

## THREE NEW SCOLECOSPOROUS HYPHOMYCETES FROM WATERS IN BELARUS

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**Abstract:** Three new species of hyphomycetes are described from aquatic habitats in Belarus: *Anguillospora rubescens* has reddish colonies and long, needle-shaped, almost straight conidia formed on percurrent conidiogenous cells; *Sporidesmium fuscum* is dematiaceous and has straight cylindrical conidia produced on percurrent conidiogenous cells. *Taeniolella typhoides* is also dematiaceous and produces dark brown thick-walled conidia singly or in short chains. These fungi were isolated from submerged decaying herbaceous plants, tree leaves and corticated or decorticated wood.

**Key words:** Taxonomy, freshwater hyphomycetes, streams.

### Introduction

While surveying aquatic hyphomycetes of Belarus, several new or interesting scolecosporous species have been isolated. One of them, *Filosporella exilis* Gulis & Marvanová (1998) have been recently described as new. Three others are presented in this paper.

### Material and Methods

All material in nature was collected in watercourses of Minsk region unless otherwise stated by the first author, who also isolated the fungi into monoconidial pure cultures. The labelling VG-119, VG-155 etc. refers to living cultures, the IMI numbers denote herbarium material. The colony colours were determined after Rayner (1970). Sporulation was observed in distilled water (standing cultures at 15 or 10 °C or aerated cultures at 18 °C, sometimes followed by standing culture incubation). Pigment production was observed on 2% malt agar (Difco) or on CYA (Pitt 1979).

## Descriptions

*Anguillospora rubescens* Gulis & Marvanová sp. nov.

Fig. 1, Pl. I

Etm.: *rubescens* (Lat.) = becoming reddish. Refers to the production of reddish pigment.

Fungi mitosporici, Hyphomycetes, Moniliaceae. Teleomorphosis ignota.

Coloniae modice crescentes, gossypinae, griseobrunneae, postea in parte reversa pigmentum vinaceum producentes. Corpuscula sclerotialia mollia adsunt. Fructificatio copiosa, subaquatica, structurae conidiogenae parietibus subfuscis. Conidiophora lateralialia vel terminalialia, typice brevia, dispersa vel aggregata, nonnumquam caespitosa, simplicia vel basi parce ramosa. Cellulae conidiogenae incorporatae vel discretatae, cum elongationibus percurrentibus nonnullis praeditae. Conidia recta vel paulo curvata, longifusoida, (120-) 260-440 (-570) x 3.5-5.5 (-7)  $\mu\text{m}$ , apice subulata, basi truncata vel cum extensione percurrente praedita, usque ad 40 septata, cum parietibus sinuosis. Seccasio schizolytica.

**Holotypus:** IMI 380375, ex VG-119.

Mitosporic fungi, moniliaceous hyphomycetes. Teleomorph unknown.

Colonies (MA 2 %) growing moderately fast, reaching 12-13 mm diam. in 10 d at 15 °C, pale purplish grey, becoming darker with age, reverse brown vinaceous with a dark brick margin. On CYA the colony is livid vinaceous to pale vinaceous, with concentric pale grey rings, reverse chestnut in the centre, with a red concentric outer zone and a saffron margin. Aerial mycelium cottony, abundant. Hyphal aggregations or soft prosenchymatic sclerotial bodies of thin-walled hyphae form on agar after submergence. Sporulation profuse after two days, below water, in standing or aerated distilled water. Conidiogenous structures have pale fuscous walls, which is more pronounced in aged cultures. Conidiophores micro- to semimacronematous, single or densely aggregated, often forming scattered tufts or loose conidiomata on sclerotial bodies, typically short, simple or rarely with a few basitonus branches, intercalary, lateral or terminal. Conidiogenous cells integrated with conidiophores as well as with conidial initials or discrete, later usually with few short, percurrent elongations. Conidia long-fusoid, straight or faintly curved, (120-) 260-440 (-570) x 3.5-5.5 (-7)  $\mu\text{m}$ , up to 40 septate, often with slightly wavy outline; apex subulate, base truncate after secession, often with an inconspicuous frill, later typically with percurrent, rarely excentric subulate extension sometimes slightly bulbous just below the basal conidial scar, up to 45 x 2.5-4.5  $\mu\text{m}$ . Slimy coating visible due to granular deposits (Fig. 1,J) on its surface may be present on both ends of floating conidia. Conidial secession schizolytic.

We revealed new growth occurring on both ends of conidia after secession: on the distal end the new hyaline cell wall merges imperceptibly with the slightly fuscous old one; at the proximal end a distinct discontinuity of the cell wall or even a very short frill is seen around the basal conidial scar (Fig. 1,K). With the light microscope it is not possible to distinguish whether the discontinuity involves both inner and outer cell wall layers or solely the outer ones.

