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## Taxonomy of *Dactylella* complex and *Vermispora*. II. The genus *Dactylella*

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The anamorph genus *Dactylella* is extremely heterogenous, comprising members of saprotrophic, oospore or nematode-egg parasites. In view of the vast biological differences, a subdivision into more natural entities is needed. According to morphological observations and phylogenetic analyses of the ITS regions, 28 species are accepted in *Dactylella* including two new species, *D. clavispora* sp. nov. and *D. xinjiangensis* sp. nov. Five species with short conidiophores formerly assigned to *Dactylella* are transferred to an erected genus *Brachyphoria* gen. nov. *Dactylella spermatophaga* is transferred to *Vermispora* as *V. spermatophaga* due to its fusoid conidia and repeatedly elongate conidiophores. Among several isolates originally identified as *D. oxyspora*, five are considered to represent this species, one is reidentified as *D. rhombospora*. *Dactylella atractoides* and *D. beijingensis* are considered as synonyms of *D. oxyspora* and *D. heptameres* respectively.

**Key words:** *Dactylella*, key, taxonomy

### Introduction

Grove (1884) introduced the genus *Dactylella* and characterized it as “Saprophytic. Vegetative hyphae creeping, sparse. Conidiophores erect, simple, septate or non-septate, smooth, hyaline. Conidia borne singly at the apex of conidiophore, ellipsoidal or fusoid or cylindrical, one-celled at first, later 2- to many-septate, hyaline”. Subramanian (1963) discussed the status of two closely related genera *Dactylella* and *Monacrosporium* Oudemans and transferred 11 species of *Dactylella* with conidia having one wider and longer cell than the other cells to *Monacrosporium*. This was followed by Cooke and Dickinson (1965). In a subsequent paper, Subramanian (1977) redefined the genus *Dactylella* as “Hyalophragmoconidia acrogenous, solitary, gangliar and

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clavate. Conidiophores simple, determinate and show neither sympodial nor percurrent proliferation.” and introduced *Drechsleromyces* Subram., *Monacrosporiella* Subram., *Gangliophragma* Subram., and *Lactydina* Subram. for fungi previously assigned in *Dactylella*. Yadav (1960), on the other hand, considered the shape of the conidia an inadequate distinction and treated the genera *Monacrosporium* as well as *Dactylina* Arnaud as synonyms of *Dactylella*. Similarly, Matsushima (1971, 1975), proposed a broad concept of *Dactylella* including therein species with branched and unbranched conidiophores and a variety of conidial shapes as well as degrees of conidial septation. Rubner (1996) revised the generic circumscription of *Dactylella* and restricted the genus as non-predacious. Scholler *et al.* (1999) accepted this amendment and proposed a new generic concept for predatory anamorphic *Orbiliaceae* (*Ascomycota*) on the basis of phylogenetic analysis of the 18s rDNA, 5.8s rDNA, ITS1 and ITS2 sequences, leaving non-predacious species in *Dactylella*. Li *et al.* (2005) redefined the systematic classification of nematode-trapping fungi. However several predacious species had still been described under *Dactylella* (Liu *et al.*, 2003; Zhang *et al.*, 2005). Besides predacious species, *Dactylella* still includes species diverse in morphology and behaviour. Some species are saprotrophic, while others are oospore or nematode-egg parasites. A systematic treatment of *Dactylella* is therefore necessary and is the object of this paper.

## **Materials and methods**

### ***Fungal isolation***

The soil samples were taken from several natural reserves collected from 6 Provinces in China. About 1 gram soil from each sample was placed on each cornmeal agar (CMA) plate supplemented with nematodes and incubated at 25 °C. Three plates were used for each sample. The plates were examined under dissection microscope after 3-4 weeks of incubation. The conidia of the target fungi were picked up from conidiophores with a bamboo needle and transferred to PDA (Potato Dextrose Agar). The fungus was transferred to a new agar plate for purification after growing out. The pure cultures on PDA slants were preserved in a refrigerator.

### ***Agar media and incubation***

Potato Dextrose Agar (Difco) and Cornmeal Agar (Difco) were used for fungal culture. The stock cultures of the isolates were preserved on PDA slants

at 4°C with annual transfer. For morphological studies, fungi were incubated on agar plates at 25°C in a constant-temperature chamber. The colony diameter was measured at the 7th or 15th day after inoculation.

### ***Microscopic mounts***

All measurements, unless indicated otherwise, were made from PDA cultures, on which the fungi usually sporulated well. The water mounts were used for all observations, measurements and photographs under a Nikon 80i microscope with DIC. The arithmetic means and standard errors were calculated based on approximately 30 measurements.

### ***Molecular methods***

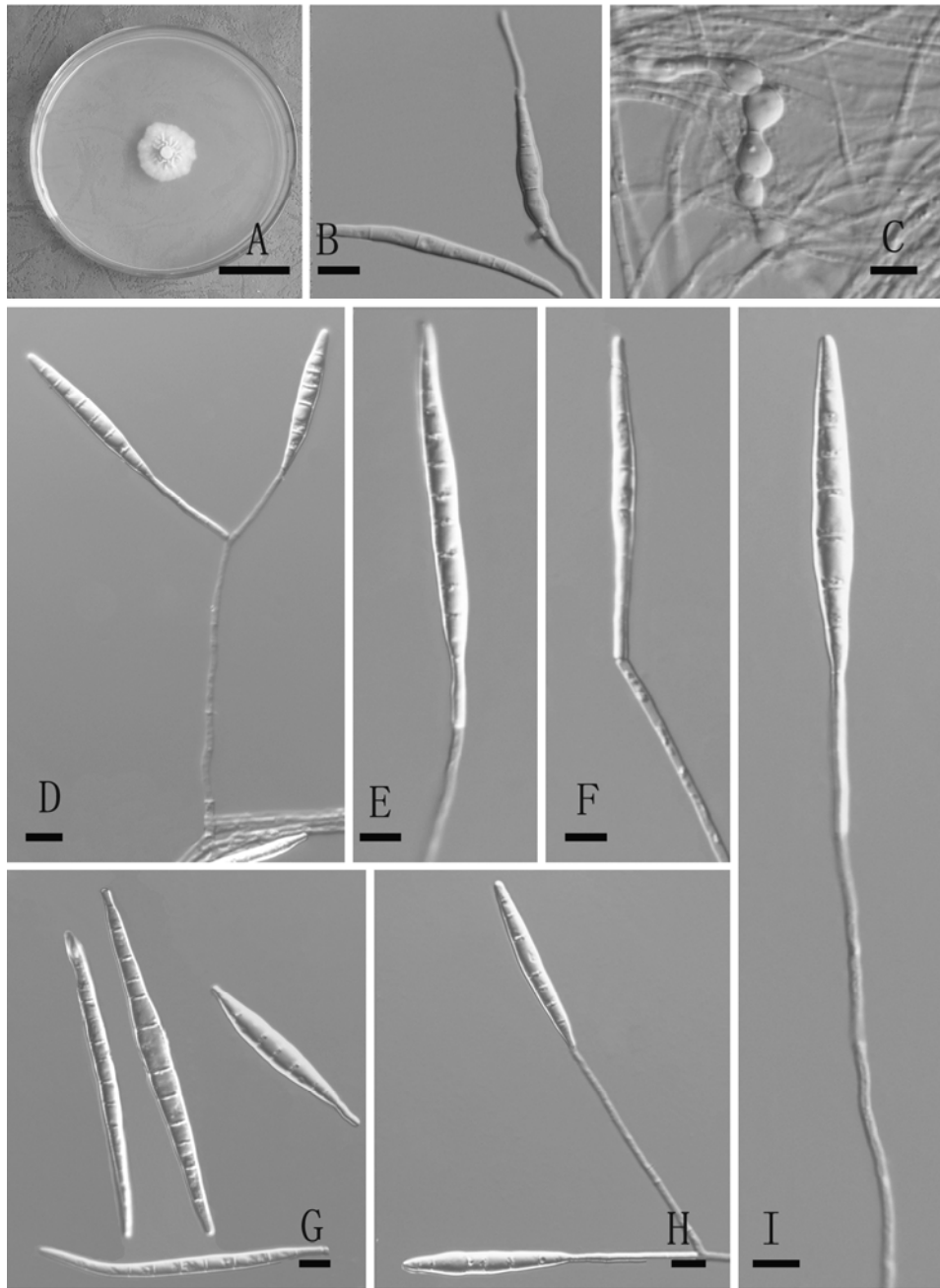
Methods used for sequencing and reconstructing phylogeny were described in the previous paper (Chen *et al.*, 2007) and sequences from GenBank were listed in Table 1 in that paper.

## **Results and discussion**

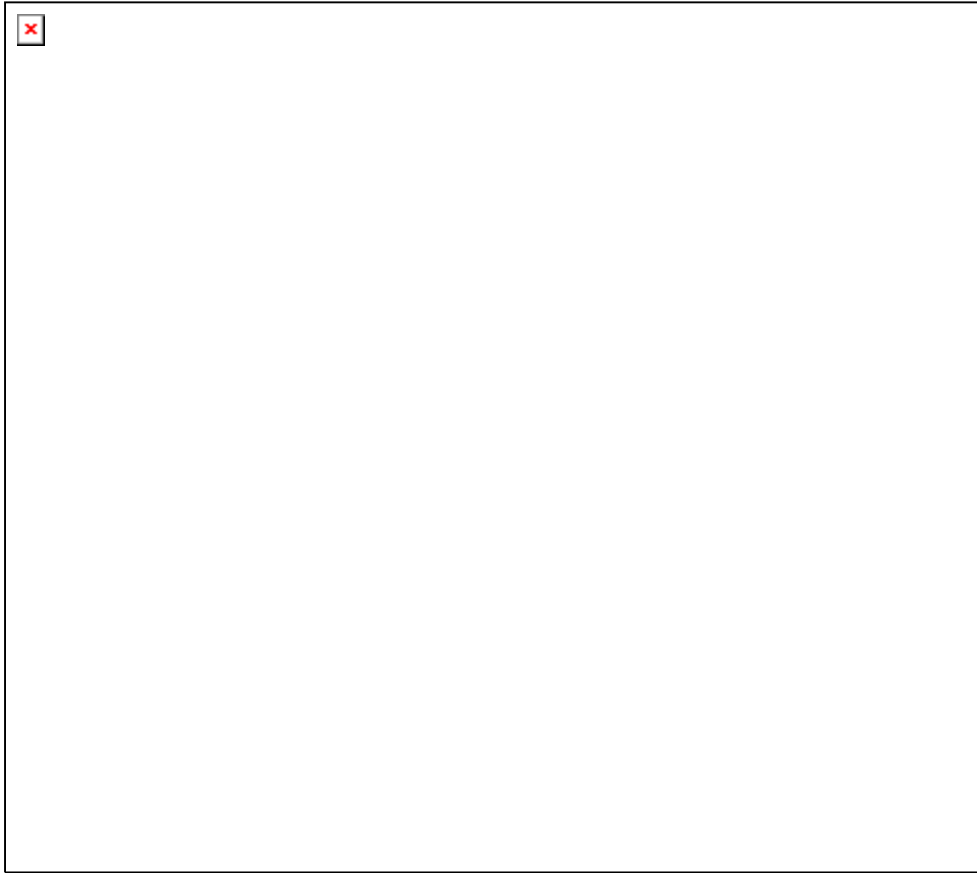
The phylogeny of *Dactylella* species is reconstructed based on ITS sequences alignment (Fig. 1, Chen *et al.*, 2007). The neighbor-joining tree contains 27 sequences representing 17 species composed of available strains worldwide. Species of *Dactylella* can be divided into two clades. Isolates with fusiform or clavate conidia constitute one clade. Phenotypic similarity among closely related species in well-defined lineages was observed in this clade. *Dactylella oxyspora* (Sacc. & Marchal) Matsushima and *D. attractoides* Drechsler are indistinguishable by molecular analysis and are treated as synonyms. *Dactylella arnaudii* Yadav also clustered together with *D. oxyspora*, but the multishaped conidia indicate its status as a separate species. The second clade includes isolates with cylindrical or clavate conidia with the exception of *Dactylella panlongna* X.F. Liu & K.Q. Zhang. It is prevalent that fusiform and clavate conidia produced simultaneously in *D. panlongna*, which partly explain the unexpected classification of *D. panlongna*.

***Dactylella arnaudii*** Yadav, Transactions of the British Mycological Society 43: 603, 1960 (Figs 1-2)

*Colonies* white, compact with irregular edge, slow growing, reaching 1.5-2 cm in diam. after incubation at 25°C for 15 days. *Vegetative hyphae* hyaline, thin-walled, branched, 1-2 µm wide. *Conidiophores* hyaline, solitary, erect or with small branches, septate, 25-201.5 µm long, 2-3 µm wide at the



**Fig. 1.** *Dactylella arnaudii* (CBS 129.83). **A.** Colony on PDA. **B.** Conidia with germ tube. **C.** Chlamydospores. **D-F, H-I.** Conidiophores and conidia. **G.** Conidia. Bars: A = 2 cm, B-I = 15  $\mu$ m.



**Fig. 2.** *Dactylella arnaudii* (IMI 77850). **A-G.** Conidia. Bars: A-G = 15  $\mu$ m.

base, 1-1.5  $\mu$ m at the apex. *Conidia* hyaline, thin-walled, 3-10-septate, fusiform, clavate, sometimes rostrate, borne singly at the apex of the conidiophores and on short branches, 54-(69)-88  $\times$  4.5-(7)-10  $\mu$ m.

*Habitat:* Dead stems.

*Distribution:* UK (Yadav, 1960).

*Material examined:* UK, Hertfordshire, St. Albans, from decayed stems of *Heracleum sphondylium*, 25 August 1958, A.S. Yadav (IMI 77850, holotype); ex-type living culture CBS 129.83.

*Notes:* *Dactylella arnaudii* is typified by its multishaped conidia. Some are fusiform, which are similar to the conidia of *D. oxyspora* in outline (Saccardo and Marchal, 1885), others with rostrate, like conidia of *D. yunnanensis* K.Q. Zhang, Xing Z. Liu & L. Cao (Zhang *et al.*, 1994). However the multishaped conidia of *D. arnaudii* indicate it is a separate species.

***Dactylella attenuata*** R.H. Gao, Xing Z. Liu, L.P. Lei & T.F. Li, Mycologia 89: 521, 1997 (Fig. 3)

*Colonies* on CMA whitish, moderately growing, attaining a diam. of 2.9 cm within 7 days at 25°C, producing sparse aerial mycelium. *Hyphae* hyaline, septate and branched. *Conidiophores* slender, erect, hyaline, simple or occasionally branched, 72-256 µm long, 1-2 µm wide, 1-10 conidia produced on short sterigma at the apex of conidiophores branching in a loose capitate and a somewhat radial arrangement. *Conidia* hyaline, elongate-fusoid to cylindrical, 7-12 (mainly 7-8)-septate, 40.5-(50)-74.5 × 3-(4)-5 µm.

*Habitat:* Soil.

*Distribution:* China (Gao *et al.*, 1997).

*Material examined:* China, Yunnan Province, Xishuangbanna, Menlun, in rainforest soil, 11 December 1993, D.Y. Yang, (HMAS 71590, holotype).

*Notes:* *Dactylella attenuata* bears notable resemblance to *Brachyphoris helminthodes* (Drechsler) J. Chen, L.L. Xu, B. Liu & Xing Z. Liu, *B. oviparasitica*, *Dactylella rhopalota* Drechsler and *Dactylellina leptospora* (Drechsler) M. Scholler, G. Hagedorn & A. Rubner in conidial morphology (Gao *et al.*, 1997). However, both *Brachyphoris helminthodes* and *B. oviparasitica* produce very short conidiophores and parasitize mature oospores and nematode eggs respectively ((Drechsler, 1952; Stirling and Mankau, 1978). *Dactylella rhopalota* has rather wider, clavate conidia with 4-8, mostly 7 septa measuring 28-(37)-45 × 6.5-(8.5)-10.5 µm (Drechsler, 1943). *Dactylellina leptospora* traps nematodes by stalked knobs and non-constricting rings (Drechsler, 1937).

