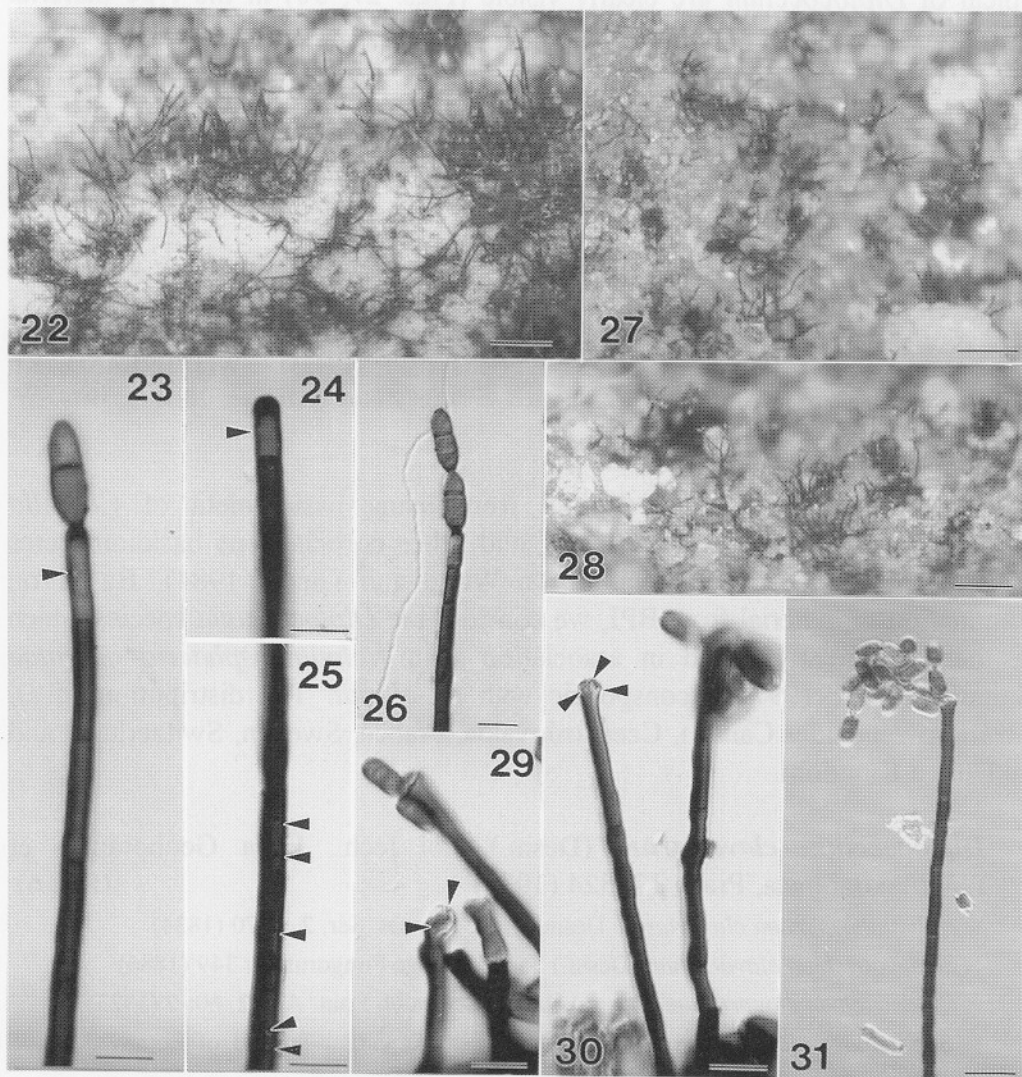
3. *Diplococcium bicolor* Hol.-Jech., Folia Geobotanica et Phytotaxonomica, Praha 17: 317 (1982).
(Fig. 3)

This species produces lageniform to obclavate, uniseptate, versicolored conidia. It is unique in that the conidia occur in branched chains and are often aggregated in whorls around the conidiogenous cells. It is known only from the type locality (Czechoslovakia).

4. *Diplococcium capitatum* Piroz., Mycological Papers 129: 14 (1972).
(Figs. 4, 27-31)

Material examined: TANZANIA, Kigoma, Kakombe, on dead fallen rachides of *Elaeis guineensis*, 19 July 1963, K.A. Pirozynski M21b (DAOM 133945, isotype).