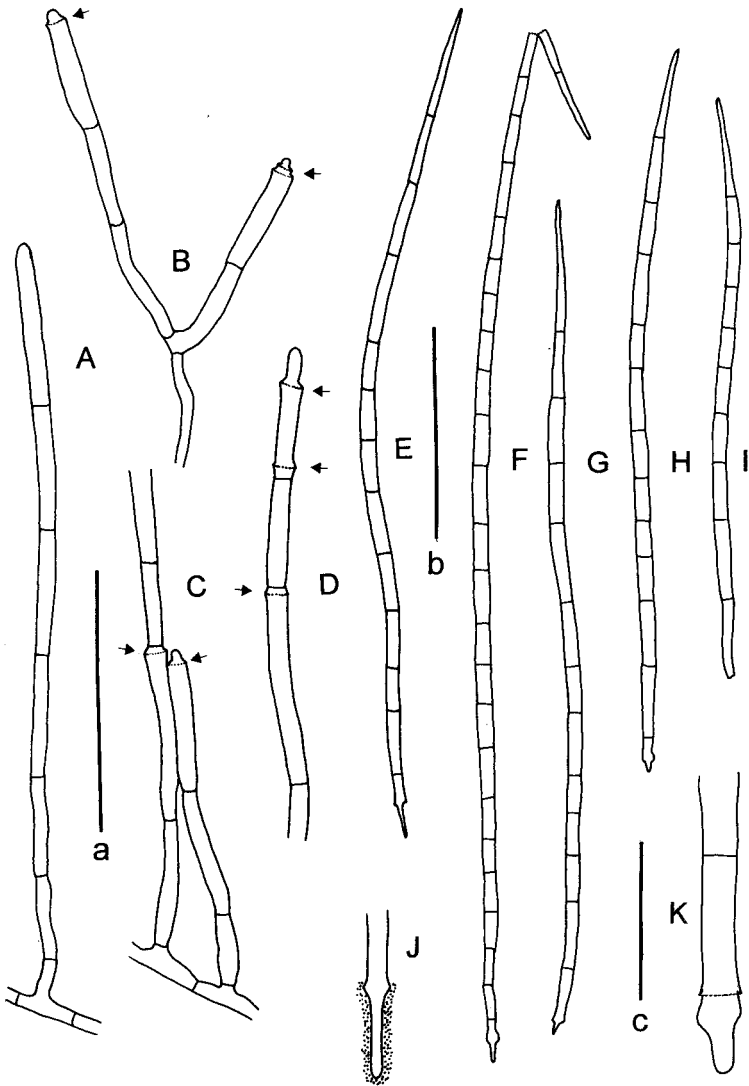
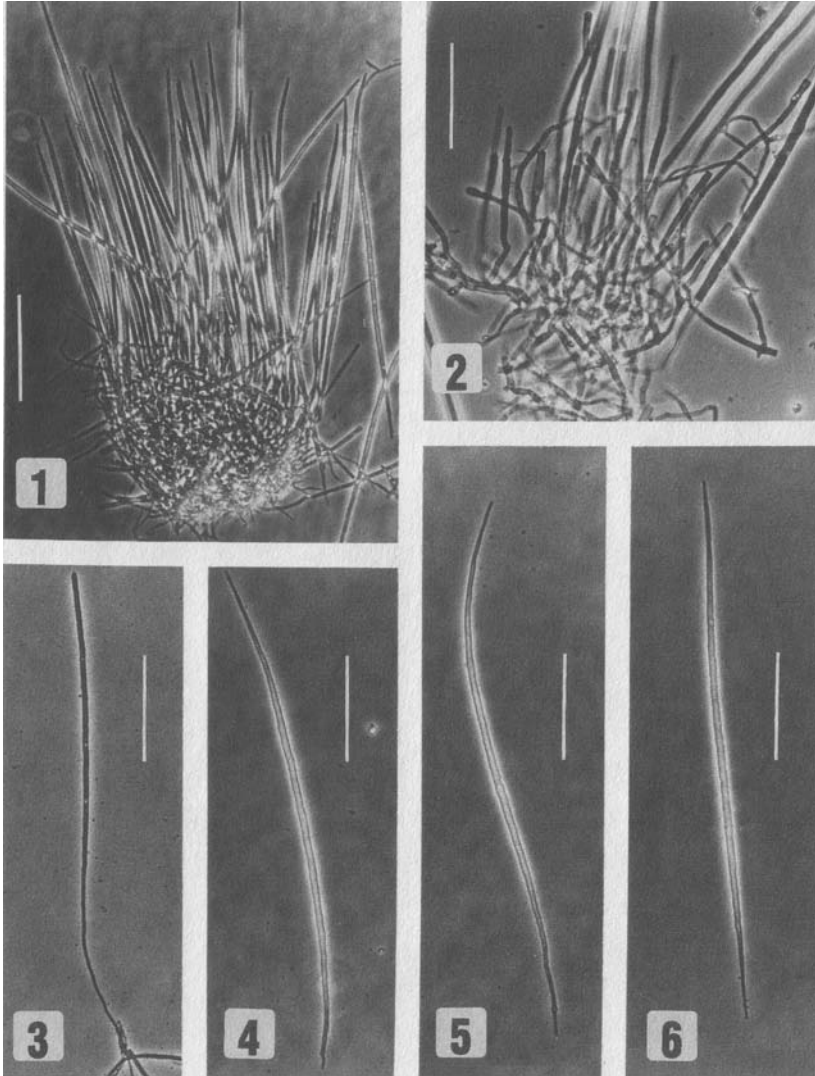