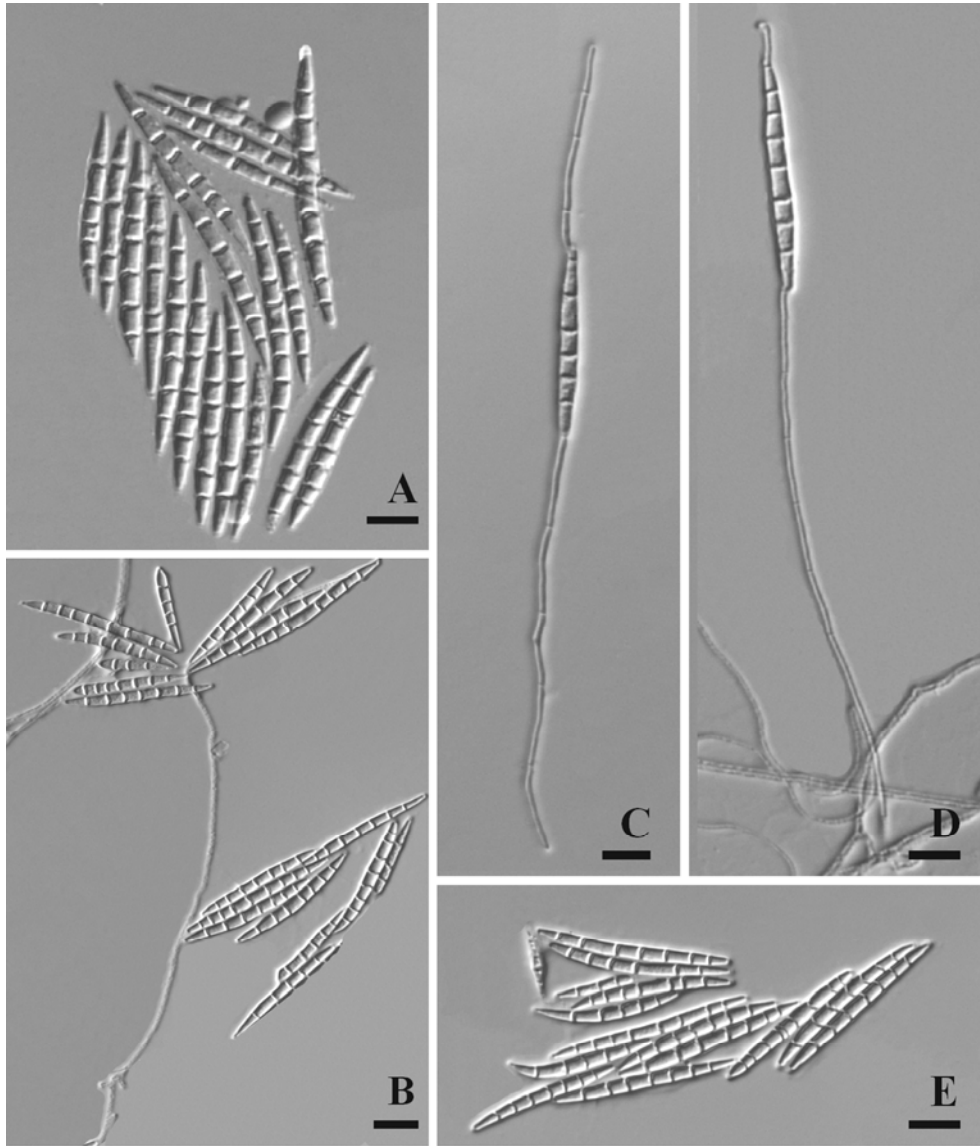
***Dactylella clavata*** R.H. Gao, M.H. Sun & Xing Z. Liu, Mycotaxon 56: 191, 1995 (Fig. 4)

*Colonies* on PDA whitish, moderately growing, extending to a diam. of 4.8 cm within 15 days at 25°C. *Conidiophores* hyaline, erect, septate, simple or with several branches, 59-(70)-90 µm long, 1.5-4 µm wide at the base, 1-2 µm at the apex. A single conidium formed at the apex of the conidiophore or its branches. *Conidia* hyaline, clavate, rounded at the apex, tapering toward the truncate base, 5-7-septate, 41.5-(49.5)-64 × 6-(7)-8 µm. *Chlamydospores* spherical or broadly ellipsoidal, present in older cultures.

*Habitat:* Soil.

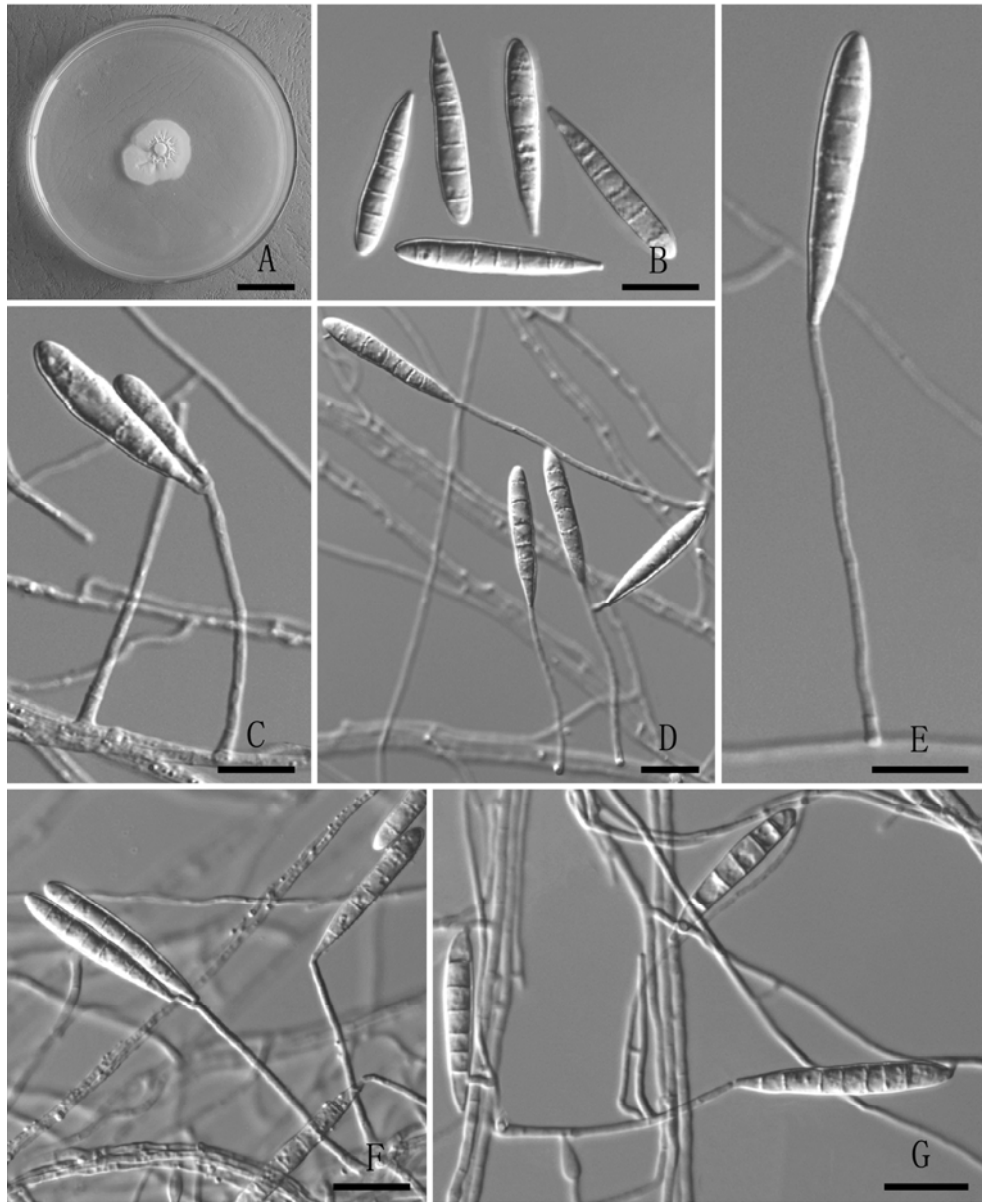
*Distribution:* China (Gao *et al.*, 1995).

*Material examined:* China, Hainan Province, Xisha Islands, in soil of *Cocos nucifera*, 16 April 1993, F.J. Chen (HMAS 69236, holotype); ex-type living culture CBS 167.95; China, Yunnan Province, in soil of paddy field, 2004, Y.E. Hao, SDT-2-34.



**Fig. 3.** *Dactylella attenuata* (HMAS 71590). **A, E.** Conidia. **B, D.** Conidiophores and conidia. **C.** Conidium with germ tubes. Bars: A-E = 20  $\mu$ m.

*Notes:* *Dactylella clavata* is similar to *D. ramosa*, *D. rhopalota* and *D. chichisimensis* in conidial morphology. *Dactylella rhopalota* however produces shorter mainly 7-septate conidia (Drechsler, 1943). *Dactylella ramosa* bears 3-9-septate, cylindrical-clavate and somewhat narrower conidia (Matsushima, 1971) and *D. chichisimensis* possesses pale yellow, nearly



**Fig. 4.** *Dactylella clavata*. **A.** Colony on PDA. **B.** Conidia. **C-G.** Conidiophores and conidia. Bars: A = 2 cm, B-G = 20  $\mu$ m.

spherical, embedded microsclerotia, a particular characteristic different from other species in *Dactylella* (Watanabe *et al.*, 2001).



***Dactylella clavispora* J. Chen, L.L. Xu, B. Liu & Xing Z. Liu, sp. nov.**

Mycobank: 510344

(Fig. 5)

*Coloniae* lente crescentes, albae. *Mycelium* effusum. *Hyphis* hyalinis, septatis, ramosis. *Conidiophora* erecta, septata, hyalina, simplicia, parce ramosa, 60-99-148  $\mu\text{m}$  longa, basi 2.5-5.5  $\mu\text{m}$  crassa, apice 1.5-2.5  $\mu\text{m}$  crassa. *Conidia* hyalina, clavata, 1-3-septata, plerumque 3-septata, 18-(25)-32.5  $\times$  7.5-(9)-11  $\mu\text{m}$ .

*Colonies* on PDA whitish with sparse aerial mycelium, extending to 5.2 cm in diam. after incubation at 25°C for 10 days. *Hyphae* hyaline, septate, branched, commonly 1.5-2  $\mu\text{m}$  wide. *Conidiophores* simple, erect, straight, rarely branched, 60-(99)-148  $\mu\text{m}$  long, 2.5-5.5  $\mu\text{m}$  at the base, tapering gradually upwards to 1.5-2.5  $\mu\text{m}$  wide at the apex, and bearing a single conidium. *Conidia* hyaline, obclavate or cylindrical, distally rounded and tapering proximally to a narrowly truncate base, sometimes constricted at septa, 1-3 (mainly 3)-septate, 18-(25)-32.5  $\times$  7.5-(9)-11  $\mu\text{m}$ . *Chlamydospores* absent.

*Habitat*: Living leaf of *Betula* sp.

*Distribution*: UK.

*Holotype*: UK, England, Cumbria, Meathop Wood, from living leaf of *Betula* sp., August 1970, J.C. Frankland, CBS 844.70. Specimen deposited in Mycological Herbarium, Institute of Microbiology, Chinese Academy of Sciences, HMAS 140510.

*Notes*: *Dactylella clavispora* resembles *D. cylindrospora* (R.C. Cooke) A. Rubner in conidial shape and size. The difference is that conidiophores of *D. cylindrospora* often produce a loose branching system with more than one conidium on each conidiophore (Cooke *et al.*, 1969), while conidiophores of *D. clavispora* usually produce a single conidium at the apex. Furthermore, the conidia of *D. clavispora* are smaller compared with *D. cylindrospora* (Cooke *et al.*, 1969). Molecular data have shown that *D. clavispora* is distant from *D. cylindrospora*, although they have similar conidia (Chen *et al.*, 2007).

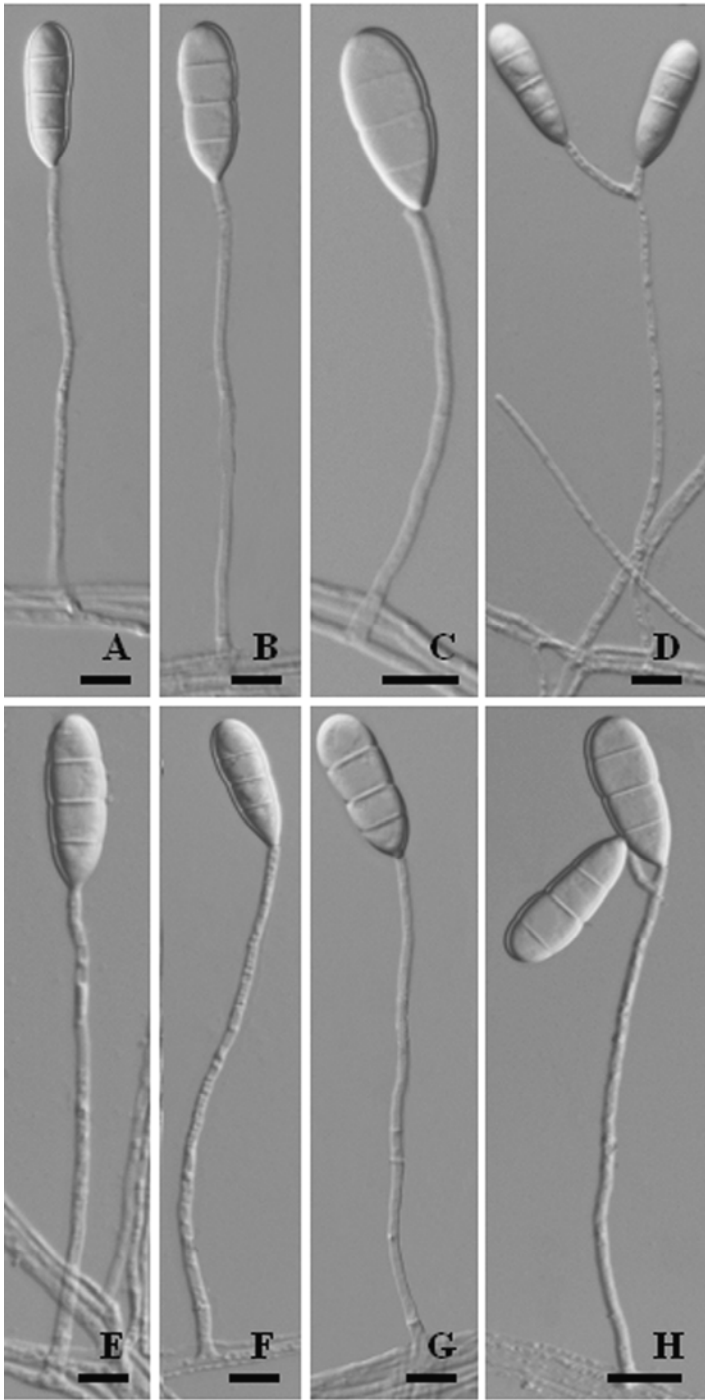
***Dactylella coccinella* Y. Yang & Xing Z. Liu, Mycotaxon 91: 127-132, 2005.**

(Fig. 6)

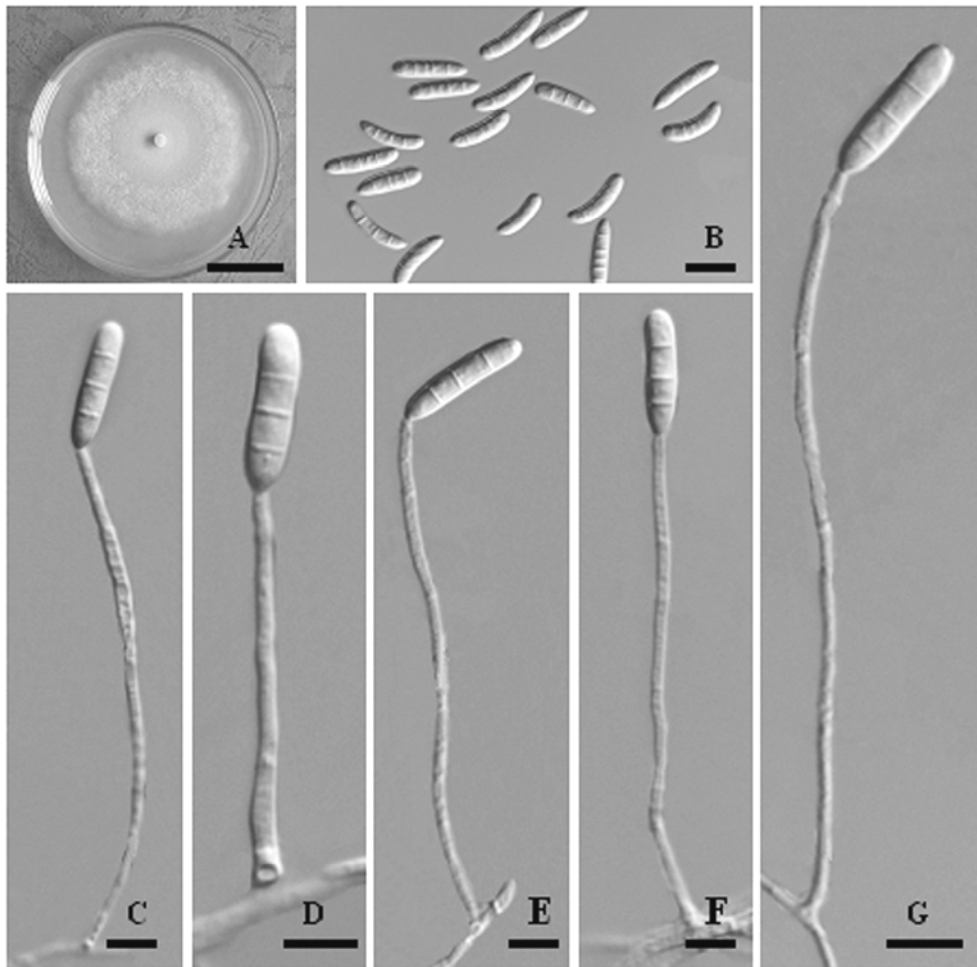
*Colonies* on PDA effuse, slightly brown, felty with sparse aerial mycelium, reaching 4 cm in diam. for 15 days at 25°C, *Hyphae* hyaline, septate, branched, 1.5-3.5  $\mu\text{m}$  wide. *Conidiophores* erect, simple, unbranched, hyaline, septate, 68.5-108  $\mu\text{m}$  long, 1.5-3.5  $\mu\text{m}$  wide at the base, tapering to 1-2.5  $\mu\text{m}$  at the apex, bearing only one holoblastic conidium. *Conidia* cylindrical, broadly rounded at the apex, truncate at the base, sometimes appreciably curved, 3-6 (mainly 5)-septate, 25.5-(28)-33  $\times$  4.5-(6)-7  $\mu\text{m}$ . *Chlamydospore* absent.

