

# The mycoparasitism of *Platygløea bispora*\*

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*Summary.* *Platygløea bispora* Hauerslev, an auricularioid heterobasidiomycete, parasitises species of the genus *Tubulicrinis* Donk. The parasite grows intrahyemially in host fructifications and lacks basidiocarps. Colacosomes are responsible for the host-parasite interaction. Presence of colacosomes and lack of basidiocarps justify the transfer of *P. bispora* into the genus *Colacogloea* Oberw. & Bandoni.

## INTRODUCTION

Quite an intensive and successful search for inconspicuous, intrahyemial, heterobasidiomycetous mycoparasites has been undertaken during the past few decades. Several previously unknown auricularioid and tremelloid taxa have been discovered. In classifying the simple-pored, auricularioid mycoparasites, it turned out that they are heterogeneous according to their host-parasite-interactions. Obviously, these interactive structures are of considerable systematic importance. *Occultifur internus* (L. S. Olive) Oberw., growing internally in basidiocarps of species of the *Dacrymycetales*, has haustoria (Oberwinkler 1990) which appear morphologically similar to those of species of the *Tremellales*. Tremelloid haustoria also occur in species of *Spiculogloea* P. Roberts (Roberts 1996, 1997). A surprising discovery was the mycoparasitic interaction through colacosomes (Bauer & Oberwinkler 1991) in *Platygløea peniophorae* Bourdot & Galzin. As a result of this, a comparative restudy of *Platygløea* J. Schröt. species led to the proposal of the new genus *Colacogloea* Oberw. & Bandoni (Oberwinkler *et al.* 1990a).

*Platygløea bispora* was described from a single collection from Denmark (Hauerslev 1987), growing on *Tubulicrinis angustus* (D. P. Rogers & Weresub) Donk (*Corticaceae*). A rediscovery of the species in Taiwan provided adequate material for an ultrastructural investigation of the host-parasite interaction.

## MATERIAL AND METHODS

For the description and illustrations in this contribution, the following specimen was examined: *Platygløea bispora* Hauerslev, Taiwan, An-Ma-San near Ta-Shue-San, c. 2000 m, 30 March 1989, leg. F. Oberwinkler, G. Wagner, & E. Langer FO 40934. Living and untreated material, as well as herbarium material, of different developmental stages was studied with a Zeiss photoscope III, using phase optics and Nomarski

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interference contrast optics. For transmission electron microscopy samples were fixed in 2% glutaraldehyde in 0.1 M sodium cacodylate buffer at pH 7.2 overnight or during several days. Following six transfers in 0.1 M sodium cacodylate buffer, the material was postfixed in 1% osmium tetroxide in the same buffer for 2 hours in the dark, washed in distilled water, and stained in 1% uranyl acetate solution for 1 hour in the dark. After 5 washes in distilled water, the material was dehydrated in acetone, using 10 minute changes at 25%, 50%, 70%, 95%, and  $3 \times 100\%$  acetone. The material was embedded in Spurr's (1969) plastic. Series of sections were cut on a Reichert ultramicrotome using a diamond knife and, after mounting on Formvar-coated single slot copper grids, stained with lead citrate (Reynolds 1963) at room temperature for 3 to 5 minutes, and washed again with water. The thin sections were examined at 80 kV with a Zeiss EM 109 transmission electron microscope.

