

## THREE NEW HYPHOMYCETES FROM FOAM

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*Pachycladina mutabilis* gen.nov., sp.nov., *Flagellospora leucorhynchos* sp.nov. and *Sigmoidea praelonga* sp.nov. are illustrated and described from Czechoslovakian waters.

Even when the European woodland streams are the most frequently investigated ones as regard the aquatic hyphomycete communities, they may still yield some new taxa belonging to this group. Three new hyphomycetes, whose conidia undoubtedly occur also in other countries, were isolated from Czechoslovakian highland waters.

In the descriptive terminology, a distinction is made between 'elongation' and 'proliferation' of conidiogenous cells, in the sense of Descals (1985); elongation concerns only the cell wall, whereas proliferation involves replication of the whole conidiogenous cell. Both cases may appear on the same conidiophore.

**Pachycladina** gen.nov.

(Etym. *pachys* (Gr.) = thick, *clados* (Gr.) = branch)

Deuteromycotina, Moniliales. Coloniae pallidae, hyphae hyalinae. Conidiophora hyphis ceteris valde similia, septata, indeterminata, pars conidiifera e segmentis caducis, saepe ut sympodium dispositis, consistens. Conidia apicalia et lateralia, solitaria, robusta, cellulis plus-minusve inflatis, aut simplicia et longifusoidea, aut ramosa cum elementis ad apicem versus attenuatis, septata, ramis paucis, adnatis, raro distantibus, sequentialibus; processus basalis frequens. Dehiscencia conidiorum schizolytica.

Sp. typ.: *Pachycladina mutabilis* sp.nov.

**Pachycladina mutabilis** sp.nov. (Figs 1, 2)

(Etym. *mutabilis* (Lat.) = changing; refers to the number of branches)

Coloniae in agar maltoso modice crescentes, albae, dein pallide luteo-roseae, leviter zonatae, mycelio aereo sparso, funiculoso. Hyphae in substrato cum cellulis inflatis, tenuitunicatis. Conidiophora apicalia vel lateralia, usque ad  $ca\ 50 \times 3-4\ \mu m$ , segmentis caducis  $ca\ 10-27 \times 3-4.5\ \mu m$ , raro sympodialiter vel per cicatricem prolificantibus. Conidia simplicia  $55-126 (-212) \times 5-8\ \mu m$ , recta vel paulo curvata, ad apicem versus attenuata. Conidia ramosa cum axe  $70-160 \times 5-8\ \mu m$ , recto vel flexo, rami (1-) 2 (-3), recti vel paulo curvati, antrorsi vel horizontales,  $40-80 \times 4-7\ \mu m$ ; illi adnati extensi et saepe quasi oblique transversi ad axem, ad apicem versus attenuati, cum insertione lata vel paulo attenuata. Basis conidiorum

truncata vel bulbosa, apices obtusi vel subulati, processus basalis saepe adest, usque ad  $ca\ 50\ \mu m$  longus,  $3-6\ \mu m$  crassus, centralis vel lateralis, cylindraceus vel bulbosus. Conidia densiter septata, cellulis saepe subinflatis.

In spuma in rivulo parvo prope pago Javorník, montibus Bílé Karpaty, Moravia orientalis, Czechoslovakia, 12 Apr. 1984, leg. L. Marvanová. IMI 309241, holotypus (ex CCM F-11885).

Colonies (MA) growing moderately, 18-21 mm diam/20 days/ca 15 °C, whitish, becoming pale luteous to salmon (Rayner, 1970), indistinctly zonate, radiately sulcate, mycelium mostly adpressed, aerial mycelium sparse, funiculose. Substrate hyphae with thin-walled, inflated cells. Sporulation under and above water, in stationary cultures. Conidiophores micro- to semimacronematous, single, simple, apical or lateral, septate, indeterminate, up to  $ca\ 50 \times 3-4\ \mu m$  when lateral, the conidiiferous part consisting of caducous segments  $10-27 \times 3-4.5\ \mu m$ , often arranged as a sympodium or pseudosympodium, occasionally bearing short percurrent or sympodial elongations. Conidia single, apical or lateral, robust, with somewhat inflated cells, long fusoid or branched. Simple conidia straight or slightly curved,  $55-120 (-212) \times 5-8\ \mu m$ ; branched conidia with axis  $70-160 \times 5-8\ \mu m$ , straight or bent at branch insertions. Branches (1-) 2 (-3), adnate, growing just from the adjacent parts of the neighbouring cells of the axis and typically stretched out in one line crossing the axis obliquely (Fig. 2B, C), less often distant or two adnate and one distant, sometimes antrorse or horizontal,  $40-80 \times 4-7\ \mu m$ , attenuate distally, insertion of the lower ones usually submedian, broad or slightly narrowed. Conidial apices obtuse or subulate, base truncate or bulbous, basal extension frequent, excentric or percurrent, up to  $ca\ 50 \times 3-6\ \mu m$ . Conidial cells usually slightly and irregularly inflated.