This species described from palms is unique in having unbranched conidiophores which bear terminal, irregularly swollen or bulbous, polytretic conidiogenous cells. Percurrent regeneration of the conidiophores has been noted (Pirozynski, 1972). Holubová-Jechová (1982) considered the conidiogenous cells in this species "atypical" and proposed its exclusion from *Diplococcium*. We consider *D. capitatum* an acceptable species because conidiogenous pores



Figs. 22-26. *Diplococcium asperum* (from isotype, DAOM 133941c). 22. Colony on natural substratum. 23. A conidiophore bearing a conidium. 24, 25. Apical and central portions of conidiophores, respectively. 26. Apical portion of a conidiophore with two rough-walled conidia in a chain. **Figs. 27-31.** *Diplococcium capitatum* (from isotype, DAOM 133945). 27, 28. Colonies on natural substratum. 29, 30. Conidiophores bearing conidia at the swollen apex. 31. Conidiophore bearing chains of uniseptate conidia at the swollen apex. Bars: 22, 27, 28 = 100 μm ; 23-26, 29, 30 = 10 μm ; 31 = 20 μm . Arrow heads indicate conidiogenous pores.

typical of *Diplococcium* are clearly visible (Figs. 29, 30) in the type material (DAOM). It is known only from the type locality (Tanzania).

5. *Diplococcium clarkii* M.B. Ellis, More Dematiaceous Hyphomycetes, 391 (1976). (Fig. 5)

Teleomorph: presumably *Helminthosphaeria odontiae* Höhn., Sitzungsber. Akad. Wiss. Wien Math. Naturwiss. Kl. Abt. I, 116: 109 (1907).

Material examined: FRANCE, Hautes Pyrénées, Capvern, on Corticiaceae, 4 Sep. 1994, F. Candoussau FC300 (BPI 749440); *ibid.*, Bois de Amou, on Corticiaceae on *Alnus* sp., 25 Aug. 1986, F. Candoussau FC350 (BPI 749456); *ibid.* Pyrénées Atlantique, Bois de Pau, on Corticiaceae, 30 July 1995, F. Candoussau FC381 (BPI 749425). SWITZERLAND, Kt. Thurgau, Grutried, near Wangi, on decorticated wood of *Alnus glutinosa*, 23 June 1974, W. Matheis FC376 (BPI 749448).

This species has been reported from living basidiomata of *Cristella confinis*, *Hyphoderma praetermissum*, and other corticiaceous basidiomycetes (Ellis, 1976; Holubová-Jechová, 1982; White and Ginns, 1984). Based on examination of material from BPI, we consider the *Diplococcium* species which has been frequently found in association with *Helminthosphaeria odontiae* (Samuels *et al.*, 1997) is conspecific with *D. clarkii*. The distribution of *D. clarkii* now includes Canada, Czechoslovakia, France, Sweden, Switzerland, and the United Kingdom

6. *Diplococcium clavariarum* (Desm.) Hol.-Jech., Folia Geobotanica et Phytotaxonomica, Praha 17: 324 (1982). (Fig. 6)

≡ *Helminthosporium clavariarum* Desm., Ann. Sci. nat. Sér. 2, 2: 70 (1834).

≡ *Scolecotrichum clavariarum* (Desm.) Sacc., Sylloge Fungorum 4: 349 (1886).

≡ *Cladotrichum clavariarum* (Desm.) Höhn., Zentralbl. Bakt. Abt. 2, 60: 9 (1923).

≡ *Spadicoides clavariarum* (Desm.) S. Hughes, Canadian Journal of Botany 36: 806 (1958).

Teleomorph: presumably *Helminthosphaeria clavariarum* (Tul.) Fuckel, Symb. Mycol.: 166 (1870).

This well documented species is known to occur on aphylloraceous basidiomata of the Clavariaceae (Ellis, 1963; Holubová-Jechová, 1982; Samuels *et al.*, 1997).

7. *Diplococcium constrictum* (C.J.K. Wang and B. Sutton) R.C. Sinclair, Eicker and Bhat, Transactions of the British Mycological Society 85: 736 (1985). (Fig. 7)

≡ *Spadicoides constricta* C.J.K. Wang and B. Sutton, Mycologia 74: 498 (1982).