### RESULTS AND DISCUSSION

*Platygløea bispora*, a mycoparasite of *Tubulicrinis* species, is well characterised morphologically by thin-walled, clamped and scattered hyphae, 1 – 2.5  $\mu\text{m}$  in diameter. The parasite grows internally and on the surface of host fructifications without producing basidiocarps. Globose to subglobose, ampulla-like hyphal swellings, 8 – 10  $\mu\text{m}$  in diameter, have botryose contents (Figs. 1A, 2A, B), which could be identified as aggregations of colacosomes (Figs. 2A – D, 3 A– C). Such bodies have been described as unique structures of cellular host-parasite interactions in *Colacogloea peniophorae* (Bourdot & Galzin) Oberw. & Bandoni (Oberwinkler *et al.* 1990a, Bauer & Oberwinkler 1991). They represent distinct vesicular bodies with electron dense cores and electron transparent marginal regions. The vesicular content of each colacosome projects through the cell wall of the parasite and then interacts with the cell wall of the host (Fig. 3B, C). The genus *Colacogloea* (Oberwinkler *et al.* 1990a) was proposed to accommodate the single species *C. peniophorae* which deviates markedly from *Platygløea disciformis* (Fr.) Neuhoff, the type species of *Platygløea*. Martin (1940) and Bandoni (1956) reported and illustrated galls caused by *C. peniophorae*, but were unable to clarify structural and functional details. These structures are agglomerations of colacosomes. Because of the identical ultrastructural features of the host-parasite-interaction in *Colacogloea peniophorae* and *Platygløea bispora*, the latter is here transferred to the genus *Colacogloea*.

***Colacogloea bispora* (Hauerslev) Oberw. & Bauer comb. nov.**

Basionym: *Platygløea bispora* Hauerslev, Friesia 11: 331 (1987).

The taxonomy of *Platygløea* and *Colacogloea* species remains inadequately investigated. In *C. peniophorae* the arrangement of colacosomes varies in collections from Europe and North America. The latter have the botryose clusters of colacosomes in gall-like hyphal swellings. European material appears to be devoid of galls, the colacosomes being located in those parts of the parasite hyphae which attach to the host cells (Oberwinkler *et al.* 1990a, Bauer & Oberwinkler 1991).

*Colacogloea bispora* exhibits the botryose arrangement of colacosomes in the material from Taiwan. No galls and no specific structures of host-parasite interactions have been reported from the type material which was collected in Denmark (Hauerslev 1987). However, this collection has only been studied with the light microscope. In addition, this fungus was considered to have two-celled basidia. The number of basidial cells varies in the Taiwanese collection from 2 to 4. All other features, inclusive of the characteristic spirally-coiled basidia (Fig. 1B) and simple septal pores (Fig. 3D) appear to be identical. We therefore consider both collections as conspecific.

*Colacogloea peniophorae* and *C. bispora* can be readily distinguished on the basis of morphological features, e.g. types of fructification, presence or lack of anamorph stages, morphology of basidia and basidiospores. It appears that *C. bispora* is a specific parasite of species of *Tubulicrinis*. European specimens have been reported

