



## Ingoldian fungi from semiarid Caatinga biome of Brazil. The genus *Campylospora*

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### Abstract

All three species of the genus *Campylospora* (*C. chaetocladia*, *C. filicladia* and *C. parvula*) were found in foam samples collected in water bodies of three areas in the semiarid region, northeast Brazil. *Campylospora filicladia* is a new record for Brazil. Descriptions, comments, geographical distribution, illustrations and a key to the genus is provided.

**Key words** – anamorphic fungi – hyphomycetes – lotic environment – taxonomy – tropical

### Introduction

*Campylospora* Ranzoni was established in 1953. The type species, *C. chaetocladia* Ranzoni, is characterized by simple, small, conidiophores with monoblastic conidiogenous cells, and staurosporous asymmetric conidia, consisting of a basal cell (deltoid) and a lateral cell (allantoid), both with two diverging branches at each end (Ranzoni 1953, Nawawi 1974). *Campylospora chaetocladia* has been found in water bodies in many parts of the world including Africa (Ingold 1956, 1958, Dixon 1959), Central America (Santos-Flores & Betancourt-López 1997), North America (Crane 1968), South America (Cressa & Smits 2007), Asia (Nemade et al. 2010), Europe (Nilsson 1964) and Oceania (Regelsberger & Messner 1987).

The second species, *C. parvula* Kuzuha was described on submerged leaves in Tokyo, Japan (Kuzuha 1973). This species has the smallest branches of the genus. According to Kuzuha (1973), the material reported by Ingold & Ellis (1952) is similar to *C. parvula*. *Campylospora filicladia* Nawawi, proposed in 1974, has the thinnest branches in the genus (Nawawi 1974).

Conidia of *Campylospora* have been reported in many parts of the world (Chauvet 1991, Santos-Flores & Betancourt-López 1997). The genus is usually found in water (Fabre 1998), submerged leaves (Ranzoni 1953, Nawawi 1974, Kane et al. 2002) and foam (Santos-Flores & Betancourt-López 1997). *Campylospora parvula* was reported as endophytic in roots of *Lyonia ovalifolia* (Sati & Belwal 2005) and *Alnus glutinosa* (Fisher & Petrini 1989), while *C. chaetocladia* was found as an endophyte in *Murraya koenigii* (Sati & Belwal 2005).

Although the genus is frequently found, full characterization and description of new species is reserved only for the species isolated in pure culture. Some similar conidia of *Campylospora* were collected by Ingold & Ellis (1952) and Ingold (1959), however, these authors only indicate the possibility of new species, since the fungi were not isolated in pure culture. Thus, the diversity of Ingoldian fungi, and particularly *Campylospora*, may be underestimated.

## Methods

The material described in this study was derived from foam samples collected in water bodies of three areas in the semiarid Caatinga biome in the northeast of Brazil. These areas are considered of high biological importance (Velloso et al. 2002), and are located at Chapada do Araripe and Serra de Ibiapaba from Ceará state and Brejo Paraibano from Paraíba state. For observation of Ingoldian fungi, the technique proposed by Descals (2005) was applied. The foam samples were collected and packaged in plastic bottles of 250 mL and adding 5-10 mL of alcohol (70%). The material collected was homogenized and 0.2 mL of each sample was transferred to slides. The slides were exposed at room temperature to complete evaporation. A drop of lactic acid was added to the slides and then a cover slip which was sealed with nail polish. The identification was made from the observation of micro morphological characters of conidia and compared with specific literature. The illustrations were made by camera lucida coupled to an Olympus BX-51 microscope. The materials were deposited in the Herbarium of the State University of Feira de Santana (HUEFS).

## Results

All of the three described *Campylospora* spp., *C. chaetocladia*, *C. filicladia* and *C. parvula*, were found in Brazil along with a fourth species that is not determined to species.

***Campylospora*** Ranzoni, Farlowia 4: 373, 1953.

Conidia tetra- or polyradiate, hyaline, composed of two parts, deltoid and allantoid; both with two diverging branches at the ends; schyzolitic secession.

