
***Obeliospora minima* sp. nov. and four other hyphomycetes with conidia bearing appendages**

Wen Ping Wu^{1*} and Eric H.C. McKenzie²¹Novozymes China, 14 Xin Xi Lu, Shang Di Zone, Haidian District, Beijing 100086, PR China²Herbarium PDD, Landcare Research, Private Bag 92170, Auckland, New Zealand

Wu, W.P. and McKenzie, E.H.C. (2003). *Obeliospora minima* sp. nov. and four other hyphomycetes with conidia bearing appendages. *Fungal Diversity* 12: 223-234.

Five dematiaceous hyphomycetes with conidia bearing setulae, *Obeliospora minima* sp. nov., *O. basispira*, *Bahusutrabeeja dwaya*, *Nawawia filiformis* and *Phialosporostilbe setosa*, are described and illustrated. *Obeliospora minima* differs from the two known species of the genus, *O. basispira* and *O. triappendiculata*, by its smaller conidia with only 3 setulae. All these genera and species are reported for the first time from China.

Key words: *Bahusutrabeeja dwaya*, hyphomycetes, *Nawawia filiformis*, *Obeliospora basispira*, *Phialosporostilbe setosa*.

Introduction

During studies on the fungi associated with plant litter in China, five dematiaceous hyphomycetes with conidia bearing setulae were found. They belong to four genera previously unknown for China. One of them is a new species of the genus *Obeliospora* Nawawi & Kuthub.

***Obeliospora minima* W. Wu & McKenzie, sp. nov.** (Figs. 1-3)

Colonies effusae, pallide brunneae. *Mycelium* immersum vel superficiale, ex hyphis ramosis, septatis, pallide brunneis, laevibus, 2-3 μm crassis compositum, ad setarum et conidiophorum aggregatum. *Setae* steriles, simplices, erectae, rectae, atrobrunneae, crassitunicatae, laeves, 1 septatae, apicem acutum versus attenuatae, 70-120 μm longae, 4-5 μm crassae, ad basim inflatae 7-10 μm crassae. *Conidiophora* mononematosae, solitaria vel aggregata, ex hypharum aggregatum oriunda, simplicia, raro ramosa, flexuosa, pallide brunnea, laevia, 0-1 septata. *Cellulae conidiogenae* in conidiophoris integratae, terminales, monophialidicae, doliiformia, 10-12 μm longae, 6-8 μm crassae; colla conspicue cupulata, 5-7 μm diam., 2.5-3 μm alta; secession conidiorum planum eundem producentes proliferatione enteroblastica. *Conidia* acrogena, solitaria, sicca, conica vel pyramidalia, laevia, hyalina, parietibus tenuibus, 8-10 μm diam., 7-9 μm alta, cum 3 setulae, voronata simul gemmantia, 7-12 μm longae. *Conidiorum secessio* schizolytica.

* Corresponding author: W.P. Wu; e-mail: wuwp@novozymes.com

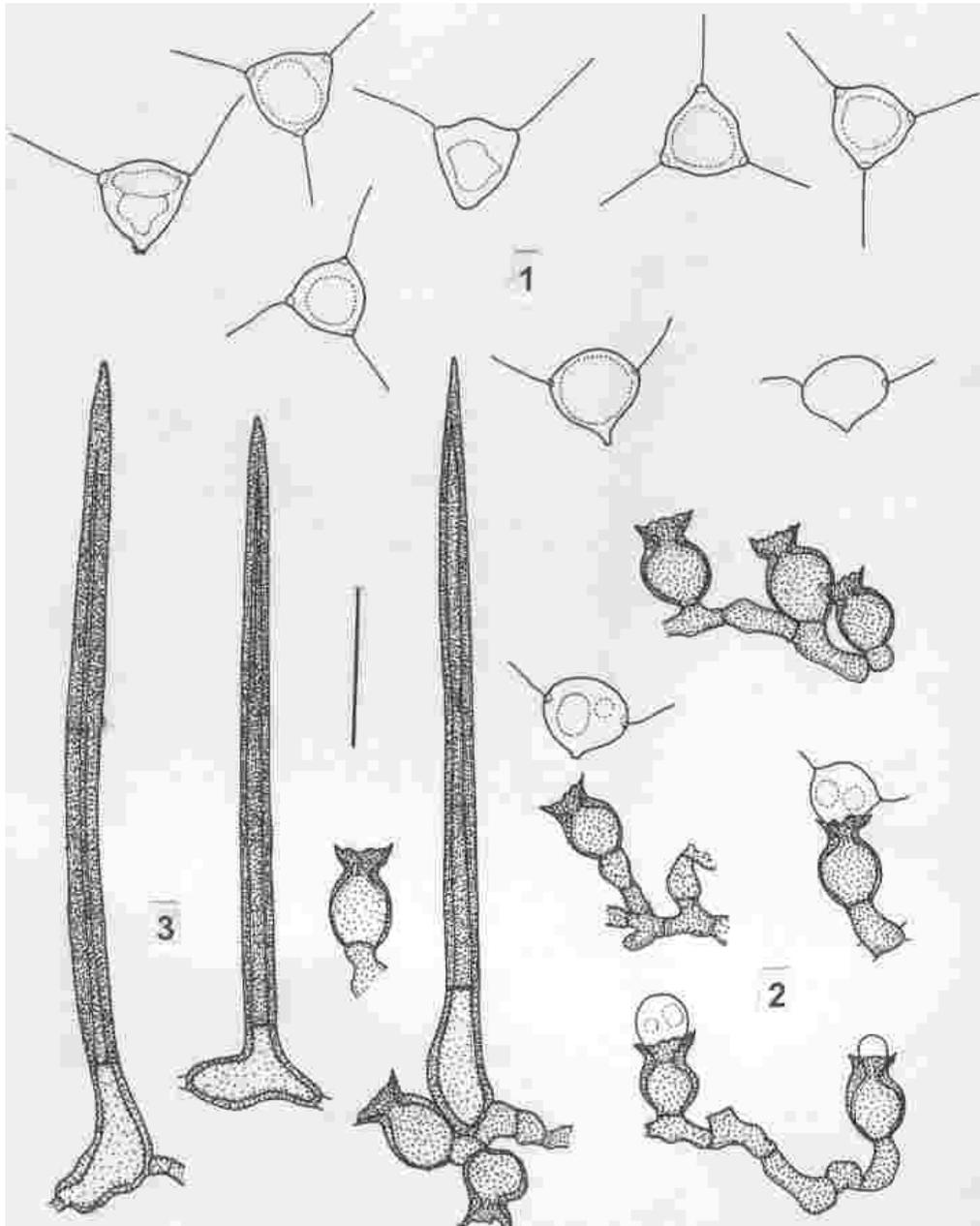
Holotypus: CHINA, Guangxi Province, Shangsi, Shiwandashan, Wangle, in ramunculus ignotes, 2 January 1997, Wenping Wu (WUFH 1268c).