In standing distilled water there is  $ca\ 80\%$  of simple conidia,  $ca\ 19\%$  of conidia with one, and  $ca\ 1\%$  with two branches. In foam samples, the ratio of two-armed and simple conidia was nearly 1 : 1; conidia with one or three branches were rare.

Cultures examined: CCM F-10284, stream foam in the Radějovské údolí valley, White Carpathians, Czecho-

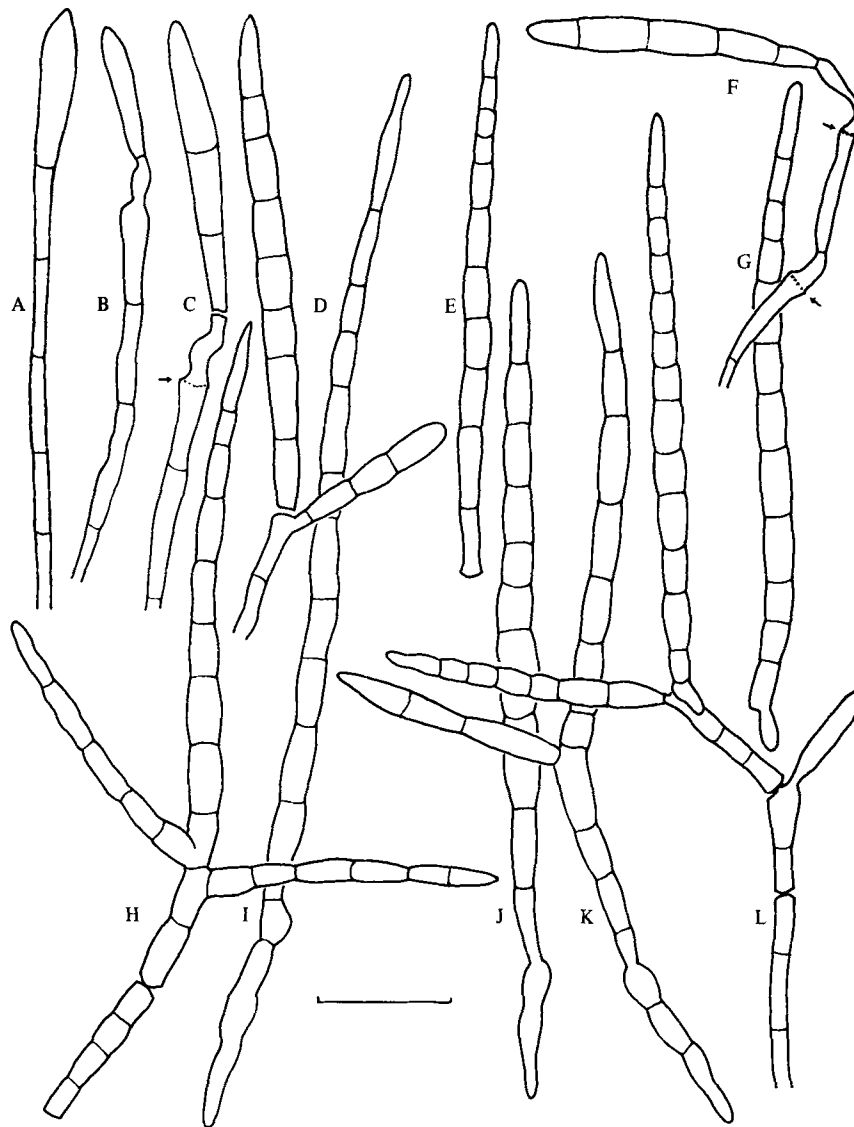


Fig. 1. (A-L) *Pachycladina mutabilis* CCM F-11885. A, B, F, developing conidia (note the percurrent elongations of conidiogenous cells in C and F); C, D, just detached simple conidia; E, I, J, G, simple conidia; H, K, branched conidia; L, conidium breaking down into segments. Scale = 20  $\mu$ m.

slovakia; CCM F-10885, 10985, 11185, 11885, 11985, stream foam near the village of Javornik, White Carpathians, Czechoslovakia, L. Marvanová.

