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## Notes on dictyosporous hyphomycetes from China VII. The genus *Nimbya*

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Two new species, *Nimbya dianthi* and *N. dolichi* are described. They differ from previously reported *Nimbya* species in conidial morphology and host range. Another five species are recorded from China and the genus is reviewed based on literature. The diagnostic characters of 17 accepted species of *Nimbya* are tabulated and a key to the all known species is provided.

**Key words:** new species, *Macrospora*, *Nimbya dianthi*, *Nimbya dolichi*.

### Introduction

The genus *Nimbya* was introduced as a segregate of *Alternaria* by Simmons (1989), with *N. scirpicola* (Fuckel) Simmons as the type. *Nimbya* species produce multicellular, transversely distoseptate conidia with rarely a few longitudinal septa. Recent molecular characterization has revealed that *Nimbya* and *Embellisia* are sister taxa of the remaining *Alternaria* and *Ulocladium* spp., and they are more closely related to *Alternaria* than is *Stemphylium* (Pryor and Bigelow, 2003).

Five species of *Nimbya* were originally reported (Simmons, 1989), and subsequently, ten species have been added to the genus (Table 1). Most species are plant pathogens causing leaf lesions. Six species have been recorded on *Amaranthaceae*, six on *Cyperaceae* and *Juncaceae*, one on *Euphorbiaceae*, one on *Compositae* and one on *Solanaceae*. Teleomorphs are known for four species (Table 1.) and these have been studied in detail (Lucas and Webster, 1964; Simmons, 1989; Johnson *et al.*, 2002). Two new species are described in this paper. They differ from previously reported *Nimbya* species in conidial morphology and host range. A further five species have been recorded

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**Table 1.** Diagnostic characteristics of the species of *Nimbya*.

Species	Conidio- phore size ( $\mu\text{m}$ )	Conidia		Transverse distosepta (lumina)	Number of secondary conidia	Shape of rostrat	Teleomorph	Host/Habitats	References
		Size ( $\mu\text{m}$ )	Shape ( $\mu\text{m}$ )						
<i>Nimbya alternantherae</i> (Holcomb & Antonop.) E.G. Simmons & Alcorn		80-115 $\times$ 18-20	Narrowly ovoid	6-10	0-2	Column or filiform	Unknown	<i>Alternanthera philoxeroides</i>	Simmons, 1995
<i>Nimbya caricis</i> E.G. Simmons	40-150 $\times$ 5-6	65-95 $\times$ 10-16	Ellipsoid to broadly obclavate	7-10	Common	Column	Unknown	<i>Carex hoodii</i>	Simmons, 1989
<i>Nimbya celosiae</i> E.G. Simmons & Holcomb	18-50 $\times$ 5-7	100-190 $\times$ 12-17	Ellipsoid to obclavate	12-15	0	Column or filiform	Unknown	<i>Celosia cristata</i>	Simmons, 1995
<i>Nimbya crassoides</i> (Davis) E.G. Simmons	up to 50	65-90 $\times$ 15-20	Broadly obclavate	7-9	0	Filiform	Unknown	<i>Froelichia floridana</i>	Simmons, 1995
<i>Nimbya dianthi</i> T.Y.Zhang & G.Z.Zhao	30-85 $\times$ 4.5-7.5	31-67 $\times$ 9.5-13.5	Obclavate	3-9	0-2	Cylindrical or filiform	Unknown	<i>Dianthus</i> sp.	This paper
<i>Nimbya dolichi</i> T.Y.Zhang & G.Z.Zhao	31-65 $\times$ 5-10	30-65 $\times$ 10.5-15.5	Ellipsoid or obclavate	5-9	0	Filiform	Unknown	<i>Dolichos</i> sp.	This paper
<i>Nimbya euphorbiicola</i> W.Q. Chen & T.Y. Zhang	45-110 $\times$ 4.5-7	85-130 $\times$ 11-15 (including beak)	Obclavate or cylindrical	5-8	0	Column	Unknown	<i>Euphorbia heterophylla</i>	Chen <i>et al.</i> , 1997
<i>Nimbya gomphrenae</i> (Togashi) E.G. Simmons	65-123 $\times$ 5-8	56-216 $\times$ 11-20	Elong-obclavate to obclavate	5-14	1	Filiform	Unknown	<i>Gomphrena globosa</i>	Simmons, 1989
<i>Nimbya heteroschemos</i> (Fautrey) E.G. Simmons		75-100 $\times$ 18-22	Obclavate	6-9	0	Beakless or narrowly filiform	Unknown	<i>Carex vulpina</i>	Simmons, 1989
<i>Nimbya juncicola</i> E.G. Simmons		75-200 $\times$ 11-15	Narrowly ellipsoid or narrowly obclavate	Up to 17	2	Column	<i>Pleospora valesiaca</i> (Niessl) Muller	<i>Juncaceae</i>	Lucas and Webster, 1964; Simmons, 1989