Colonies effuse, pale brown, sparse. *Mycelium* immersed or superficial, composed of pale brown, branched, smooth, septate hyphae 2-3 μm wide, loosely aggregated at the base of setae and conidiophores. *Setae* sterile, simple, erect, straight, dark brown to blackish, thick-walled, smooth, 1-septate near the base, tapered gradually towards the acute to pointed apices, 70-120 μm long, 4-5 μm wide, with inflated base 7-10 μm wide. *Conidiophores* absent or present then mononematous, occurring singly or in small groups, arising from aggregated hyphae, simple, rarely branched except occasionally at the base, flexuous, pale brown, smooth, thick-walled, 0-1 septate. *Conidiogenous cells* integrated, terminal, monophialidic, doliiform, 10-12 μm long, 6-8 μm wide, with cup-shaped collarete at the apex, 5-7 μm wide and 2.5-3 μm deep, proliferating enteroblastically and producing several conidia sub-endogenously at the same level. *Conidia* acrogenous, solitary, dry, conical to pyramidal, smooth, hyaline, thin-walled, 8-10 μm wide, 7-9 μm high and furnished with 3 thin, hyaline setulae, 7-12 μm long. *Conidium secession* schizolytic.

Other material examined: CHINA, Guang Dong Province, Luofushan, on dead branches of unidentified plant, 6 October 1998, Wenping Wu (WUFH 1924b).

Notes: *Obeliospora* was erected by Nawawi and Kuthubutheen (1990) for a single dematiaceous hyphomycete species, *O. basispira* Nawawi & Kuthub., colonizing submerged decaying wood in a freshwater stream. The genus is characterized by presence of subulate setae; mononematous, solitary or grouped, pigmented conidiophores; terminal, integrated, enteroblastic, monophialidic, doliiform conidiogenous cells ending in conspicuously flared, cup-shaped collarettes; and acrogenous, semi-endogenous, hyaline, globose to subglobose phialoconidia furnished with several non-septate, filiform appendages formed simultaneously about the crown. *Obeliospora basispira* and *O. triappendiculata* Kuthub. & Nawawi are the only two species described so far in this genus. The setose colony, hyaline, aseptate and appendaged conidia formed singly within a deep collarete at the apex of doliiform phialides in *O. minima* are typical of *Obeliospora* as described by Nawawi and Kuthubutheen (1990) and Kuthubutheen and Nawawi (1994).

The present fungus differs from the two described species by its shorter conidiophores and its much smaller conidia with shorter appendages (Table 1). In *O. basispira*, the conidiophores are well-developed with 3-5 septa, and conidia are larger (15-19 \times 13-15 μm), subglobose to napiform, and furnished with 4-8 hairlike appendages up to 46 μm long. *Obeliospora triappendiculata* has similar conidial morphology to *O. minima*, but it has longer setae, conidiophores, conidiogenous cells and conidia. Furthermore, the setae and conidiophores in *O. triappendiculata* have more septa than those of *O. minima*.



