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Four Noteworthy Coprophilic Mucorales From Eastern Poland

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Results of recording of four species of *Mucorales* from Poland are given.

Coprophilic fungi occurring on dung of small vertebrates are rather poorly known in Polish mycoflora as compared to the fungi growing on big beasts faeces. S k i r g i e ł ł o and Z a d a r a (1978) listed many species of *Mucorales* isolated only from dung of ungulates and *Leporineae*. The are no records from Poland regarding the species growing on pellets of small rodents and amphibians, contrary to other countries, particularly to America (B e n j a m i n, 1959, 1978) where many interesting species have been found. The recent research of the author has resulted in recording of several noteworthy species new to Poland (*Mucorales*: *Dimargaritaceae*, *Mortierellaceae*, *Thamnidiaceae*, *Piptocephalidaceae*). The descriptions below include only the characters which were observed in the collected material.

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Tieghemiomyces californicus Benjamin, 1959

Colonies on dung white, compact. Substrate vegetative hyphae sparse. Sporophores septate (septae with a conspicuous tubular projection), white, initially simple, branching in age, bearing long sterile setae, 400-500 µm long and 9-10 µm wide above sporogenous region. Sporophore cells 50-130 µm long (vide Benjamin 60-150 µm). First order branches sparse (4-7), arising from the axes at 1/4 of sporophore height. Second, third and fourth order branches arranged subverticillately

or irregularly under septa. Tips of branches usually sterile. Sporogenous cells barrel--shaped, one to four in row, 7-1 µm long and 2.2-5 µm thick, verticillate or irregularly arranged, usually on the last order branches of sporophore. Merosporangia bispored. The first spore budding from the sporogenous cell, the second from the former, both 3-4 x 4-5 µm (Benjamin 3-3.5 x 3.5-4 µm), smooth, globose to ovoid. Zygospores not found.

Tieghemiomyces californicus was described from USA (B e n j a m i n, 1959) and recorded many times in California on dung of mice. The present communication is the first European record of the species. The fungus was found in September 1992, on dung of bank vole (*Clethrionomys glareolus*), in the Białowieża National Park (Białystok province). Attempts to subculture this strain on CMA failed.

Mortierella multidivaricata Benjamin, 1978

Colonies both on dung and on CMA (in the presence of *Mucor* sp.) white, cobwebby, profusely sporulating; in axenic culture low and collapsing in age. Substrate hyphae thin, 2.5-5 µm in diameter (vide Benjamin (2)-3-5-(7) µm), branched, emerging from the substratum and climbing on sporophores of mucoralean fungi. Sporophores abundantly 2-4 times branching, growing laterally mostly from swellings of aerial hyphae (Fig. 2a). Sporophore branches cylindrical to clavate, variable in length and width, 13-35 x 10-20 µm; first order branches arising simultaneously, these of higher orders usually somewhat shorter and thinner, 7-25 x 6-10 µm. Ultimate branches forming 2 to 3 long, tapering pedicles, 30-57 µm long and 2-2.5 µm wide at base, bearing single, two-spored sporangiola at the tip. Sporangiola 15-18 x 7-10 µm, with the wall dissolving at maturity. Spores yellowish, hemispherical, 9.5-12 x 6.5-11 µm, rounding after freeing; at first smooth, later delicately sculptured. Chlamydospores 15-25 µm in diameter. Wall with broadly conical spines, 1.5 µm long and 1.5 µm wide at base, sometimes breaking away in the old material and leaving crater-like fracture. Zygospores not observed.

Mortierella multidivaricata has been hitherto known only from a typical gathering in Moscow by C. Stoianowitch (B e n j a m i n, 1978). In Poland it was found twice on mice pellets from Goławice (Warsaw province) and Kuligi (Biebrza Fens,

Thamnostylum piriforme (Bainier) von Arx et Upadhyay, 1970

Colonies on natural substratum and on CMA white, up to 2 cm high, greying in age. Sporophores hyaline at first, becoming brownish in age, smooth or verrucose, simple or sympodially branched, nonseptate; their apices sterile or bearing sporangia.

