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## A review of *Cirrenalia* (hyphomycetes) and a new species

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A new helicosporous hyphomycete, *Cirrenalia longipes*, collected from dead wood in Yunnan, China, is described and illustrated. The new species is characterized by dark-brown to black conidia with long multi-septate basal filaments, which usually separate from the conidial body. The differences with other species in *Cirrenalia* are discussed. Three species of *Cirrenalia*, *C. donnae*, *C. macrocephala* and *C. nigrospora* are new to China. Characteristics of 16 *Cirrenalia* species are tabulated.

**Key words:** *Cirrenalia donnae*, *Cirrenalia longipes*, *Cirrenalia macrocephala*, *Cirrenalia nigrospora*.

### Introduction

*Cirrenalia* was established by Meyers and Moore (1960) based on the type species *C. macrocephala*, a recombination of the marine species *Helicoma macrocephala* Kohlm. (1958). *Cirrenalia* is characterised as helicosporous, dematiaceous, with conidia strongly constricted at the septa, cells distinctly non congruent, increasing in diam. irregularly from the base to the apex, terminal cell generally conspicuously larger and darker than the subterminal cells. The initial concept of *Cirrenalia* was as a genus of marine fungi. This was emended by Kohlmeyer (1966) who extended the range of habitats. Since the first terrestrial species *Cirrenalia donnae* B. Sutton (Sutton, 1973) was added to the genus, many taxa have been described from marine and terrestrial environments.

Goos (1985) systematically dealt with the genus and discussed the 10 accepted species with provided a key. Raghu-Kumar *et al.* (1988) described the additional species *Cirrenalia basiminuta* Raghuk. & Zainal from marine habitats and amended the diagnostic characteristics of the species of *Cirrenalia* summarized by Goos (1985). In subsequent years *Cirrenalia acericola* Mel'nik

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(Mel'nik, 1988), *C. caffra* Matsush. (Matsushima, 1996) and *Cirrenalia adarca* Kohlm. (Kohlmeyer *et al.*, 1997) were added to the genus. Kohlmeyer *et al.* (1997) established the connection between *C. adarca* and its teleomorph *Juncigena adarca* Kohlm., Volkm.-Kohlm. et O.E. Erikss. by culturing ascospores to produce the anamorphic stage on seawater agar. This is the first time that a teleomorph has been connected to a member of genus *Cirrenalia*. *Cirrenalia nigrospora* Somrithipol, Chatmala et E.B.G. Jones was described from fruits and seeds in a forest in Thailand (Somrithipol *et al.*, 2002). Presently there are 15 species, including 7 marine lignicolous species and 8 terrestrial species (Tables 1, 2).

During our investigations on helicosporous hyphomycetes in China, several interesting specimens of *Cirrenalia* were collected from different localities. One of them collected from dead wood in Yunnan characterized having fuscous to black conidium with long multi-septate basal conidial filament usually separated from conidial body is different from the other species in genus. Herewith, it is described as new to science. Three other species of *Cirrenalia* new to China are noted in present paper. A synopsis of 16 species of *Cirrenalia* (including the new species) is provided (Table 2).

## Genus and species

***Cirrenalia*** Meyers & R.T. Moore, *Am. J. Bot.* 47: 346 (1960)

Type species: *Cirrenalia macrocephala* (Kohlm.) Meyers & R.T. Moore (1960)