*Teleomorph*: *Orbilia coccinella* (Benedict, 1972).

*Material examined*: From *Orbilia coccinella*, Oct 1972, R.G. Benedict (HMAS 87787, holotype); ex-type living culture CBS 916.72.



**Fig. 5.** *Dactylella clavispora* sp. nov. **A-H.** Conidiophores and Conidia, conidia borne on simple, erect conidiophores. Bars: A-H = 10  $\mu$ m.



**Fig. 6.** *Dactylella coccinella*. **A.** Colony on PDA. **B.** Conidia. **C-G.** Conidiophores and conidia. Bars: A = 2 cm, B-G = 10  $\mu$ m.

*Notes:* *Dactylella coccinella* was first isolated by Benedict (1972) from teleomorph *Orbilia coccinella* (Sommerfeld) Fries. This fungus shares a similar conidial morphology with *D. cylindrospora*, *D. clavata* and *D. tenuis* (Yang and Liu, 2005), but can be distinguished with the following characteristics: *D. cylindrospora* produces a plurality of 3-7-septate conidia at the apex of conidiophores or their branches in a loose capitata arrangement (Cooke *et al.*, 1969); *D. clavata* has branched conidiophores on which borne 5-7-septate, clavate conidia (Gao *et al.*, 1995); *D. tenuis* produces wider, cylindrical or clavate 1-4-septate conidia (Drechsler, 1937).

***Dactylella cylindrospora*** (R.C. Cooke) A. Rubner, *Studies in Mycology* 39: 109, 1996 (Fig. 7)

= *Arthrobotrys cylindrospora* (R.C. Cooke) S. Schenck, W.B. Kendr. & Pramer, *Canadian Journal of Botany* 55: 982, 1977.

= *Candelabrella cylindrospora* R.C. Cooke, *Transactions of the British Mycological Society* 53: 477, 1969.

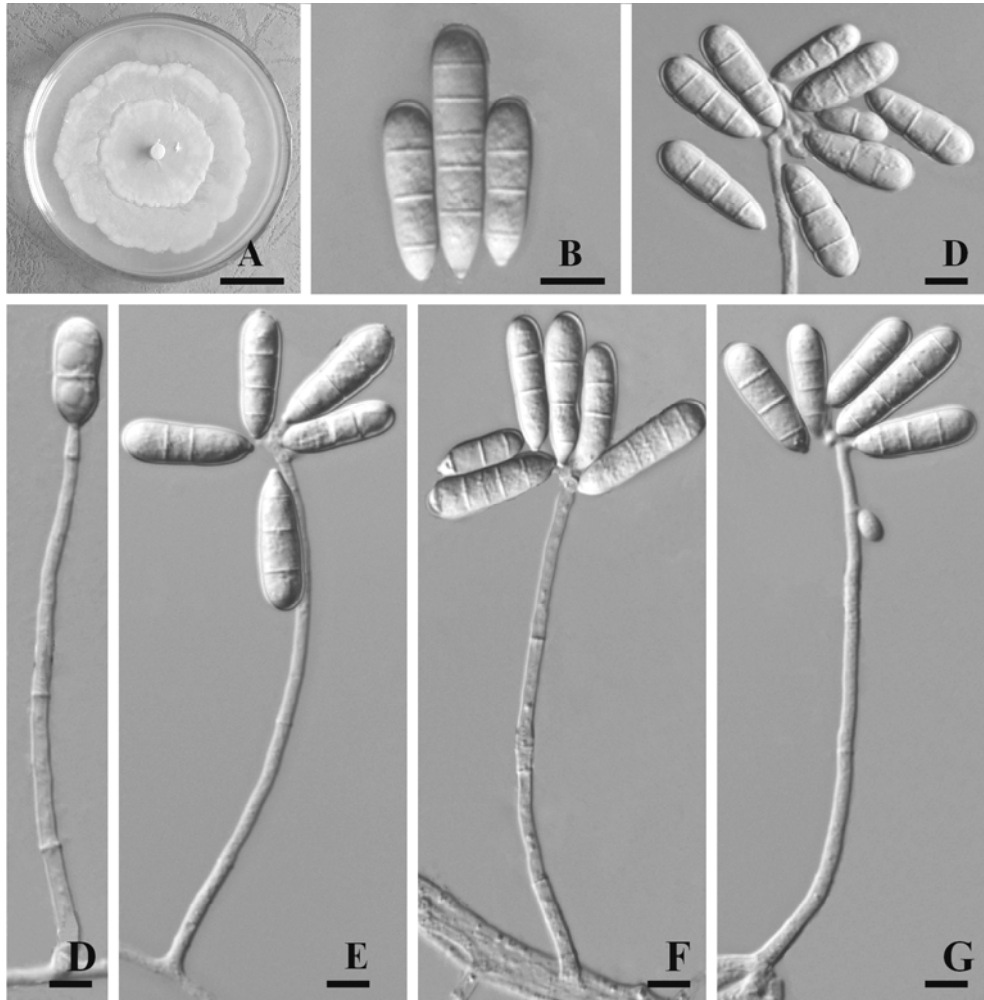
*Colonies* on PDA white, at first smooth but soon becoming compactly fluffy due to the formation of abundant interwoven aerial hyphae, zonate centrally, extending to 6.5 cm in diam. after incubation at 25°C for 15 days. *Hyphae* hyaline, septate, branched, commonly 1.5-4 µm wide. *Conidiophores* erect, straight, 80-219.5 µm long, 2.5-6 µm wide at the base, 1-2 µm at the apex. *Conidia* hyaline, obconical, clavate or cylindrical, broadly rounded at the apex and convexly protruded at the truncate base, produced at the apex of conidiophores or their branches in a loose capitate and somewhat radial arrangement, 3-7 (mainly 3)-septate, 29-(36)-51 × 8.5-(11)-13 µm. *Chlamydospores* absent.

*Habitat*: Soil.

*Distribution*: Western Samoa (Cooke, 1969).

*Material examined*: Samoa, Western Samoa, Upolu, Nafanua, from soil of cocoa propagation bed, March 1969, R.C. Cooke (IMI 140015, holotype); ex-type living culture CBS 325.70.

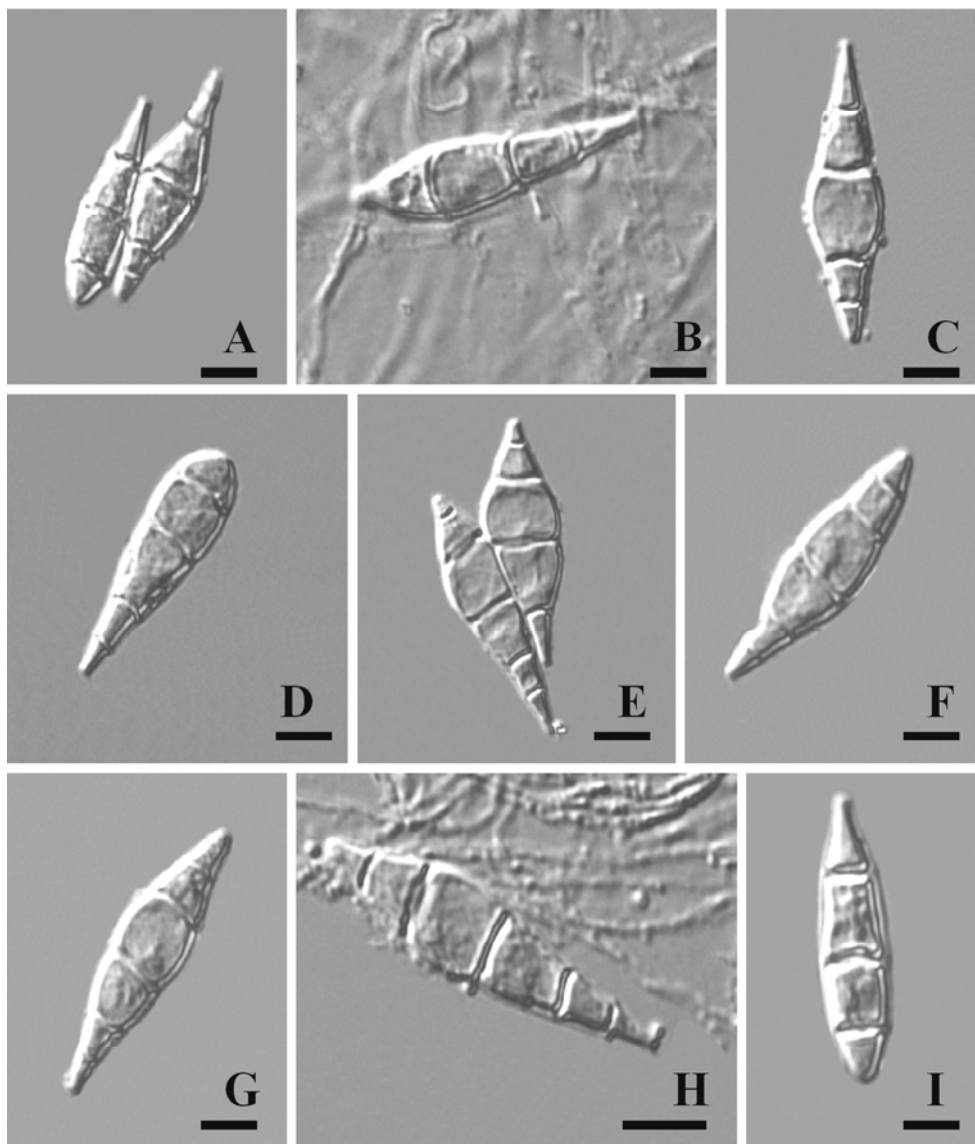
*Notes*: *Dactylella cylindrospora* was ascribed to *Candelabrella* (Cooke, 1969), later to *Arthrobotrys* (Schenck *et al.*, 1977) due to its loosely branched conidiophores. According to molecular research, the morphological features especially the ramifications of conidiophores do not reflect phylogenetic relationships, which resulted in the redelimitation of *Arthrobotrys* as a predatory genus with adhesive networks (Scholler *et al.*, 1999). This fungus has characters consistent with the generic concept of *Dactylella* in having branched, non-arthrobotryoid conidiophore apex and hyaline, clavate or cylindrical conidia (Cooke *et al.*, 1969). The ex-type culture (CBS 325.70) produces longer and wider conidia with a large number of septa than in Cooke's observations, which might be caused by its plastic reaction to subculturing. *Dactylella cylindrospora* resembles *D. tenuis*, *D. coccinella* and *D. clavata*. *Dactylella tenuis* differs in producing single cylindrical or clavate 1-4-septate conidia on each conidiophore (Drechsler, 1937), *D. coccinella* has simple conidiophores bearing one cylindrical 3-6-septate conidium at the apex (Yang and Liu, 2005), and *D. clavata* deviates considerably in its clavate conidia measuring 41.5-(49.5)-64 × 6-(7)-8 µm (Gao *et al.*, 1995).



**Fig. 7.** *Dactylella cylindrospora*. **A.** Colony on PDA. **B.** Conidia. **C-G.** Conidiophores and conidia. Bars: A = 2 cm, B-G = 10 μm.

***Dactylella heptameres*** Drechsler, *Mycologia* 35: 354, 1943 (Figs 8-9)  
 = *Dactylella beijingensis* Xing Z. Liu, C.Y. Shen & W.F. Qiu, *Mycosystema* 5: 113, 1992.

*Colonies* on PDA thin, cumulous, extending to 4-4.5 cm diam. after incubation at 25°C for 15 days. *Mycelium* spreading with sparse aerial hyphae. *Vegetative hyphae* smooth-walled, hyaline, 1.5-3 μm wide. *Conidiophores* arising from submerged hyphae, erect, colourless, septate, 104-207.5 μm long, 2.5-3.5 μm wide at the base, 1.5-2.5 μm at the apex. *Conidia* holoblastic, borne singly at the apex or branches of the conidiophores, colourless, fusiform, 3-6



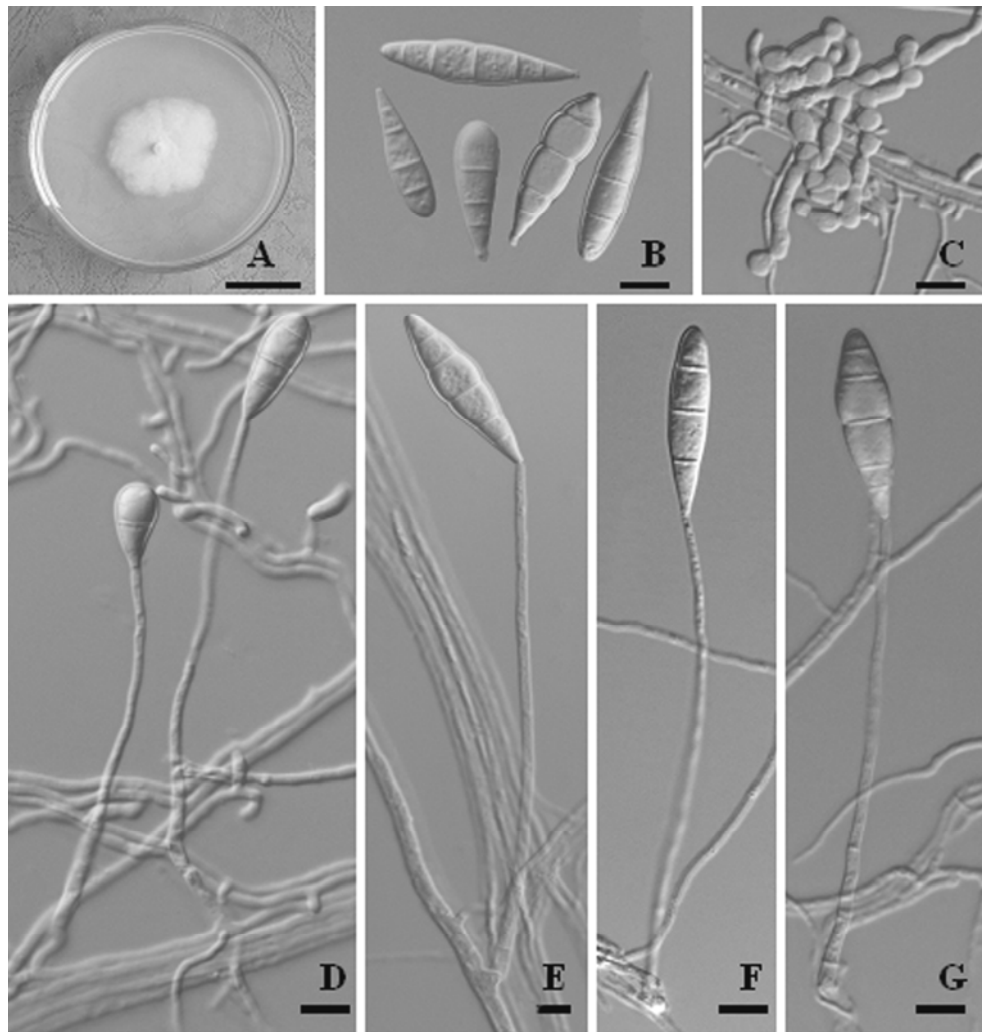
**Fig. 8.** *Dactylella heptameres* (HMAS 62569). **A-I.** Conidia. Bars: A-I = 15  $\mu$ m.