Conidia of this species are mainly characterized by the irregularity of branching and by breaking easily, at least in culture, at various points, mostly in the proximal part. Along with this is a tendency to form branches or outgrowths from the new end cells on or beside the exposed half-septum

(Fig. 1 D, L). The irregularly inflated cells give the conidia a wavy outline. Hence the unbranched conidia may resemble those of the anamorph of *Hymenoscyphus imberbis* (Bull.: Fr.) Dennis (Marvanová, unpubl.); however, the colony of the latter is dark grey with black reverse and the conidia do not branch. A great variation in branching pattern was described in *Pseudozyma prolificans* Bandoni (1985), which is a yeast-like fungus with

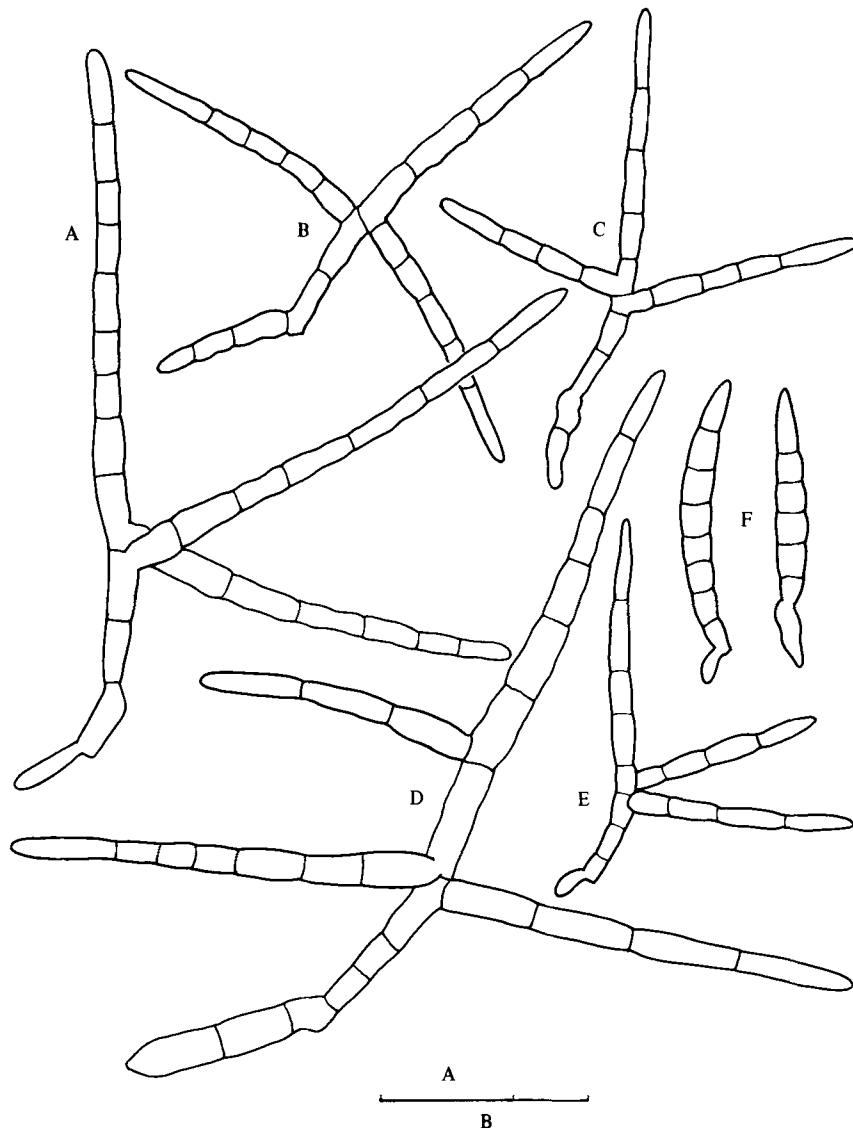


Fig. 2. (A-F) *Pachycladina mutabilis*, conidia from foam. A-E, branched conidia; note the adnate branches in D, lying in a line; F, simple conidia. Scale A = 20  $\mu\text{m}$ , scale B = 50  $\mu\text{m}$ ; A, D, to scale A, the remainder to scale B.

tiny conidia and a black substrate mycelium appearing in aged cultures. *Tricladium robustum* Marvanová (1984) has somewhat similar but more regularly branched and not disarticulating conidia.

The conidiogenesis of *P. mutabilis* is not quite clear in detail; the fertile portions break very easily in water, making it impossible to obtain an

undisturbed preparation. In an intact culture viewed under low power, the simple conidia were seen at various levels among the conidiophores protruding above water.

Until now, conidia of *P. mutabilis* have been collected only in running waters on limestone ground.