Fig. 1. *Anguillospora rubescens*, VG-119. A. Developing conidium. B-D. Conidiophores with percurrent proliferation of conidiogenous cells (arrows). E-I. Detached conidia. J. Percurrent extension on conidial base coated with mucous sheath. K. Detail of conidial base showing inconspicuous frill (remnant of conidial cell wall) and slightly inflated percurrent basal extension. Scale bar a = 50  $\mu\text{m}$  (for A-D, J). Scale bar b = 100  $\mu\text{m}$  (for E-I). Scale bar c = 25  $\mu\text{m}$  (for K).



Pl. I. *Anguillospora rubescens*, VG-119. 1. Conidioma formed in water. 2. Detail of conidioma. 3. Developing conidium. 4-6. Detached conidia. Note the variously formed basal extensions: excentric (4), percurrent from a bulbous base (5), percurrent integrated (6). Scale bar for 1,3-6 = 100  $\mu$ m, for 2 = 50  $\mu$ m.

Specimens examined: VG-119, river Nacha near the village Kladi, on submerged decaying grass blades collected on 20 Apr. 1997. VG-154, VG-155 (IMI 380381), VG-156, stream near the village Komarovo, on submerged decaying leaves of *Acer negundo* L. collected on 25 Oct. 1997.

This species differs from the well known members of *Anguillospora* Ingold by the combination of typically straight long-fusoid conidia between 260 and 440  $\mu\text{m}$  long with subulate ends, which lack intercalary attenuations.

The pigment and the long conidia suggest a possible identity with *Anguillospora gigantea* Ranzoni. Unfortunately no type material of *A. gigantea* has been deposited and the drawings in the protologue do not show much details. However, there are also substantial differences between our material and *A. gigantea*: the latter has sigmoidly curved spores; even when the curvature is not strong, it appears on the drawings (Ranzoni 1953, Figs. 1 K and 3 B-G) and is described in the protologue: »The curvature is not always restricted to one plane, so that... it is more or less sigmoid...». The sclerotial bodies of thick-walled hyphae are claimed to give rise to loose sporodochia when submerged and may resemble the soft sclerotia of our fungus. However, in *A. rubescens* these appear only after submergence and no tissue of thick-walled hyphae has been seen before or after submergence. In our species curved conidia are less common and appear in aged cultures of some isolates only.

Ecologically, *A. gigantea* seems to prefer warmer months in California (in latitudes between 32-42 N) where it »was found only during the summer and early fall months«, whereas our fungus was collected in April and October in a cool climate area (54-55 N). Therefore we hesitate to choose our fungus as a neotype of *A. gigantea*.

Our species is somewhat similar to *A. longissima* (Sacc. & Syd.) Ingold, where some isolates also produce reddish pigment, the conidia tend to proliferate at the ends after secession and unlike *A. crassa* Ingold, *A. furtiva* Descals & J. Webster (Descals et al. 1999) and *A. fustiformis* Marvanová & Descals (1996) lack the shiny appearance, believed to be due to glycogen reserves. *A. rosea* Descals & J. Webster (Descals et al. 1999) has pale pinkish colonies and the conidia are typically sigmoidly curved, parallel-walled, have no basal extension and the ends are rounded.

Conidia of our fungus are also similar to those of *Pseudoanguillospora stricta* Iqbal, but the conidiogenous cells of the latter proliferate sympodially (Marvanová 1996), the conidia rarely show any postsecessional growth and the colonies lack reddish pigment. *Kontospora halophila* A. Roldán, Honrubia & Marvanová produces apparent red pigment in culture, but its conidia are wider and often bear lateral caducous branches. The fungus occurs in waters with high content of mineral salts (Roldán et al. 1990). The caespitose conidiomata with long acicular conidia in *A. rubescens* resemble fructifications of *Linodochium formosum* Minter & Hol.-Jech. but the latter has conidiogenous cells grouped at conidiophore apices, with 1-3 conidia arising more or less synchronously at each conidiogenous cell. Moreover, members of this genus seem to prefer coniferous substrates (Minter & Holubová-Jechová 1981).

***Sporidesmium fuscum* Gulis & Marvanová sp. nov.**

Fig. 2, Pl. II, 1-3

Etym.: *fuscum* (Lat.) = fuscous.

Fungi mitosporici, Hyphomycetes, Dematiaceae. Teleomorphosis ignota.