Conidia in this species are described as solitary in Wang and Sutton (1982). Conidial catenation is, however, obvious on the basis of new conidia being produced from the basal cell of primary conidia (Sinclair *et al.*, 1985). Several collections from New York have been recorded (Wang and Sutton, 1982).

8. *Diplococcium dendrocalami* Goh, K.D. Hyde and Umali, Mycologia 90: 515 (1998). (Fig. 8)

This species somewhat resembles *D. clavariarum* since the conidia are approximately the same width, ellipsoidal, thick-walled, and have a thick dark septum. The latter is a parasite on carpophores of *Clavaria* species (Holubová-Jechová, 1982; Samuels *et al.*, 1997) whereas *D. dendrocalami* is saprophytic. It also differs from *D. dendrocalami* in having conidiophores which are mainly branched and slender (3.5-6 μm wide). *Diplococcium dendrocalami* is also comparable to *D. insolitum* in which the conidiophores are attenuated and sometimes regenerated percurrently. However, the conidia in *D. insolitum* are mainly 2-septate, versicolored and broadly obclavate (Holubová-Jechová, 1982).

9. *Diplococcium graminearum* R.F. Castañeda and W.B. Kendr., University of Waterloo Biology Series 35: 47 (1991). (Fig. 9)

This species was described from dead stem of a grass. It is known only from the type locality (Cuba).

10. *Diplococcium grovei* (M.B. Ellis) R.C. Sinclair, Eicker and Bhat, Transactions of the British Mycological Society 85: 736 (1985). (Fig. 10)
 \equiv *Spadicoides grovei* M.B. Ellis, Mycological Papers 93: 12 (1963).

This is an acceptable species based on its catenate conidia (Wang, 1976), although the conidiophores are unbranched. It is known from Canada, the United Kingdom and the United States of America.

11. *Diplococcium heterosporum* G. Arnaud ex Zeller and Tóth, Botanikai Közlemenyek 49: 108 (1961). (Fig. 11)

Conidia of this species are unicellular (4.5-5 \times 2.5-3.5 μm) or uniseptate (7-10 \times 3-4 μm), guttulate, and borne in short chains from unbranched conidiophores. It is known only from the type locality (Hungary).

12. *Diplococcium insolitum* Hol.-Jech., Folia Geobotanica et Phytotaxonomica 17: 321 (1982). (Fig. 12)
= *Diplococcium catenulatum* (C.J.K. Wang and B. Sutton) R.C. Sinclair, Eicker and Bhat, Transactions of the British Mycological Society 85: 736 (1985).
≡ *Spadicoides catenulata* C.J.K. Wang and B. Sutton, Mycologia 74: 497 (1982).

This species is distinct in the genus in having unbranched conidiophores and broadly obclavate, 2-septate, versicolored conidia. Percurrent regeneration of the conidiophores has been reported (Holubová-Jechová, 1982).

13. *Diplococcium lawrencei* B. Sutton, Mycological Papers 132: 49 (1973). (Fig. 13)

This is a distinct species having dichotomously branched conidiophores. It resembles *D. clavariarum* but has smaller conidia. It is reported from Canada, Czechoslovakia, Poland, and the United States of America.

14. *Diplococcium laxusporum* R.F. Castañeda and W.B. Kendr., University of Waterloo Biology Series 35: 47 (1991). (Fig. 14)

This species was described from dead leaves of *Bucida palustris* and known only from the type locality (Cuba). It is comparable to *D. clarkii*, but differs in having unbranched conidiophores and 2-septate, versicolored conidia.

15. *Diplococcium pandani* B. Huguenin, Bulletin Soc. Mycol. France, 80: 185 (1964). (Fig. 15)

This species was reported to occur on living leaves of *Pandanus tectorius* (Ellis, 1976). The catenate conidia are mostly nonseptate but occasionally have 1-3 septa.

16. *Diplococcium parcum* Hol.-Jech., Folia Geobotanica et Phytotaxonomica, Praha 17: 315 (1982). (Fig. 16)

This species is distinct in producing nonseptate, obpyriform conidia in short branched chains. It is known only from Czechoslovakia (Holubová-Jechová, 1982).

17. *Diplococcium peruamazonicum* Matsush., Matsush. Mycol. Mem. 7: 49 (1993). (Fig. 17)

This species was reported from decaying palm petioles. It is known only from the type locality (South America).