**Table 1 continued.** Diagnostic characteristics of the species of *Nimbya*.

Species	Conidio- phore size ( $\mu\text{m}$ )	Conidia		Transverse distosepta (lumina)	Number of secondary conidia	Shape of rostrat	Teleomorph	Host/Habitats	References
		Size ( $\mu\text{m}$ )	Shape ( $\mu\text{m}$ )						
<i>Nimbya major</i> (Pavgi & U.P. Singh) E.G. Simmons	Up to 150	60-90 $\times$ 7-10	Narrowly obclavate	8-10	0-3	Column	Unknown	<i>Nicotiana plumbaginifolia</i>	Simmons, 2000
<i>Nimbya perpunctulata</i> E.G. Simmons	70-125 $\times$ 4-5	80-100 $\times$ 10-14	Ellipsoid or subcylindrical	6-10	0	Filiform	Unknown	<i>Alternanthera philoxeroides</i>	Simmons, 2004
<i>Nimbya pimpriana</i> (V.G. Rao) E.G. Simmons		205-260 $\times$ 12.5-17 (including beak)	Narrowly obclavate	5-13	0	Filiform	Unknown	<i>Celosia cristata</i>	Simmons, 1995
<i>Nimbya rhapontici</i> (Nelen) E.G. Simmons	Up to 75	70-118 $\times$ 12-22	Long ovoid to ellipsoid	7-10	0	Long filiform	Unknown	<i>Rhaponticum carthamoides</i>	Simmons, 1997
<i>Nimbya scirpicola</i> (Fuckel) E.G. Simmons	50	100-120 $\times$ 15-20	Long narrow- obclavate	9-11	2-3	Column	<i>Macrospora scirpicola</i> (DC.: Fr.) Funckel	<i>Cyperaceae</i>	Simmons, 1989; Wong and Hyde, 2001
<i>Nimbya scirpinfestans</i> E.G. Simmons & D.A. Johnson	10-30 $\times$ 3-4	30-80 $\times$ 4-6 or 90-130 $\times$ 6-8	Narrowly ellipsoid or narrowly ovoid	3-8	1-2	Column	<i>Macrospora scirpinfestans</i> E.G. Simmons & D.A. Johnson	<i>Scirpus acutus</i>	Johnson <i>et al.</i> , 2002
<i>Nimbya scirpivora</i> E.G. Simmons & D.A. Johnson	15-40 $\times$ 4-5	20-60 $\times$ 5-8	Narrow-ovoid	4-9	Abundant	Narrow column	<i>Macrospora scirpivora</i> E.G. Simmons & D.A. Johnson	<i>Scirpus</i> sp.	Johnson <i>et al.</i> , 2002

from China. The diagnostic characteristics of 17 known species of *Nimbya* are listed in Table 1 and a key to all these species is provided.

### Results: *Nimbya* species from China

*Nimbya alternantherae* (Holcomb & Antonopoulos) Simmons & Alcorn, Mycotaxon 55: 142. 1995. (Fig. 1)

= *Alternaria alternantherae* Holcomb & Antonopoulos, Mycologia 68: 1126. 1976.

*Material examined*: CHINA, Guangyuan, Sichuan Province, on leaves of *Alternanthera philoxeroides* (Mart) Griseb, G.Z. Zhao, HSAUP II<sub>0</sub>2670 (ZGZ II<sub>0</sub>0370); Fuzhou, Fujian Province, on leaves of *A. philoxeroides*, H.M. Liu, HSAUP L-376; Nanchang, Jiangxi Province, on leaves of *A. philoxeroides*, H. Deng, HSAUP II<sub>0</sub>4334 (DHII<sub>0</sub>0334) and Chongqing, HSAUP II<sub>0</sub>2798\* (ZGZ II<sub>0</sub>0498).

*Notes*: This species was originally described as *Alternaria alternantherae* (Holcomb and Antonopoulos, 1976), a pathogen of a leafspot disease of alligatorweed, *Alternanthera philoxeroides* (Mart.) Griseb., in Louisiana, and also is pathogenic on ornamental *Amaranthaceae* species (Holcomb, 1978). Spots occurred on leaves and stems with the leafspots more numerous and prominent. Disease symptoms first appeared as small purple lesions that developed into centrally tan-coloured, necrotic leafspots and enlarged to 2-3(-4) mm diam. Simmons (1995) transfer the species and another isolate from leafspot of *Alternanthera denticulate* to *Nimbya*. The holotype was used up in isolation work. Simmons (1995) designed the neotype: BPI dried-down culture EGS 39-124 ex ATCC32833 ex Holcomb and Antonopoulos's holotype.

The species was first reported in China as *Alternaria alternantherae* on *Alternanthera philoxeroides* (Cao *et al.*, 1990), which was also used as a biocontrol agent to prevent *Alternanthera philoxeroides* spreading in China (Xiang, 1998; Xiang *et al.*, 2002a,b,c).

*Nimbya celosiae* Simmons & Holcomb, Mycotaxon 55: 144. 1995. (Fig. 2)

*Material examined*: CHINA, Fuzhou, Fujian Province, on leaves of *Celosia cristata* L., HSAUP II<sub>0</sub>4055 (DHII<sub>0</sub>055); Guilin, Guangxi Zhuang Autonomous Region, on leaves of *C. cristata*, HSAUP992034 (ZGZ990534).

*Notes*: *Nimbya celosiae* is similar to *N. alternantherae* in both parasitizing plants of *Amaranthaceae* and in conidial shape. *Nimbya alternantherae* have distinctly constricted transverse septate conidia and conidial beaks exhibit various swollen cells, while conidia of *N. celosiae* are not distinctly constricted and conidial beaks are evenly long and narrow (filiform).

The size range of conidia of the Chinese collections are 50-120 × 15-21 μm, which are compatible with those of original descriptions (60-100 × 10-18 μm) by Simmons (1995).

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\*The 'II<sub>0</sub>' indicates that the specimen was collected in 2000.