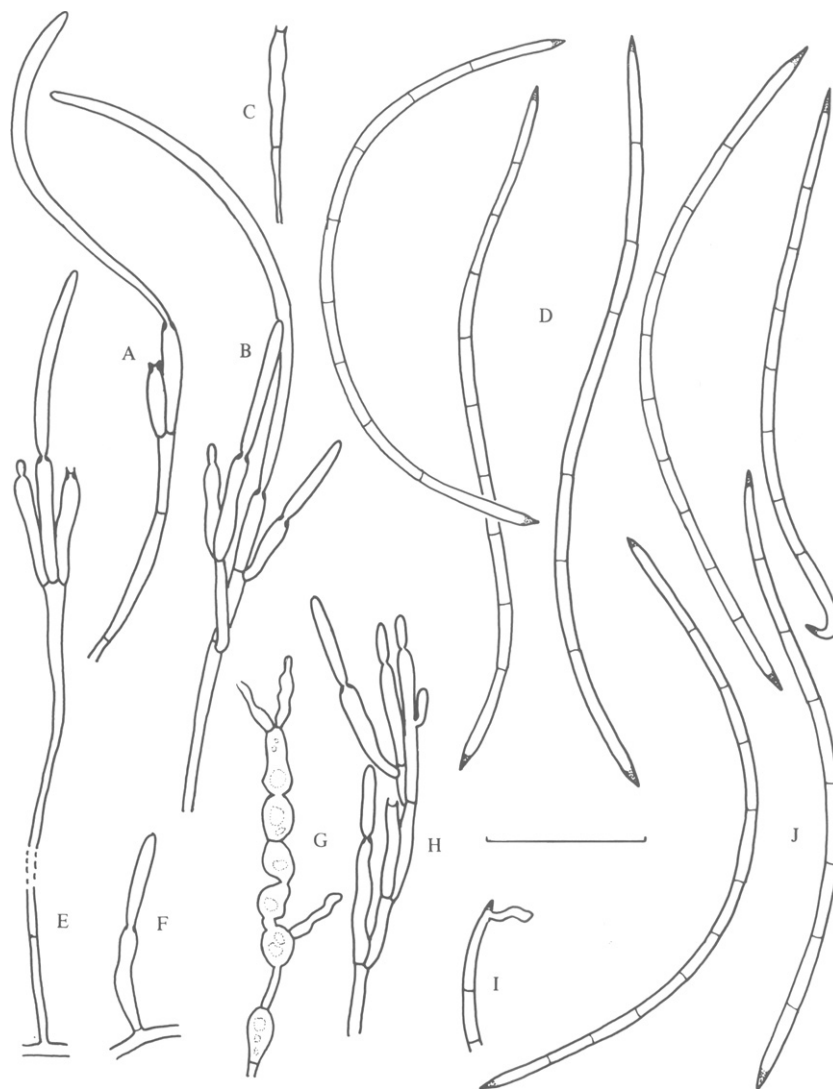


Fig. 3. (A–J) *Flagellospora leucorhynchos* CCM F-10386. A, B, E, F, H, conidiophores with developing conidia; D, J, free conidia, the dotted tips show the occluded parts; C, single conidigenous cell with the collarette; G, chain of inflated cells; I, germ-tube below the conidial tip. Scale = 20  $\mu\text{m}$ .

***Flagellospora leucorhynchos* sp. nov.** (Fig. 3)

(Ety. *leucon* (Gr.) = white; *rhynchos* (Gr.) = beak)

Coloniae in agar maltoso lente crescentes, albidae, dein pallide ochraceae, adpressae, mycelium aereum sparsum, funiculosum. Cellulae inflatae, catenatae vel agglomeratae, tenuitunicatae, hyalinae, in mycelio in substrato adsunt. Conidiophora singularia, apicalia lateralique, simplicia vel sparse ramosa, hyphis ceteris valde similia, 1.5–2  $\mu\text{m}$  lata, septata. Cellulae conidiogenae 1–3, apicales vel

laterales, phialiformes, elongatae vel subclavatae, cum collari brevi, interdum proliferantes, 7–15  $\times$  2–2.5  $\mu\text{m}$ . Conidia apicalia, in loco eodem repetite singulatim formata, sigmoidea vel arcuata, cylindrica, 75–137  $\times$  1.5–2 (–2.5)  $\mu\text{m}$ , 7–12 septata, apicibus acutis, in pigmentis acidis non coloratis, ca 1  $\mu\text{m}$  longis. Dehiscencia schizolytica.

In spuma in rivulo parvo loco Rejvíz dicto, montibus Hrubý Jeseník, Moravia septentrionalis, Czechoslovakia, 1 Sept. 1983, leg. L. Marvanová. IMI 309243 holotypus (ex CCM F-10386).

