# *Catenomycopsis rosea* gen. et sp. nov (Hyphomycetes), anamorph of *Chaenothecopsis haematopus*

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Several single- and multiascospore cultures of *Chaenothecopsis haematopus* produced a hyphomycetous anamorph. *Catenomycopsis rosea* gen. et sp. nov, is introduced to accommodate this fungus. Detailed description and illustration of the cultural and morphological characters are provided. *Chaenothecopsis haematopus*, previously only known from Australia and Tasmania, is reported from South America.

The genus *Chaenothecopsis* Vainio belongs to Caliciales *s.lat.* (Tibell, 1984). As with other species of this genus, *Chaenothecopsis haematopus* Tibell is non-lichenized. It occurs as a saprotroph on old wood in cool temperate *Nothofagus* forests. It was recently described from New Zealand (Tibell, 1987), and was then also known from Tasmania. In this paper it is recorded as new to South America.

So far there are no reports on anamorphs of *Chaenothecopsis* found in nature. Relatively recently, Samuels & Buchanan (1983) were able to grow *Chaenothecopsis schefflerae* (Samuels & D. E. Buchanan) Tibell in axenic culture and showed that this species produces a *Phialophora*-like anamorph.

During comprehensive investigations of cultures of *Chaenothecopsis*, both anamorphs and teleomorphs have been obtained in several species. The anamorphs, in most cases, were coelomycetous. The anamorph of *Ch. haematopus*, however, is hyphomycetous, and is described below.

## MATERIALS AND METHODS

Herbarium specimens (in UPS) and living cultures: New Zealand, Wellington, Tongariro National Park, 22 Oct. 1986, Tibell 16625 (UPSC 2082, 2409); ditto, Tararua State Forest, 1 km NW of Mt. Holdsworth Lodge, 10 Jan. 1990, Tibell 19002. Argentina, Tierra del Fuego, 4 km NW of Ushuaia, 6 Jan. 1989, Tibell 17460 (UPSC 3023); ditto, National Park, Rio Pipo, 8 Jan. 1989, Tibell 17611 (UPSC 3026).

Cultures from ascospores were obtained by the standard procedure described by Tibell (1990). For germination, the ascospores were plated on malt yeast extract agar, malt extract peptone, potato dextrose agar, potato dextrose agar with 2% sorbitol and further grown on the same media.

The soluble substances were extracted with acetone and investigated in the three standard solvent systems described by Culberson (1972).

For transmission electron microscopy, small pieces of the cultures were fixed in 2·5% glutaraldehyde buffered with sodium cacodylate at pH 7·2, post-fixed in 2% potassium permanganate at 4 °C for 2 h, embedded in Epon, sectioned and double-stained with lead citrate and uranyl acetate.

For scanning electron microscopy, parts of cultures were fixed in glutaraldehyde, mounted on a specimen stub, air-dried and coated with gold. In some preparations colonies were dried and immediately coated with gold.