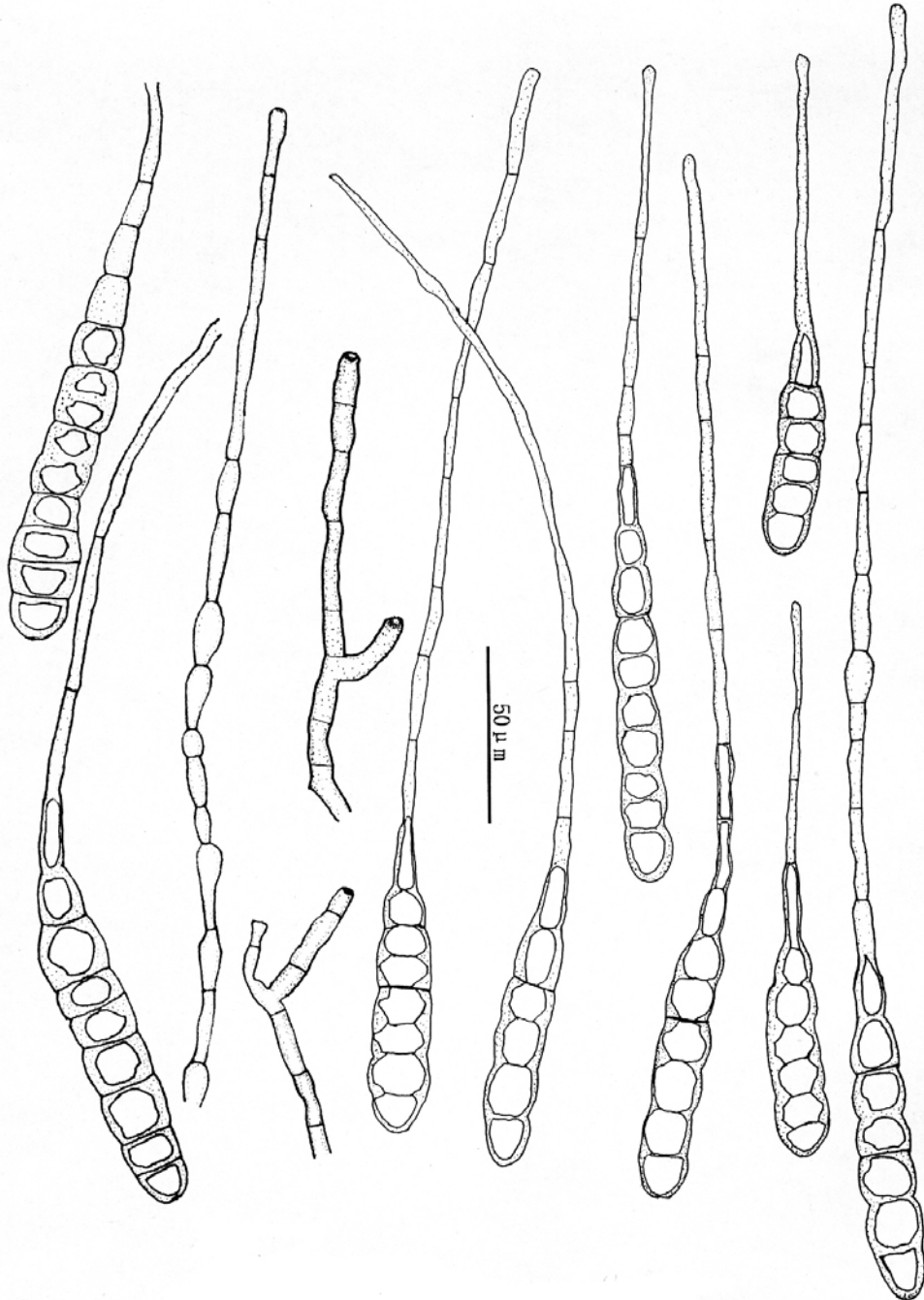


Fig. 1. Conidiophores and conidia of *Nimbya alternantherae* from HSAUP II<sub>0</sub>2670.