*Colonies* (MA) growing slowly, 8–10 mm diam/21 days/ca 15°, whitish, later pale buff, aerial mycelium scanty, in the centre, funiculose. Chains or groups of thin-walled inflated cells appear on the substrate mycelium. Sporulation under water, in stationary cultures. *Conidiophores* single, apical, or lateral, simple to branched, semimacronematous, 1.5–2 µm wide. *Conidiogenous cells* 1–3, apical or lateral, phialidic, elongate, sometimes subclavate, 7–15 × 2–2.5 µm, with a short collarette and a periclinal thickening, occasionally proliferating percurrently. *Conidia* single, apical, sigmoid or arcuate, cylindrical, 75–137 × 1.5–2 (–2.5) µm, 7–12 septate, with acute ends not staining in acidic dyes, the occluded part ca 1 µm long. Germination typically from any cell but from the very ends (Fig. 3 I).

*Cultures examined*: CCM F-22583, from stream foam, near the village of Borinka, Little Carpathians, Czechoslovakia; CCM F-23883, 24183, 24283, from stream foam, near the village of Rejvíz, Hrubý Jeseník Mountains, Czechoslovakia; CCM F-10386, stream foam, near the village of Babice, Moravian Kars, Czechoslovakia, L. Marvanová.

This species has probably been confused with *Flagellospora curvula* Ingold (1942), which, however, has (1) typically complex branched conidiophores with numerous phialidic conidiogenous cells without collarettes and periclinal thickenings, often with irregularly elongate and narrowed apical parts; (2) conidia widest in the median part, mostly 3 (–5) septate, germinating also from the tips which do stain well in acidic dyes; (3) the colonies developing some brownish colour with age. These differences seem subtle, but they are stable enough to justify description of a new species. The occlusion (wall thickening?) in the conidial apices is probably a part of the continuing maturation after secession, which is rather frequent with conidia of aquatic hyphomycetes, e.g. secondary branching in some species, percurrent basal extension. The ends of still attached conidia stain well, and some detached conidia from a 3-day culture may still germinate from the ends, even when through a narrow area.

*Flagellospora leucorhynchus* occurs in streams on acidic as well as basic ground.

***Sigmoidea praelonga* sp. nov.** (Figs 4, 5, 6 A–L)

(Etym. *praelongus* (Lat.) = very long, refers to the conidia)

*Coloniae* in agar maltoso modice crescentes, pallide ochraceae, mycelio in substrato radiante, mycelio aereo lanoso, copioso, dein sparso. Cellulae inflatae, aggregatae, globosae, hyalinae, crassitunicatae, 5–10 µm diam, vel hyphae latae, pallide brunneae, crassitunicatae, nonnumquam adsunt in substrato. Conidiophora apicalia lateral-

iaque, simplicia vel ramosa, 5–170 × 2–5 µm, cylindrica vel inflata, septata, cum insertione lata vel paulo attenuata. Cellulae conidiogenae apicales vel laterales, rhachidem denticulatam vel radulam brevem gerentes. Conidia saepe fasciculata, apicalia lateralique, scolecoidea, recta vel paulo curvata, ad apicem versus leviter attenuata, raro clavata, interdum in senectute fragmentantia, 22–200 (–315) × 2.5–4 µm, usque ad 26 septata, basi paulo angustata, cicatrix tenuis vel subrefractiva, processus basalis rarus, plerumque lateralis.

In spuma rivuli prope pago Babice, collibus Moravský Kras dictis, Moravia meridionalis, Czechoslovakia, 17 Dec. 1985, leg. L. Marvanová. IMI 309242 holotypus (ex CCM F-10786).

*Colonies* (MA) growing moderately, 15–20 mm diam/20 days/ca 15°, pale buff (Rayner, 1970), substrate mycelium in radial strands, aerial mycelium whitish, dense, woolly, spread over the whole colony in fresh isolates, restricted to the central part in long-kept cultures. Groups of globose, thick-walled, hyaline cells 5–10 µm diam, or hyphae with pale brown, rough and thick walls, 5–8 µm wide, may be present in the substrate. Sporulation under water and on the water–air interface. *Conidiophores* semimacronematous, single, apical or lateral, simple or branched, 5–170 × 2–5 µm, cylindrical or inflated, continuous to septate, insertion of lateral conidiophores broad or slightly narrowed. *Conidiogenous cells* apical or lateral, indeterminate, the elongations forming a short denticulate rachis or a radula. *Conidia* usually in groups of 2–5 or more, apical and lateral, scolecooid, slightly tapering distally, fragmenting in older cultures of some isolates, straight to slightly curved, 22–200 (–315) × 2.5–4 µm, up to 26-septate, apex subulate, base slightly narrowed, scar truncate, thin to slightly refractive and thickened, basal extension rare, short, mostly excentric. Secession schizolytic, in standing distilled water tardy, after touching the colony surface. Premature detached conidia may be clavate and short.