**Table 1.** Details of *Cirrenalia* species.

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<i>C. acericola</i> Mel'nik, <i>Mikologiya i Fitopatologiya</i> 22: 496 (1988)
<i>C. adarca</i> Kohlm., Volkm.-Kohlm. & O.E. Erikss., <i>Botanica Marina</i> 40: 292 (1997)
<i>C. basiminuta</i> Raghuk. & Zainal, in Raghukumar, Zainal & Jones, <i>Mycotaxon</i> 31: 163 (1988)
<i>C. caffra</i> Matsush. [as ' <i>caffera</i> '], <i>Matsu. Mycol. Mem.</i> 9: 6 (1996)
<i>C. donnae</i> B. Sutton, <i>Mycol. Pap.</i> 132: 33 (1973)
<i>C. fusca</i> I. Schmidt, <i>Mycotaxon</i> 24: 419 (1985)
<i>C. indica</i> G.V. Rao & A.P. Reddy, <i>Indian J. Mycol. Res.</i> 16: 368 (1978)
<i>C. japonica</i> Sugiy., <i>Trans. Mycol. Soc. Japan</i> 22: 47 (1981)
<i>C. lignicola</i> P.M. Kirk, <i>Trans. Br. Mycol. Soc.</i> 77: 283 (1981)
<i>C. macrocephala</i> (Kohlm.) Meyers & R.T. Moore, <i>Am. J. Bot.</i> 47: 347 (1960)
≡ <i>Helicoma macrocephala</i> Kohlm., <i>Ber. Bayer. Bot. Ges.</i> 71: 99 (1958)
<i>C. nigrospora</i> Somrithipol, Chatmala et E.B.G. Jones, <i>Nova Hedwigia</i> 75: 477 (2002)
<i>C. palmicola</i> Matsush., <i>Matsu. Mycol. Mem.</i> 1: 17 (1980)
<i>C. pseudomacrocephala</i> Kohlm., <i>Mycologia</i> 60: 266 (1968)
<i>C. pygmaea</i> Kohlm., <i>Ber. Bayer. Bot. Ges.</i> 79: 35 (1966)
<i>C. tropicalis</i> Kohlm., <i>Mycologia</i> 60: 267 (1968)

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Table 2. Synopsis of *Cirrenalia* species.

Species/ habitat	Conidiophore size ( $\mu\text{m}$ )	Conidia morphology				
		Color	Coiling	Size ( $\mu\text{m}$ )	Septation	Diam. of filament ( $\mu\text{m}$ )
<b>Marine species</b>						
<i>C. adarca</i>	-	Pale to dark brown	Irregular	12-25	4-9	4-12
<i>C. basiminuta</i>	8.2-28 $\times$ 1.4-2.5	Light brown	$\frac{1}{4}$ -1	29-41 $\times$ 18-34	3-5	9-14
<i>C. fusca</i>	-33 $\times$ 2	Brown to dark brown	1 $\frac{1}{2}$	20-36 $\times$ 20-30	2-4	11-22.5
<i>C. macrocephala</i>	3.5-25 $\times$ 2-5	Bright reddish brown	$\frac{1}{4}$ -1	20-25	2-7	10-15
<i>C. pseudomacrocephala</i>	23-30 $\times$ 3-5	Fuscous to grey brown	$\frac{1}{4}$	27-38	3-6	16-20
<i>C. pygmaea</i>	-	Black	$\frac{1}{2}$ -1	25-31 $\times$ 28-34	3-4	16-23
<i>C. tropicalis</i>	25-42 $\times$ 2.5-5	Light reddish brown	1-1 $\frac{1}{2}$	30-38	6-12	9-12
<b>Terrestrial species</b>						
<i>C. acericola</i>	6-8 $\times$ 30	Dark brown	$\frac{1}{2}$	24-27	3-5	12-15
<i>C. caffra</i>	-	Pale brown to brown	$\frac{1}{2}$ -1 $\frac{1}{2}$	10-22	3-8	5.0-7.5
<i>C. donnae</i>	-35 $\times$ 3-6	Reddish brown	1	20-25.5	7-11	10
<i>C. indica</i>	6-9 $\times$ 3-6	Pale to dark brown	$\frac{1}{4}$ - $\frac{1}{2}$	10-18	-	10-15
<i>C. japonica</i>	-63 $\times$ 2.5-6	Reddish brown	$\frac{1}{2}$ -1	18-28	4-9	12-20
<i>C. lignicola</i>	- $\times$ 2	Olivaceous brown	1 $\frac{1}{2}$ -2	15-20	Up to 12	5-6
<i>C. nigrospora</i>	- $\times$ 5-5.5	Black	1	50-75	7-11	10-20
<i>C. palmicola</i>	- $\times$ 1-2.5	Dark brown	1-3	40-100 $\times$ 5-8	10-30	5-8
<i>C. longipes</i>	- $\times$ 4-6	Dark brown to black	1 $\frac{1}{2}$ -2 $\frac{1}{2}$	50-75	Up to 35	6-15.5

***Cirrenalia longipes* G.Z. Zhao & X.Z. Liu, sp. nov.** (Fig. 1)

*Etymology:* *longipes*, referring to the long basal cells of conidial filament.