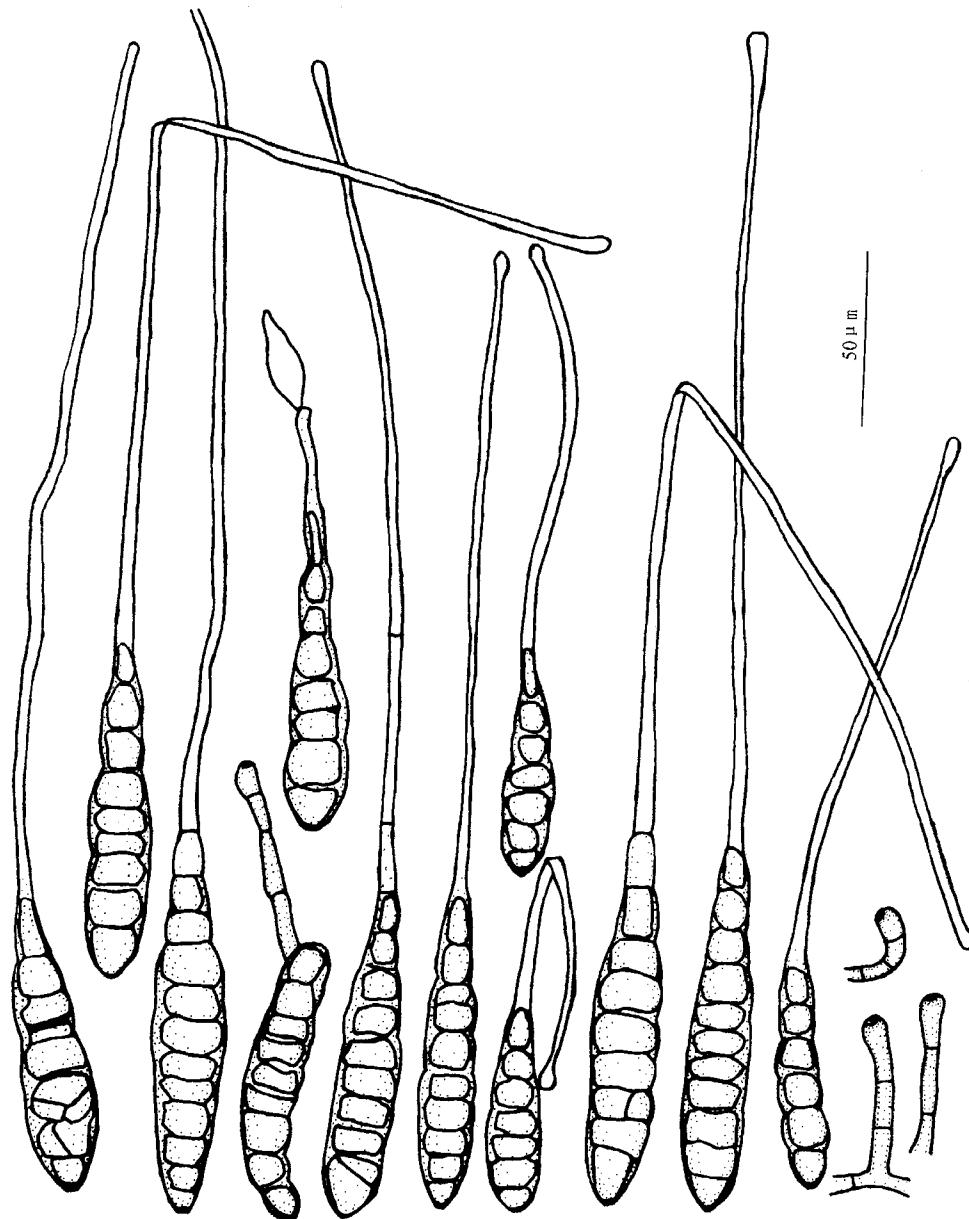


Fig. 2. Conidiophores and conidia of *Nimbya celosiae* from HSAUP II<sub>0</sub>4055.

***Nimbya dianthi* T.Y. Zhang & G.Z. Zhao, sp. nov.** (Fig. 3)

*Conidiophora* solitaria, erecta, septata, recta vel paulo curvata, eramosa, pallide brunnea, 30-85 × 4.5-7.5 µm. *Conidia* solitaria vel breviter catenata, obclavata, pallide brunnea vel brunnea, transverse 3-9- (pseudo-) septata, longitudinaliter vel oblique 0-1- distoseptata, leviter constricta, levia, 31-67 × 9.5-13.5 µm; cellula basali saepe rotundata; rostra 31-100 × 2.5-4.5 µm, aliquando pseudorostrum praedita.

**Holotypus:** in foliis vivis *Dianthi* sp. Shaanxi Provincia, Sinica. HSAUP 960301 (ZTY96-120).

*Conidiophores* solitary, erect, straight or slightly curved, unbranched, septate, pale brown, 30-85 × 4.5-7.5 µm. *Conidia* solitary or in short chains, obclavate, pale brown to brown, conidial body with 3-9 transverse septa, 0-1 longitudinal or oblique septa, slightly constricted at septa, surface smooth, 31-67 × 9.5-13.5 µm excluding beak, with broadly rounded, dark brown basal cell; upper cell tapering into a long beak, cylindrical or filiform, pale brown, septate, up to 31-100 × 2.5-4.5 µm. Some of the juvenile and mature conidia are pseudorostrate. After becoming fertile, the tip of the pseudorostrum often expands and extends, becoming nearly as thick as the normal conidiophore.

*Substrate:* On leaves of *Dianthus* sp.

*Notes:* This fungus is the first species of *Nimbya* reported on member of the *Caryophyllaceae*. *Nimbya dianthi* is similar to *N. dolichi* in conidium morphology, but the latter has relatively broader conidia with a longer and column beak. Besides, the beaks of primary conidia in *N. dianthi* usually become secondary conidiophores (pseudorostra) and produce secondary conidia.

***Nimbya dolichi* T.Y. Zhang & G.Z. Zhao, sp. nov.** (Fig. 4)

In substrato naturali coloniae epiphyllae vel caulicolae. *Mycelium* fere immersum. *Hyphae* ramosae, septatae, hyalinae, subhyalinae vel albo-lutescentes, irregulares. *Conidiophora* macronematosa, simplicia, 1-2-geniculata vel ramosa, septata, 31-65 × 5-10 µm; *Conidia* solitaria vel raro catenata, recta vel curvata; anguste ellipsoidea vel anguste obclavata, transverse 5-9- distoseptata et 0-5-euseptata, longitudinaliter vel oblique 0-4 distoseptata, 30-65 × 10.5-15.5 µm, dilute brunnea vel brunnea, laevia; rostro 11-80 × 2.0-3.5 µm.

**Holotypus:** in foliis *Dolichotis* sp, in Monte Xiaowutai, Hebei Provincia, Sinica, HMAS 65889.

*Colonies* mainly epiphyllous and caulicolous. *Mycelium* mostly immersed. *Hyphae* branched, septate, smooth, colourless, subhyaline to light brown, irregular. *Conidiophores* macronematous, arise directly from intra substrate hyphae, erect, simple, branched, with a single apical scar or rarely 1-2 geniculate with 2-3 scars, 31-65 × 5-10 µm. *Conidia* solitary or rarely in chains of 2-3, straight or slightly curved, ellipsoidal or obclavate, conidial bodies 30-65 × 10.5-15.5 µm, dilute brown, surface smooth, 5-9 transverse distosepta and 0-5 transverse eusepta, 0-4 longitudinal or oblique distosepta. Beaks filiform, septate, hyaline to subhyaline, ca. 11-80 × 2-3.5 µm.