Coloniae modice crescentes, griseae, gossypinae, pars reversa atra. Parietes cellularum fuscae. Conidiophora micro- vel semimacronematosa, terminalia vel lateralialia, nodosa, usque ad 450  $\mu\text{m}$  longa, simplicia vel parce ramosa. Cellulae conidiogenae incorporatae, percurrenter prolificantes, apud locos conidiogenos saepe inflatae. Conidia singularia, simplicia, recta, cylindrica, (90-) 130-220 (-330)  $\times$  (3.5-) 4-5.5  $\mu\text{m}$ , 12-18 (-23) septata, apex cupulatus, basis truncata. Septa praecipue transversa, rarissime obliqua, crassa vel tenua. Extensio basalis rara, brevis, excentrica. Secessio schizolytica, tarda.

**Holotypus:** IMI 380377, ex VG-80.

Mitosporic fungi, dematiaceous hyphomycetes. Teleomorph unknown.

Colonies (MA 2 %) 52 mm diam. in 35 d at room temperature, or 5-12 mm diam in 13 d at 15 °C, mouse grey, sometimes darker in the centre and paler at the margin, aerial mycelium abundant, cottony, becoming lower and less dense towards the colony margin, reverse leaden or fuscous black. Cell walls fuscous. Sporulation underwater and at the water level. Conidiophores micro- to semimacronematous, terminal or lateral and then up to 450  $\mu\text{m}$  long, simple or sparsely branched, often nodose. Conidiogenous cells integrated with the conidiophore, proliferation percurrent, usually followed by symmetrical or asymmetrical swelling below the site of conidium detachment, in the second case giving an impression of sympodial elongation. Conidia single, simple, straight, cylindrical, integrated with the conidiogenous cell, (90-) 130-220 (-330)  $\times$  (3.5-) 4-5.5  $\mu\text{m}$  with 12-18 (-23) septa, rounded at the apex, truncate at the base. Septa of two kinds: thicker, more or less alternating regularly with thin ones, mostly transverse, very rarely oblique. Basal extension rarely present and then short, excentric, resembling a germ-tube. Formation of secondary lateral conidia seen occasionally. Conidial secession schizolytic, tardy. Fragmentation of conidia into few-celled segments takes place after prolonged incubation in water.

Specimens examined: VG-63, in a hardwater stream near the village Raubichi, on submerged decaying twigs collected in Sep. 1994. VG-80, in a hardwater stream, right tributary of the river Berezina near the village Schatkovo, Bobruisk region, on submerged decaying leaves of *Populus nigra* L. collected in May 1996. VG-81 (IMI 380378), the same locality and date, from submerged decorticated wood. VG-94, in a stream without woody riparian vegetation, near the village Selivanovka, on submerged decaying grass blades collected in Oct. 1996. VG-118, VG-124 (IMI 380383), in the slow-flowing river Muzhanka near the village Zamuzhanje, on submerged decorticated wood collected on 20 Apr. 1997. VG-123 (IMI 380376), in the slow-flowing river Ptich near the village Voronichi, on submerged decaying leaves of *Nuphar lutea* (L.) Smith collected on 22 Apr. 1997. VG-125, in a stream near the Village Velikoje Selo, on decaying submerged grass blades collected on 15 May 1997. VG-136, in the river Berezina, the Berezinsky Biosphere Reserve, on submerged decaying wood collected on 10 Oct. 1997.