Figs. 1-3. *Obeliospora minima*. 1. Conidia. 2. Conidiophores and conidiogenous cells with developing conidia. 3. Setae. Bar = 20 μ m.

The differences between these fungi are marked, and are considered to be of sufficient magnitude to warrant separating our fungus into a new species.

Table 1. A comparison of *Obeliospora minima*, *O. basispira* and *O. triappendiculata*.

	<i>O. basispira</i> (Nawawi and Kuthubutheen, 1990)	<i>O. triappendiculata</i> (Kuthubutheen and Nawawi, 1994)	<i>O. minima</i>
Setae	1-2 septate, up to 190 μm long, 4-5 μm wide	5-septate, up to 180 μm long, 6-8.5 μm wide	1-septate, 70-120 μm long, 4-5 μm wide
Conidiophores	3-5 septate, 20-38 \times 2.5-3 μm	2-3 septate, up to 70 μm long, 2.5-4.5 μm	0-1 septate, 5-10 \times 2-3 μm
Conidiogenous cells	Doliiform, 8-13 μm long, 8-10 μm wide	Doliiform, 11-17 μm long, 11-14 μm wide	Doliiform, 10-12 μm long, 6-8 μm wide
Collarette	cup-shaped, 5-10 μm wide, 7-14 μm deep	Funnel shaped, 13-24 μm wide, 7-13 μm deep	Cup-shaped, 5-7 μm wide, 2.5-3 μm deep
Conidia	Subglobose to napiform, 15-19 μm across, 13-15 μm high	Conical to pyramidal, 21-24 μm across, 21-28 μm high	Conical to pyramidal, 8-10 μm across, 7-9 μm high
Setulae	4-8, 25-46 μm long	3, 44-55 μm long	3, 7-12 μm long

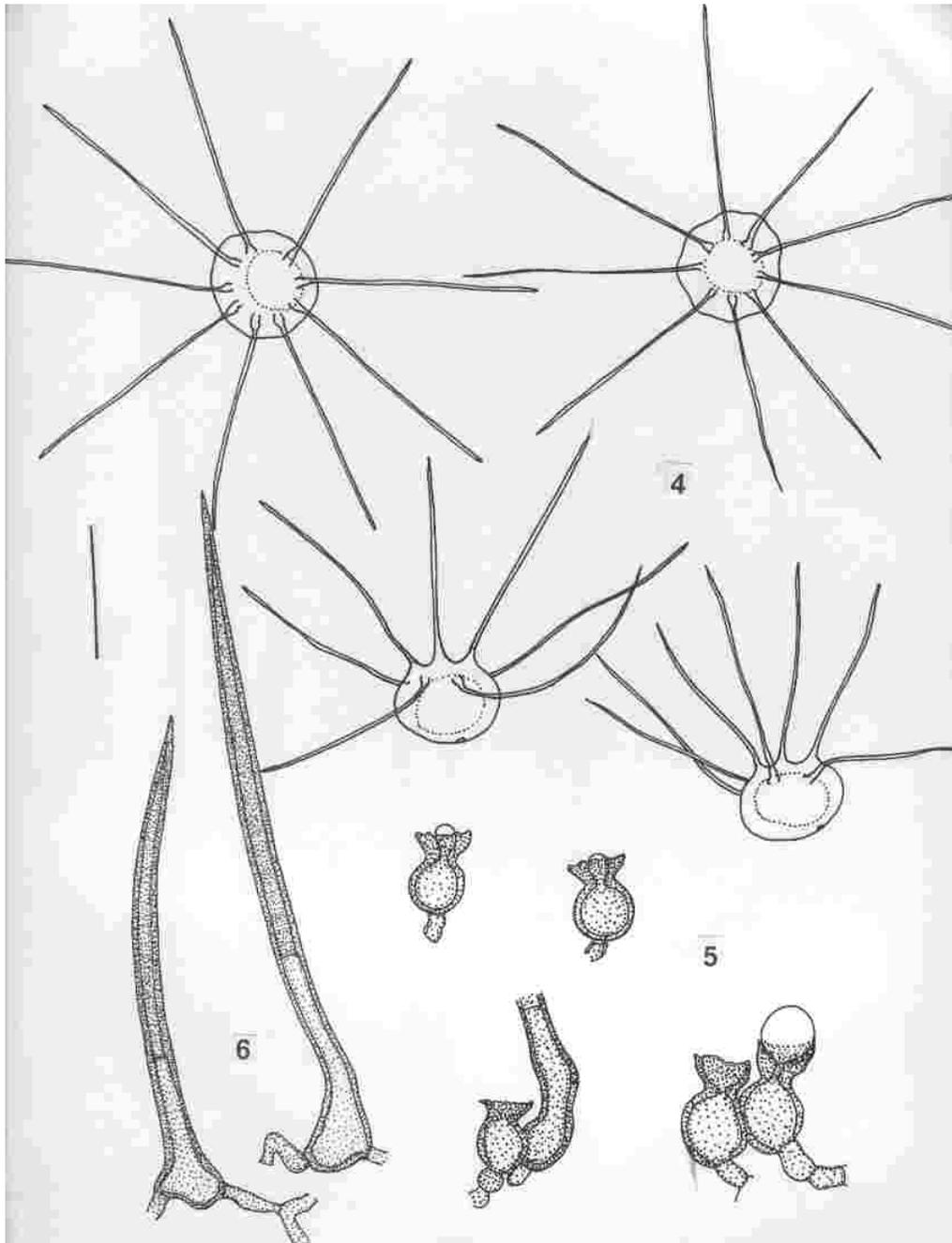
Obeliospora basispira Nawawi & Kuthub., Mycotaxon 37: 397 (1990).