18. *Diplococcium pulneyense* Subram. and Sekar, Kavaka 15: 91 (1989).

(Fig. 18)

This species was reported as the anamorphic state of *Otthia pulneyensis* Subram. and Sekar in culture (Subramanian and Sekar, 1989).

19. *Diplococcium spicatum* Grove, J. Bot., London 23: 167 (1885). (Fig. 19)

The type species of the genus, it produces uniseptate, short cylindrical conidia in short or long chains. It is common on dead wood and bark of various broad-leaved and coniferous trees. Records of this fungus include Canada, Czechoslovakia, Japan, Poland, Rumania and the United Kingdom.

20. *Diplococcium stoveri* (M.B. Ellis) R.C. Sinclair, Eicker and Bhat, Transactions of the British Mycological Society 85: 736 (1985). (Fig. 20)
≡ *Spadicoides stoveri* M.B. Ellis, Mycological Papers 131: 22 (1972).

This species is distinct in having 1-7-septate conidia. The conidiophores are unbranched, borne singly or in fascicles from stromata on leaves of *Elaeis guineensis*. The conidia are usually solitary but occasionally produced in short chains.

21. *Diplococcium varieseptatum* Goh and K.D. Hyde, sp. nov.

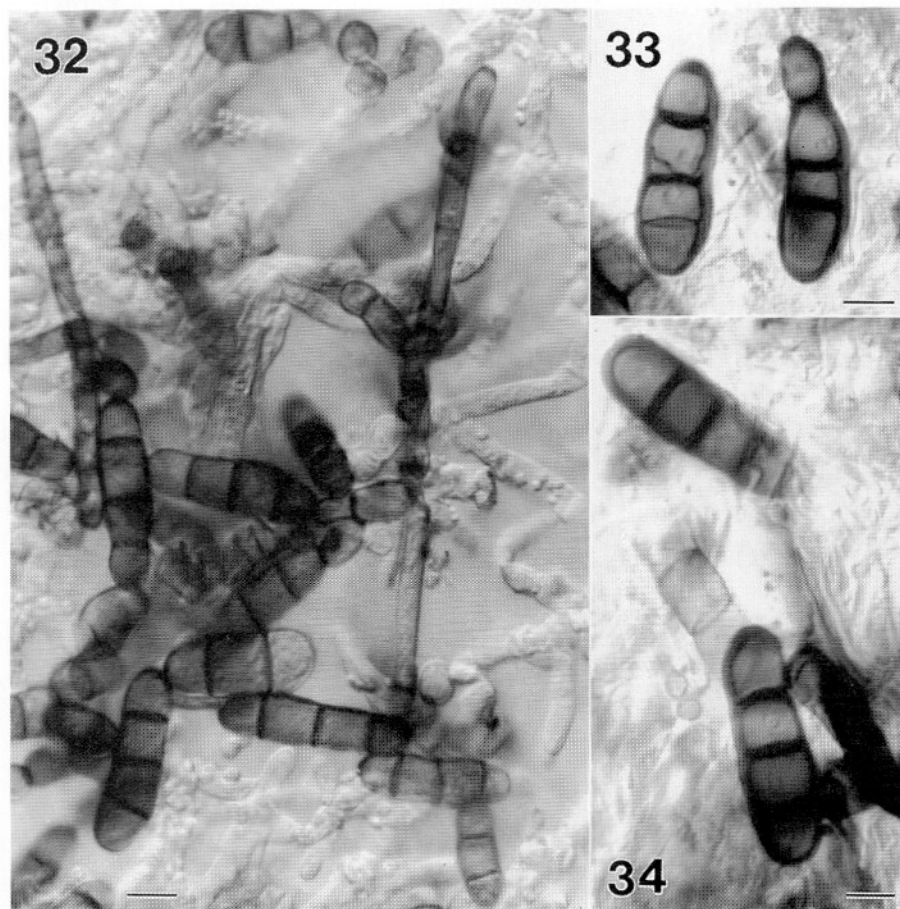
(Figs. 21, 32-34)

Etymology: *varieseptatum*, referring to the septation of the conidia which varies from uniseptate to 5-septate.