***Campylospora chaetocladia*** Ranzoni, Farlowia 4: 373, 1953.

Figs 1–2

Conidia tetra- or polyradiate, hyaline, composed of two parts, deltoid and allantoid; both with two diverging branches at the ends; deltoid with 3–4 cells, 6–9 × 12–15 µm; allantoid with 3–4 cells, 10.5–16.5 × 3–6 µm; basal cells truncated; apical cells of both parts are triangular to pyramidal; branches with tapered apex, 0-septate, 30–50 × 1.5–3 µm.

Material examined – BRAZIL. Ceará: Missão Velha, Chapada do Araripe, River Missão Velha, in foam, 2 Aug 2011, *P.O. Fiuza* (HUEFS 141553); BRAZIL. Paraíba: Alagoa Grande, Brejo Paraibano, River Pitombeira, in foam, 16 Dec 2011, *P.O. Fiuza* (HUEFS 141557); BRAZIL. Ceará: Ubajara, Serra de Ibiapaba, Stream Gameleira, in foam, 15 Jun 2012, *P.O. Fiuza* (HUEFS 141558).

Geographical distribution – Cosmopolitan.

*Campylospora chaetocladia* differs from other species by having larger branches (35–50 × 3–5 µm) and the apical cells of conidia are triangular to pyramidal (Ranzoni 1953). The characteristics and dimensions of the collected material are in agreement with those mentioned by Ranzoni (1953), except for the branches, which are narrower. The conidia found in Brejo Paraibano, had crossed apical branches (Fig. 1), which usually occurs in *C. filicladia*. Ingold & Cox (1957) studying *C. chaetocladia* and *Tripospermum myrti* (Lind) S. Hughes in pure culture, noted that the two genera have a similar development of conidia. These authors considered the possibility of transferring *Campylospora* to *Tripospermum*. *Campylospora chaetocladia* has been found on every continent. It is frequently recorded in subtropical to tropical waters, which is corroborated by Chauvet (1991), who recorded the species prefers waters with a temperature ≥ 16 ° C. In South America, *C. chaetocladia* was recorded in Venezuela by Cressa & Smits (2007) and Brazil in São Paulo by Schoenlein-Crusius & Milanez (1990) and Schoenlein-Crusius (2002), and Minas Gerais by Rosa et al. (2009). This is the first record in Brazilian semiarid.

***Campylospora filicladia*** Nawawi, Trans. Br. mycol. Soc. 63(3): 604, 1974.

Fig. 3

Conidia tetra- or polyradiate, hyaline, composed of two parts, deltoid and allantoid; both with 4 cells and two diverging hair like branches at the ends; deltoid, 6–9 × 10.5–13.5 µm; allantoid 10.5–13.5

× 4.5–6 µm; basal cells truncated; apical cells of both parts rounded; branches with tapered apex, 0-septate, 16.5–25.5 × 0.5–0.7 µm; apical branches crossed.

Material examined – BRAZIL. Ceará: Ubajara, Serra de Ibiapaba, River Minas, in foam, 18 Jul 2012, *P.O. Fiuza* (HUEFS 141559).

Geographical distribution – Australia (Matsushima 1989); China (Chan et al. 2000); India (Sridhar & Kaveriappa 1992, Ravijara et al. 1998); France (Fabre 1998); Malaysia (Nawawi 1974); Puerto Rico (Santos-Flores & Betancourt-López 1994, 1997); New Zealand (Aimer & Segedin 1985); Taiwan (Matsushima 1980); Venezuela (Castañeda-Ruiz et al. 2003, Silva & Briedis 2009, 2011).

*Campylospora filicladia* is characterized by the rounded apex of apical cell and the thinnest branches in the genus (Nawawi 1974). The characteristics and dimensions are in accordance with Nawawi (1974), except for the wide of the branches (0.5–0.7 µm). *Campylospora filicladia* is generally observed with the apical branches crossed (Nawawi 1974, Santos-Flores & Betancourt-López 1997). Santos-Flores & Betancourt-López (1997) provided an identification key for the genus, using the crossing branches as an important step, however, after observation of various materials, we believe it is not a diagnostic feature for the species. *Campylospora filicladia* was recorded on decaying leaves of *Canna generalis* and litter by Matsushima (1980, 1989). This is the first record for Brazil.