(Figs. 4-6)

Colonies effuse, pale brown, sparse. *Mycelium* immersed or superficial, composed of pale brown, branched, smooth, septate hyphae 2-3 μm wide. *Setae* sterile, simple, erect, straight, dark brown to blackish, thick-walled, smooth, 1(-2)-septate near the base, tapered gradually towards the acute to pointed apices, 70-150 μm long, 3-4.5 μm wide, with inflated base 7-9 μm wide. *Conidiophores* absent or present then mononematous, occurring singly or in small groups, arising from aggregated hyphae, simple, rarely branched except occasionally at the base, flexuous, pale brown, smooth, thick-walled, 0-1 septate. *Conidiogenous cells* integrated, terminal, monophialidic, doliiform, 8-12 μm long, 6-10 μm wide, with cup-shaped collarette at the apex, 6-8 μm wide and 3.5-5 μm deep, proliferating enteroblastically and producing several conidia sub-endogenously at the same level. *Conidia* acrogenous, solitary, dry, subglobose to napiform, smooth, hyaline, thin-walled, 13-17 μm wide, 11-14 μm high and furnished with 7-9 (mostly 9) thin, hyaline setulae, 20-35 μm long. *Conidium secession* schizolytic.

Material examined: CHINA Guang Dong Province, Dinghushan, on rotten wood of unidentified plant, 10 October 1998, Wenping Wu (WUFH 2086).

Notes: *Obeliospora basispira* was described as a saprobe occurring on submerged decaying wood in a freshwater stream in Malaysia (Nawawi and Kuthubutheen, 1990). The general appearance of this fungus from Chinese collection agrees well with the original description. However, most conidia have 9 appendages, while this was described as 6-8 in the type collection by



Figs. 4-6. *Obeliospora basispira*. **4.** Conidia. **5.** Conidiophores and conidiogenous cells with developing conidia. **6.** Setae. Bar = 20 μ m.

Nawawi and Kuthubutheen (1990). Apparently, the Chinese specimen represents only the second collection of this species.

Bahusutrabeeja dwaya Subraman. & Bhat, Canadian Journal of Botany 55: 2204 (1977). (Figs. 7-9)

Description and illustration: Subramanian and Bhat (1977).

Material examined: CHINA, Guang Dong Province, Dinghushan, on dead branches of unidentified plant, 9 October 1998, Wenping Wu (WUWP1853 b).