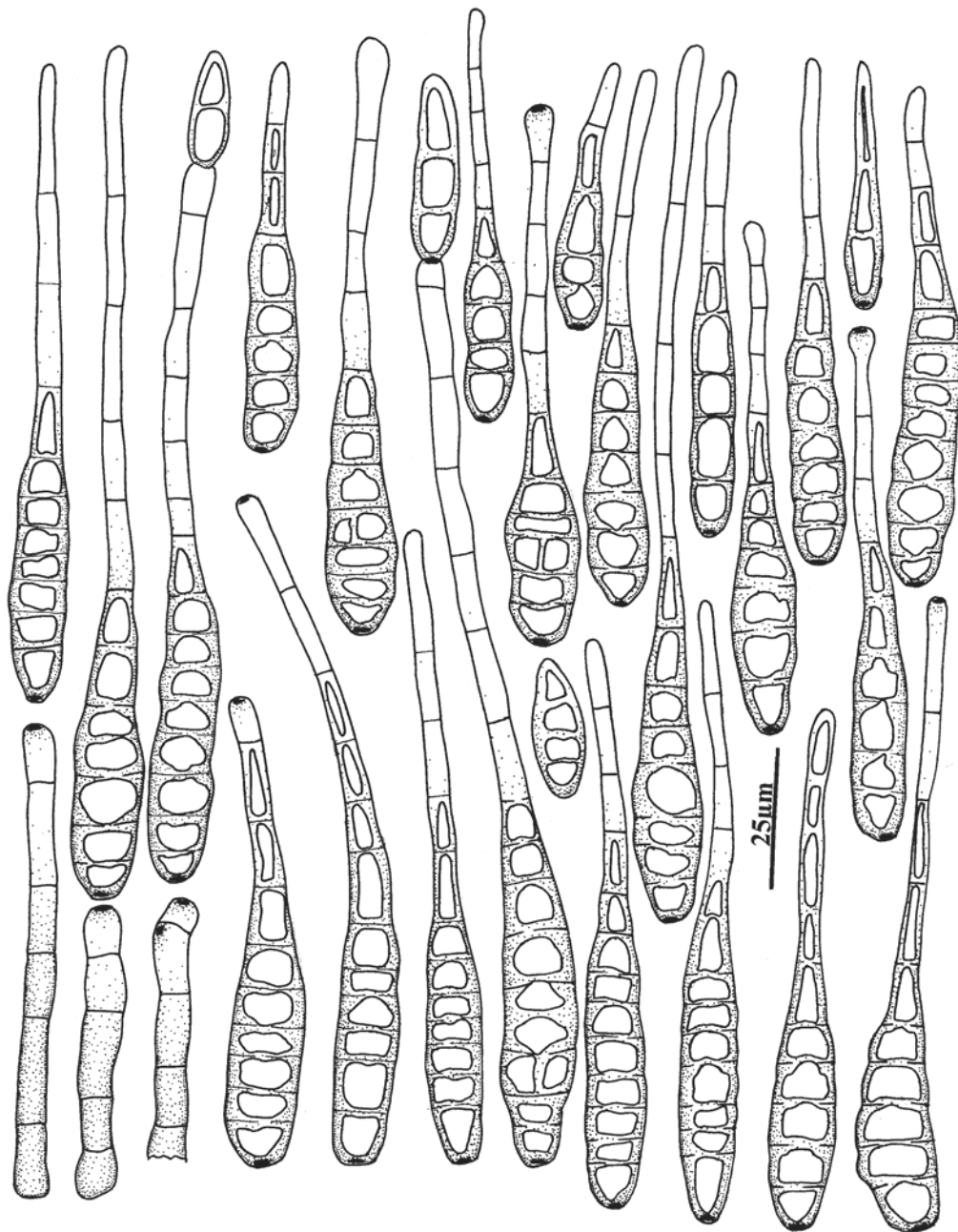


Fig. 3. Conidiophores and conidia of *Nimbya dianthi* from holotype.