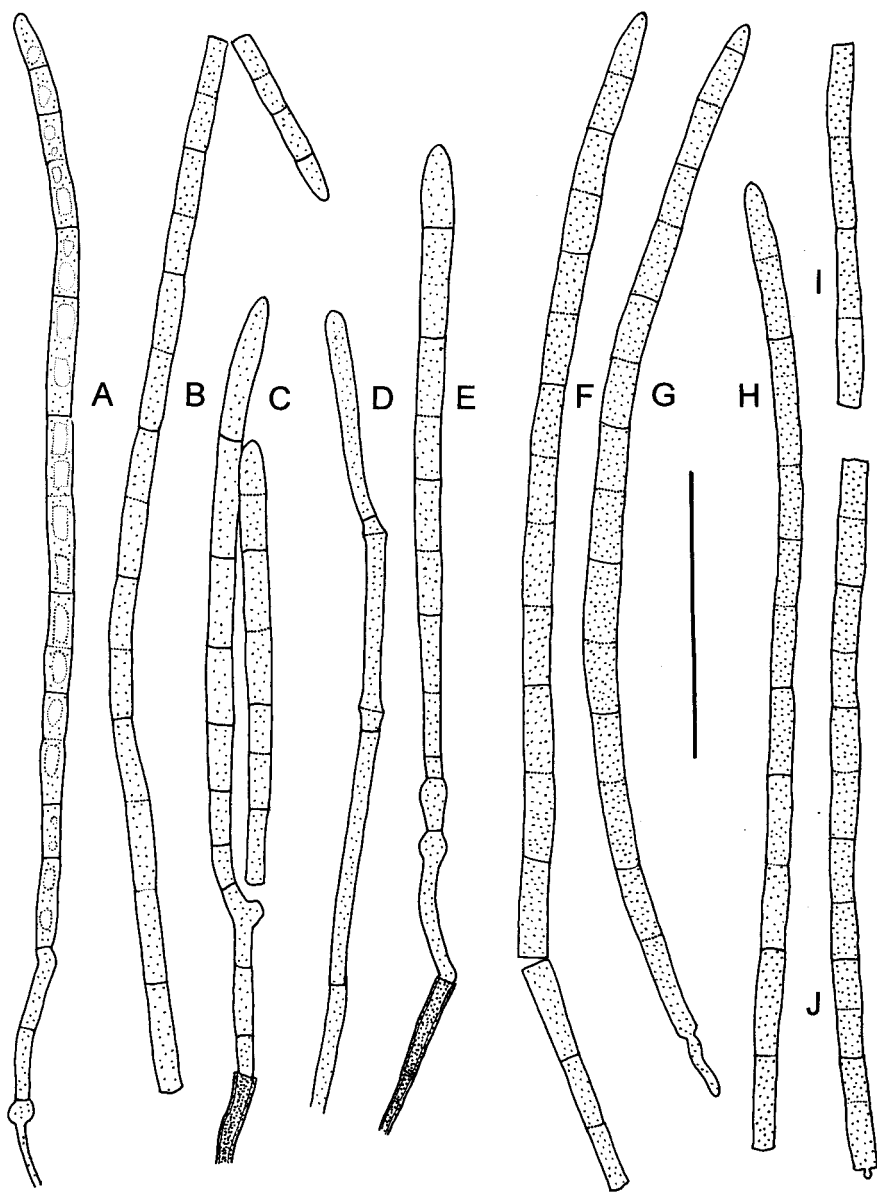
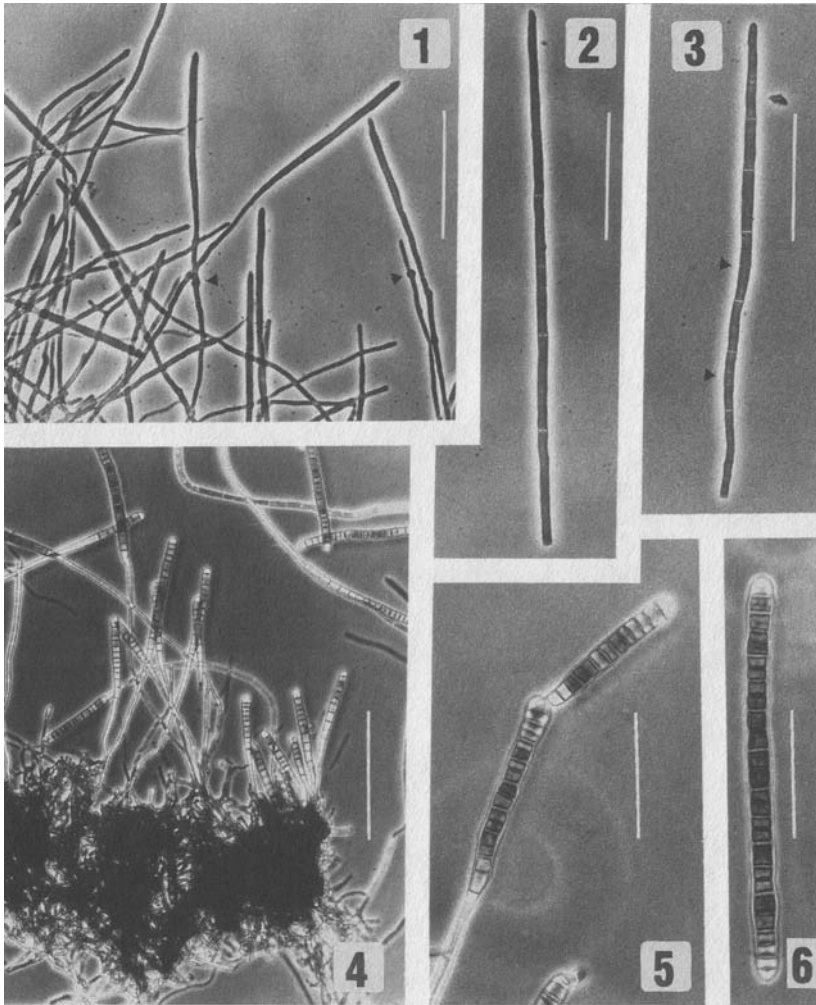


Fig. 2. *Sporidesmium fuscum*, VG-80. A, C-E. Developing conidia on conidiophores. In C and E the conidiophores emerge from old brown thick-walled hyphae. B, F-H. Detached conidia. I, J. Part-conidia. Scale bar = 50  $\mu$ m.



Pl. II. *Sporidesmium fuscum*, VG-80. 1. Developing conidia. Note the nodose proliferations (arrowheads). 2, 3. Detached conidia. Note the thin septa alternating with thick ones (arrowheads). Scale bar for 1-3 = 50  $\mu$ m. *Taeniolella typhoides*, VG-126a. 4. Group of developing conidia. 5. Conidiophore with a primary and a secondary conidium. 6. Detached conidium. Scale bar for 4 = 90  $\mu$ m, for 5, 6 = 45  $\mu$ m.