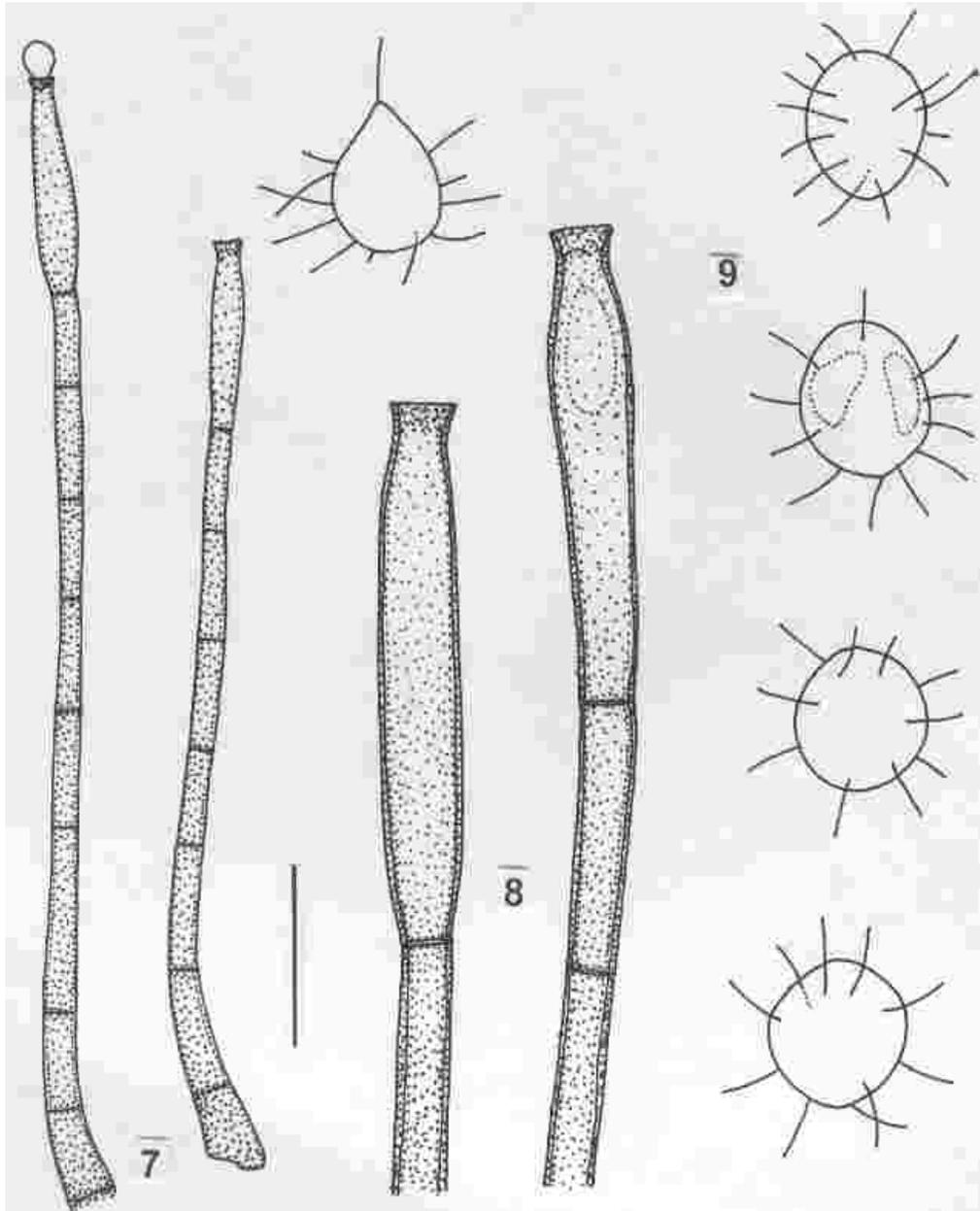
Bahusutrabeeja was introduced by Subramanian and Bhat (1977) for an interesting fungus, *B. dwaya* Subraman. & Bhat, isolated from dead twigs of *Coffea arabica* L. from India. It was characterized by single, dark brown conidiophores with terminal phialidic conidiogenous cells, and hyaline, aseptate conidia bearing a few appendages. Four species, *B. angularis* V.G. Rao & de Hoog (1986), *B. bunyensis* McKenzie (1997), *B. dubhashii* Bhat (1994), and *B. globosa* Bhat & W.B. Kendr. (1993) have been described since then. The conidia from Chinese collection are globose, 12-14 µm diam., and with up to 13 appendages, each up to 6 µm long. This matches the original description of *B. dwaya*.

Nawawia filiformis (Nawawi) Marvanová, Transactions of the British Mycological Society 75: 227 (1980). (Figs. 10-13)

≡ *Clavatospora filiformis* Nawawi, Transactions of the British Mycological Society 61: 390 (1973).

Colonies effuse, hairy, pale brown. *Mycelium* partly immersed and partly superficial, composed of pale brown, septate hyphae 2-3 µm wide. *Conidiophores* cylindrical, single or in small groups, erect, straight, unbranched or occasionally branched irregularly, thick-walled, smooth, medium to dark brown, becoming paler towards the apex, often proliferating percurrently, 3-7 septate, 100-180 µm long, 4-4.5 µm wide. *Conidiogenous cells* integrated, terminal, phialidic, medium brown, smooth, cylindrical 17-50 µm long, 3.5-6.5 µm wide at the widest part, 3-4 µm wide just below the terminal collarette; collarettes funnel-shaped, 1.5-2 µm long, 3-5 µm wide at the tip, often proliferating. *Conidia* of two types: a) hyaline, aseptate, ellipsoid to oval, smooth, thin-walled, base truncate, apex rounded or occasionally with a short appendage, 7.5-12.5 × 3.5-6.5 µm, formed before the second type; b) hyaline, aseptate, smooth, thin-walled, turbinate to triangular-shaped, viewed from above the conidium is also triangular and from each corner of the triangle has a long, hair-like appendage, 10-25 µm long, base truncate, 13-18 µm long and 14-18 µm wide.

Material examined: CHINA, Guang Dong Province, Dinghushan, on rotten wood of unidentified plant, 10 October 1998, Wenping Wu (WUWP2069).



Figs. 7-9. *Bahusutrabeija dwaya*. 7, 8. Conidiophores and conidiogenous cells. 9. Conidia. Bar: 7 = 50 μ m; 8, 9 = 20 μ m.

There are three accepted species of *Nawawia* Marvanová, *N. filiformis* (Nawawi) Marvanová, *N. nitida* Kuthub., G.M. Liew & Nawawi, and *N. dendroidea* K.D. Hyde, Goh & T. Steinke (Marvanová, 1980; Kuthubutheen *et*

al., 1992; Hyde *et al.*, 1996). The Chinese specimen definitely belongs to *N. filiformis*. Two types of conidia were also noted for *N. filiformis* in the original description. However, the two spore types are not found to be produced together. On natural substrate only the triangular setulate spore was produced, while on 2% malt agar only the ellipsoid, non-setulate spore was formed.