*Cultures examined*: CCM F-10778, stream foam, Slovenský Raj Mountains, Czechoslovakia; CCM F-10381, foam, stream under the Buková dam, Little Carpathians, Czechoslovakia; CCM F-10482, stream foam, near Brno, Moravian Kars, Czechoslovakia; CCM F-10286, 10786, stream foam, near Babice, Moravian Kars, Czechoslovakia, L. Marvanová.

The generic classification of this species causes some problems. If we exclude the genera around *Cercospora* Fres. which are plant pathogens with an intramatrical primary mycelium and conidiophores often growing from stromatic tissue, there remain *Pseudoanguillospora* Iqbal (1974b), *Mycocentrospora* Deighton (1972) and *Sigmoidea* Crane (1968) as possible candidates.

*Pseudoanguillospora stricta* Iqbal (1974b), the

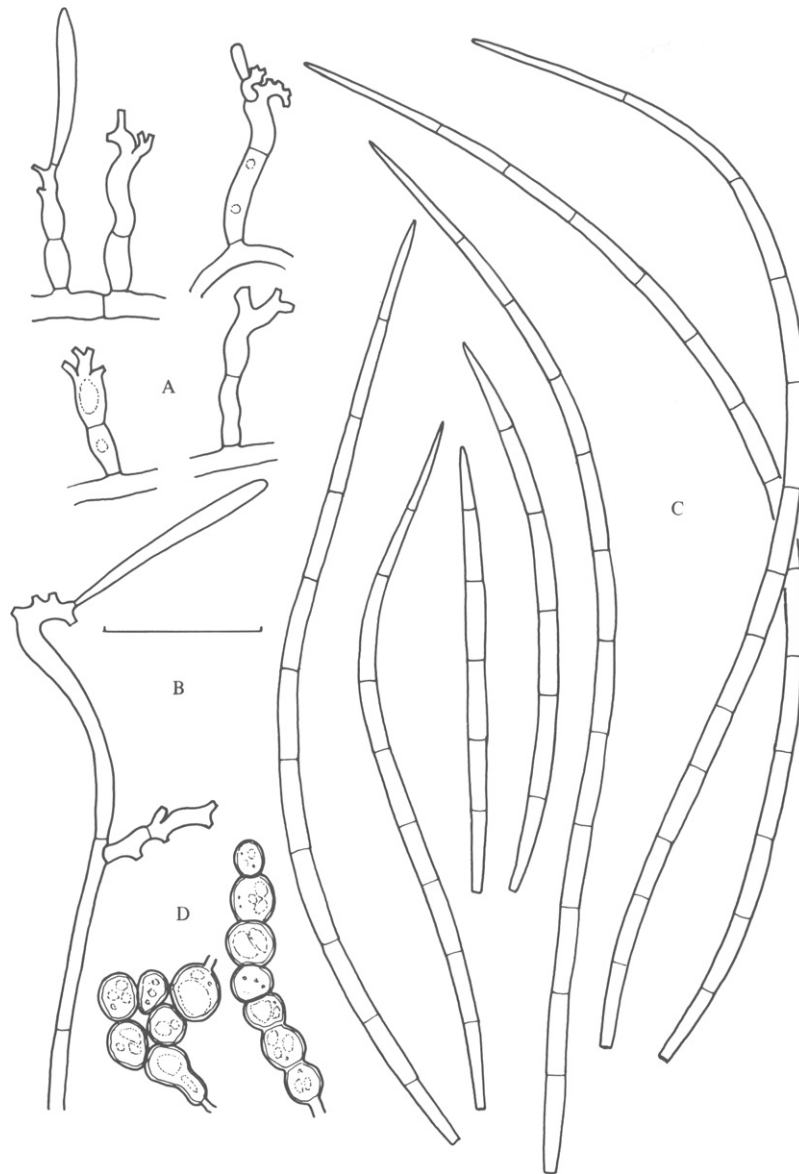


Fig. 4. (A–D) *Sigmoidea praelonga* CCM F-10786. A, B, spent conidiophores and developing conidia; C, detached conidia; D, thick-walled inflated cells. Scale = 20  $\mu\text{m}$ .

type species, has very similar conidia which, when seen detached, may easily be confused with those of *Sigmoidea praelonga*. However, the conidiogenous cells of the former do not form denticulate rachis or radula and the colony is dark grey. *Pseudoanguillospora prolifera* Iqbal (1974b), claimed to have sympodially proliferating conidiogenous cells, simple long conidiophores and conidia seceding

sometimes by means of a separating cell, is an imperfectly known species whose type material was not available. *Pseudoanguillospora gracilis* Sinclair & Morgan-Jones (1979) lacks denticulate rachis, has smaller and thinner conidia and dark colonies.