(mainly 6)-septate, rounded at the apex, attenuate sharply at the base, 33-(42.5)-55.5  $\times$  7.5-(8.5)-9  $\mu$ m. *Chlamydospores* present.

*Habitat:* Decaying leaves, soil.

*Distribution:* USA (Drechsler, 1943), China (Liu *et al.*, 1992).

*Material examined:* China, Beijing Province, from soil, 2001, X.Z. Liu, AS 6.0297; *ibid.* 2001, X.Z. Liu, AS 6.0298; *ibid.* 29 April 1991, Z.Q. Miao, HMAS 62569.



**Fig. 9.** *Dactylella heptameres* (AS 6.0298). **A.** Colony on PDA. **B.** Conidia. **C.** Chlamydospores. **D-G.** Conidiophores and conidia. Bars: A = 2 cm, B-G = 10  $\mu$ m.

*Notes:* This fungus fits Drechsler's original description of *Dactylella heptameres* quite well. Liu *et al.* (1992) distinguished *D. beijingensis* from *D. heptameres* by the constriction at the septum, while according to our further observation, the constriction of conidia at the septa might be caused artificially, which does not justify erection as a distinct species. We treat *D. beijingensis* as synonym of *D. heptameres*. *Dactylella heptameres* is similar to *D. pulchra* (Linder) de Hoog and Oorschot as well as *D. oxyspora* (Drechsler, 1943). *Dactylella pulchra* produces 4-8-septate conidia which are slightly curved and

produces terminal and lateral sterigmata on its conidiophores (Linder, 1934), *D. oxyspora* bears 6-12 septate conidia, which are rather longer with measurements of 50.5-(66.5)-98.5 × 9-(10.5)-12 µm (Saccardo and Marchal, 1885).

***Dactylella intermedia*** T.F. Li, L.P. Lei & Xing Z. Liu, Mycotaxon 66: 493, 1998 (Fig. 10)

*Colonies* on PDA white, gradually weak towards the erose edge, moderate-growing, extending to a diam. of 4-4.5 cm within 15 days at 25°C. *Hyphae* hyaline, septate, branched, mostly 1.5-2.5 µm wide. *Conidiophores* erect, hyaline, simple or occasionally branched, 142-308 µm long, 3-4 µm wide at the base, 2-2.5 µm wide at the apex, a single conidium produced at the apex of conidiophore. *Conidia* fusiform, conically acuminate at both ends, with a slightly inflated central cell next to the base, 5-8 (mainly 7)-septate, 40.5-(66)-82 × 8-(11.5)-13 µm. *Chlamydospores* absent.

*Habitat*: Soil, litter of *Ziziphus spina-christi* and *Ficus religiosa*.

*Distribution*: China (Li *et al.*, 1998), Oman (Elshafie, 1998).

*Material examined*: Oman, Alkoud, Sultan Qaboos University, from litter of *Ziziphus spina-christi* and *Ficus religiosa*, 1998, A.E. Elshafie, CBS 109506.

*Notes*: *Dactylella intermedia* is characterized by conidia with a slightly inflated central cell which results in treatment as intermediate between *Dactylella* and *Monacrosporium* (Li *et al.*, 1998). Scholler *et al.* (1999) classified predatory anamorphic *Orbiliaceae* into four genera based mainly on types of trapping device supplemented with saprotrophic activity, cellulolytic activity and predatory ability based on 18s rDNA, 5.8srDNA, ITS1 and ITS2 sequence analysis. The inflated larger central cell of the conidia therefore has less value in delimitation between *Dactylella* and *Monacrosporium*. *Dactylella intermedia* resembles *Dactylella rhombica* Matsush., *D. heptameres* and *D. oxyspora*, while the conidia of *D. rhombica* are rather large and especially wider (Matsushima, 1971). *Dactylella heptameres* produces shorter conidia with rounded apex (Drechsler, 1943), while *D. oxyspora* bears 6-11-septate and narrower conidia (Saccardo and Marchal, 1885).

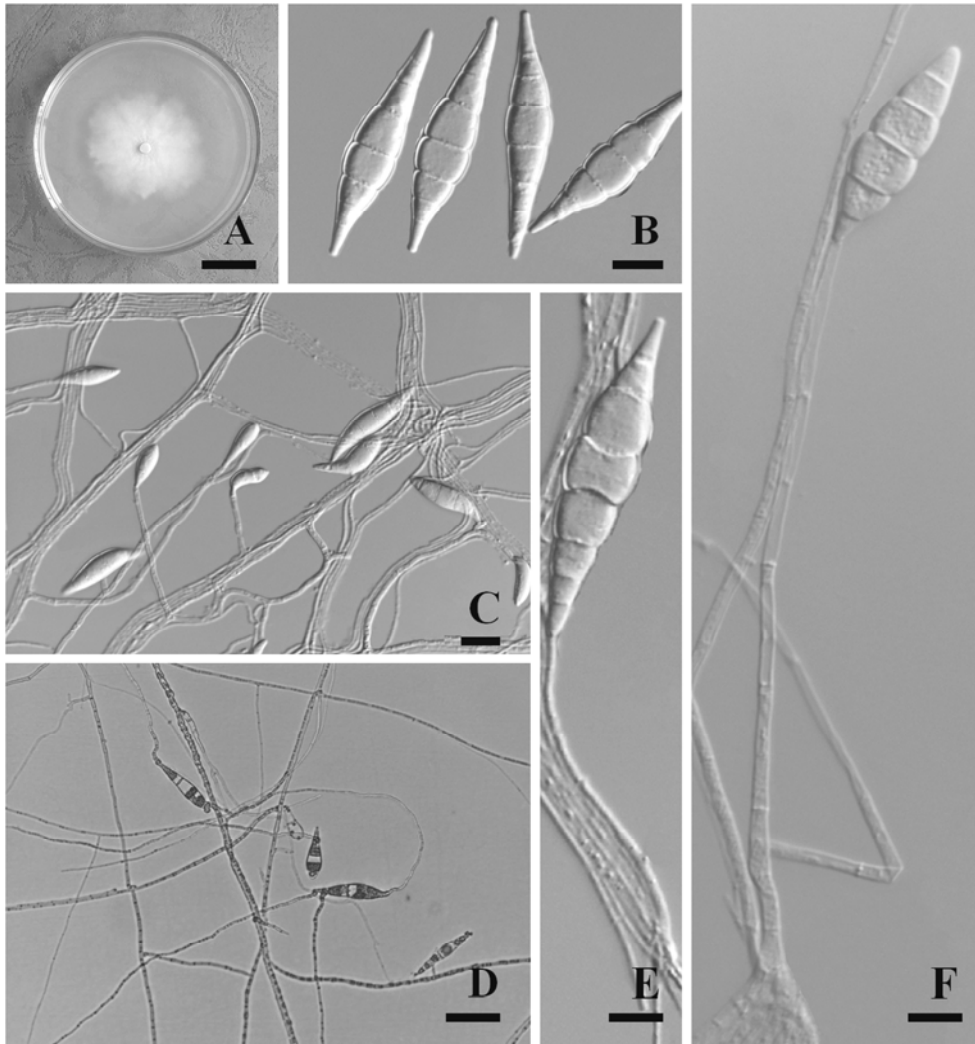
***Dactylella minuta*** Grove, Journal of Botany 22: 199, 1884.

*Mycelium* sparse, white. *Fertile hyphae* cylindrical, thin, hyaline, simple. *Conidiophore* 120-150 µm long, bears singly clavate, hyaline, 6-8-septate conidia. 60-70 × 14-15 µm. (after Grove, 1884)

*Habitat*: Dead wood.

*Distribution*: UK (Grove, 1884).





**Fig. 10.** *Dactylella intermedia*. **A.** Colony on PDA. **B.** Conidia. **C-F.** Conidiophores and conidia. Bars: A = 2 cm, B-C, E-F = 15  $\mu$ m, D = 40  $\mu$ m.

*Notes:* Rubner (1996) examined the type specimen (located in K) consisting of a piece of dead wood but detected no *Dactylella* on it, so we could acquire a small amount of information from the original illustration as following: conidiophores ascending, unbranched, to which attached a single conidium; conidia clavate, multiseptate, rounded at the apex, attenuate towards the base. *Dactylella minuta* resembles *D. clavata*, *D. ramosa* and *D. rhopalota* in having clavate conidia, while differing mainly in its longer and wider

conidia as compared to *D. clavata* (Gao *et al.*, 1995), *D. ramosa* (Matsushima, 1971) and *D. rhopalota* (Drechsler, 1943).

***Dactylella oxyspora*** (Sacc. & Marchal) Matsush., Microfungi of the Solomon Islands and Papua-New Guinea (Osaka): 22, 1971 (Figs 11-12)

= *Monacrosporium oxysporum* Sacc. & Marchal, Bulletin de la Societe Royale de Botanique de Belgique 24: 63, 1885.

= *Dactylella atractoides* Drechsler, Mycologia 35: 360, 1943.

= *Drechsleromyces atractoides* (Drechsler) Subram., Kavaka 5: 93, 1977.

*Colonies* on PDA white, at first colourless but soon forming compact tufts with irregular edges, growing fast to 2-2.5 cm in diam. after incubation at 25°C for 15 days. *Vegetative hyphae* hyaline, septate, branched, mostly 1-3 µm wide. *Conidiophores* simple, erect, straight or slightly curved, hyaline, sometimes sympodially proliferating at the apex, forming 1-7 conidia, 80-234 µm long, 2-3 µm wide at the base, 2-2.5 wide above. *Conidia* hyaline, mostly spindle-shaped, occasionally club-shaped, straight or somewhat curved, 6-11-septate, measuring 50.5-(66.5)-98.5 × 9-(10.5)-12 µm. *Chlamydospore* present.

*Teleomorph*: *Orbilium fimicoloides* (Webster *et al.*, 1998).

*Habitat*: Root of *Hordeum vulgare*, agricultural soil, old stem of *Angelica archangelica*, rabbit pellet, soil, decay leaves of *Lycopersicon esculentum*, dead stem of *Cirsium arvense*.

*Distribution*: China, Germany, Japan (Matsushima, 1971) Netherlands, USA,.

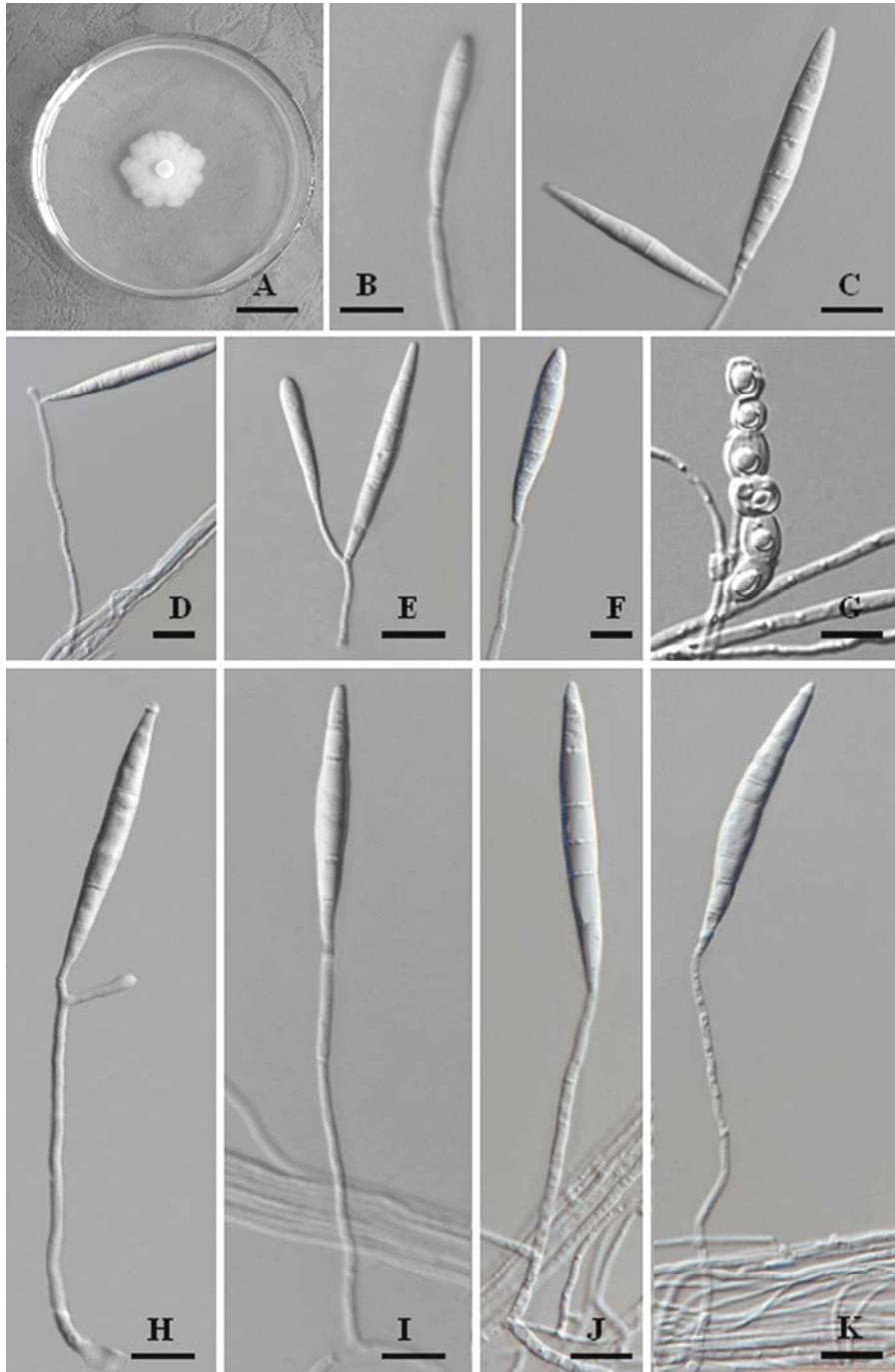
*Material examined*: Germany, Kiel-Kitzeberg, from old stem of *Angelica archangelica*, October 1965, W. Gams, CBS 280.70. Netherlands, Noordoostpolder, arknese, ovinkhoeve, from root of *Hordeum vulgare*, 1988, M. Barth, CBS 157.89. Netherlands, Oostelijk Flevoland, from agricultural soil, 7 October 1969, J.W. Veenbaas-Rijks, CBS 257.70. Netherlands, Zuidelijk Flevoland, Almeerderhout F61, from rabbit pellet, March 1984, CBS 291.84. USA, California, from soil under bamboo, March 1991, L. Smith & A. Rubner, CBS 497.92.

*Notes*: This species is widespread and has been reported in a number of countries. The multiseptate, spindle, occasionally clavate conidia indicate its position in *Dactylella*.

*Dactylella oxyspora* bears notable resemblance to *D. atractoides* in morphology of conidia and conidiophores. Firstly, both of them produce spindle-shaped, occasionally club-shaped, multiseptate conidia of similar size, viz. *D. oxyspora* 6-11-septate, 50.5-(66.5)-98.5 × 9-(10.5)-12 µm (Saccardo and Marchal, 1885), *D. atractoides* 5-11-septate, 46-(65.5)-88.5 × 8.5-(9)-12 µm (Drechsler, 1943); Secondly, their conidiophores are simple or sympodially developed, thereby becoming rather extensively ramified. Drechsler (1943) had mentioned the similarity between *D. oxyspora* and *D. atractoides*, and distinguished these species by the shorter conidia with round ends of *D. atractoides*. After observing a number of isolates of both species, we found



**Fig. 11.** *Dactylella oxyspora* (CBS 250.70). **A.** Colony on PDA. **B.** Conidia. **C.** Chlamydospores. **D-H.** Conidiophores and conidia. Bars: A = 2 cm, B-H = 10  $\mu$ m.