Four isolates of this species (VG-63, VG-80, VG-81 and VG-94) produce black soluble pigment in stationary liquid culture (potato maltose broth). Culture filtrates showed antimicrobial activities against Gram-positive bacteria (Gulis & Stephanovich 1999).

This species was originally reported as *Mycocentrospora varians* R.C.Sinclair & Morgan-Jones (Gulis & Stephanovich 1996). However, a thorough study of the conidiogenesis revealed percurrent proliferation of conidiogenous cells, which bars classification in *Mycocentrospora* Deighton. Search in literature led us to *Sporidesmium* Link in the broad sense as understood by Ellis (1958, 1971, 1978). It is saprotrophic, dematiaceous, has percurrently proliferating conidiogenous cells and transversely septate conidia. Kirk (1982) segregated *Sporidesmiella* P.M. Kirk with distoseptate conidia and Subramanian (1992) split the rest of *Sporidesmium* into six genera. As generic criteria he used combinations of conidial septation (eu- or disto-), conidiophore proliferation and the shape of conidiophore segments resulting from the proliferations. However, the genus is still rather heterogeneous, comprising species with various conidial shapes: clavate, obclavate, long-fusoid or cylindrical, with thick or thin cell walls. Percurrent proliferations of conidiophore marked by inflations around the detachment scars is characteristic for *Gangliophora* Subram. based on *Sporidesmium casuarinae* Matsush., but the conidiophores in our fungus are much less and only rarely branched, conidia are longer and less wide. *Sporidesmium fragmentisporum* Matsush. (Matsushima 1993) described from a decaying palm petiole collected in a National Park in Ecuador (no closer data on the habitat given) is the most similar species to our taxon: it has semimacronematous conidiophores with percurrently proliferating conidiogenous cells, often inflated and asymmetrical at the point of inflation and conidia fragmenting into smaller units. Like our fungus, it also has thicker and thin septa (not mentioned in the description, but see Matsushima 1993, fig. 565 and Pl. 205). However, it differs by having much shorter conidiophores as well as conidia (only up to 85 µm, which is below the lower limit of *S. fuscum*). At the same time we are aware of the marginal position of *S. fragmentisporum* in the genus *Sporidesmium* and its eventual segregation together with *S. fuscum*.

Members of *Sporidesmium* often occur on woody substrates or on decaying plant tissues. Several species are already described from water habitats: *S. ensiforme* Descals (1982), *S. taxodii* J.L.Crane (Crane 1972), and four new species by Cabello et al. (1990), who also reported some species from a river hitherto known from terrestrial habitats only. The name of another species suggests at least moist habitat, i.e. *S. paludosum* M.B.Ellis (Ellis 1958) described from decaying leaves and culms of *Cladium mariscus* (L.) Pohl which is a swamp-inhabiting plant. Abdullah (1980) found *Sporidesmium flexum* Matsush. on *Thuja plicata* foliage collected from the bottom of a small pond. Three of the above species (*S. ensiforme*, *S. longisporum* Cabello, Cazau et Arambarri and *S. taxodii*) are similar to our in the long conidia. However, *S. ensiforme* has conidia at least twice as long as our species, in *S. longisporum* the conidia are significantly shorter, distinctly tapering towards apex and distoseptate. *S. taxodii* has shorter and wider long-fusoid conidia.

***Taeniolella typhoides*** Gulis & Marvanová sp. nov. Figs. 3,4, Pl. II, 4-6

Etym.: *Typha* = cat tail, reed mace, *-oides* means 'similar to'. Refers to the impression the attached conidia give when seen under low magnification.

Fungi mitosporici, Hyphomycetes, Dematiaceae. Teleomorphosis ignota.

Coloniae modice crescentes, griseae, gossypinae, pars reversa atra. Conidiophora dispersa vel aggregata, micro- vel semimacronematosa, simplicia, glabra vel verrucosa. Cellulae conidiogenae incorporatae. Prolificatio non visa. Conidia singularia vel nonnumquam in catenis acropetalibus curtis oriunda, recta vel paulo curvata, cylindrica, (35-) 118-243 x 8-11  $\mu\text{m}$ , usque ad 40 septata, apice rotundata, basi truncata vel convexa, raro cum extensione parabasali excentrica. Cellulae subinflatae, parietibus crassis, glabris vel verrucosis, segmenta breviora atrobrunnea, cellulae terminales pallescentes. Sporulatio subaquatica. Secessio conidiorum tarda, schizolytica.

**Holotypus:** IMI 380380, ex VG-126a.

Mitosporic fungi, dematiaceous hyphomycetes. Teleomorph unknown.