Sporangia brown, wall diffluent. Sporophores 12-15 µm wide at base, apically swollen to 40-50 µm below sporangium. Sporangiola in subapical clusters, arising in whorls or laterally from vesicles (Fig. 2c, d) or, sometimes, directly from sporophores (Fig. 2e), or from inconspicuous protuberances. Sporangiolar pedicles 80-100 µm long, strongly recurved distally. Sporangiola subglobose or obpyriform, 20-35 µm in diameter, yellowish-brown, usually containing c. 20 spores. Columellae of sporangiola hemispherical, usually 12 µm in diameter. Spores alike in sporangia and sporangiola, ovoid, 5-6 x 3.5-4 µm. Zygospores not observed.

Found on dung of common rat (*Rattus norvegicus*) in Warsaw in July 1992. It is the first Polish record of this very common, cosmopolitan fungus.

The species is very variable, particularly so far as the size of sporophores and the number of sporangiola in the cluster is concerned. On dung, in the presence of competitive species of *Mucor*, very tall sporophores, bearing exclusively subapical clusters of sporangiola were mostly found. In axenic culture, on rich medium, short sporophores with small numbers of sporangiola and tall sporophores bearing numerous clusters of sporangiola prevailed.

The simple sporophores are similar to that of *Helicostylum elegans* Corda. Its sporangiola have 8-22-33 µm in diameter and are borne on strongly recurved pedicles, 55-70 mm long; spores are ovoid, 7.5-8.8 x 5.5-6.5 µm (according to Corda). The size of spores of a strain of *Thamnostylum piriforme*, isolated by U p a d h y a y (1973) was very close to that of *Helicostylum elegans*. It is probable that some of the Polish records of *H. elegans*, cited by S k i r g i e ł ł o and Z a d a r a (1978), refer in fact to *Thamnostylum piriforme*. It seems that the best diagnostic criterion allowing to discriminate the species is the presence of columella in sporangiola of *Th. piriforme*.

Piptocephalis lepidula (Marchal) Benjamin, 1959

Piptocephalis lepidula has been hitherto recorded from Belgium, Netherlands, Great Britain, USA, USSR and Japan. The records below constitute the first findings of this species in Poland. It seems to be quite common.

The species was found 5 times: on dung of toad (Bufo bufo) in the Białowieża National Park, August 1991; on dung of shrew (*Sorex* sp.) in the Kampinos National Park, July 1992; on dung of bank vole (*Clethrionomys glareolus*) in the Białowieża National Park, September 1992; on dung of bank vole (*Clethrionomys glareolus*) in the Kampinos National Park, July 1992; on dung of striped field mouse (*Apodemus agrarius*) in the Białowieża National Park, September 1992.

Piptocephalis lepidula is known as a facultative parasite of other mucoralean fungi (B e n j a m i n, 1959). The Polish strains when growing on naturals substrata, produced aerial hyphae running around the hyphae of different species of *Mucor* and penetrated them with haustoria.