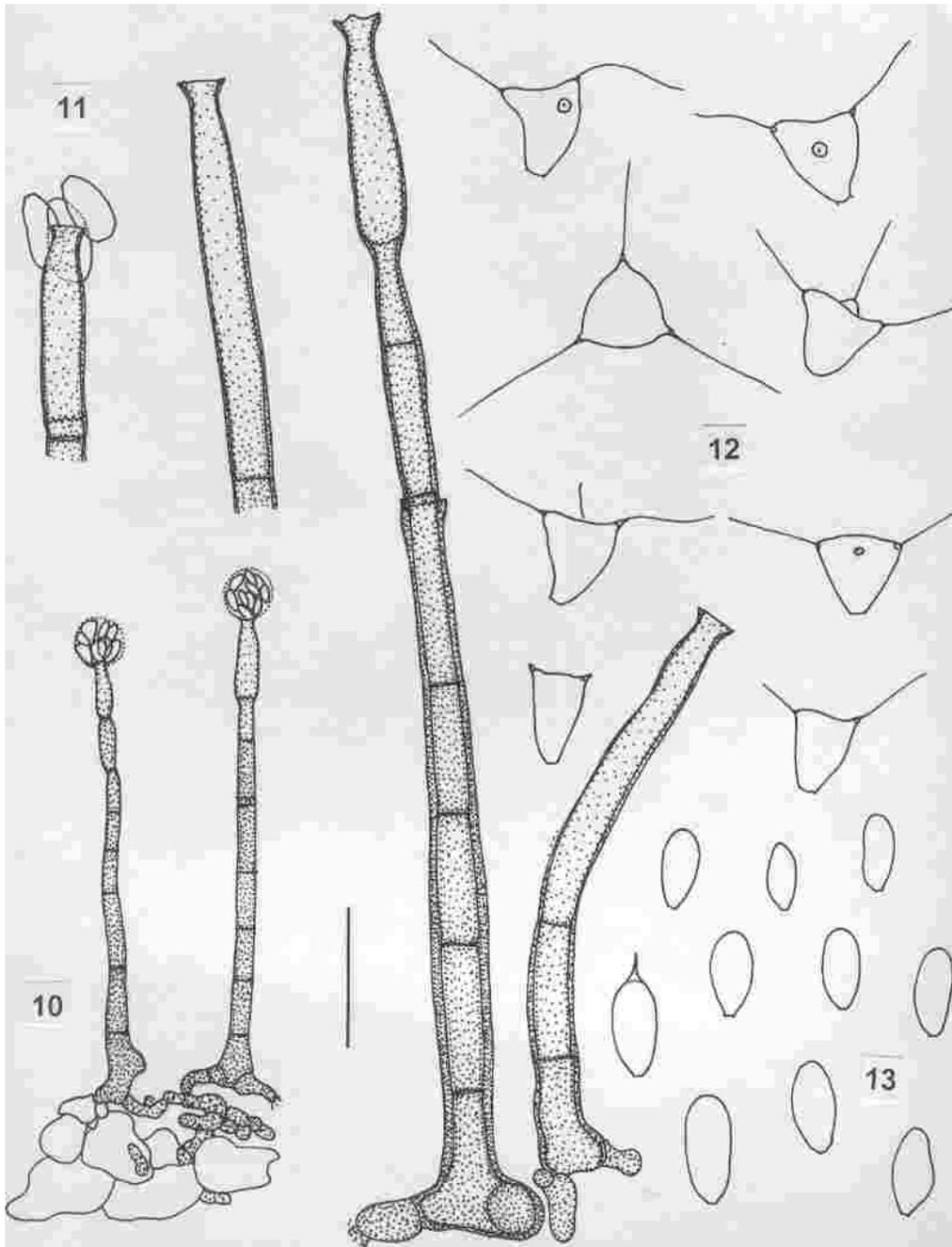
Chalarodes McKenzie, *Nawawia* Marvanová, and *Phialosporostilbe* Mercado & Portales are three dematiaceous hyphomycete genera with similar conidial morphology and conidiogenesis (Marvanová, 1980; Mercado and Portales, 1985; McKenzie, 1991; Kuthubutheen *et al.*, 1992). They all have phialidic conidiogenous cells and hyaline, aseptate, tetrahedral to pyramidal conidia with 2-4 distal setulae, and sometime also a single basal setula. The catenate conidia formed in single conidiophores in *Chalarodes* distinguish it from the other two genera, *Nawawia* and *Phialosporostilbe*. The two latter genera can be further distinguished by conidiomata, single conidiophores in *Nawawia* and synnemata in *Phialosporostilbe*. Hyde *et al.* (1996) pointed out that *Phialosporostilbe* and *Nawawia* may be congeneric, and they placed a new synnematous *Phialosporostilbe*-like species into *Nawawia*, as *N. dendroidea* K.D. Hyde, Goh & T. Steinke. Bhat and Kendrick (1993) suggested that a reassessment of these genera is needed.