***Campylospora parvula*** Kuzuha, J. Jap. Bot. 48 (7): 220, 1973.

Fig. 4

Conidia tetra- or polyradial, hyaline, composed of two parts, deltoid and allantoid; both with 4 cells and two diverging setose branches at the ends; deltoid, 8–12 × 13.5–15 µm; allantoid 12–13.5 × 4.5–6 µm; basal cells truncated; apical cells of both parts pyramidal; branches 0-septate, 4.5–6 × 1.5 µm.

Material examined – BRAZIL. Ceará: Ubajara, Serra de Ibiapaba, Stream Gameleira, in foam, 27 Jul 2012, *P.O. Fiuza* (HUEFS 141558).

Geographical distribution – Africa (Chen et al. 2000); Austria (Voglmayr 1996); Brazil (Schoenlein-Crusius & Grandi 2003); Canada (Barlocher 1987); England (Ingold 1974, 1975, Fisher & Petrini 1989); France (Wood-Eggenschwiler & Barlocher 1983); Germany (Wood-Eggenschwiler & Barlocher 1983); India (Sridhar & Kaveriappa 1992, Ravijara et al. 1998, Sati & Belwal 2005, Sati & Arya 2009); Ireland (Harrington 1997); Japan (Kuzuha 1973); Peru (Matsushima 1993); Puerto Rico (Betancourt et al. 1987, Santos-Flores & Betancourt-López 1994, 1997); Sweden (Nilsson 1964); Switzerland (Wood-Eggenschwiler & Barlocher 1983); Taiwan (Matsushima 1980); Venezuela (Silva & Briedis 2009, 2011).

*Campylospora parvula* has the smallest branches of the genus. The characteristics and dimensions agree with the literature (Kuzuha 1973), although the branches are smaller. According to Nawawi (1974), the finger-shaped branch on the conidia was not mentioned in the description or shown in the drawing of Kuzuha (1973). Ingold (1974) observed conidia in foam very similar to those found by Kuzuha (1973) and pointed out that the author of the species would not have observed the finger-shaped branch and registered it as an appendix. *Campylospora parvula* was found by Matsushima (1980) in leaves of *Canna generalis*. Later, Fisher & Petrini (1989) observed the species as endophytic in roots of *Alnus glutinosa*. *Campylospora parvula* was observed in Brazil, São Paulo (Schoenlein-Crusius & Grandi 2003). This is the first record from Brazilian semiarid.