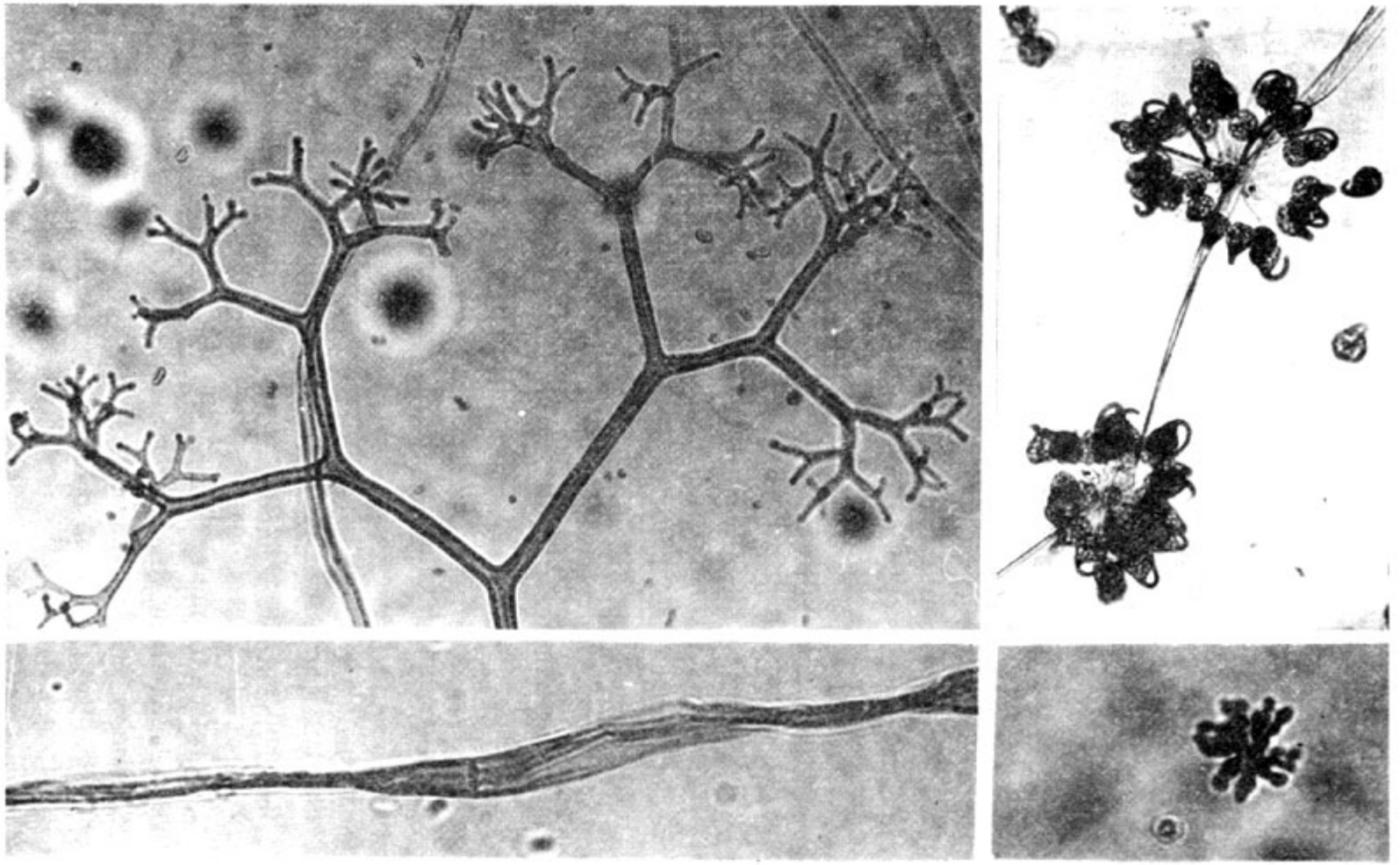

Fig. 1. *Piptocephalis lepidula* (Marchal) Benjamin (A-C); *Thamnostylum piriforme* (Bainier) von Arx et Upadhyay (D)
A – detail of distal dichotomous branch system of one primary branch of a sporophore, x 375; B – typical septum in lower region of sporophore with tubular perforation, x 750; C – the vesicle showing arrangement of nearly mature merosporangia, x 750; D – the sporophore with a sporangiolar clusters, x 100