Coloniae in substrato naturali nigrae, granulosae, inconspicuae, constantes e sporodochiis arcte aggregates, sub lente sporodochia singula sparsa brunnea visibilia. Mycelium sparsum, pro maxima parte submersum. Conidiophora brevia, simplicia vel obsoleta, non ramosa, erecta, recta vel flexuosa, pallide brunnea vel brunnea, septata, laevia, 4-6  $\mu\text{m}$  lata. Cellulae conidiogenae monoblasticae, in conidiophoris incorporatae, terminalis, determinatae. Conidia acrogena, solitaria, sicca, helicoidea, laevia. Conidia juvenuta, rufobrunnea cum cellula basali pallide brunnea, 4-7-septata, in 1 vel 1.5 spiris convoluta, apex obtusus; filum ad apice 26  $\mu\text{m}$  crassum, basim versus decrescens, 121  $\times$  2.5-4  $\mu\text{m}$ . Conidia arcte 1½-2½ ad semel contorta ad maturitatem, atrobrunnea, 50-75  $\mu\text{m}$  diam., ad 35-septa, non vel leniter constricta, ad apicem obtuse; filum ad partem latissimam (vel ad apicem), 6-15.5  $\mu\text{m}$  crassum, basim versus decrescens, ad septa constricta,

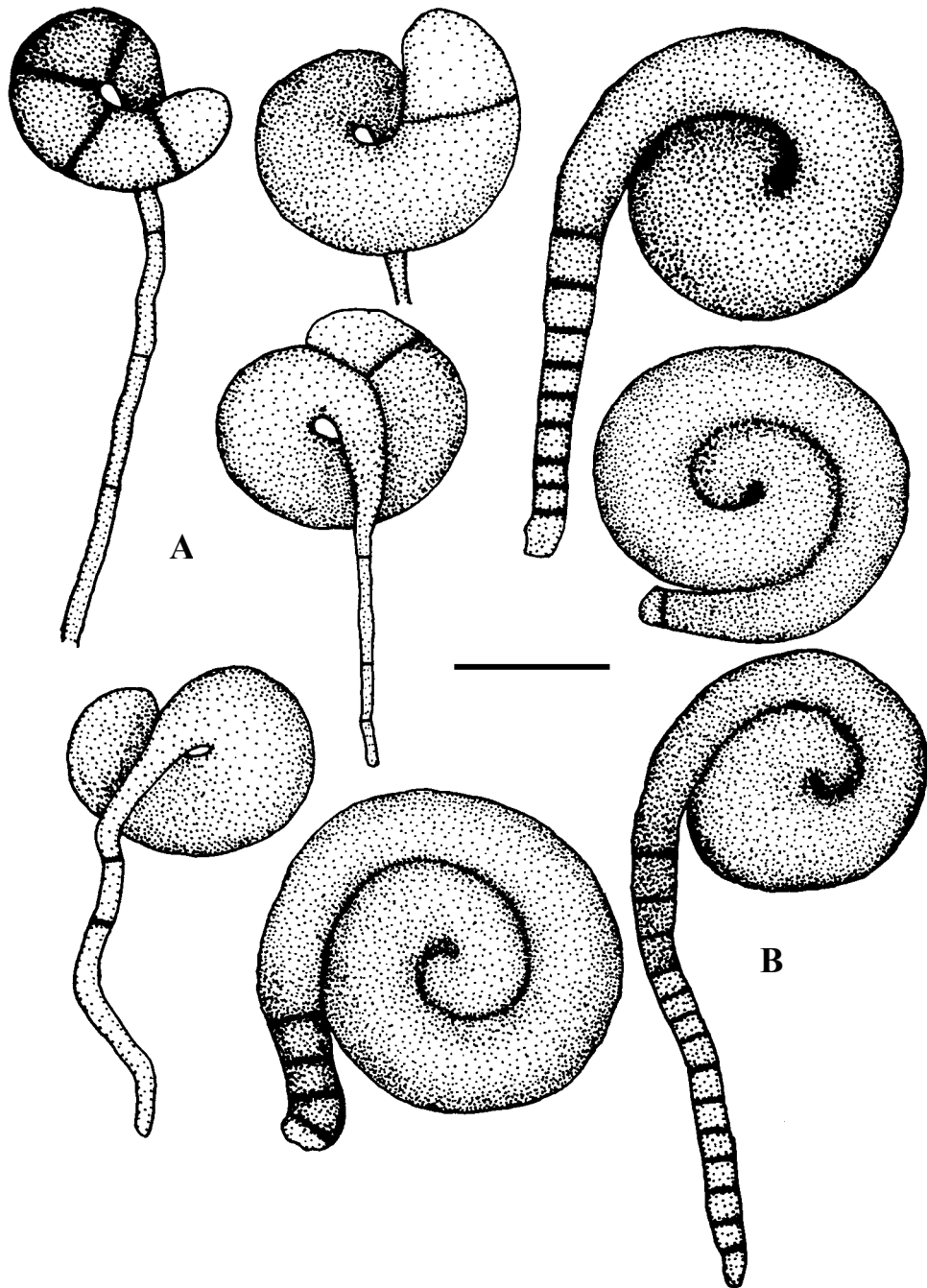
**Holotypus:** in lingo emortuo arboris ignotae, in Monte Gaoligongshan, Tongbiguan, Yunnan Provincia Sinica, 20 October 2003, G.Z. Zhao, HMAS 88754 (= ZGZII<sub>03</sub>218).