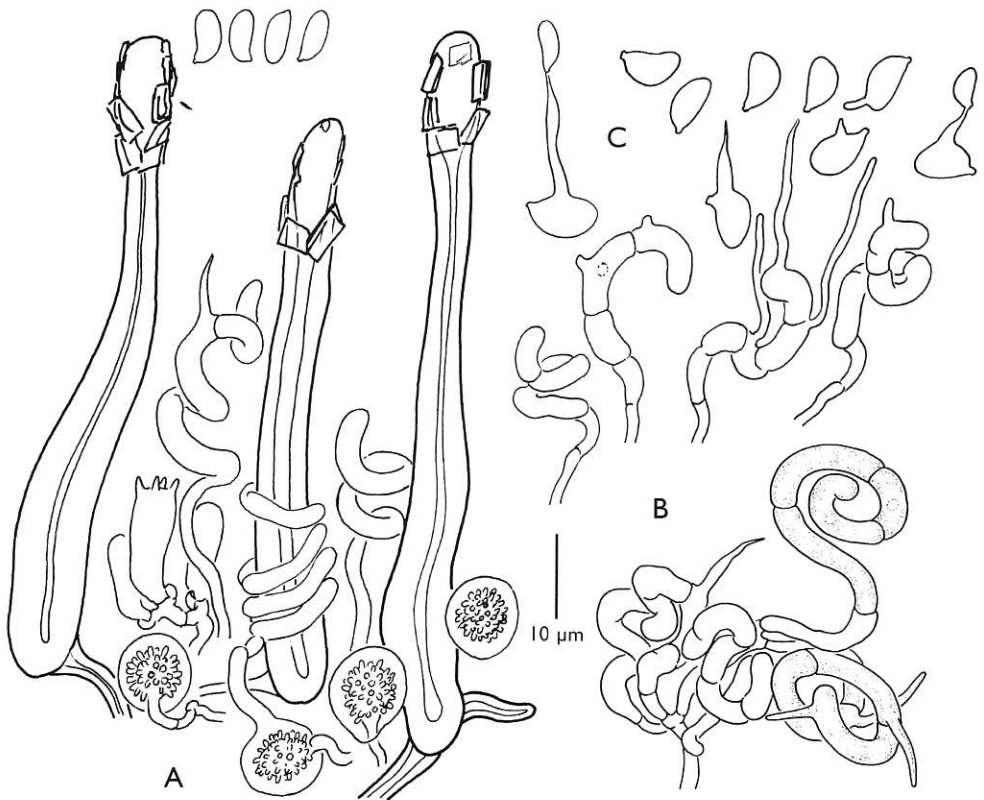


FIG. 1. A Section through fructification of *Tubulicrinis strangulatus* with thick-walled cystidia, holobasidia, basidiospores, and the parasite, *Colacogloea bispora*, with hyphae, coiled basidia, and gall-like swellings with colacosomes. B Coiled basidia of *Colacogloea bispora* originating from one generative hypha. C Basidia of *Colacogloea bispora* in different stages of development, and basidiospores, several germinating by repetition.