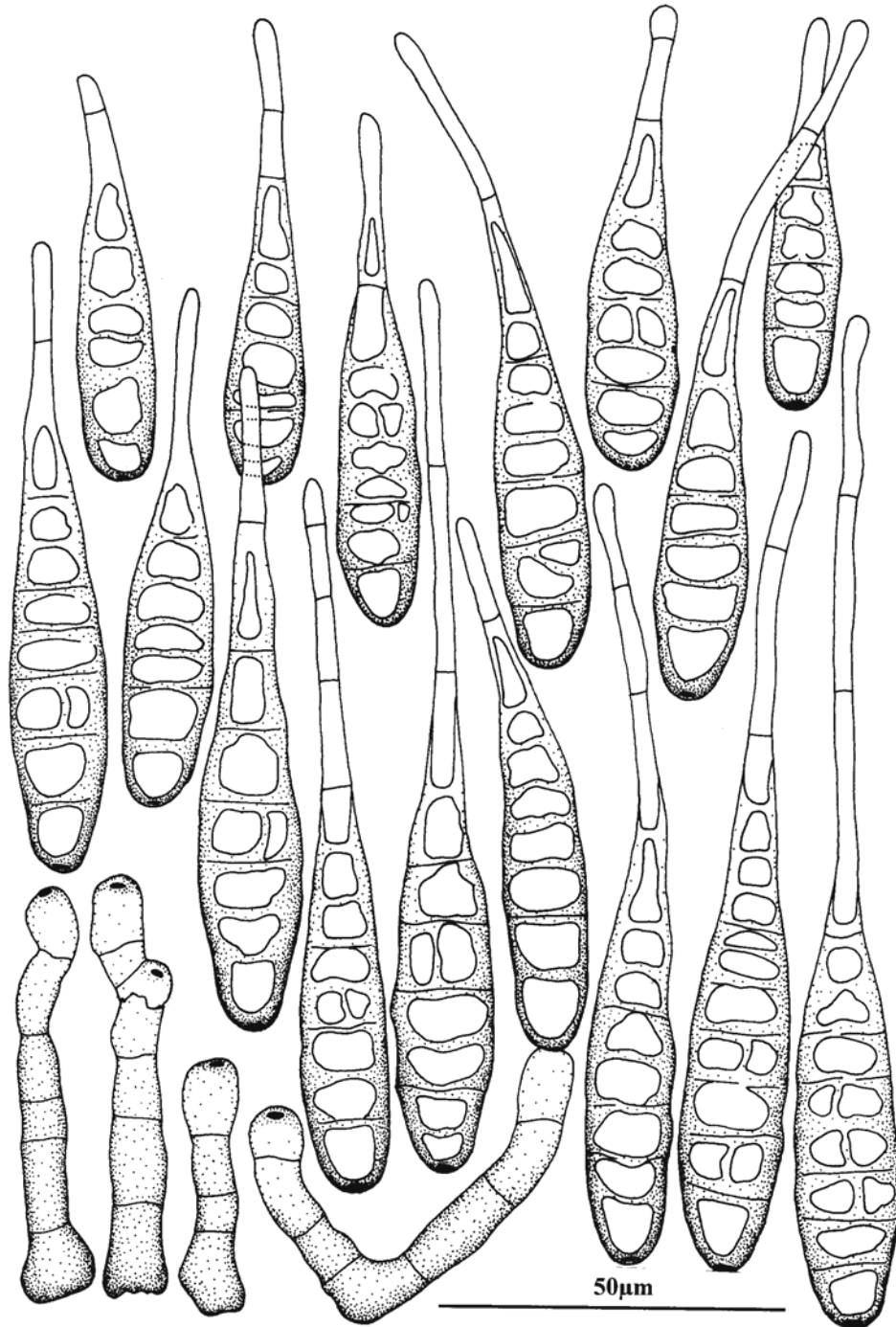
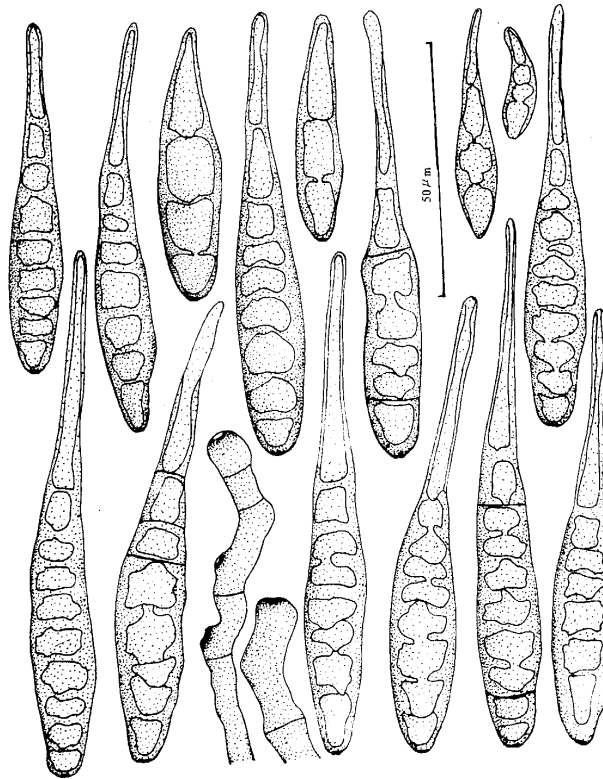


Fig. 4. Conidiophores and conidia of *Nimbya dolichi* from holotype.



**Fig. 5.** Conidiophores and conidia of *Nimbya euphorbiicola* (Chen and Zhang, 1997).

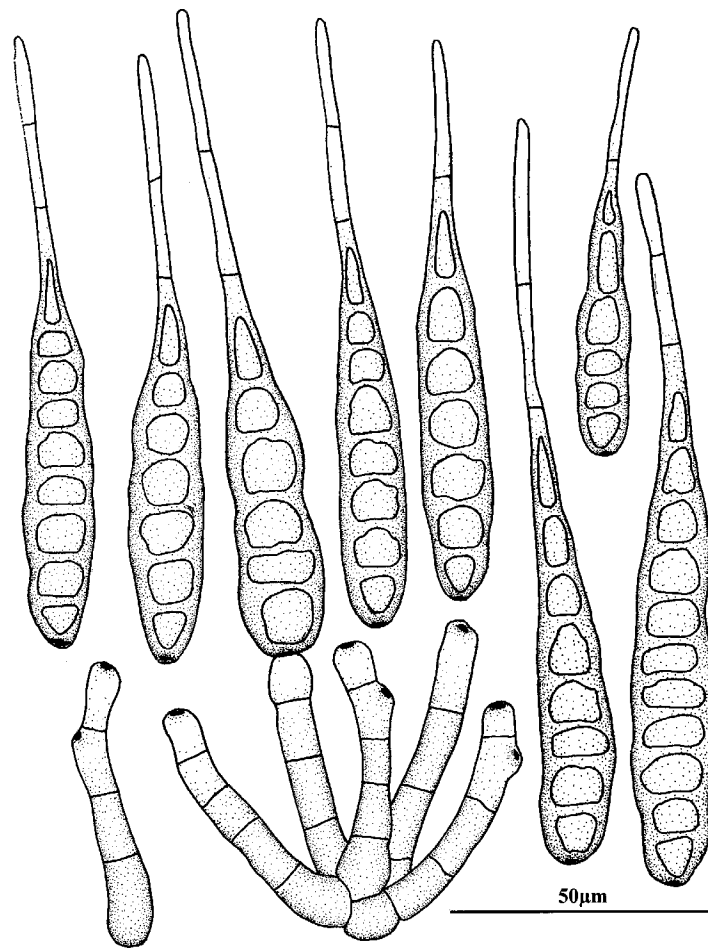
*Substrate:* On leaves of *Dolichos* sp.