Coloniae in substrato naturale effusae, atrobrunneae. *Conidiophora* solitaria vel sparse fasciculata, ramosa, erecta, cylindrica, usque 250 µm longa, 4-6 µm lata, distincte multiseptata, saepe ad septa constricta, crassitunicata, laevia, griseobrunnea. *Cellulae conidiogenae* in conidiophoris incorporatae, polytreticae, terminales et intercalares. *Conidia* catenulata, cylindrica vel ellipsoidea, (11-)19-42(-60) × (5-)7-11(-15) µm, utrinque late rotundata vel interdum ad basem obconica, crassitunicata, laevia, (1-)2-3(-5)-septata, ad septa non constricta vel leniter constricta, pallide brunnea, concoloria; septa ca 1.5-3 µm crassa et atriora.

Holotypus: FRANCE, Bois de Feuilles, 64 Bonnut, 60 km de la Côte Atlantique, in *Phanaerochaete sordida*, 9 Apr. 1995, F. Candoussau, FC360 (BPI 749438).

Colonies on natural substratum effuse, dark brown. *Mycelium* immersed. *Setae* and hyphopodia absent. *Conidiophores* arising singly or in small groups,



Figs. 32-34. *Diplococcium varieseptatum* (from holotype, BPI 749438). **32.** Squash mount of conidiophores and chains of conidia. **33, 34.** Conidia. Bars = 10 μ m.

branched, erect, cylindrical, up to 250 μ m long, 4-6 μ m wide, distinctly multiseptate, often constricted at the septa, thick-walled, smooth, greyish brown. *Conidiogenous cells* integrated, polytretic, terminal and intercalary. *Conidia* borne in short chains, cylindrical to ellipsoidal, (11-)19-42(-60) \times (5-)7-11(-15) μ m, broadly rounded at both ends or sometimes obconical at the base, thick-walled, smooth, (1-)2-3(-5)-septate, not constricted or slightly constricted at the septa, translucent brown, concolorous; septa *ca* 1.5-3 μ m thick and darkly pigmented.

Teleomorph: presumably *Helminthosphaeria corticiorum* Höhn., Sitzungsber. Akad. Wiss. Wien Math.-Naturwiss. Kl. Abt. I, 116: 109 (1907).

Other material examined: FRANCE, Ariège, 09410 Moulis, on *Hyphoderma* sp., 8 June 1995, N. de Munnik 0806 comm. FC370 (BPI 749435); *ibid.* 09800 Lac de Bethmale, elev. 1300 m, on *Phanaerochaete sordida*, June 1995, N. de Munnik 2702 comm. FC371 (BPI

749429); *ibid.* Haute Garonne, Ravin de Fonsegrive 31, on *Phanaerochaete sordida*, 5 Mar. 1994, J.F. Magni A9446 (BPI 749439); *ibid.*, on Corticiaceae (?*P. sordida*) on branches, 18 Feb. 1996, J.F. Magni A9619 (BPI 749453).

This species has been found in association with *Helminthosphaeria corticiorum* on several occasions (five out of fifteen specimens examined). Since the anamorph-teleomorph connection has yet to be proved, it is described here as a new *Diplococcium* species. It is unique in the genus with its large conidia with 1-5 thick septa. More illustrations of this species with its presumed teleomorph are provided by Samuels *et al.* (1997).

Unacceptable, rejected, and questionable species

1. ***Diplococcium avellaneum*** Sappa and Mosca, *Allionia* 2: 222 (1954).

This is an unacceptable species on the basis of the non-catenate conidia borne on short denticles on conidiogenous cells. It has been transferred to *Scoleobasidiella avellanea* (Sappa and Mosca) M.B. Ellis (1971a).

2. ***Diplococcium catenulatum*** (C.J.K. Wang and B. Sutton) R.C. Sinclair, Eicker and Bhat, *Transactions of the British Mycological Society* 85: 736 (1985).

≡ *Spadicoides catenulata* C.J.K. Wang and B. Sutton, *Mycologia* 74: 497 (1982).

The mature conidia in this species are ovate to broadly obclavate, 2(3)-septate and borne in chains. The conidiophores are unbranched. Percurrent regeneration of the conidiophores has been reported (Wang and Sutton, 1982). The overall morphology is very similar to *D. insolitum* Hol-Jech. (Holubová-Jechová, 1982) and we consider them to be conspecific. The name *D. insolitum* takes precedence.

3. ***Diplococcium conjunctum*** (Bonord.) Sacc., *Sylloge Fungorum* 4: 375 (1886).