## RESULTS

### *Taxonomy*

**Catenomycopsis** O. Const., gen. nov.

Etym.: *catena* = chain, in reference to the arrangement of conidia

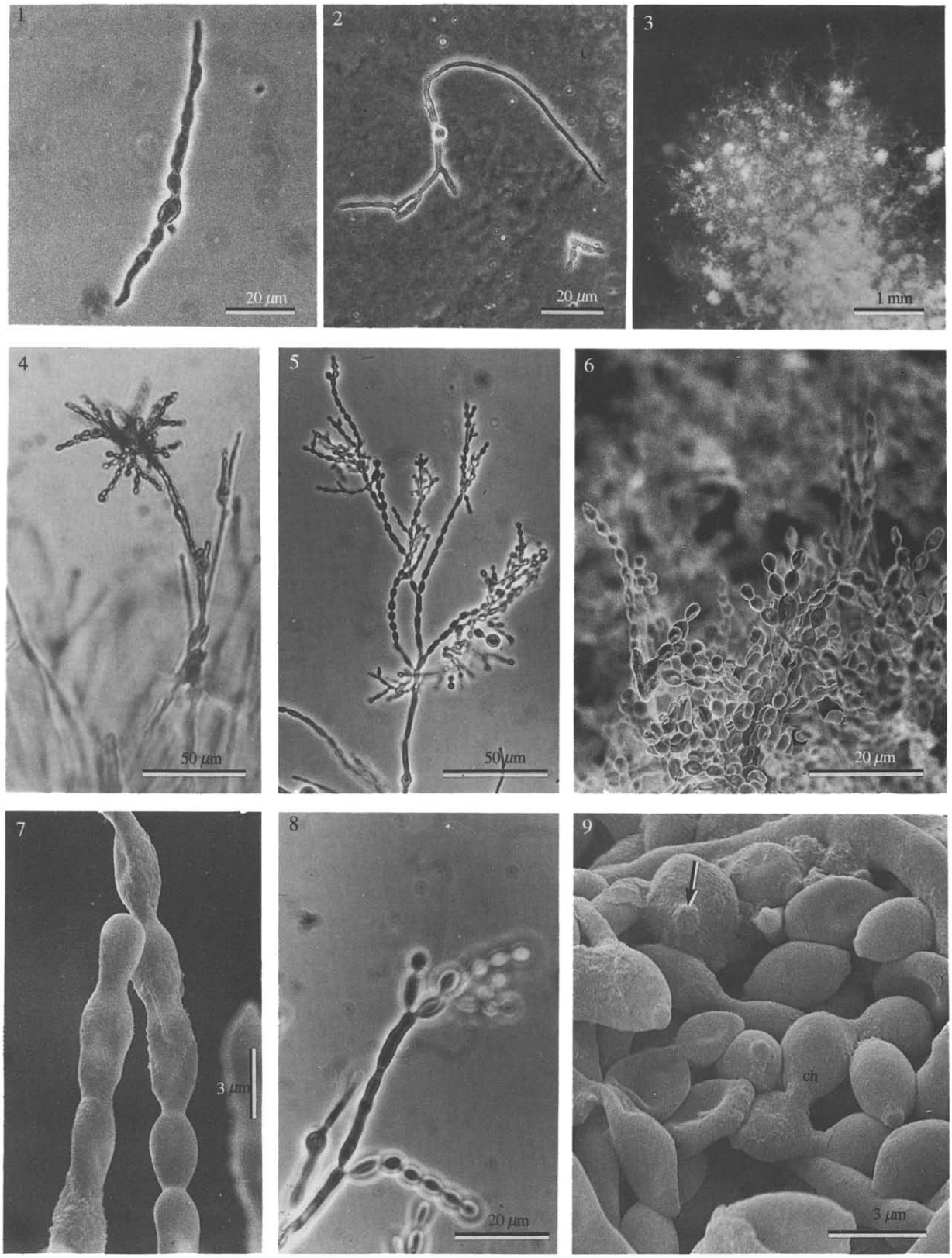
Fungus anamorphicus ad Hyphomycetes pertinens. *Conidiophora* simplicia, ex unica vel plurimis, cylindraceis, cellulis cum parietibus incrassatis composita. *Conidia* holoblastica, continua, elliptica, laevia, hyalina, crassitunicata, acropeta, simplices vel ramosae catenae formans. *Teleomorph*osis ad *Chaenothecopsis* (Caliciales) pertinens.

Species typica: *Catenomycopsis rosea* O. Const.

Anamorphic fungus belonging to Hyphomycetes. *Conidiophores* mononematous, simple, composed of one to numerous, colourless, more or less cylindrical cells with thick walls, constricted at septa. *Conidia* holoblastic, non-septate, colourless, ellipsoidal, thick-walled, arranged in acropetal, simple or branched chains. *Teleomorph* belonging to *Chaenothecopsis* (Calicialies).

**Catenomycopsis rosea** O. Const., sp. nov. (Figs 1–14)

*Coloniae in vitro* post 50 dies 9–11 mm, primum pallidae, deinde roseae, reverso fusciore. *Hyphae vegetativae* hyalinae, 1·5–3 µm latae. *Conidiophora* simplicia, ad 280–450 µm alta, 2–3 µm lata, pariete 0·7–1 µm crasso, septata, ad septum modice constricta. *Conidia*