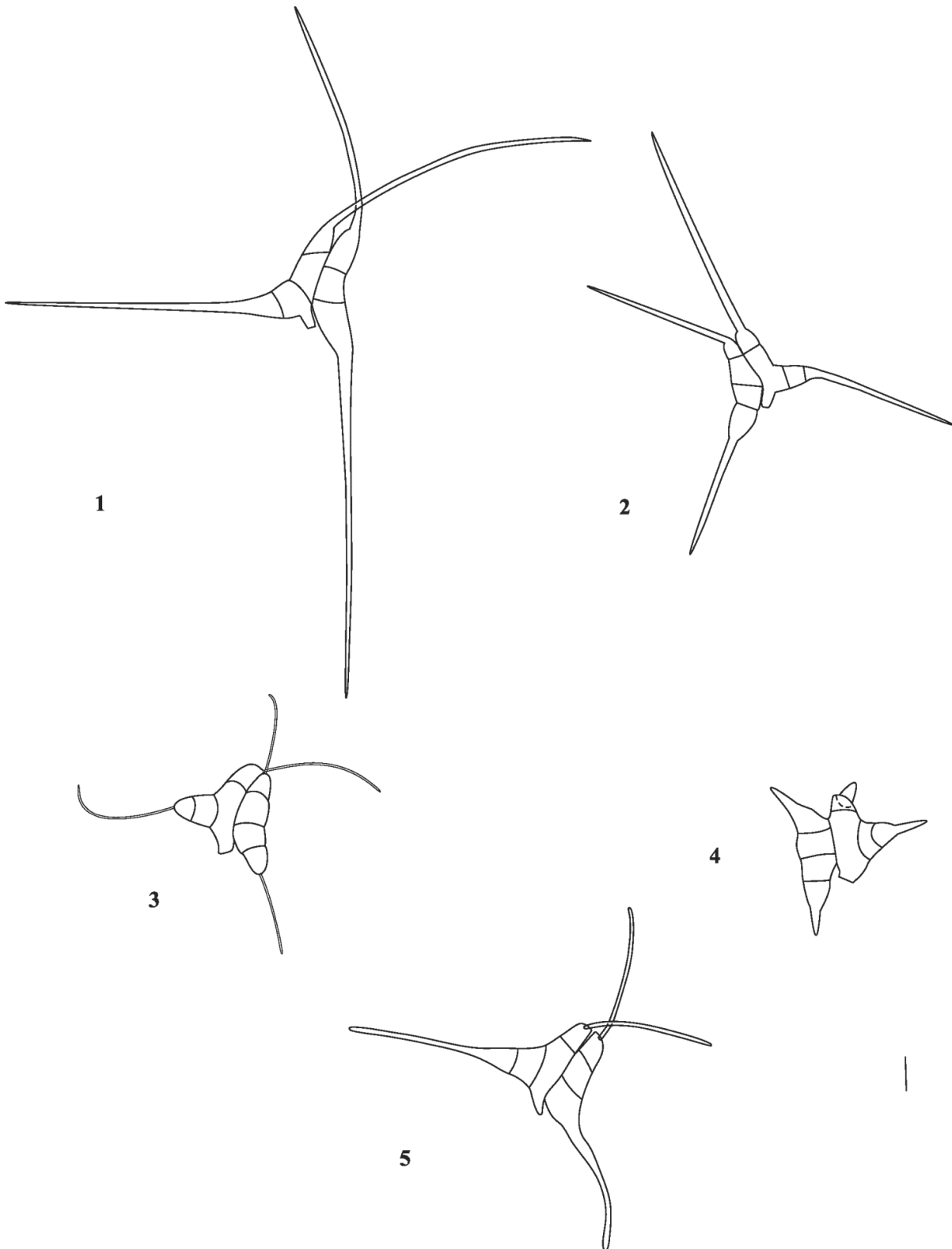
***Campylospora* sp.**

Fig. 5

Conidia tetra- or polyradial, hyaline, composed of two parts, deltoid and allantoid, both with two diverging branches at the ends; deltoid triangular to pyramidal with 4 cells, 7.5–9 × 13.5–15 µm; allantoid with 3 cells, 12–13.5 × 3–4.5 µm; basal cells with ends rounded; apical cells of both parts rounded; branches 0-septate, 18–20 × 1–2 µm.

Material examined – BRAZIL. Ceará: Ubajara, Serra de Ibiapaba, River Minas, in foam, 28 May 2012, *P.O. Fiuza* (HUEFS 141559).

The conidia of this species are similar to those of *C. filicladia* in dimensions of allantoids, deltoid and apical cells rounded. However, these conidia have branches that are wider than those of *C. filicladia*, being, for this feature, closer to *C. chaetoclada*. This taxon differs from other species of *Campylospora* in having basal cells with a rounded base. Unfortunately, these conidia were not isolated and grown in pure culture, and thus it is impossible to clarify it as a new species.



**Figs 1–5** – Conidia of *Campylospora* spp. 1, 2 *C. chaetoclada*. 3 *C. filicladia*. 4 *C. parvula*. 5 *Campylospora* sp. – Bar = 5  $\mu$ m.

## Key to species of *Campylospora*

- 1a. Conidia basal cells truncated ..... 2  
1b. Conidia basal cells rounded.....*Campylospora* sp.  
2a. Conidia branches less than 15 µm long.....*C. parvula*  
2b. Conidia branches more than 15 µm long ..... 3  
3a. Conidia branches less than 1 µm wide.....*C. filicladia*  
3b. Conidia branches more than 1 µm wide.....*C. chaetocladia*

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