**Fig. 12.** *Dactylella oxyspora* (CBS 310.84). **A.** Colony on PDA. **B-F, H-K.** Conidiophores and conidia. **G.** Chlamydospores. Bars: A = 2 cm, B-K = 15  $\mu$ m.

that the characteristics of conidial morphology could not differentiate these species. According to the reasons enumerated above plus the molecular evidence, *D. attractoides* should be a synonym of *D. oxyspora*.

***Dactylella panlongna*** X.F. Liu & K.Q. Zhang *Flora fungorum sinicorum* 33: 81, 2006 (Fig. 13)

*Colonies* on PDA white, moderately growing, extending 2.5-3 cm in diam. after incubation at 25°C for 15 days. *Vegetative hyphae* hyaline, septate, branched, mostly 2-3 µm wide; *Conidiophores* simple, erect, straight, hyaline, 129-280 µm in length, 2.5-3.5 µm wide at the base, tapering upwards to an apical diam. of 1.5-2 µm. *Conidia* hyaline, mostly spindle-shaped, occasionally club-shaped, straight or somewhat curved, 6-11-septate, 50-(69.5)-76 × 6-(7)-8 µm. *Chlamydospore* present.

*Habitat*: Soil.

*Distribution*: China, Yunnan Province (Liu and Zhang, 2006).

*Material examined*: China, Yunnan Province, Wen Mountain, Panlong Town, from soil, April 2002, Z.W. Zhao, YMF 1.00128.

*Notes*: *Dactylella panlongna* resembles *D. oxyspora* in conidial morphology (Liu and Zhang, 2006), while the conidiophores of *D. oxyspora* often repeatedly branched as compared to the simple, erect conidiophores of *D. panlongna*, further more the conidia of *D. panlongna* appear much narrower than in *D. oxyspora* (Saccardo and Marchal, 1885).

***Dactylella pulchra*** (Linder) de Hoog & Oorschot, *Studies in Mycology* 26: 118, 1985. (Fig. 14)

= *Dactylaria pulchra* Linder, *Mycologia* 26: 438, 1934.

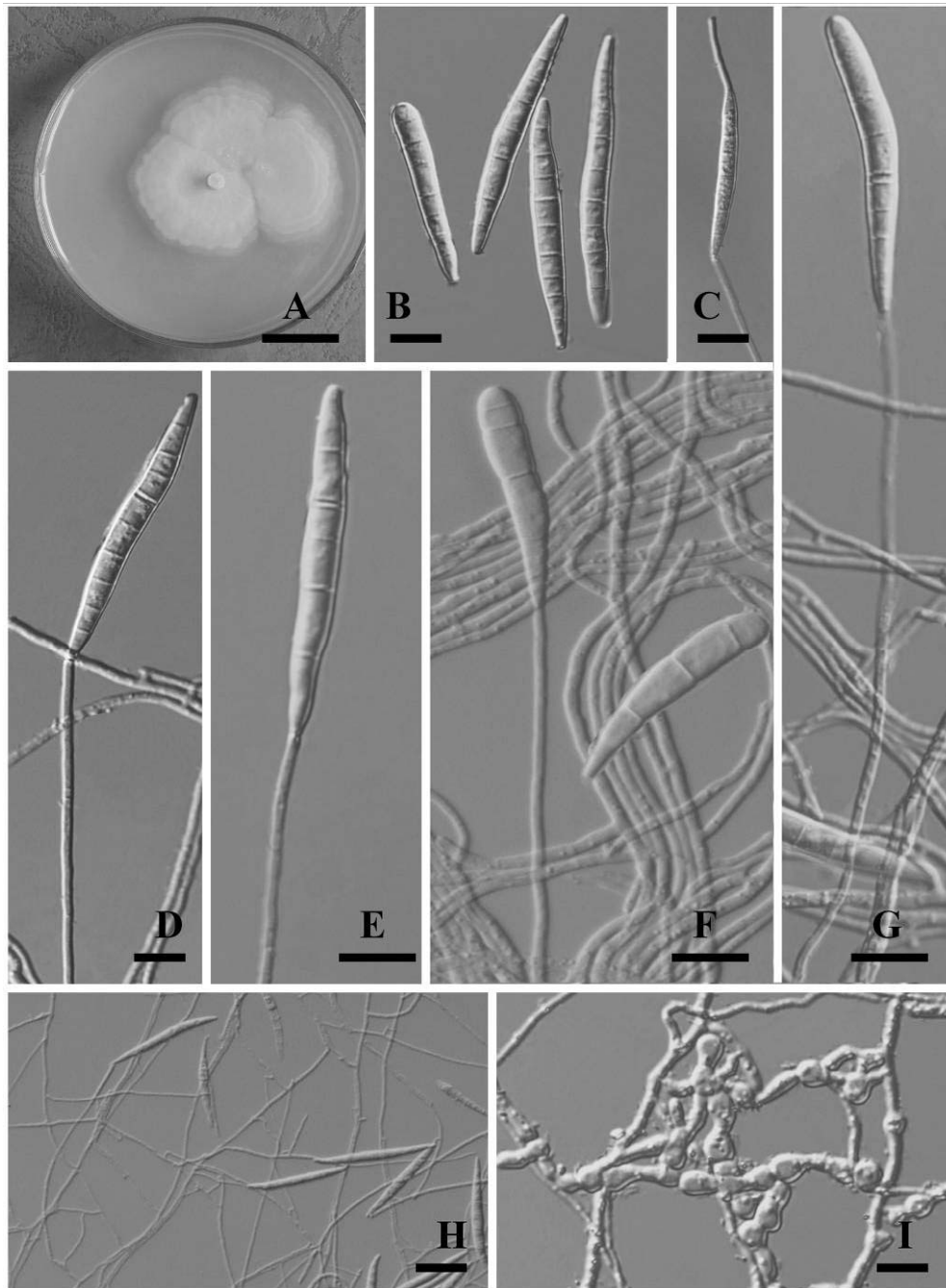
*Conidiophores* erect, 1-3-septate, 100-175 × 3.5-4 µm, slightly tapering upwards to 2-2.5 µm, hyaline, simple or short branched at the apices and bearing terminal and lateral sterigmata on the somewhat zigzag terminal or subterminal cells. *Conidia* hyaline, oblong fusoid and occasionally slightly curved, 4-8-septate, 27-(34)-45 × 7-(9)-11 µm.

*Habitat*: Decaying tobacco stems.

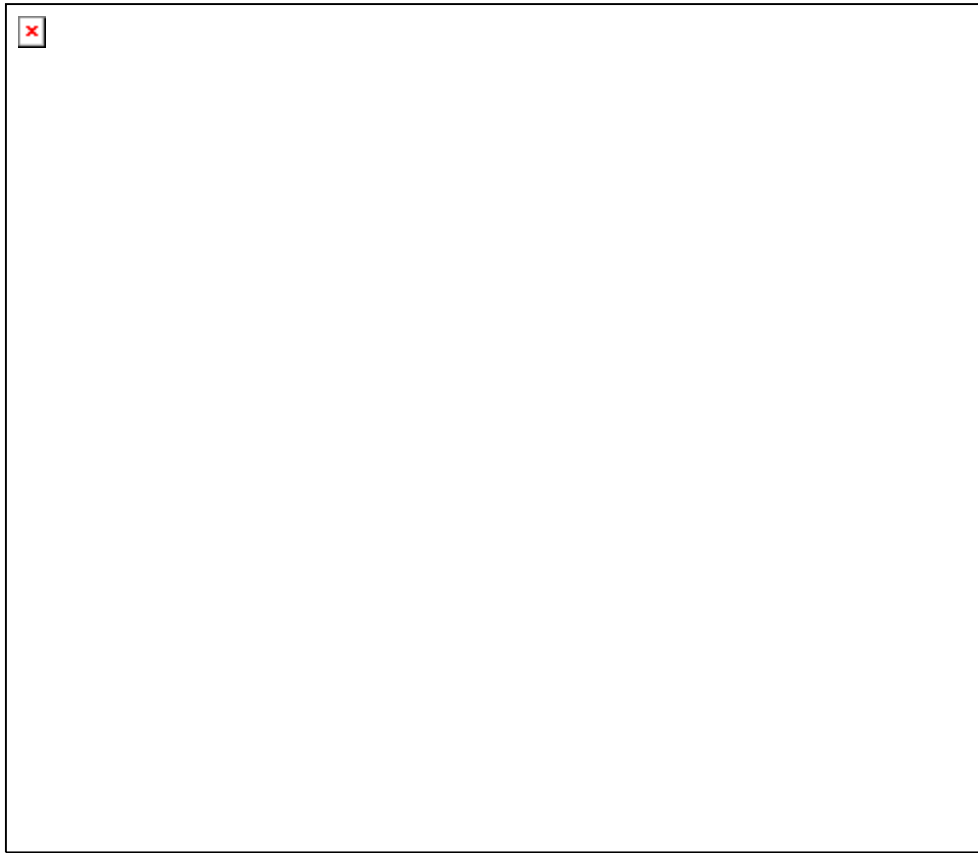
*Distribution*: USA (Linder, 1934).

*Specimen examined*: USA, Cambridge, Massachusetts, in a greenhouse on flower pots made of tobacco stems, December 1933, D.H. Linder, FH06-9299.

*Notes*: *Dactylella pulchra* was first reported as *Dactylaria pulchra* due to its terminal and lateral sterigmata on the somewhat zigzagged terminal or subterminal cells (Linder, 1934). De Hoog and Oorschot (1985) excluded this species from *Dactylaria* according to the typical conidia of *Dactylella*. The appearance of conidia as well as conidiophores of *D. pulchra* is similar to *D. attenuata*, *D. cylindrospora* and *D. rhopalota* (Linder, 1934). *Dactylella*



**Fig. 13.** *Dactylella panlongna*. **A.** Colony on PDA. **B.** Conidia. **C-H.** Conidiophores and conidia. **I.** Chlamydozoospores. Bars: A = 2 cm, B-I = 15  $\mu$ m.



**Fig. 14.** *Dactylella pulchra*. **A-F.** Conidia. **G-I.** Conidiophores and conidia. Bars: A-F = 15  $\mu\text{m}$ , G, I = 50  $\mu\text{m}$ , H = 100  $\mu\text{m}$ .

*attenuata* produces slender conidia (Liu *et al.*, 1997), *D. cylindrospora* bears 3-7-septate cylindrical conidia on sympodial conidiophores (Cooke *et al.*, 1969), while *D. rhopalota* has 4-8-septate clavate conidia (Drechsler, 1943).

***Dactylella ramosa*** Matsush., Microfungi of the Solomon Islands and Papua-New Guinea (Osaka): 22, 1971.

*Colonies* in sterile leaves of *Musae paradisiacae* white, effuse, slightly floccose. *Conidiophores* hyaline, septate, tufty, ramose repetitively, 2-3  $\mu\text{m}$  wide at the base; terminal ramus non or seldom septate, upwardly curved, 175  $\mu\text{m}$  long, 1.5-2  $\mu\text{m}$  wide at the base, 1  $\mu\text{m}$  wide at the apex. *Conidia* hyaline, solitary, terminal, cylindro-clavate, 3-9-septate, not or slightly constricted at the septum, rostrate at the base, rounded or slightly truncate at the apex, 32-54  $\times$  4-6  $\mu\text{m}$  (after Matsushima, 1971).

**Habitat:** Decaying leaves.

**Distribution:** Japan (Matsushima, 1971).

**Material examined:** Cuba, La Habana, from leaf of *Mimusops commersonii* (Sapotaceae), September 1993, R. Castañeda, CBS 478.93.

**Notes:** *Dactylella ramosa* shares similar conidial morphology with *D. clavata* (Gao *et al.*, 1995), *D. rhopalota* (Drechsler, 1943) and *D. minuta* (Grove, 1884) while differ in the formation of repeatedly ramose conidiophores. The living culture (CBS 478.93) cannot sporulate in any case.

***Dactylella rhombospora*** Grove, Journal of Botany 23: 166, 1885 (Fig. 15)

**Colonies** on PDA white, extending to 2 cm in diam. after incubation at 25°C for 15 days. **Mycelium** spreading. **Vegetative hyphae** colourless, septate, branched, mostly 1-2.5 µm wide. **Conidiophores** colourless, septate, simple, 148-250 µm long, 4-4.5 µm wide at the base, 1-3 µm wide at the apex. **Conidia** colourless, mostly spindle-shaped, occasionally club-shaped, 5-8 (mainly 7)-septate, 40-(52)-66 × 8.5-(11)-13 µm. **Chlamydospores** present in aged cultures, in chains or clusters, globose to subglobose, around 6-8 µm.

**Habitat:** Leaf litter.

**Distribution:** Spain, UK (Grove, 1884), USA (Drechsler, 1937).

**Material examined:** Spain, Canary Islands, La Gomera, from leaf litter, October 1999, R.F. Castañeda, CBS 102487, received as *Dactylella oxyspora*.

**Notes:** Though Grove's description indicates perhaps more septa, the fungus agrees well enough in general morphology and conidial diameter with *D. rhombospora*. *Dactylella rhombospora* resembles *D. oxyspora* and *D. intermedia* in conidial morphology, while *D. oxyspora* bears 6-11-septate longer conidia (Saccardo and Marchal, 1885), the conidia of *D. intermedia* also have 5-8 (mainly 7) septa with distinctly larger size 40.5-(66)-82 × 8-(11.5)-13 µm (Li *et al.*, 1998).

***Dactylella rhopalota*** Drechsler, Mycologia 35: 357, 1943 (Fig. 16)

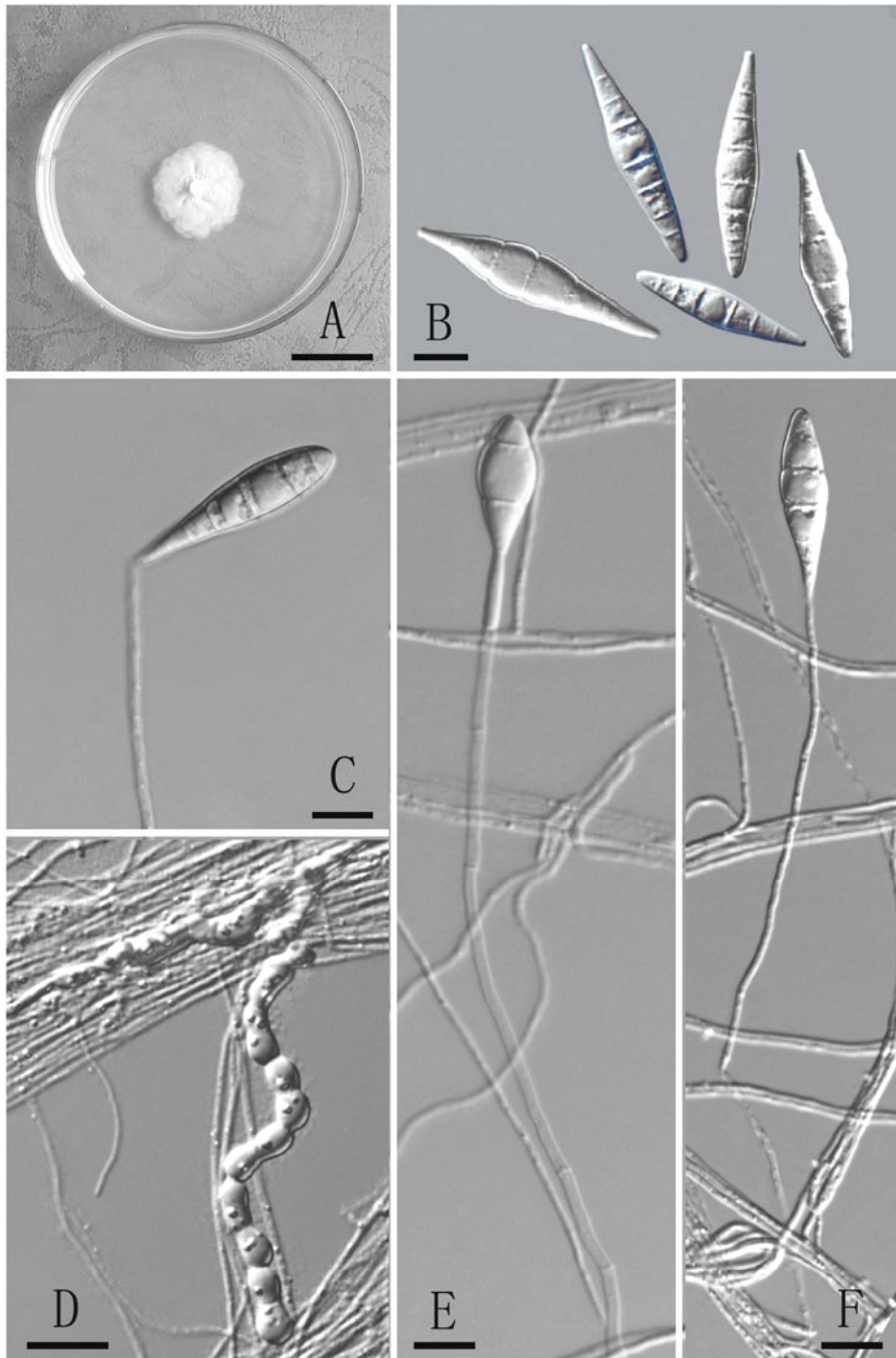
= *Gangliophragma rhopalota* (Drechsler) Subram., Kavaka 5: 94, 1977.