Colonies (MA 2 %) 23-26 mm diam. in 14 d at 15 °C, lavender grey to pale olivaceous grey, aerial mycelium cottony, reverse dark olivaceous grey. After several months incubation under water, minute sclerotial bodies ca. 100  $\mu\text{m}$  diam. with radiating hyphae at the margin appear at the bottom of the Petri dish. Sporulation underwater, in stationary cultures or after a several-day aeration followed by submerged incubation in standing distilled water. Conidiophores micro- or semimacronematous, intercalary, lateral or apical and then sometimes extremely long, scattered or aggregate, simple, glabrous or verrucose in the proximal part. Conidiogenous cells integrated with supporting structures, proliferation not seen. Conidia single or sometimes in short acropetal chains, straight or somewhat curved, cylindrical, (35-) 118-243 x 8-11  $\mu\text{m}$ , up to 40 septate (in nature up to 470 x 9-14  $\mu\text{m}$ , up to 60 septate), rounded at the apex, truncate or convex at the base, sometimes with a thinner hilum on one or both ends, rarely with an excentric basal extension. Cells slightly inflated, walls thick, brown, glabrous or sometimes verrucose, few-celled segments occasionally dark brown, the uppermost cell typically paler. Thin secondary (?) septa may be present, but not regularly. Secession schizolytic, tardy in stationary culture, after several months of submergence.

Specimens examined: VG-126 (IMI 380382), VG-126a, in the slow-flowing river Ptich near the village Voronichi, on submerged decaying leaves of *Nuphar lutea* (L.) Smith collected on 22 Apr. 1997.

The anamorph genus *Taeniolella* S.J.Hughes (1958) is relatively broadly defined. Conidia are typically flexuous, less often straight, simple or branched, catenate with inflated, glabrous or verrucose cell walls. *Taeniolella* spp. are typically terrestrial and are usually collected on woody debris, rarely on leaves, herbaceous stems or mushrooms (Ellis 1971, 1976). Several species were described as parasitic on lichenized fungi (Hawksworth 1979, Diederich 1990). Four species were reported from water environments: *Taeniolella aquatilis* (Woron.) Mil'ko (1985) from water in the river Volga in Russia, *T. americana* J.L.Crane & Schokn. (Crane & Schoknecht 1982) from submerged decaying catkin of *Liquidambar styraciflua* L. in a pond in North America

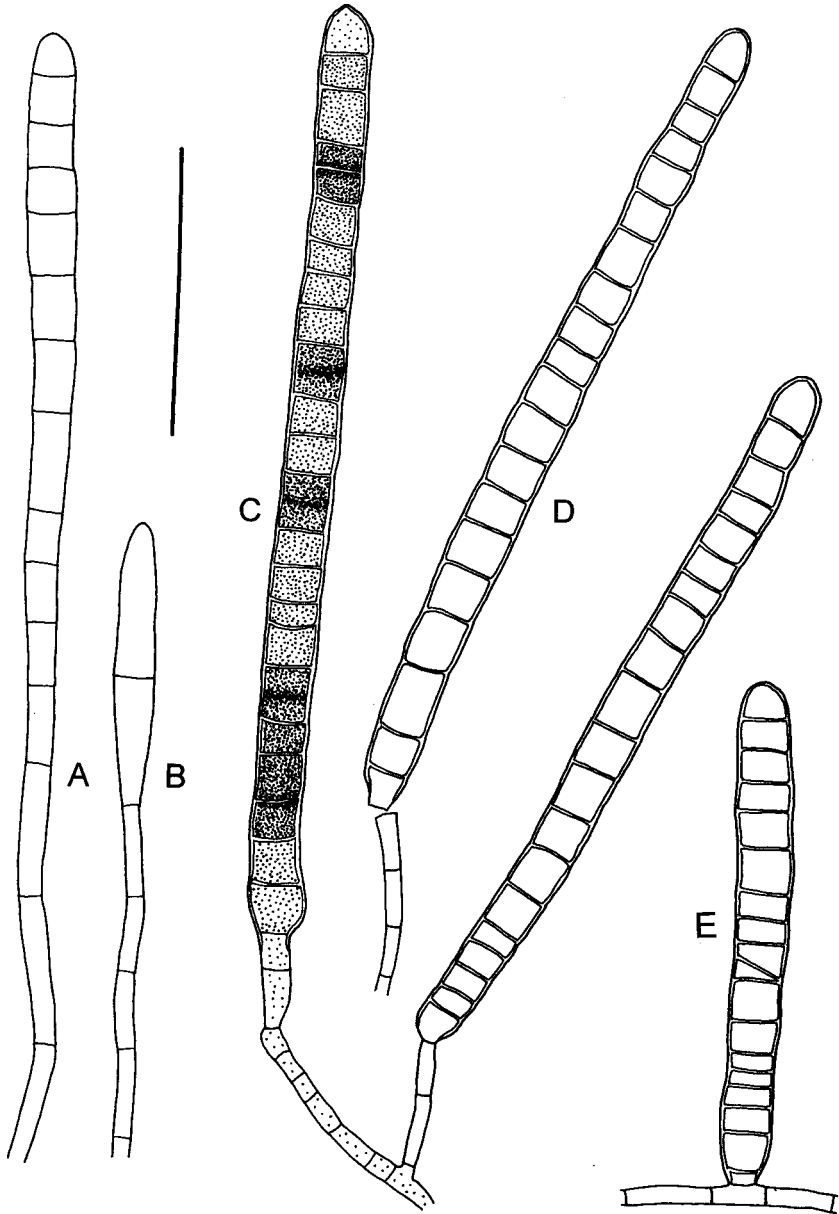


Fig. 3. *Taeniolella typhoides*, VG-126a. A,B. Young stages of conidial development. C. Conidia on branched conidiophore. D. Detached conidium near its conidiophore. E. Sessile conidium on intercalary conidiogenous cell. Scale bar = 50  $\mu$ m.