**Figs 1–9**. *Catenomycopsis rosea*. **Fig. 1**. Germinating ascospore after 5 d on PDA. **Fig. 2**. Germinating conidium after 6 d on PDA. **Fig. 3**. Conidiogenous structures in 40-d-old culture on PDA. **Figs 4, 5**. Conidiophores and conidia in 11-month-old colony on PDA. **Fig. 6**. Chains of conidia in 5-month-old subculture on PDA. **Fig. 7**. Chains of conidia in 5-month-old subculture on PDA. **Fig. 8**. Young conidiogenous structure in 11-month-old colony on PDA. **Fig. 9**. Conidia partly connected in chains (ch). Separate conidia with protruding scars (arrow). Five-month-old culture on MEA. Fig. 1: Tibell 19002; Fig. 2: Tibell 16625; Fig. 3: holotype; Figs 4, 5, 8: UPSC 3026; Figs 6, 7: UPSC 2409; Fig. 9: UPSC 3023.

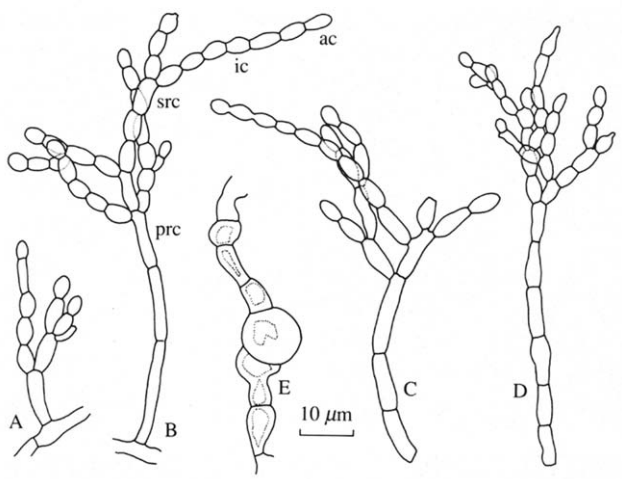



**Fig. 10**. *Catenomycopsis rosea* (holotype). A, Reduced conidiogenous structure; B–D, Conidiophores with primary ramoconidia (prc), intercalary conidia (ic), secondary ramoconidia (src) and apical conidia (ac). Six-month-old colony on PDA. E. Thick-walled swollen cells in 11-month-old culture on PDA.