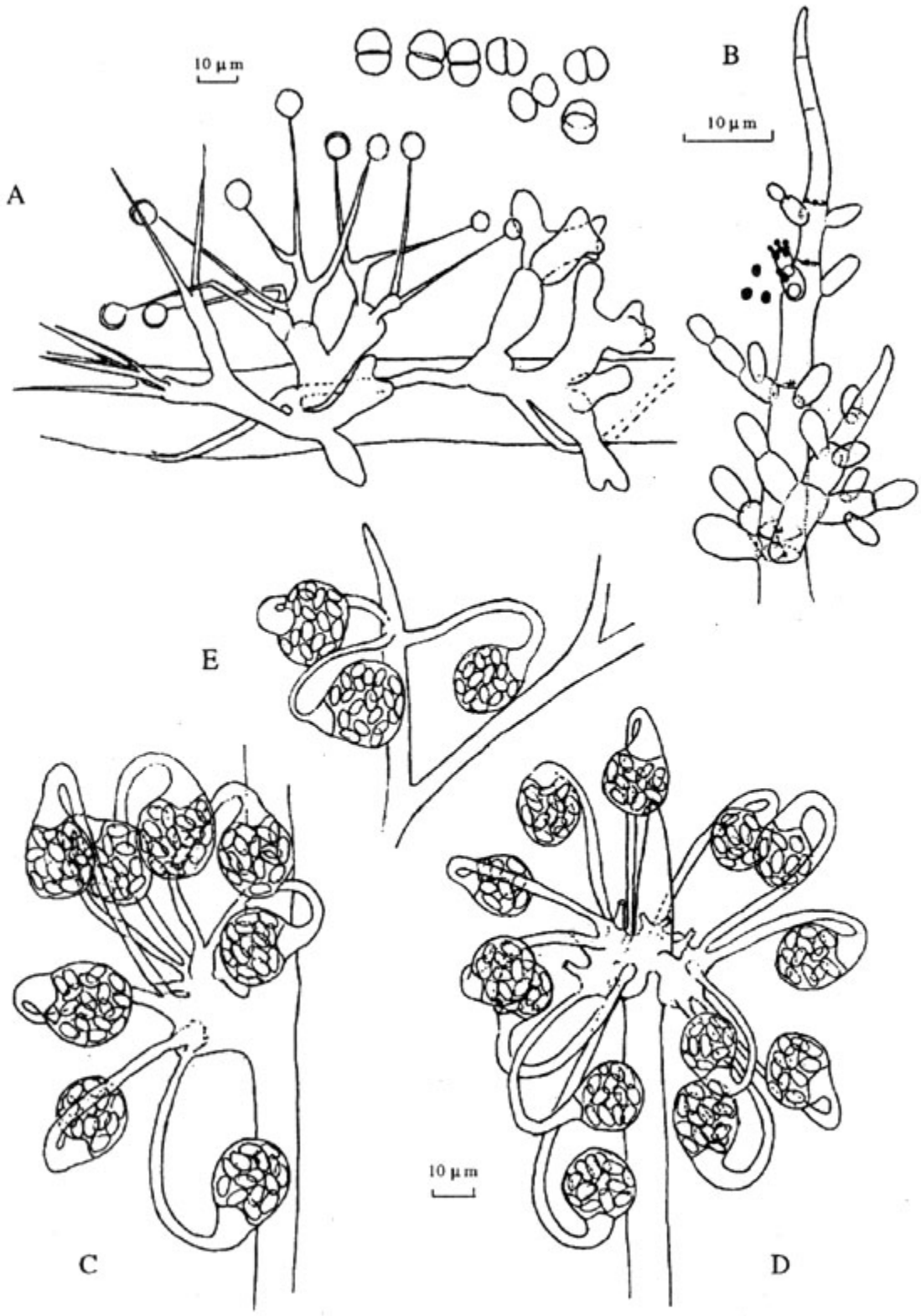

Fig. 2 *Mortierella multidivaricata* Benjamin (A); *Tieghemiomyces californicus* Benjamin (B); *Thamnostylum piriforme* (Bainier) von Arx et Upadhyay (C-D)

A – sporangiophores showing simultaneous development of immature sporangiola and mature sporangiospores; B – single fertile branch system showing origin and arrangement of sporiferous barrel – shaped cells; C – lateral vesicle with pedicellate sporangioles; D – subapical verticil of pedicellate sporangioles; E – pedicellate sporangioles arising directly from sporophore

Parasitic hyphae produced thicker, aseptate and longitudinally striate sporophores. However, sporophores growing directly from the substrata and attached with rhizoids were also very common.

All Polish strains match well the description of Benjamin, apart from the dimension of merosporangiospores which are smaller (3-5.5 x 1.5-2.5 μm) than those in B e n j a m i n (1959; 3.9-6.6 x 2.2-2.6 μm). Spherical, smooth zygospores, 38 μm in diameter, borne on smooth suspensors were find in the subculture of strain one. Its size and shape is similar to the immature zygospore illustrated in B e n j a m i n (1959, Pl. 4h).

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