*Mycocentrospora* according to Deighton (1971) is a plant-pathogenic genus. However, *M. acerina* (Hartig) Deighton (1972), the type, is capable of

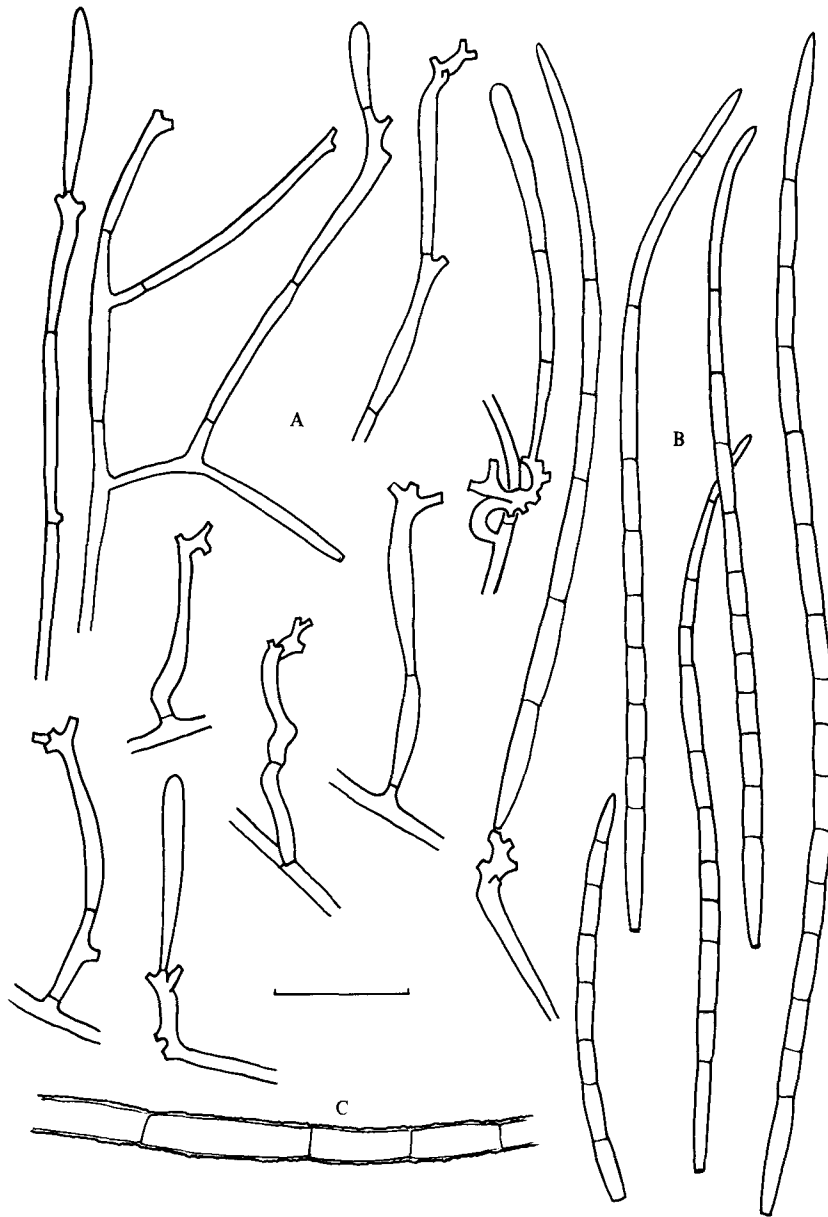


Fig. 5. (A-C) *Sigmoidia praelonga* CCM F-10778. A, developing conidia and spent conidiophores; B, free conidia; C, thick-walled, pale brown hypha. Scale = 20  $\mu\text{m}$ .

sporulation, dissemination, and colonization as a saprophyte under water. There are four further aquatic species of *Mycocentrospora* which have scolecoïd conidia: (1) *Mycocentrospora angulata* (Petersen) Iqbal (1974a) has a somewhat confusing protologue: the conidial width given in the text does not agree with that on the drawings (Petersen,

1963); the type material is lacking. (2) *Mycocentrospora filiformis* (Greathead) Iqbal (1974a) should normally produce a basal extension before conidium release; type material has not been deposited (Greathead, 1961). (3) *Mycocentrospora varians* Sinclair & Morgan-Jones (1979) has dark grey colonies, no denticulate rachis and smaller conidia.