*Notes:* *Nimbya dolichi* is similar to *N. dianthi* in conidium body shape and size, but its conidia are filiformly true beaked, and the pseudorostrum is seldom present. It is the first species of *Nimbya* reported on *Leguminosae*.

***Nimbya euphorbiicola*** W.Q. Chen & T.Y. Zhang, *Mycosystema*, 16: 106. 1997. (Fig. 5)

*Material examined:* CHINA, Medical Botany Garden of Nanning, Guangxi Zhuang Autonomous Region, on stems and leaves of *Euphorbia heterophylla* L., T.Y. Zhang, 20 X. 1991, no. 100361 (HMUABO 20803, holotype).

*Notes:* Conidial morphology of *N. euphorbiicola* is similar to those of *Nimbya heteroschemos* (Fautrey) E.G. Simmons and *N. gomphrenae* (Togashi) Simmons, but differs in smaller conidia (45-65 × 11-15 μm). While conidia of *N. heteroschemos* are 75-100 × 18-22 μm and those of *N. gomphrenae* are 70 - 140 × 11-15 μm. And also the three species habit on different plant families.



**Fig. 6.** Conidiophores and conidia of *Nimbya gomphrenae* from HMUABO 100353.

Simmons (1994) found three conidia of *Nimbya* sp. on *Euphorbia marginata* when he observed the slide (BPI 0445288) of the lectotype of *Macrosporium euphorbiae* (= *Alternaria euphorbiae*). But there are insufficient numbers of conidia for speculation as to its identity with other known species of *Nimbya*.

***Nimbya gomphrenae*** (Togashi) Simmons, Sydowia, 41: 314. 1989. (Fig. 6)

= *Alternaria gomphrenae* Togashi, Bull. Imp. Coll. Agr. & For. (Morioka) 9: 6. 1926.

= *Pseudocercospora gomphrenicola* Chiddarwar, Sci. & Cult. 22: 511. 1957.

*Material examined*: CHINA, Nanning, Guangxi Zhuang Autonomous Region, on *Gomphrena globosa* Limm, HMUABO 100353.

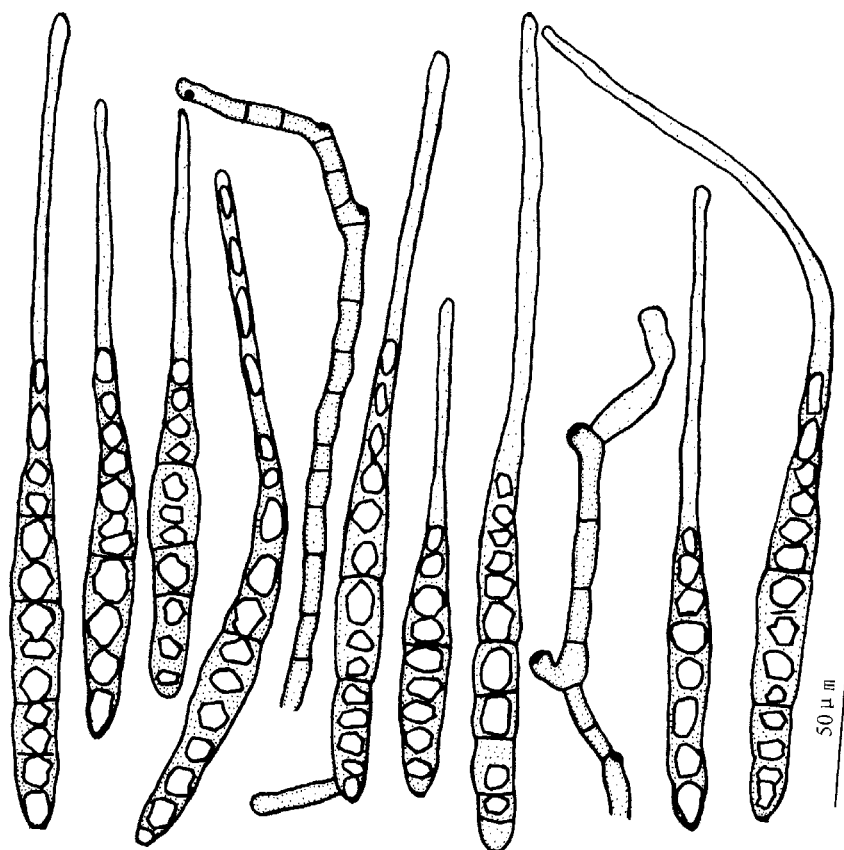


Fig. 7. Conidiophores and conidia of *Nimbya scirpicola* from HSAUP II<sub>0</sub>2524.