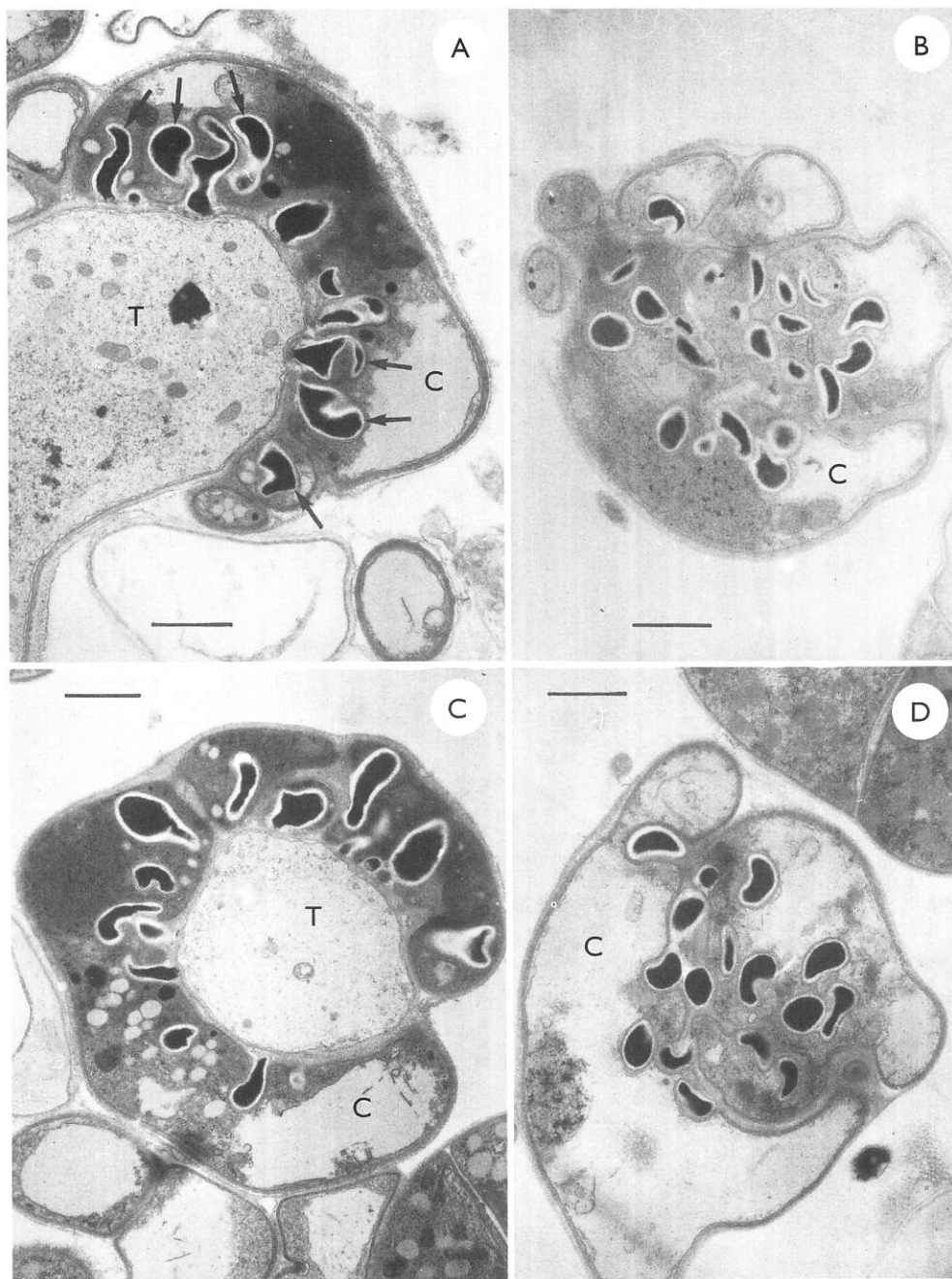


FIG. 2. TEM micrographs of colacosomes (arrowed in A) of *Colacogloea bispora* (C) and the host cells of *Tubulicrinis strangulatus* (T in A–C). Scalebars = 1  $\mu$ m.