Phialosporostilbe setosa Bhat & W.B. Kendr., Mycotaxon 49: 57 (1993).

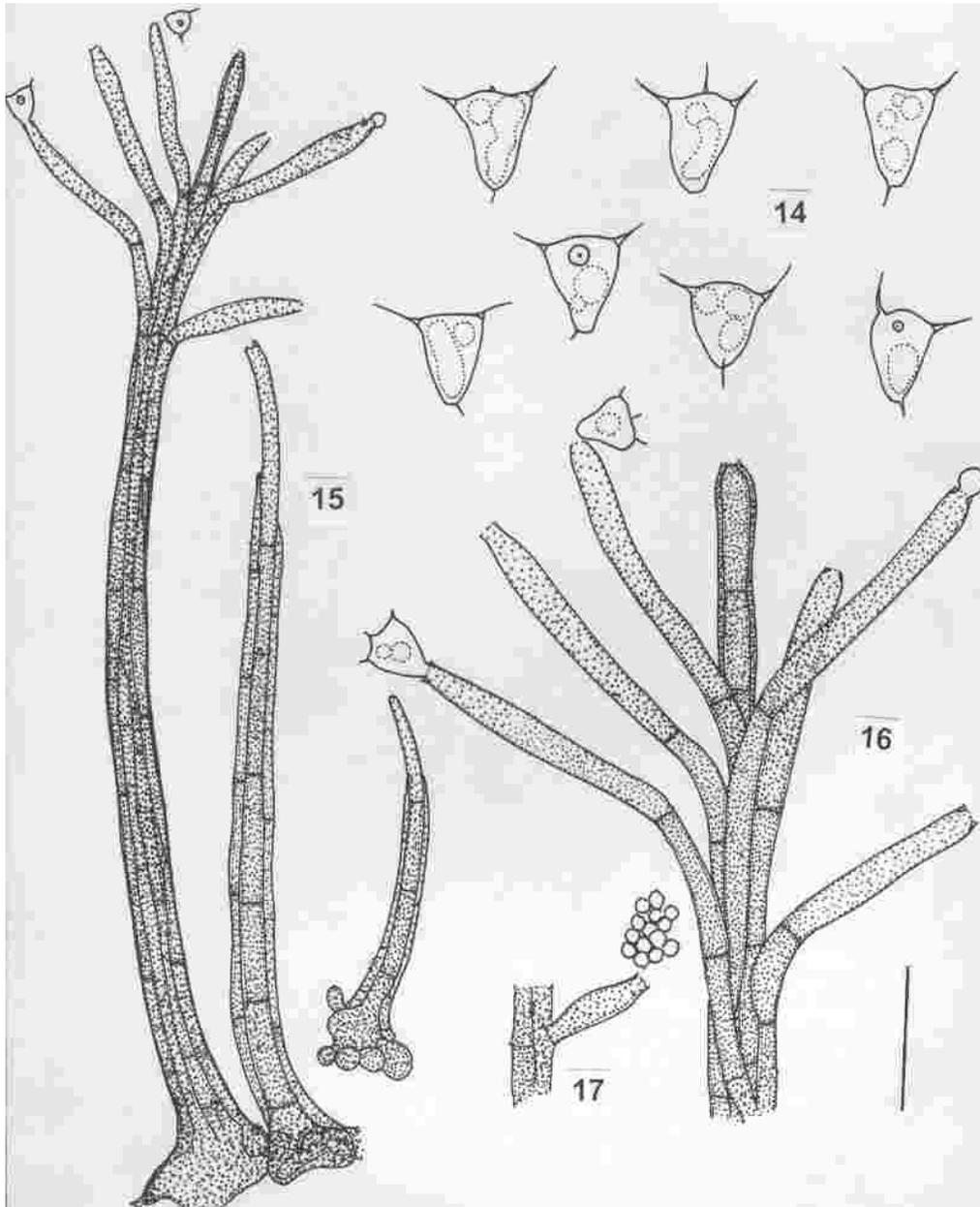
(Figs. 14-17)

Colonies effuse, hairy, greyish brown. *Mycelium* partly immersed and partly superficial, composed of pale brown, septate hyphae 2-3.5 µm wide. *Conidiomata* synnematal, solitary, erect, unbranched, straight or flexuous, up to 380 µm tall, 10-15 µm wide, composed of 5-20 parallel, thick-walled, septate, brown, smooth hyphae 3-4.5 µm wide, usually diverging $\frac{3}{4}$ distance from base to apex to form individual conidiophores, except for one in the centre which remains sterile. *Conidiophores* unbranched, medium brown to dark brown, smooth, 1-2 septate, thick-walled, up to 380 µm long, 3-4.5 µm wide. *Conidiogenous cells* phialidic, integrated, terminal, single, cylindrical, straight, thick-walled but becoming thin-walled towards the apex, up to 50 µm long, 4-5 µm wide, slightly narrowing at the apex to 2-3 µm wide, periclinal thickening obvious, collarete inconspicuous. *Conidia* hyaline, aseptate, thin-walled, smooth, round-tetrahedral to pyramidal, 8-10 µm across the widest points, 10-12.5 µm long, with 3 protuberant corners and a slightly truncate to rounded base, each corner and base is furnished with one setula, 4-6 µm long. *Microconidia* hyaline, aseptate, ellipsoidal, smooth, 2-3 µm diam., formed in drop from conidiogenous cells in the lower part of the synnema.