*Colonies* on natural substrate black, granular, inconspicuous, consisting of groups of sporodochia. Under the stereomicroscope, individually scattered, superficial, brown sporodochia are visible. Mycelium was scanty, mostly immersed. *Conidiophores* short, simple, unbranched, erect, straight or flexuous, pale-brown to brown, smooth, 4-6  $\mu\text{m}$  late. *Conidiogenous cells* monoblastic, integrated, terminal, determinate. *Conidia* acrogenous, solitary, dry, helicoid, smooth-walled. Immature conidia reddish brown, mostly coiled 1-1.5 times; width of filament distinguished increasing from base to apex, up to 26  $\mu\text{m}$  at the broadest part, septa 4-7, apex obtuse; basal parts long tapering, usually kept separated from the conidium body, 121  $\mu\text{m}$  long and 2.5-4  $\mu\text{m}$  wide at the widest part. Mature conidia gradually becoming fuscous to black, septa usually opaque, up to 35, spiraled diam. 50-75  $\mu\text{m}$ , width of filament usually slightly increasing from base to apex, unlike those in immature conidia, 6-15.5  $\mu\text{m}$  wide, coiled 1½-2½ times, basal cells brown, markedly constricted at the septa, conidia usually with the long basal conidial filament which kept separating from the body.

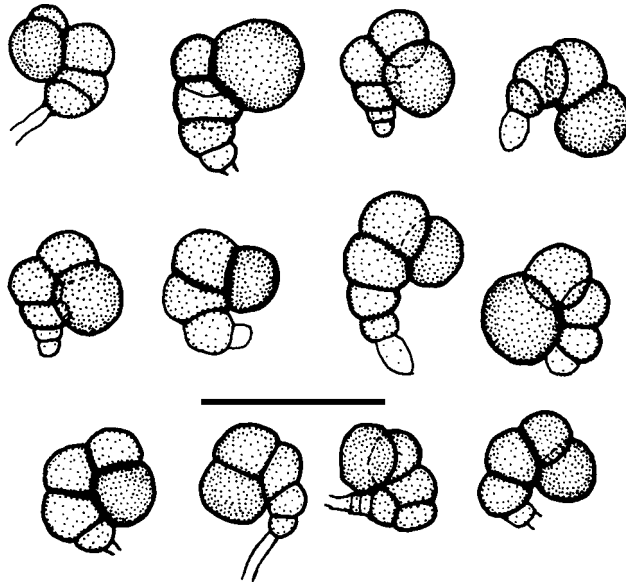
*Notes:* Long basal conidial filament of *C. longipes* with obviously separation from conidial body presents a characteristic, which distinct differed from those of marine and some terrestrial species. Of all the accepted species, *C. longipes* resembles *C. nigrospora* and *C. donnae*, but differs from *C. nigrospora* by which has tightly and regularly coiled conidia with larger intermediate cells and from *C. donnae* by which has short basal part cells of conidial filament.