*Notes:* Togashi (1944) described this species from Taiwan as *Alternaria gomphrenae*, which lately was combined to *Nimbya* by Simmons (1989). That should be the first report of the species in the genus from China.

***Nimbya scirpicola*** (Fuckel) E.G. Simmons, *Sydowia* 41: 314, 1989. (Fig. 7)

= *Sporidesmium scirpicola* Fuckel, *Fungi rhenani* 78. 1863

= *Clasterosporium scirpicola* (Fuckel) Sacc., *Syll. Fung.* 4: 398. 1886.

= *Cercospora scirpicola* (Fuckel) Zind. -Bakker, *Rev. Mycol.* 5: 66. 1940.

= *Alternaria scirpicola* (Fuckel) Sivanesan, *The Bitunicate Ascomycetes*: 526. 1984.

= *Alternaria scirpicola* (Fuckel) Lucas & Webster, in Ondrej, *Cas. Slez. Muz., Ser. A., Hist. Nat.* 23: 151. 1974. (Comb. Illegit.; basionym source not cited)

*Material examined:* CHINA, Wulumuqi, the Xinjiang Uygur Autonomous Region, on culms and stalks of an unidentified dead plant of *Poaceae*, HSAUP II<sub>0</sub>2524 (ZGZ II<sub>0</sub> 224).

*Notes:* It is believed that this fungus is a parasite since some unobvious lesions were observed where the fungus was sporulating.

*Nimbya scirpicola* was described causing a leaf spot on *Scirpus* sp. (*Cyperaceae*). The fungus on Chinese specimen is very similar to the original description by Simmons (1989), but has a minor difference in conidial morphology and size. The conidiophores of the Chinese fungus are slightly narrower (5-10  $\mu\text{m}$ ) and the conidium beak is relatively thicker (5-8  $\mu\text{m}$ ) than that of the original description. However, the minor morphological difference and different host range do not provide enough evidence to support the Chinese collection as a distinguishable new species. The teleomorph, *Macrospora scirpicola* Fuckel, has been reported many times, and it is known in China from Hong Kong (Wong and Hyde, 2001).

### Key to the known species of *Nimbya*

1. Conidia thin ovoid to long ellipsoidal..... 2
1. Conidia obclavate, ellipsoidal to thin obclavate ..... 5
2. Conidia filiformly beaked, on *Compositae* ..... *Nimbya rhapsodici*
2. Conidia with column-shaped beaks ..... 3
3. Conidia longer than 80  $\mu\text{m}$  ..... 4
3. Conidia thin ovoid, shorter than 80  $\mu\text{m}$ , on *Cyperaceae* ..... *N. scirpivora*
4. Conidia 6-8  $\mu\text{m}$  diam., on *Cyperaceae* ..... *N. scirpinfestans*
4. Conidia thicker than 10  $\mu\text{m}$  diam., on *Amaranthaceae* ..... 16
5. Conidia filiformly beaked ..... 6
5. Conidia with column-shaped beaks ..... 10
6. Conidia thick obclavate, subellipsoidal or obclavate ..... 7
6. Conidia thin obclavate ..... 9
7. Conidium bodies shorter than 65  $\mu\text{m}$ , on Leguminosae ..... *N. dolichi*
7. Conidium bodies longer than 65  $\mu\text{m}$ ..... 8
8. Conidia thick obclavate, 65-90  $\times$  15-20  $\mu\text{m}$ , on *Cyperaceae* ..... *N. crassoides*
8. Conidia obclavate, 75-100  $\times$  18-22  $\mu\text{m}$ , on *Cyperaceae* ..... *N. heteroschemos*
9. Conidia long obclavate to obclavate, on *Gomphrena globosa* ..... *N. gomphrenae*
9. Conidia thin obclavate, on *Celosia cristata* ..... *N. celosiae*
10. Conidia thin obclavate to long ellipsoidal ..... 11
10. Conidia thick obclavate, ellipsoidal to obclavate..... 13

11. Conidia shorter than 90  $\mu\text{m}$  (av.), less than 10  $\mu\text{m}$  diam. (av.), on *Solanaceae* .....*N. major*  
 11. Conidia longer than 90  $\mu\text{m}$  (av.), thicker than 10  $\mu\text{m}$  diam. (av.) ..... 12
12. Conidia thicker than 15  $\mu\text{m}$  diam. (av.), with up to 11 transverse distosepta, on *Cyperaceae* ..... *N. scirpicola*  
 12. Conidia thinner than 15  $\mu\text{m}$  diam. (av.), with up to 17 transverse distosepta, on *Juncaceae* ..... *N. juncicola*
13. Conidia shorter than 85  $\mu\text{m}$  (av.) ..... 14  
 13. Conidia longer than 85  $\mu\text{m}$  (av.) ..... 15
14. Conidia ellipsoidal to broadly obclavate, spore bodies relatively large (65-95  $\times$  10-16  $\mu\text{m}$ ) .....*N. caricis*  
 14. Conidia obclavate, spore bodies relatively small (31-67  $\times$  9.5-13.5  $\mu\text{m}$ ) .....*N. dianthi*
15. Conidia obclavate or subcylindrical, with 5-8 distosepta, on *Euphorbiaceae* .....  
 .....*N. euphorbiicola*
15. Conidia ellipsoidal to obclavate, with 12-15 distosepta, on *Amaranthaceae* ..... *N. celosiae*
16. Conidia 18-20  $\mu\text{m}$  diam. ....*N. alternantherae*  
 16. Conidia 10-14  $\mu\text{m}$  diam. .... *N. perpunctulata*

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