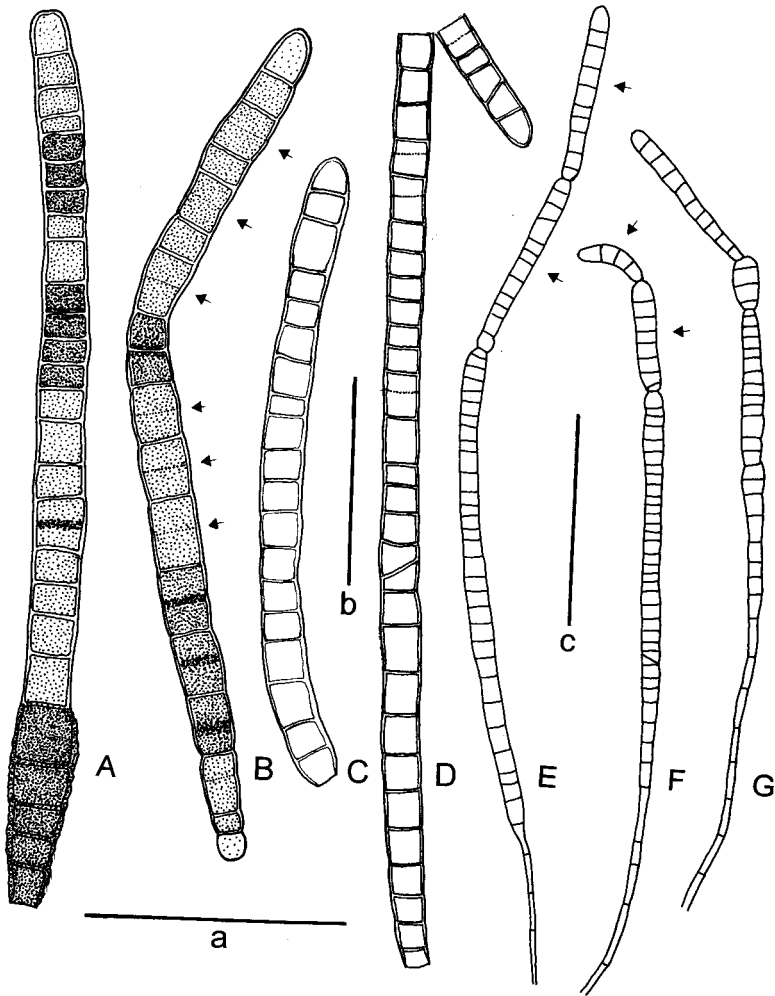


Fig. 4. *Taeniolella typhoides*. A-C. VG-126a. Detached conidia. Note the dark rough segments in A and B, and thin secondary (?) septa in B (arrows). D. Conidium from nature. Compare the length of this conidium with conidia from pure culture. E-G. VG-126a. Apical chains of secondary conidia developing *in situ* (arrows). Scale bar a = 50  $\mu\text{m}$  (for A-C), scale bar b = 50  $\mu\text{m}$  (for D), scale bar c = 100  $\mu\text{m}$  (for E-G).

(cf. Shearer & Crane 1986), *T. caffera* Matsush. (Matsushima 1996) from submerged decaying branch in a stream in South Africa and *T. rudis* (Sacc.) S.J.Hughes from decaying submerged *Comarum palustre* L. and *Phragmites australis* (Cav.) Trin. ex Steud. in a lake in Estonia (Voronin 1992).

Our species differs from all described spp. of *Taeniolella* by the capacity to produce much longer conidiophores, which is probably an adaptation to the water environment or may represent only cultural conditions. Most of the *Taeniolella* species were described from natural substrates and their morphology in pure culture is not known. Thinner secondary septa are drawn in *T. exilis* (Karst.) S.J.Hughes (Ellis 1971) but not mentioned in the description. *T. aquatilis* has twice as short conidia as in our species and they are usually only 6-14 septate. *T. americana* differs from our species by straight, rough, uniformly brown conidia which are twice as wide as in our fungus but have the same length and appear in long sometimes branched chains. *T. caffera* is much more similar to our species in producing persistent or tardily breaking chains of conidia, but its conidia are more curved, reaching half the length of those of *T. typhoides* and have glabrous cell walls. All septa are drawn equally thick (Matsushima 1996, Figs. 870, 871).

Truly dematiaceous genera (with dark, often thick conidial cell walls) occur rarely among freshwater hyphomycetes with exclusively or predominantly underwater sporulation. The melanized, usually thick structures may be a protection against damages from invertebrate feeding or bacterial lysis.

### Acknowledgements

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