***Cirrenalia macrocephala* (Kohlm.) Meyers & Moore, Am. J. Bot. 47: 347 (1960).** (Fig. 2)

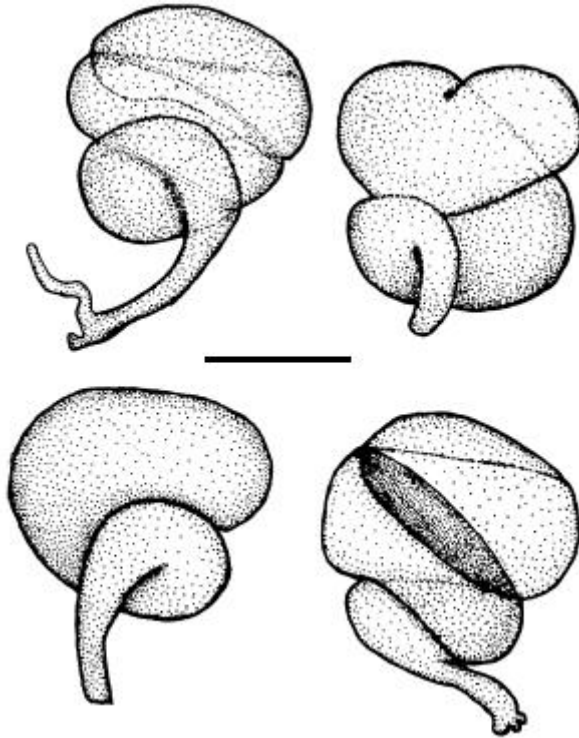
*Colonies* on natural substrate, effuse, disperse and black. *Mycelium* is mostly immersed and partly superficial; hyphae 3-5  $\mu\text{m}$  in diam., septate,



**Fig. 1.** *Cirrenalia longipes* (from holotype). Conidiophores and conidia on natural substrate. **A.** Immature conidia. **B.** Mature conidia. Bar = 25  $\mu$ m.



**Fig. 2.** *Cirrenalia macrocephala* (from HYM022). Conidiophores and conidia on natural substrate. Bar = 25  $\mu$ m.



**Fig. 3.** *Cirrenalia nigrospora* (from HMAS 86270). Conidiophores and conidia on natural substrate. Bar = 25  $\mu$ m.

hyaline to pale brown. *Conidiophores* narrow, micronematous, pale, terminal, integrated, monoblastic and determinate,  $10-20.5 \times 2.5-4.5 \mu\text{m}$ . *Conidiogenous cells* monoblastic, integrated, terminal, determinate. *Conidia* solitary, helicoids, semi-contorted, mostly coiled 0.75-1 times, 19-34.5  $\mu\text{m}$  in diam., 3-4 (5) septate, constricted at the septa, bright reddish brown; cells increase in size and pigments from base to apex: apical cell conspicuously swollen, subglobose, darker than the others, 10-17.5  $\mu\text{m}$ ; basal cell cylindrical and tapering, 4.5-11  $\mu\text{m}$  long and 3-7.5  $\mu\text{m}$  wide at the widest part.

On wood exposed to seawater, occurs in Haiyang coastal water, Shandong Province, China, May 20, 2003, Coll. Jinjing. HYM022 (permanent-slide) was preserved in HMAS.

This fungus shows typical characteristics of marine habitat and conidial morphology of *C. macrocephala*. It is easily to assign to *C. macrocephala*. A closely similar species *C. pseudomacrocephala* can be distinguished this species by fuscous to grey brown conidia, and by sizes of terminal cells (16-20  $\mu\text{m}$  in diam.) and sizes of conidiophore ( $23-30 \times 3-5 \mu\text{m}$ ).