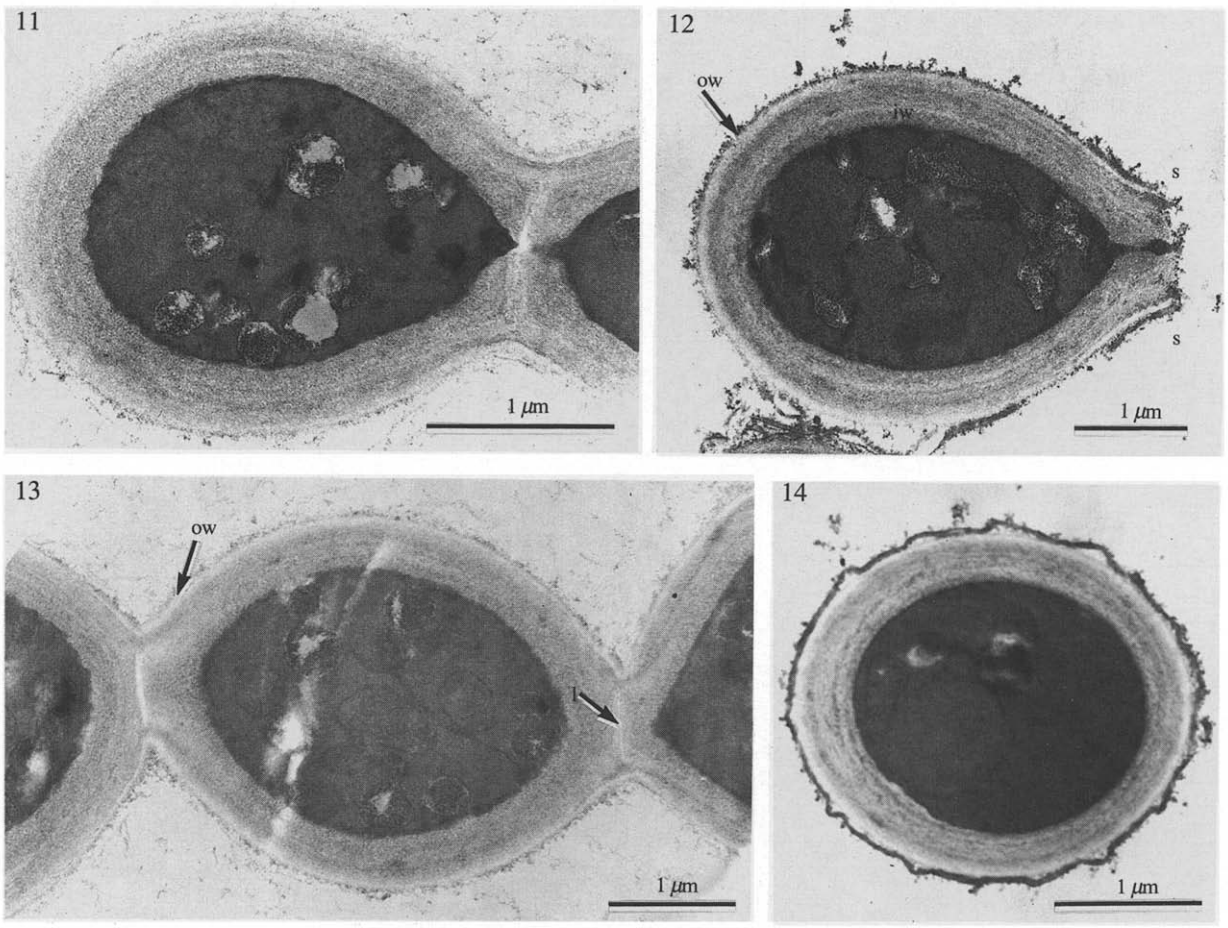
continua, hyalina, levia, pariete 0·7–1 µm crasso; *ramoconidia primaria* cylindracea, 7–11 × 2–3 µm; *conidia intercalaria* ellipsoidea, 4–6 × 2·5–3 µm; *ramoconidia secondaria* cylindracea, 4–8 × 2·5–3 µm; *conidia apicalia* globosa vel subglobosa, 2–3 µm diam.

Holotypus: UPSC 2082 cultura siccata, isolata e spora unica *Chaenothecopsis haematopus*, Tibell 16625 (UPS).

### *Description in culture*

The ascospores swell, become subspherical and start germinating within 10 d. Two germ tubes are normally produced, one from each end of the spore (Fig. 1).

*Colonies* on PDA attain 9–11 mm diam in 50 d at *ca* 20 °C, appearing smooth, but with a 1–2 mm high verrucose centre, consistency tough, first pale, later turning pale mauve to pink; margin entire or slightly lobate; the undersurface concave, reddish-yellow to pale pink and distinctly darker than the upper side. Exudate absent; diffusible pigment pale to pink yellow. The surfaces of 4- to 5-month-old colonies are irregularly ruptured in numerous, polyangular plates. Sub-




**Figs 11–14**. *Catenomycopsis rosea* (holotype). **Fig. 11**. Developing apical conidium with strongly thickened area around pore. **Fig. 12**. Mature apical conidium with the wall differentiated into a thin electron-lucent outer wall (ow) and a thick, electron-dense inner wall (iw) with many concentrical layers. Note the distinct scar (s). **Fig. 13**. Semi-mature intercalary conidia. Note that the other wall layer (ow) and a few of the concentrical wall layers are continuous between the conidia and not interrupted by the electron-lucent middle lamella (1) of the septum. **Fig. 14**. Transverse section of mature conidium. The outermost part of the wall is uneven and electron-dense. Eight-month-old culture on PDA.