≡ *Cladotrichum conjunctum* Bonord., *Handb. allgem. Mykol. Anleitung Stud. derselben*: 78 (1851).

The status of this species in *Diplococcium* is uncertain based on the short description in Saccardo (1886). The conidiophores are branched and the conidia are uniseptate, ovoid and catenate. It was originally described from living leaves of *Pelargonium* (Geraniaceae).

4. *Diplococcium cylindricum* Jaap, Lindau Kryptog. Fl. Deutschl. Hyphomycetes 8: 841 (1907).

This species was originally described from decaying wood of *Pinus* producing cylindrical, 0-1-septate, subhyaline, 12-15 × 3 μm conidia in short branched chains. It may be an acceptable species based on its conidial morphology, but it is not clear if the conidiogenous cells are polytretic.

5. *Diplococcium indivisum* (Sacc.) S. Hughes, Canadian Journal of Botany 31: 634 (1953).

≡ *Virgaria indivisa* Sacc., Michelia 2: 560 (1882).

The conidia in this species are unicellular and solitary. It has been synonymised with *Spadicoides atra* (Corda) S. Hughes (1958).

6. *Diplococcium libertianum* (Roum.) Sacc., Sylloge Fungorum 10: 606 (1892).

≡ *Monilia libertiana* Roum., Revue Mycologique 6: 107 (1884).

The status of this species in *Diplococcium* is uncertain based on the short protologue. It was originally described from a decaying stem of *Brassica oleracea*. The conidia are uniseptate, ovoid, and catenate. It is not clear whether the conidiogenous cells are polytretic.

7. *Diplococcium mirabile* Rambelli, R.C. Acad. Bologna (Fis) Ser. XI 5: 140 (1958).

This is an unacceptable species in *Diplococcium*. The conidia are solitary and are not produced from polytretic conidiogenous cells.

8. *Diplococcium pulchrum* (Richon) Sacc., Sylloge Fungorum 4: 375 (1886).

≡ *Dendryphium pulchrum* Richon, Bulletin de la Societe des Amis des Sciences Naturelles de Rouen 15: 4 (1879).

The status of this species in *Diplococcium* is uncertain based on the short protologue. The conidia are uniseptate, rounded at both ends, smooth, and catenate. It was described from decaying wood. It is unclear whether the conidiogenous cells are polytretic.

9. *Diplococcium resinae* (Corda) Sacc., Sylloge Fungorum 4: 374 (1886).
≡ *Dendryphium resinae* Corda, Icones Fungorum hucusque Cognitorum 6: 10 (1854).

This species appears to be unacceptable in *Diplococcium*. It was originally described from roots of *Pinus* sp. The conidiophores and conidia are both coarsely verrucose and darkly pigmented to almost black. The conidia are uniseptate, ellipsoidal and borne in long, moniloid chains. It is unclear whether the conidiogenous cells are polytretic.

10. *Diplococcium strictum* Sacc., Sylloge Fungorum 4: 374 (1886).

The conidia in this species are fusiform, dark-olivaceous, mostly 1-septate, very rarely 2-septate, 12-15 × 6 μm, and borne in long, branched chains. This may be an acceptable species based on the conidial morphology, but it is unclear if the conidiogenous cells are polytretic.

11. *Diplococcium uniseptatum* (Berk. and M.A. Curtis) S. Hughes, Canadian Journal of Botany 31: 634 (1953).
≡ *Virgaria uniseptata* Berk. and M.A. Curtis, Grevillea 3: 145 (1875).
≡ *Cladotrichum uniseptatum* (Berk. and M.A. Curtis) Sacc., Sylloge Fungorum 4: 373 (1886).
= *Cladosporium aterrimum* Ellis and Everh., Proceedings of the Academy of Natural Science of Philadelphia 378 (1894).

The conidia in this species are uniseptate and produced singly from unbranched conidiophores. It has been synonymised with *Spadicoides bina* (Corda) S. Hughes (1958).

Notes on anamorph-teleomorph connections

Two preliminary records of possible teleomorphs of *Diplococcium* were given by Subramanian (1983), one a member of the Pleosporaceae and the other a species of *Helminthosphaeria* Fuckel. The connection of *Diplococcium pulneyense* with *Othia pulneyensis* Subram. and Sekar, a member of the Dothideales, has been established in single-ascospore culture (Subramanian and Sekar, 1989). Several fungicolous *Helminthosphaeria* species have also been associated with *Diplococcium* species (Samuels *et al.*, 1997). The biological connection of *Diplococcium* with *Helminthosphaeria* has not been unequivocally proved. The anamorph-teleomorph connection is presumed due to the consistent close and constant physical association of the two fungi in nature.