**Colonies** on PDA white, loose and thin, reaching 6.5 cm in diam. after incubation at 25°C for 15 days. **Vegetative hyphae** colourless, septate, branched, mostly 1.5-3 µm wide. **Conidiophores** ascending, colourless, septate, mostly 58-171 µm long, 2-5 µm wide at the base, attenuating upwards to 1.5-2 µm wide at the apex. **Conidia** hyaline, mostly clavate, occasionally more nearly cylindrical, 4-8 (mainly 7)-septate, 28-(37)-45 × 6.5-(8.5)-10.5 µm. **Chlamydospore** absent.

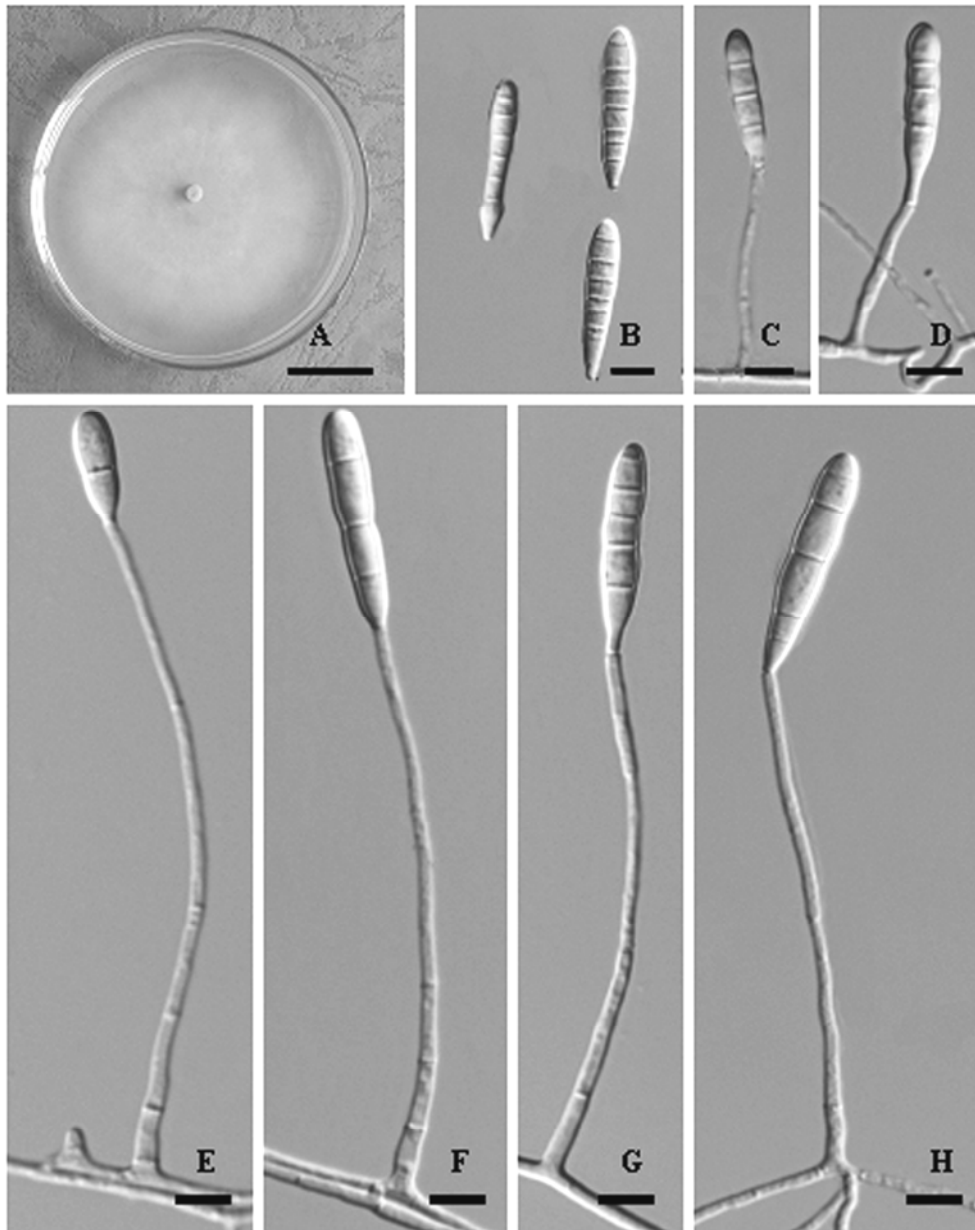
**Teleomorph:** *Orbilium* sp. (Zachariah, 1989).

**Habitat:** Living leaf, wood, litter, decaying wood, pine needles, decaying leaves.





**Fig. 15.** *Dactylella rhombospora*. **A.** Colony on PDA. **B.** Conidia. **C, E-F.** Conidiophores and conidia. **D.** Chlamydospores. Bars: A = 2 cm, B-F = 15  $\mu$ m.



**Fig. 16.** *Dactylella rhopalota*. **A.** Colony on PDA. **B.** Conidia. **C-H.** Conidiophores and conidia. Bars: A = 2 cm, B-H = 10  $\mu$ m.

*Distribution:* Netherlands (Drechsler, 1943), Sweden, UK, USA.

*Material examined:* Netherlands, Bergen, from wood of *Pinus sylvestris*, 8 October 1967, W. Gams, CBS 493.67, received as *D. minuta*. Netherlands, Baarn, from decaying wood,

8 October 1967, W. Gams, CBS 615.92, received as *D. minuta*. Netherlands, Bergen, from needle of *Pinus* sp., 1968, W. Gams, CBS 616.92, received as *D. minuta*. Sweden, Oct 1975, G.L. Hennebert, CBS 617.92, received as *D. minuta*. UK, England, Cumbria, Meathop Wood, from living leaf of *Fraxinus excelsior*, August 1970, J.C. Frankland, CBS 845.70.

*Notes:* The hyaline, 4-8 (mainly 7)-septate conidia (as CBS 845.70, a well-sporulating isolate) accommodate Drechsler's original description well with the exception of the erect, rarely branched conidiophores (Drechsler, 1943). This phenomenon is partly due to the different plasticity of the organisms studied, which left little room for doubt that the proliferations of conidiophores in this species are too wavy to be considered as taxonomically valuable. Subramanian (1977) established a new genus *Gangliophragma* for *Dactylella rhopalota* and delimited the genus as conidia gangliar, elongate, borne terminally on the conidiophores and its successive and variably separated sympodial proliferations. In fact, with its erect, rarely branched conidiophores and hyaline, clavate phragmoconidia, *D. rhopalota* is a good representative of the genus *Dactylella*.

Thakur and Zachariah (1989) found that rhizosphere bacteria and *Azotobacter* could induce ascocarp formation in culture plates. Furthermore, they supposed that under the right environmental conditions, *D. rhopalota* might express predatory activity. During our study, none of the material examined formed trapping organs, in addition *D. rhopalota* grouped into the non-trapping clade in phylogenetic analysis, so we treat it as non-predacious species.

The clavate conidia of *D. rhopalota* are similar to *D. clavata* and *D. ramosa*, while *D. clavata* has longer conidia (Gao *et al.*, 1995), *D. ramosa* produces more slender conidia (Matsushima, 1971).

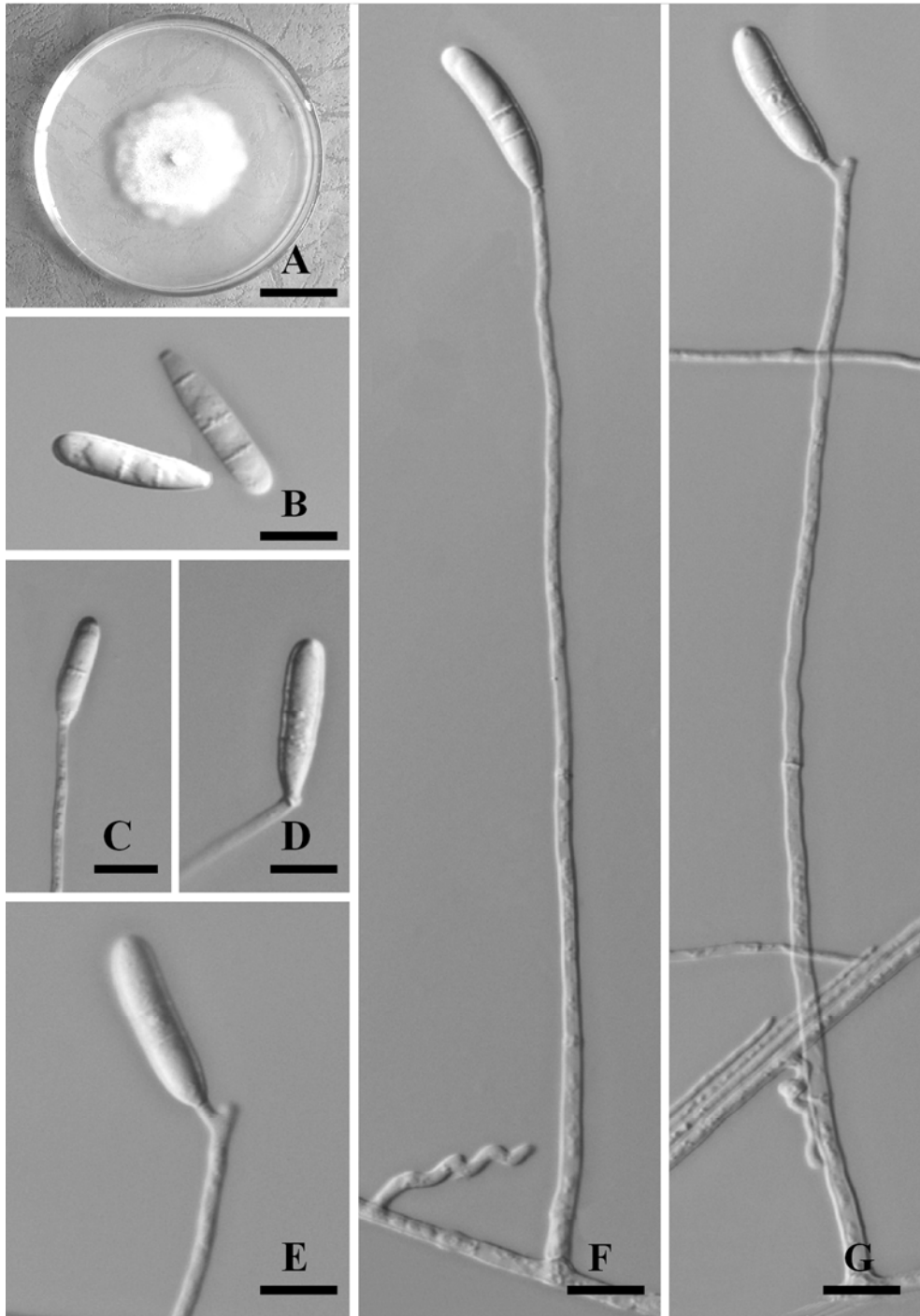
***Dactylella tenuis*** Drechsler, Mycologia 29: 538, 1937 (Fig. 17)

*Colonies* on PDA white to salmon, translucent and smooth at the early stage of culture, but soon becoming compactly fluffy due to the formation of abundant interwoven aerial hyphae, moderately growing, extending to 4 cm in diam. after incubation at 25°C for 15 days. *Vegetative hyphae* hyaline, branched, septate, 1.5-2 µm wide. *Conidiophores* hyaline, erect, septate, 142.5-207 µm long, 3-5.5 µm wide at the base, tapering upwards to a width of 1.5-2 µm. *Conidia* solitary, hyaline, cylindrical, rounded at the apex, tapering somewhat towards the slightly protruded truncate base, 1-4 (mainly 3)-septate, 24-(31)-36 × 6-(7)-9.5 µm.

*Habitat:* Decaying leaves, soil.

*Distribution:* China, USA (Drechsler, 1937).

*Material examined:* China, Xinjiang Province, from soil, 2003, X.Z. Liu, AS 6.0288.



**Fig. 17.** *Dactylella tenuis*. **A.** Colony on PDA. **B.** Conidia. **C-G.** Conidiophores and conidia. Bars: A = 2 cm, B-G = 10  $\mu$ m.

*Notes:* *Dactylella tenuis* resembles *D. cylindrospora*, *D. coccinella* and *D. anisomeres*, while differs in that *D. cylindrospora* produces a relaxly capitate arrangement of 3-7-septate conidia at the apex of conidiophores (Cooke *et al.*, 1969). *Dactylella coccinella* has narrower conidia on simple conidiophores (Yang and Liu, 2005). *Dactylella anisomeres* has elongate fusiform conidia attenuating toward the base compared to the cylindrical conidia of *D. tenuis* (Drechsler, 1962).

***Dactylella xinjiangensis* J. Chen, L.L. Xu, B. Liu & Xing Z. Liu sp. nov.**

Mycobank: 510345

(Fig. 18)

*Coloniae* lente crescentes, albae. *Mycelium* effusum. *Hyphis* sterilibus hyalinis, septatis, ramosis. *Conidiophora* erecta, septata, hyalina, simplicia, parce ramosa, 60.5-132  $\mu\text{m}$  longa, basi 2.5-4.5  $\mu\text{m}$  crassa, apice 1-2  $\mu\text{m}$  crassa. *Conidia* hyalina, obclavata, 4-7-septata, plerumque 7-septata, 39.5-(47)-54  $\times$  7-(9.5)-12  $\mu\text{m}$ .

*Colonies* on PDA white, aerial mycelium sparse, moderately growing, extending 2.5-3 cm in diam. after incubation at 25°C for 15 days. *Vegetative hyphae* colourless, septate, branched, mostly 1-3  $\mu\text{m}$  wide. *Conidiophores* simple, colourless, septate, mostly 60.5-132  $\mu\text{m}$  long, 2.5-4.5  $\mu\text{m}$  wide at the base, tapering upwards to 1-2  $\mu\text{m}$  wide at the apex. *Conidia* hyaline, obclavate, rounded at the apex, attenuating sharply towards the base, 4-7 (mainly 7)-septate, 39.5-(47)-54  $\times$  7-(9.5)-12  $\mu\text{m}$ . *Chlamydospores* ellipsoid or globose, often produced abundantly in chains or aggregated in sclerotium-like masses.

*Habitat:* Soil.

*Distribution:* China.

*Holotype:* China, Xinjiang Province, from soil, 2003, X.Z. Liu, AS 6.0287. Specimen deposited in Mycological Herbarium, Institute of Microbiology, Chinese Academy of Sciences, HMAS 140511.