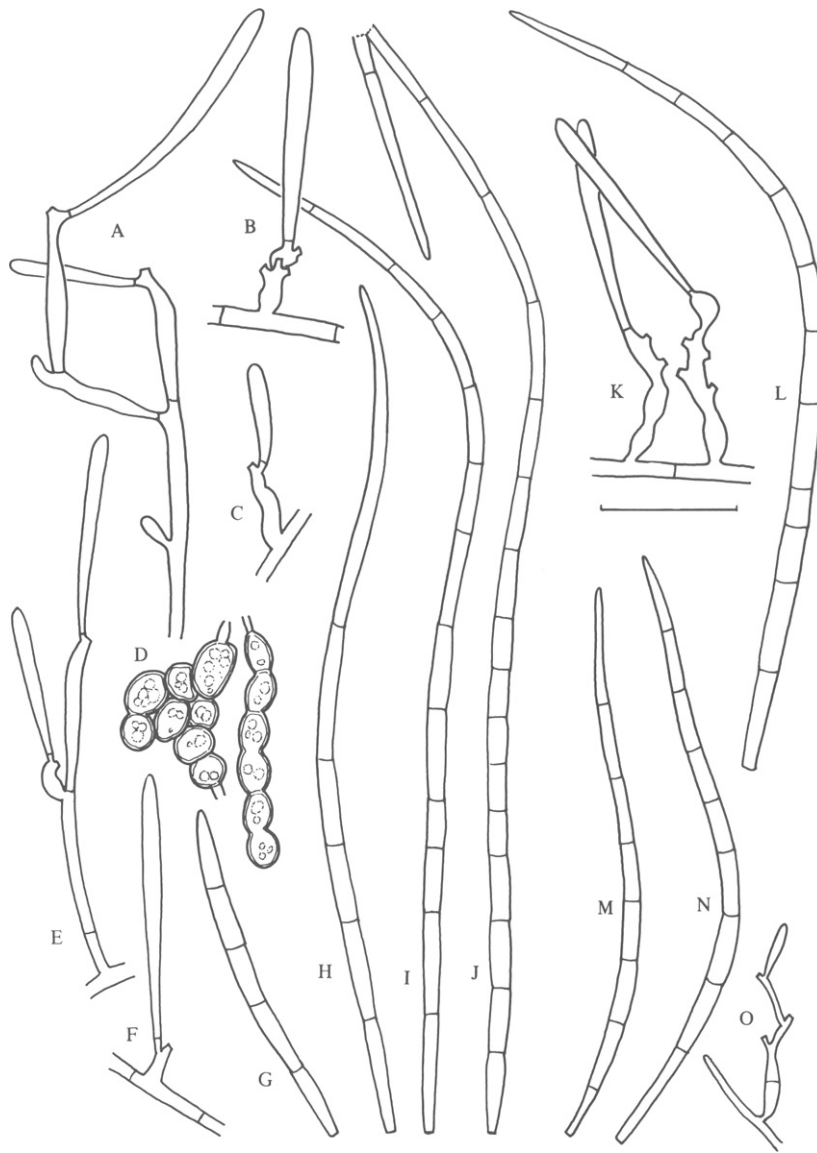


Fig. 6. (A-J) *Sigmoidea praelonga* CCM F-10381. A, B, C, E, F, development of conidia; D, thick-walled inflated cells; H-J, free conidia. K, L, *Sigmoidea praelonga* CCM F-10482. Developing and detached conidia. (M-O) *Sigmoidea prolifera*, type. M, N, free conidia; O, conidiogenous cell with a young conidium. Scale = 20  $\mu$ m.

(4) *Mycocentrospora aquatica* (Iqbal) Iqbal (1974a) according to the conidiophore branching may not belong to this genus. Type material was not available for study.

The species of *Sigmoidea* previously described have pale colonies. Both species from fresh water,

*S. prolifera* (Petersen) Crane (1968) and *S. aurantiaca* Descals (Descals & Webster, 1982), have much shorter conidiophores and conidia than *S. praelonga*. Conidia of the two marine species, *S. marina* Haythorn & Jones in Haythorn, Jones & Harrison (1980) and *S. luteola* Nakagiri & Tubaki



(1982) are strongly bent, and their end cells are devoid of cytoplasm.

The isolates of *Sigmoidea praelonga* differ from each other in some minor features: CCM F-10778 lacks the spherical inflated cells and has rough pale brown hyphae in the substrate; it also has quite long conidiophores, as does CCM F-10286. However, splitting into narrower taxa would be premature.

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