Unfortunately there is no report of any species of *Helminthosphaeria* having been cultured (Samuels *et al.*, 1997).

Acknowledgements

We wish to thank the curators of DAOM and BPI for the loan of type specimens examined in this study. We are grateful to Dr. E.C.H. McKenzie (Landcare Research, New Zealand) for his critical review of the manuscript. Helen Leung, A.Y.P. Lee, and Ken M.K. Wong are thanked for their technical and photographic assistance. The University of Hong Kong is thanked for the award of a Post-doctoral Fellowship to T.K. Goh.

References

- Castañeda Ruíz, R.F. and Kendrick, W.B. (1991). Ninety-nine conidial fungi from Cuba and three from Canada. *University of Waterloo Biology Series* 35: 1-132.
- Ellis, M.B. (1963). Dematiaceous Hyphomycetes. V. *Mycological Papers* 93: 1-33.
- Ellis, M.B. (1971a). Dematiaceous Hyphomycetes. X. *Mycological Papers* 125: 1-31.
- Ellis, M.B. (1971b). Dematiaceous Hyphomycetes. Commonwealth Mycological Institute, Kew, Surrey, England, 608.
- Ellis, M.B. (1976). More dematiaceous Hyphomycetes. Commonwealth Mycological Institute, Kew, Surrey, England, 507.
- Goh, T.K. and Hyde, K.D. (1996). *Spadicoides cordanoides* sp. nov., a new dematiaceous hyphomycete from submerged wood in Australia, with a taxonomic review of the genus. *Mycologia* 88: 1022-1031.
- Goh, T.K., Hyde, K.D. and Umali, T.E. (1998). Two new species of *Diplococcium* from the tropics. *Mycologia* 90: 514-517.
- Holubová-Jechová, V. (1982). Lignicolous Hyphomycetes from Czechoslovakia. 6. *Spadicoides* and *Diplococcium*. *Folia Geobotanica et Phytotaxonomica, Praha* 17: 295-327.
- Hughes, S.J. (1953). Conidiophores, conidia, and classification. *Canadian Journal of Botany* 31: 577-659.
- Hughes, S.J. (1958). Revisiones hyphomycetum aliquot cum appendice de nominibus rejiciendis. *Canadian Journal of Botany* 36: 727-836.
- Matsushima, T. (1993). Matsushima Mycological Memoirs No. 7. Published by the Author, Kobe.
- Pirozynski, K.A. (1972). Microfungi of Tanzania. I. Miscellaneous fungi on oil palm. II. New Hyphomycetes. *Mycological Papers* 129: 1-65.
- Saccardo, P.A. (1886). *Sylloge Fungorum*. Vol. 4. Johnson Reprint Corporation.
- Samuels, G.J., Candoussau, F. and Magni, J.F. (1997). Fungicolous pyrenomycetes 1. *Helminthosphaeria* and the new family Helminthosphaeriaceae. *Mycologia* 89: 141-155.
- Sinclair, R.C., Eicker, A. and Bhat, D.J. (1985). Branching in *Spadicoides*. *Transactions of the British Mycological Society* 85: 736-738.
- Subramanian, C.V. (1983). *Hyphomycetes: Taxonomy and Biology*. Academic Press, London.
- Subramanian, C.V. and Sekar, S. (1989). Three bitunicate ascomycetes and their tetric anamorphs. *Kavaka* 15 (1987): 87-97.
- Sutton, B.C. (1973). Hyphomycetes from Manitoba and Saskatchewan, Canada. *Mycological Papers* 132: 1-143.

- Wang, C.J.K. (1976). *Spadicoides* in New York. *Memoirs of the New York Botanical Garden* 28: 218-224.
- Wang, C.J.K. and Sutton, B.C. (1982). New and rare lignicolous Hyphomycetes. *Mycologia* 74: 489-500.
- White, G.P. and Ginns, J. (1984). *Fungi Canadenses* No. 285. Biosystematic Research Institute, Research Branch, Agriculture Canada, Ottawa, Canada.