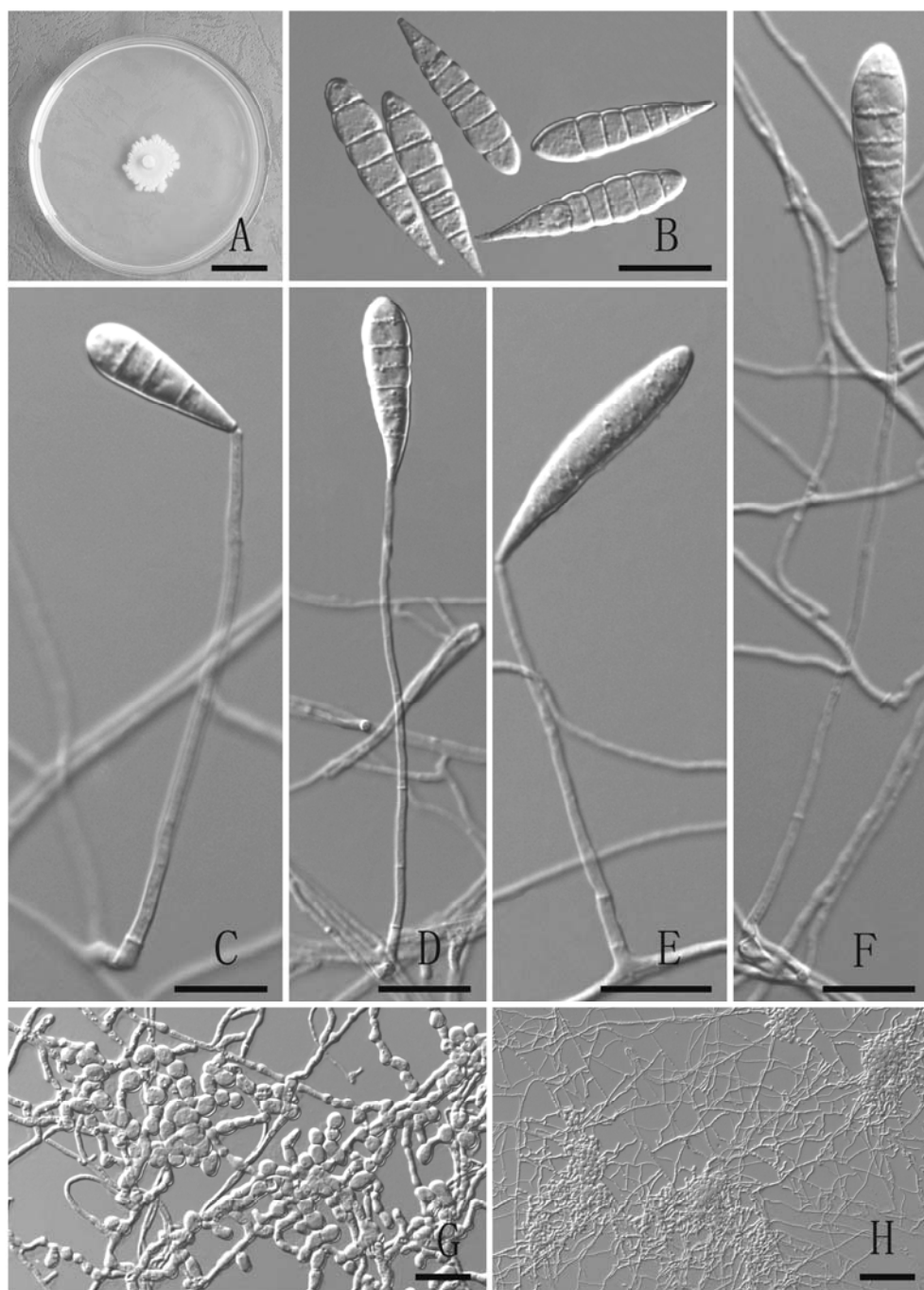
*Notes:* The distinguished characteristic of this species is the occurrence of plentiful chlamydospores. Although chlamydospores are produced in aged cultures for most taxa, *Dactylella xinjiangensis* forms chlamydospores quite easily and at the earlier stages.

*Dactylella xinjiangensis* is similar to *D. rhopalota*, however, the conidia of *D. xinjiangensis* conically acuminate at the base, while the conidia of *D. rhopalota* are occasionally nearly cylindrical (Drechsler, 1943), and furthermore, the conidia of *D. xinjiangensis* are larger than those of *D. rhopalota*. *Dactylella xinjiangensis* can be easily distinguished from *D. rhopalota* in the phylogenetic tree (Chen *et al.*, 2007).

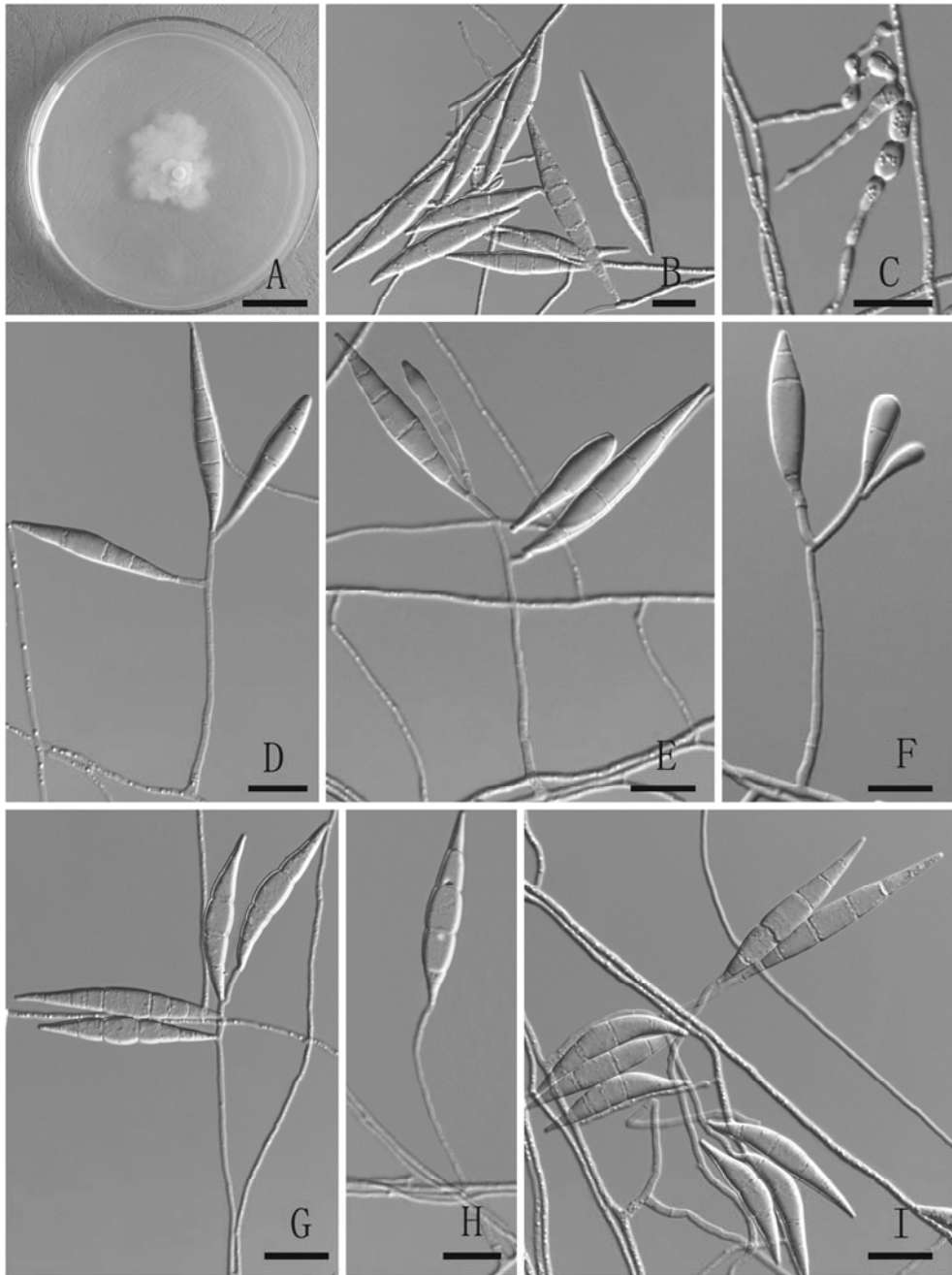
***Dactylella yunnanensis* K.Q. Zhang, Xing Z. Liu & L. Cao, Mycosystema 7: 113, 1994**

(Fig. 19)

*Colonies* on PDA whitish, cumulous, rapidly growing, attaining diam. of 5 cm within 15 days at 25°C. *Hyphae* hyaline, septate, branched, mostly 1-3



**Fig. 18.** *Dactylella xinjiangensis* sp. nov.. **A.** Colony on PDA. **B.** Conidia. **C-F.** Conidiophores and conidia. **G-H.** Chlamydospores. Bars: A = 2 cm, B-G = 15  $\mu$ m, H = 40  $\mu$ m.



**Fig. 19.** *Dactylella yunnanensis*. **A.** Colony on PDA. **B.** Conidia. **C.** Chlamydospores. **D-I.** Conidiophores and conidia. Bars: A = 2 cm, B-I = 20  $\mu$ m.



µm wide. *Conidiophores* arising from vegetative hyphae, simple or branched, erect, 78-(92)-104.5 µm long, 3-4 µm wide at the base, tapering to 1-2.5 µm wide at the apex. *Conidia* hyaline, elongate fusoid, straight or slightly curved, tapering sharply to a point at the apex, 7-10-septate, 59.5-(72)-92 × 9-(10)-11 µm. *Chlamydospores* ellipsoidal or globose, often produced in chains.

*Habitat:* Soil.

*Distribution:* China (Zhang *et al.*, 1994).

*Material examined:* China, Yunnan Province, in soil of paddyfield, 2004, Y.E. Hao, YMF 1.01447.

*Notes:* *Dactylella yunnanensis* is similar to *D. oxyspora* in conidial shape and size (Zhang *et al.*, 1994). In *D. yunnanensis* the widest part of conidia is below the middle and close to the base, and the conidia taper sharply at the apex as compared to those of *D. oxyspora*, which attenuate equally to both ends (Saccardo and Marchal, 1885).

***Dactylella zhongdianensis*** J. Zhang, M.H. Mo, J.S. Deng, X.F. Liu, T.J. Bi & K.Q. Zhang, Mycotaxon 92: 193-196, 2005 (Fig. 20)

*Colonies* on PDA white, rapidly growing, extending 2.5-3 cm in diam. after incubation at 25°C for 15 days. *Vegetative hyphae* hyaline, septate, branched, 1.5-3 µm wide. *Conidiophores* hyaline, erect, septate, simple or branched, 41-132 µm long, 3-5 µm wide at the base, tapering gradually upwards to 1-2 µm wide at the apex. *Conidia* hyaline, mostly clavate, rarely curved or slightly curved at base, rounded at the apex, often furnished with a blunt hilar protrusion at the base, 2-6-septate, mainly 3-septate, 22-(28)-37.5 × 5-(7)-8 µm.

*Habitat:* Soil.

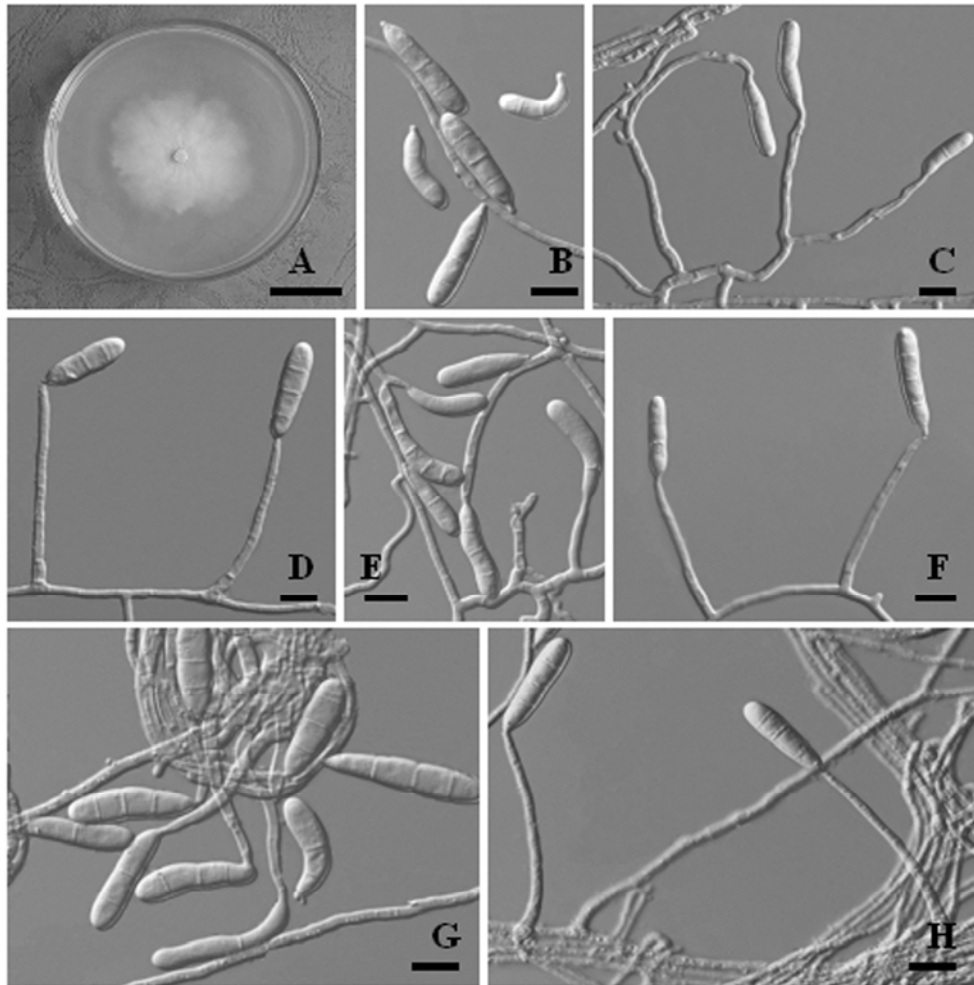
*Distribution:* China (Zhang *et al.*, 2005).

*Material examined:* China, Yunnan Province, Zhongdian, in soil, 7 September 2003, J. Zhang, YMF 1.00568.

*Notes:* Zhang *et al.* (2005) described this fungus as a predacious species with a three-dimensional adhesive network. According to our detailed observation of type isolate (YMF1.00568), the taxon cannot produce any trapping organs when challenged with nematodes. In addition, in the molecular analysis, this species clusters well with non-predacious species. Since the molecular data distinguishes between predacious and non-predacious species of *Orbiliaceae* (Scholler *et al.*, 1999), we conclude *D. zhongdianensis* to be a non-predacious species.

*Dactylella zhongdianensis* is similar to *D. tenuis* and *D. rhopalota* in conidial shape. However, *D. tenuis* is oospore-parasitic with especially long conidiophores (Drechsler, 1937). *Dactylella rhopalota* produces 4-8-septate





**Fig. 20.** *Dactylella zhongdianensis*. **A.** Colony on PDA. **B.** Conidia. **C-H.** Conidiophores and conidia. Bars: A = 2 cm, B-H = 15  $\mu$ m.

conidia measuring 28-(37)-45  $\times$  6.5-(8.5)-10.5  $\mu$ m, which are apparently larger than those of *D. zhongdianensis* (Drechsler, 1943).