***Cirrenalia nigrospora*** Somrithipol, Chatmala & E.B.G. Jones, Nova Hedwigia 75: 477-485 (2002). (Fig. 3)

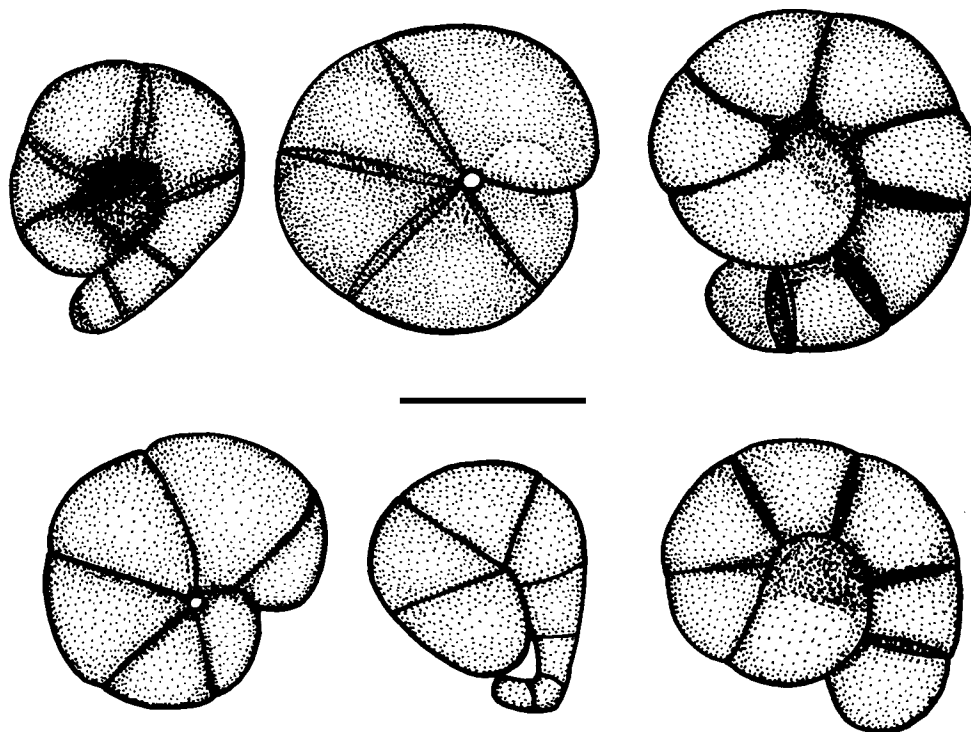
On natural substrate, conidiophores and conidia aggregated into punctiform sporodochia, dispersed, black, granular. *Mycelium* is partly superficial and partly immersed; hyphae 3-4  $\mu\text{m}$  wide, septate, brown. *Conidiophores* micronematous or semi-macronematous, 4.5-5.5  $\mu\text{m}$  wide, simple, acrogenous or arising laterally on hyphae, light brown. *Conidiogenous cells* monoblastic, integrated, terminal, determinate. *Conidia* acrogenous, solitary, dry, helicoids, mostly 1-3 times contorted, 8-12 septa, not constricted at the septa, black; cells increasing in diam. from base to apex, distinctly dissimilar; spiral 55-75  $\mu\text{m}$  diam.; terminal cell 10-18  $\mu\text{m}$  high, 6-12  $\mu\text{m}$  diam., cylindrical; central cells obtusely conical or doliiform.

Pure culture grows slowly, reaching 0.5-1 cm diam. in 20 days at 25°C on PDA. Colony on PDA effuse, gray, brown or dark brown, hairy or velvety, round, conidia richness. Conidia brown to dark brown, other conidial morphology is similar to those on natural substrate.

On dead fallen branches of undetermined tree, Dinghushan mountain, Zhaoqing, Guangdong Province, China. December 9, 2003, Coll. G.Z. Zhao, HMAS 86270 (= ZGZII<sub>03</sub>177).

***Cirrenalia donnae*** B. Sutton, Mycol. Pap. 132: 33 (1973). (Fig. 4)

On natural substrate, sporodochia formed, scattered, punctiform, dark brown, tightly, shiny, up to 0.1-0.8 mm. Mycelium mostly immersed and partly superficial. Conidiophores micronematous or semi-macronematous, brown.



**Fig. 4.** *Cirrenalia donnae* (from HMAS 88753). Conidia on natural substrate. Bar = 25  $\mu\text{m}$ .

Conidia acrogenous, solitary, dry, helicoid, 39-62  $\mu\text{m}$  diam., dark brown to black, mostly coiled 1-1.5 times, 4-11 but mostly 5 septa, mature conidia septa thick and very dark, constricted at the septa, smooth, filament 15-22  $\mu\text{m}$  thick at the broadest part; immature conidia brown, septa non-constricted, cells increasing in diam. from base to apex, basal cell conical truncate.

On decaying branches of unidentified tree, Gaoligongshan mountain, Tongbiguan, Yunnan Province, China, 20 October 2003, Coll. G.Z. Zhao, HMAS 88753 (= ZGZII<sub>03</sub>231).

The Chinese collection has distinct larger conidia than those original descriptions (20-25.5  $\mu\text{m}$  in diam.) of *Cirrenalia donnae* (Sutton, 1973). However, there are no obviously differences of other morphological characteristics between those two species. Only the difference of conidium size do not support that the Chinese specimen represents a distinguishable species.

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