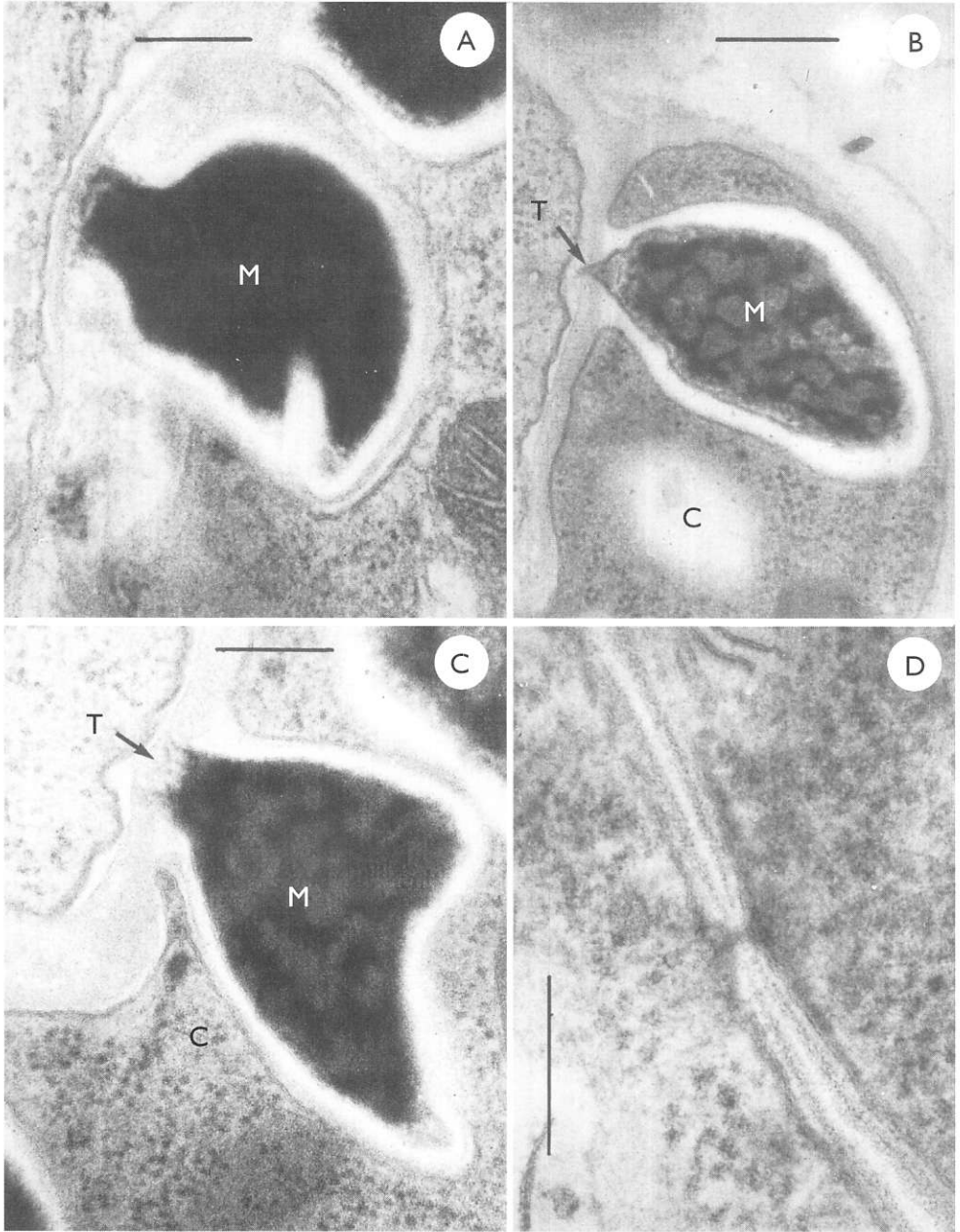


FIG. 3. **A–C** Mature colacosomes with electron dense contents (M); arrows in **B** & **C** indicate interactions with cell walls of the parasite (C) and the host (T). **D** Simple septal pore of *Colacogloea bispora*. Scalebars = 0.2 μm.

from *T. angustus* (Hauerslev 1987) and *T. subulatus* (Bourdot & Galzin) Donk (Roberts 1997) while the fungus from Taiwan grew on *T. strangulatus* K.-H. Larss. & Hjortstam (Fig. 1A). The host species has not previously been recorded from Asia, and was hitherto known only from Sweden, Norway and Romania (Hjortstam *et al.* 1988). Roberts (1997) reported and illustrated a conidial stage for his collection (Roberts 828), identified as *Achroomyces* cf. *bispora*.

Colacosomes were also found in another most unusual auricularioid and mycoparasitic fungus, *Cryptomycocolax abnorme* Oberw. & Bauer, combining important basidiomycetous and ascomycetous features (Oberwinkler & Bauer 1990). Septal pore and SPB features indicate a very early phylogenetic position, the most primitive one so far discovered among *Basidiomycetes*. The presence of clamps also appears to be an original characteristic. Obviously mycoparasitic interaction with colacosomes is also an ancient character known so far only from auricularioid simple-pored mycoparasites.

Mycoparasitic species of auricularioid heterobasidiomycetes occur either intrahyemically, as for example in *Kryptastrina inclusa* Oberw. (Oberwinkler 1990), *Occultifur internus* (L. S. Olive) Oberw. (Olive 1954, Oberwinkler 1990), *Platygløea subabdita* Hauerslev (Hauerslev 1987), and *Phragmoxenidium mycophilum* Oberw. & Schneller (Oberwinkler *et al.* 1990b), or develop gelatinous, pustular basidiocarps externally on the host fructifications, as in species of *Cystobasidium* (Lagerh.) Neuhoff and other species of *Platygløea*.

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