merged *hyphae* sparingly branched at right angles, hyaline, 1·5–3 μm wide, cylindrical or usually more or less swollen, septate every 6–12 μm. Some old cells of the aerial hyphae contain a deep red pigment which also occurs extracellularly. The pigment turns pale yellowish or brownish green when KOH is added. Numerous hyphae with swollen and thick walls are formed in old colonies (Fig. 10E). The *conidiogenous structures* appear as small, tinsel-like bushes on the mycelium, particularly at the colony margin (Figs 3, 4, 10B–D). *Conidiophores* colourless, mononematous, arising at almost right angles on the supporting hypha, simple, straight, repeatedly septate, slightly constricted at septa, 280–450 × 2–3 μm, wall smooth, *ca* 0·7–1·0 μm thick; in some cases the conidiophore is either lacking, conidia being produced on a ramoconidium sitting on a hypha, or reduced to 1–3 cells (Figs 8, 10A). *Conidia* holoblastic, unicellular, colourless, with smooth, 0·7–1 μm thick wall, produced acropetally (Figs 5–7, 10 B–D); *primary ramoconidia* (functioning as conidiogenous cells) cylindric, 7–11 × 2–3 μm, base truncate, tip provided with 1–3 minute, slightly protruding denticles on which 1–2 (–3) simple or branched chains of intercalary conidia are formed; *intercalary conidia* ellipsoidal, 4–6 × 2·5–3 μm, ends truncate, arranged in chains of up to 10 conidia; some cylindrical, somewhat longer, intercalary conidia rather frequently present; *secondary ramoconidia* similar to the primary ones but shorter, 4–8 × 2·5–3 μm; *apical conidia* commonly globose or subglobose, 2–3 μm diam, tip rounded, base truncate, *ca* 1 μm wide.

### *Ultrastructure*

In ultrathin sections the intercalary conidia (Fig. 13) appear broadly ellipsoidal, 5–6 × 2·5–3 μm, hyaline, with thick walls and distinct proximal and distal scars. Conidium wall of developing conidia 0·6–0·8 μm thick, differentiated into an outermost, electron-lucent part, and an inner part with concentrically-arranged electron-dense material (Fig. 11). In young conidia, still arranged in chains, the area around the septum of adjacent conidia is strongly thickened and pierced by a pore (Fig. 11). The inner part of the spore wall is disrupted between adjacent conidia by the electron-lucent middle lamella of the septum, while the outer part of the wall, in which several wall layers are evident, is continuous between the conidia. The mature conidium (Figs 9, 12, 14) has an uneven surface with a thin, distinctive electron-dense outermost layer including one to a few double membranes. In SEM, the conidium surface appears uneven, and protruding scars can be noticed at the ends (Fig. 9).

### *Chemistry*

About eight substances were detected in solvent system A, when apothecia from a herbarium specimen of *Chaenothecopsis haematopus* (Tibell 17611), and a culture (UPSC 2082) were extracted with acetone. Some of these substances showed as deep red to yellowish spots with strong UV fluorescence, whereas others were only visible after treatment with sulphuric acid and heat. Although these substances have not been identified even to broad groups, it is interesting to note that three of them occur in both apothecia and culture extracts. Two deep red pigments occur in the apothecia but were not detected in the culture extract. There is thus a certain degree of similarity in secondary chemistry between the anamorphic cultures and the teleomorph.

## DISCUSSION

The anamorph of *Chaenothecopsis haematopus* is rather undifferentiated and resembles various Hyphomycetes. The general morphology of the conidiogenous structures and the conidiogenesis, are very similar to those occurring in other genera with typical acropetal production of conidia, such as *Ramularia* and *Cladosporium*. However, in these two genera the conidiophore, even in culture, is clearly differentiated from the supporting hypha, the ramoconidia and intercalary conidia are often septate, and the conidial scars are pigmented. The hyphophores in Asterothyriaceae, such as *Aulaxina* and *Calenia* described by Vězda (1979) and *Microspatha* P. Karsten (Seifert, 1985), also have some resemblance to our fungus but they are definitely synnematous. As the synnematous condition is not always expressed in culture, it cannot be excluded that if conidiomata are formed by *Catenomycopsis* in nature, they may be synnema-like. However, this is highly improbable. Such anamorphs, if present, are easily detected on herbarium material, but we found none in 14 specimens examined. The appearance of conidiogenous structures of *Catenomycopsis* are reminiscent of *Spadicesporium* Borisova & Dvoinos (1982) but in the latter genus the conidiophores are stipe-like and conidia are formed on well-differentiated, sympodial conidiogenous cells. Some species of *Moniliella* Stalk & Dakin, as defined by de Hoog (1979), superficially resemble *Catenomycopsis*, but the presence of pseudomycelia, budding-cells and chlamydospores distinguish them from the latter genus.

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