Material examined: CHINA, Guang Dong Province, Dinghushan, on dead leaves of unidentified bamboo, 9 October 1998, Wenping Wu (WUWP1993).



Figs. 10-13. *Nawawia filiformis*. **10, 11.** Conidiophores and conidiogenous cells. **12.** Conidia with appendages. **13.** Conidia without appendage. Bars: 10 = 50 μ m; 11-13 = 20 μ m.



Figs. 14-17. *Phialosporostilbe setosa*. **14.** Conidia; **15, 16.** Synnematal conidiomata and phialidic conidiogenous cells. **17.** Microconidia formed from phialidic conidiogenous cells. Bars: 15 = 50 μm ; 14, 16, 17 = 20 μm .

The three synnemalous species, *Nawawia dendroidea*, *P. setosa* and *P. turbinata* Mercado & Portales differ slightly from each other in morphology of

synnemata, conidia and their appendages. They all have the same shaped and very similar sized ($8.5-12 \times 7-10 \mu\text{m}$) conidia. However, in *P. setosa*, conidia have a single basal appendage and there is a microconidial state present at the basal part of synnemata. These features are absent in the other two species. *N. dendroidea* is very close to *P. turbinata*, but it has slightly wider and longer conidia, much larger synnemata, and divergence of the more numerous conidiophores begins one quarter of the distance from the base (Hyde *et al.*, 1996). Our collection agrees well with *P. setosa*, especially with the development of basal conidial setulae and a microconidial state (Bhat and Kendrick, 1993).

Acknowledgements

K. Aunstrup and K. Chen, the R & D center, Novo Nordisk China, Beijing, are thanked for their support for this work. W.P. Wu would also like to thank W.Y. Zhuang and her colleagues from the Institute of Microbiology, The Chinese Academy of Sciences, Beijing for their great support during sampling trips from which the cited collections were made.

References

- Bhat, D.J. (1994). Two undescribed species of conidial fungi from forests of Western Ghats in southern India. *Indian Journal of Forestry* 17: 129-133.
- Bhat, D.J. and Kendrick, B. (1993). Twenty-five new conidial fungi from the Western Ghats and the Andaman Islands (India). *Mycotaxon* 49: 19-90.
- Hyde, K.D., Goh, T.K. and Steinke, T. (1996). *Nawawia dendroidea*, a new synnematosous hyphomycete from submerged *Phragmites* in South Africa. *Mycological Research* 100: 810-814.
- Kuthubutheen, A.J., Liew, G.M. and Nawawi, A. (1992). *Nawawia nitida* sp. nov. (hyphomycetes) and further records of *Nawawia filiformis* from Malaysia. *Canadian Journal of Botany* 70: 96-100.
- Kuthubutheen, A.J. and Nawawi, A. (1994). *Henicospora longissima* sp. nov., *Obeliospora triappendiculata* sp. nov., *Paraulocladium fabisporum* sp. nov. and other hyphomycetes from Malaysia. *Mycological Research* 98: 677-685.
- Marvanová, L. (1980). New or noteworthy aquatic hyphomycetes: *Clavatospora*, *Heliscella*, *Nawawia* and *Heliscina*. *Transactions of the British Mycological Society* 75: 221-231.
- McKenzie, E.H.C. (1991). Dematiaceous hyphomycetes on *Freycinetia* (Pandanaceae). 3. *Chalarodes* gen. nov. *Mycotaxon* 42: 89-93.
- McKenzie, E.H.C. (1997). *Bahusutrabeeja bunyensis* sp. nov. (hyphomycetes) from Queensland, Australia, and a new name for *Chalara australis* McKenzie. *Mycotaxon* 61: 303-306.
- Mercado, S.A. and Portales, M.J. (1985). Nuevo género de hifomicete fialídico de Cuba. *Revista del Jardín Botánico Nacional Universidad de la Habana, Cuba* 6: 57-60.
- Nawawi, A. and Kuthubutheen, A.J. (1990). *Obeliospora*, a new genus of setose, phialosporous hyphomycetes with appendaged conidia. *Mycotaxon* 37: 395-400.
- Rao, V. and de Hoog, G.S. (1986). New or critical hyphomycetes from India. *Studies in Mycology* 28: 1-84.

Subramanian, C.V. and Bhat, D.J. (1977). *Bahusutrabeeja*, a new genus of the hyphomycetes. Canadian Journal of Botany 55: 2202-2206.

(Received 13 October 2002; accepted 18 November 2002)