### Key to *Dactylella* species

1. Conidia 1-septate, clavate or elongate ellipsoidal in outline .....2
1. Conidia more than 1-septate.....3
2. Conidia 13-(17)-21  $\times$  2-(2.5)-3  $\mu$ m, not constricted at the septum .....*D. polyclona*
2. Conidia 17-(21.5)-25  $\times$  2.5-(3)-4  $\mu$ m, slightly constricted at the septum ..... *D. arrhenopa*

3. Conidia mainly 3-septate.....	4
3. Conidia mainly more than 3-septate.....	10
4. Conidia clavate.....	5
4. Conidia cylindrical or fusiform.....	6
5. Conidia 18-(25)-32.5 × 7.5-(9)-11 μm.....	<i>D. clavispora</i>
5. Conidia 22-(28)-37.5 × 5-(7)-8 μm.....	<i>D. zhongdianensis</i>
6. Parasites of oospores of <i>Pythiaceae</i> .....	7
6. Saprotophs.....	9
7. Conidia spindle-shaped or pod-shaped.....	<i>D. stenocrepis</i>
7. Conidia cylindrical or sometimes elongate spindle-shaped.....	8
8. Conidiophores 45-85 μm long.....	<i>D. anisomeres</i>
8. Conidiophores mainly more than 200 μm long.....	<i>D. tenuis</i>
9. Conidia 41.5-(49.5)-64 × 6-(7)-8 μm.....	<i>D. clavata</i>
9. Conidia sometimes curved, 29-(36)-51 × 8.5-(11)-13 μm.....	<i>D. cylindrospora</i>
10. Conidia sometimes rostrate.....	<i>D. arnaudii</i>
10. Conidia never rostrate.....	11
11. Conidiophores bearing terminal and lateral sterigmata.....	<i>D. pulchra</i>
11. Conidiophores erect, without apical proliferation.....	12
12. Conidia elongate ellipsoidal or strobiliform.....	<i>D. strobilodes</i>
12. Conidia cylindrical, clavate or fusiform.....	13
13. Conidia cylindrical.....	14
13. Conidia clavate or fusiform or elongate fusoid.....	15
14. Conidia 3-6 (mainly 5)-septate, 25.5-(28)-33 × 4.5-(6)-7 μm.....	<i>D. coccinella</i>
14. Aquicolous, conidia 35-65 × 6-9 μm.....	<i>D. submersa</i>
15. Conidia mostly clavate.....	16
15. Conidia clavate or fusiform or elongate fusoid.....	20
16. Conidiophores repeatedly branched.....	<i>D. ramosa</i>
16. Conidiophores simple, occasionally branched.....	17
17. Conidiophores shorter than 100 μm.....	<i>D. chichisimensis</i>
17. Conidiophores up to 150 μm, and even longer.....	18
18. Conidia 60-70 μm long.....	<i>D. minuta</i>
18. Conidia shorter than 60 μm.....	19

## Fungal Diversity

19 Chlamydo spores produced abundantly at early stages.....	<i>D. xinjiangensis</i>
19. No Chlamydo spore observed .....	<i>D. rhopalota</i>
20. Conidia tapering to a point at the apex.....	<i>D. yunnanensis</i>
20. Conidia rounded at the apex .....	21
21 Conidia elongate fusiform.....	22
21. Conidia clavate or fusiform .....	23
22. Conidia 3-6 (mainly 5)-septate.....	<i>D. attenuata</i>
22. Conidia 6-8-septate, capturing and consuming <i>Geococcus vulgaris</i> and <i>Euglypha laevis</i> .....	<i>D. passalopaga</i>
23. Conidia fusiform .....	24
23. Conidia mostly fusiform, occasionally clavate .....	26
24. Conidia mainly 6-septate, 50-70 × 14-20 μm .....	<i>D. rhombica</i>
24. Conidia mainly 7-septate .....	25
25. Conidia 40.5-(66)-82 × 8-(11.5)-13 μm .....	<i>D. intermedia</i>
25. Conidia 40-(52)-66 × 8.5-(11)-13 μm.....	<i>D. rhombospora</i>
26. Conidia 6-11-septate .....	27
26. Conidia no more than 7-septate.....	<i>D. heptameres</i>
27. Conidia 50.5-(66.5)-98.5 × 9-(10.5)-12 μm.....	<i>D. oxyspora</i>
27. Conidia 50-(69.5)-76 × 6-(7)-8 μm.....	<i>D. panlongna</i>

### Check-list of epithets used in *Dactylella* and allied species

**ambrosium** – *Fusarium ambrosium* (Gadd & Loos) Agnihothr. & Nirenberg  
– Studies in Mycology 32: 98, 1990.

= *Monacrosporium ambrosium* Gadd & Loos – Transactions of the British Mycological Society 31: 17, 1947.

= *Dactylella ambrosia* (Gadd & Loos) K.Q. Zhang, Xing Z. Liu & L. Cao – Mycosystema 7: 112, 1994.

**anisomeres** – *Dactylella anisomeres* Drechsler - Sydowia 15: 92, 1962.

**arcuata** - *Gamsylella arcuata* (Scheuer & J. Webster) M. Scholler, Hagedorn & A. Rubner - Sydowia 51: 108, 1999.

= *Dactylella arcuata* Scheuer & J. Webster - Mycological Research 94: 720, 1990.

= *Monacrosporium arcuatum* (Scheuer & J. Webster) A. Rubner - Studies in Mycology 39: 49, 1996.

**arnaudii** - *Dactylella arnaudii* Yadav - Transactions of the British Mycological Society 43: 603, 1960.

**arrhenopa** - *Dactylella arrhenopa* (Drechsler) K.Q. Zhang, Xing Z. Liu & L. Cao - Mycosystema 7: 112, 1994.  
= *Trichothecium arrhenopum* Drechsler - Phytopathology 33: 232, 1943.

**asthenopaga** - *Dactylellina asthenopaga* (Drechsler) M. Scholler, Hagedorn & A. Rubner - Sydowia 51: 110, 1999.  
= *Dactylella asthenopaga* Drechsler - Mycologia 29: 498, 1937.  
= *Dactylariopsis asthenopaga* (Drechsler) - Mikologiya i Fitopatologiya 1: 279, 1967.  
= *Monacrosporium asthenopagum* (Drechsler) A. Rubner - Studies in Mycology 39: 50, 1996.

**attractoides** - *Dactylella oxyspora* (Sacc. & Marchal) Matsush. - Microfungi of the Solomon Islands and Papua-New Guinea (Osaka): 22, 1971.  
= *Dactylella attractoides* Drechsler - Mycologia 35: 360, 1943.  
= *Drechsleromyces attractoides* (Drechsler) Subram. - Kavaka 5: 93, 1977.

**attenuata** - *Dactylella attenuata* R.H. Gao, Xing Z. Liu, L.P. Lei & T.F. Li - Mycologia 89: 521-523, 1997.

**brevistipitata** - *Brachyphoris brevistipitata* (B. Liu, Xing Z. Liu & W.Y. Zhuang) J. Chen, L.L. Xu, B. Liu & Xing Z. Liu, **comb. nov.**  
Mycobank: 510642  
= *Dactylella brevistipitata* B. Liu, Xing Z. Liu & W.Y. Zhuang - Nova Hedwigia 81: 145-155, 2005.

**chichisimensis** - *Dactylella chichisimensis* Ts. Watan. - Mycoscience 42: 633, 2001.

**clavata** - *Dactylella clavata* R.H. Gao, M.H. Sun & Xing Z. Liu - Mycotaxon 56: 191, 1995.

**coccinella** - *Dactylella coccinella* Y. Yang & Xing Z. Liu - Mycotaxon, 2005.

**copepodii** - *Dactylellina copepodii* (G.L. Barron) M. Scholler, Hagedorn & A. Rubner - Sydowia 51: 110, 1999.  
= *Dactylella copepodii* G.L. Barron - Canadian Journal of Botany 68: 692, 1990.  
= *Monacrosporium copepodii* (G.L. Barron) A. Rubner - Studies in Mycology 39: 54, 1996.

**cylindrospora** - *Dactylella cylindrospora* (R.C. Cooke) A. Rubner - Studies in Mycology 39: 109, 1996.

- = *Candelabrella cylindrospora* R.C. Cooke - Transactions of the British Mycological Society 53: 477, 1969.
- = *Arthrobotrys cylindrospora* (R.C. Cooke) S. Schenck, W.B. Kendr. & Pramer - Canadian Journal of Botany 55: 982, 1977.

**dasguptae** - *Dactylellina leptospora* (Drechsler) M. Morelet - Bulletin de la Société des Sciences naturelles et d'Archéologie de Toulon et du Var 178: 6, 1968.

- = *Dactylaria dasguptae* S.K. Shome & U. Shome - Mycopathologia et Mycologia Applicata 30: 216, 1966.
- = *Dactylella dasguptae* (S.K. Shome & U. Shome) de Hoog & Oorschot - Studies in Mycology 26: 105, 1985.

**formosana** - *Dactylellina formosana* (J.Y. Liou, G.Y. Liou & Tzean) M. Scholler, Hagedorn & A. Rubner - Sydowia 51: 110, 1999.

- = *Dactylella formosana* J.Y. Liou, G.Y. Liou & Tzean - Mycological Research 99: 751-755, 1995.

**fusariispora** - *Dactylellina leptospora* (Drechsler) M. Morelet - Bulletin de la Société des Sciences naturelles et d'Archéologie de Toulon et du Var 178: 6, 1968.

- = *Kafiaddinia fusariispora* (Drechsler) Mekhtieva - Khishchnye nematofagovye Griby-Gi-fomitsety: 124, 1979.
- = *Dactylella fusariispora* (Mekhtieva) K.Q. Zhang, Xing Z. Liu & L. Cao - Mycosystema 7: 112, 1994.

**haptospora** - *Arthrobotrys haptospora* (Drechsler) S. Schenck, W.B. Kendr. & Pramer - Canadian Journal of Botany 55: 983, 1977.

- = *Dactylaria haptospora* Drechsler - Mycologia 32: 459, 1940.
- = *Kafiaddinia haptospora* (Drechsler) Mekhtieva - Khishchnye nematofagovye Griby-Gi-fomitsety: 125, 1979.
- = *Dactylella haptospora* (Drechsler) K.Q. Zhang, Xing Z. Liu & L. Cao - Mycosystema 7: 112, 1994.

**helminthodes** - *Brachyphoris helminthodes* (Drechsler) J. Chen, L.L. Xu, B. Liu & Xing Z. Liu, **comb. nov.**

Mycobank: 510651

- = *Dactylella helminthodes* Drechsler - Mycologia 44: 553, 1952.

**heptameres** - *Dactylella heptameres* Drechsler - Mycologia 35: 354, 1943.

**huisuniana** - *Dactylellina huisuniana* (J.L. Chen, T.L. Huang & Tzean) M. Scholler, Hagedorn & A. Rubner - Sydowia 51: 110, 1999.

= *Dactylella huisuniana* J.L. Chen, T.L. Huang & Tzean - Mycological Research 102: 1269, 1998.

**implexa** - *Dactylella implexa* (Berk. & Broome) Sacc. - Sylloge Fungorum 4: 194, 1886.

= *Dactylium implexum* Berk. & Broome - The Annals and magazine of natural history: zoology, botany, and geology. Ser. 4, 11: 345, 1873.

**intermedia** - *Dactylella intermedia* T.F. Li, L.P. Lei & Xing Z. Liu - Mycotaxon 66: 493, 1998.

**iridis** - *Arthrobotrys iridis* (Ts. Watan.) M. Scholler, Hagedorn & A. Rubner - Sydowia 51: 110, 1999.

= *Trinacrium iride* Ts. Watan. - Mycologia 84: 794, 1992.

= *Dactylella iridis* (Ts. Watan.) K.Q. Zhang, Xing Z. Liu & L. Cao - Mycosystema 7: 112, 1994.

= *Monacrosporium iridis* (Ts. Watan.) A. Rubner & W. Gams - Studies in Mycology 39: 77, 1996.

**leptospora** - *Dactylellina leptospora* (Drechsler) M. Morelet - Bulletin de la Société des Sciences naturelles et d'Archéologie de Toulon et du Var 178: 6, 1968.

= *Dactylella leptospora* Drechsler - Mycologia 29: 498, 1937.

= *Dactylosporium leptospora* (Drechsler) Mekht. - Mikologiya i Fitopatologiya 1: 277, 1967.

= *Monacrosporium leptosporum* (Drechsler) A. Rubner - Studies in Mycology 39: 79, 1996.

**lignatilis** - *Dactylella lignatilis* M.H. Mo, W. Zhou, Y. Huang, Z.F. Yu & K.Q. Zhang - Mycotaxon 91: 185, 2005. Type species YMF 1.00596 doesn't produce spores and the ITS sequence analysis showed a far distance from any species of *Dactylella*, the taxonomic position should be further evaluated.

**lobata** - *Gamsylella lobata* (Dudd.) M. Scholler, Hagedorn & A. Rubner - Sydowia 51: 108, 1999.

= *Dactylella lobata* Dudd. - Transactions of the British Mycological Society 34: 489, 1951.

= *Monacrosporium lobatum* (Dudd.) A. Rubner - Studies in Mycology 39: 80, 1996.

**minuta** - *Dactylella minuta* Grove - Journal of Botany 22: 195, 1884.

= *Dactylella minuta* var. *fusiformis* Grove - Journal of Botany 24: 129, 1886.

**multiformis** - *Arthrobotrys multiformis* (Dowsett, J. Reid & Kalkat) M. Scholler, Hagedorn & A. Rubner - Sydowia 51: 103, 1999.

= *Dactylella multiformis* Dowsett, J. Reid & Kalkat - Mycologia 76: 563, 1984.

= *Monacrosporium multiforme* (Dowsett, J. Reid & Kalkat) A. Rubner - Studies in Mycology 39: 84, 1996.

**oviparasitica** - *Brachyphoris oviparasitica* (G.R. Stirling & Mankau) J. Chen, L.L. Xu, B. Liu & Xing Z. Liu, **comb. nov.**

Mycobank: 510644

= *Dactylella oviparasitica* G.R. Stirling & Mankau - Mycologia 70: 777, 1978.

**oxyspora** - *Dactylella oxyspora* (Sacc. & Marchal) Matsush. - Microfungi of the Solomon Islands and Papua-New Guinea (Osaka): 22, 1971.

= *Monacrosporium oxysporum* Sacc. & Marchal - Bulletin de la Societe Royale de Botanique de Belgique 24: 63, 1885.

**passalopaga** - *Dactylella passalopaga* Drechsler - Journal of the Washington Academy of Sciences 26: 403, 1936.

**polycetona** - *Dactylella polycetona* (Drechsler) K.Q. Zhang, Xing Z. Liu & L. Cao - Mycosystema 7: 113, 1994.

= *Trichothecium polycetinum* Drechsler - Mycologia 44: 550, 1952.

**pseudoclavata** - *Arthrobotrys pseudoclavata* (Z.Q. Miao, Xing Z. Liu, S.D. Li & M.X. He) J. Chen, L.L. Xu, B. Liu, Xing Z. Liu, **comb. nov.**

Mycobank: 510646

= *Dactylella pseudoclavata* Z.Q. Miao, Xing Z. Liu, S.D. Li & M.X. He - Canadian Journal of Botany 81: 452, 2003.

**pulchra** - *Dactylella pulchra* (Linder) de Hoog & Oorschot - Studies in Mycology 26: 118, 1985.

= *Dactylaria pulchra* Linder - Mycologia 26: 438, 1934.

**ramosa** - *Dactylella ramosa* Matsush. - Microfungi of the Solomon Islands and Papua-New Guinea (Osaka): 22, 1971.

**rhombica** - *Dactylella rhombica* Matsush. - Microfungi of the Solomon Islands and Papua-New Guinea (Osaka): 22, 1971.

**rhombospora** - *Dactylella rhombospora* Grove - Journal of Botany 23: 166, 1885.

- rhopalota** - *Dactylella rhopalota* Drechsler - Mycologia 35: 357, 1943.  
= *Gangliophragma rhopalota* (Drechsler) Subram. - Kavaka 5: 94, 1977.
- shizishanna** –*Arthrobotrys shizishanna* (X.F. Liu & K.Q. Zhang) J. Chen, L.L. Xu, B. Liu & Xing Z. Liu, **comb. nov.**  
Mycobank: 510647  
= *Dactylella shizishanna* X.F. Liu & K.Q. Zhang – Fungal diversity 14: 104, 2003.
- spermatophaga** - *Vermispora spermatophaga* (Drechsler) J. Chen, L.L. Xu, B. Liu & Xing Z. Liu **comb. nov.**  
Mycobank: 510645  
= *Dactylella spermatophaga* - Phytopathology 28: 91, 1938.
- stenocrepis** - *Dactylella stenocrepis* Drechsler - Sydowia 15: 94, 1961.
- stenomeces** - *Brachyphoris stenomeces* (Drechsler) J. Chen, L.L. Xu, B. Liu & Xing Z. Liu, **comb. nov.**  
Mycobank: 510652  
= *Dactylella stenomeces* - Phytopathology 53: 1052, 1963.
- strobilodes** - *Dactylella strobilodes* Drechsler - Mycologia 42: 371, 1950.
- submersa** - *Dactylella submersa* (Ingold) Sv. Nilsson - Botaniska Notiser 115: 78, 1962.  
= *Piricularia submersa* Ingold - Transactions of the British Mycological Society 27: 45, 1944.
- tenuifusaria** - *Brachyphoris tenuifusaria* (Xing Z. Liu, R.H. Gao, K.Q. Zhang & L. Cao) J. Chen, L.L. Xu, B. Liu & Xing Z. Liu, **comb. nov.**  
Mycobank: 510643  
= *Dactylella tenuifusaria* Xing Z. Liu, R.H. Gao, K.Q. Zhang & L. Cao - Mycological Research 100: 236, 1996.
- tenuis** - *Dactylella tenuis* Drechsler - Mycologia 29: 538, 1937.
- tylopaga** - *Lactydina tylopaga* (Drechsler) Subram. - Kavaka 5: 95, 1977.  
= *Dactylella tylopaga* Drechsler - Mycologia, 27: 220, 1935.  
= *Dactylina tylopaga* (Drechsler) Subram. - Journal of the Indian Botanical Society 42: 297, 1964.
- yunnanensis** - *Dactylella yunnanensis* K.Q. Zhang, Xing Z. Liu & L. Cao - Mycosystema 7: 113, 1994.



**zhongdianensis** - *Dactylella zhongdianensis* J. Zhang, M.H. Mo, J.S. Deng, X.F. Liu, T.J. Bi & K.Q. Zhang – Mycotaxon 92: 193, 2005.

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