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MORPHOLOGICAL CHARACTERISTICS OF VEGETATIVE MYCELIA AND ANAMORPHS IN DIFFERENT COLLECTIONS OF XYLOTROPHIC BASIDIOMYCETOUS MUSHROOMS*

Studies of morphological characteristics of vegetative mycelia and asexual stages – anamorphs (sporulating and/or not sporulating) in the life cycle of basidiomycetous mushrooms provide valuable information on their biology and classification [1–9].

Different collections of 22 species (27 strains) of xylotrophic Basidiomycetes belonging to 15 genera (*Flammulina elastica*, *F. velutipes*, *F. rossica*, *Fomes fomentarius*, *Fomitopsis pinicola*, *Ganoderma adspersum*, *G. lucidum*, *G. resinaceum*, *Hypholoma fasciculare*, *Laetiporus sulphureus*, *Lentinus tigrinus*, *Panellus stipticus*, *Phellinus igniarius*, *Ph. robustus*, *Pholiota alnicola*, *Ph. aurivella*, *Ph. destruens*, *Piptoporus betulinus*, *Pleurotus ostreatus*, *Polyporus varius*, *Psathyrella condolleana*, *Schizophyllum commune*) from the Culture Collection of the Laboratory of Fungal Biology and Biotechnology, Yerevan State University (FCC-YSU) [10] were observed for morphologies with focus on hyphal clamps, presence and types of anamorphs, chlamydospores, cuticular cells, hyphal loops and others. Dikaryotic cultures were isolated from fruiting bodies collected on different wood substrates in territories of Armenia, Russia, Germany, France, Italy and Iran. Malt-extract agar medium (1.5 % MEA) with chloramphenicol (100 mg/L) was used for culture isolation. Collections were genetically identified based on nuclear rDNA-ITS and partial 28S sequencing data [11–12]. Micromorphological observations were realized after growing mycelia on sterile microscope cover slips placed onto MEA plates [13–15]. An Axioplan-2 imaging microscope (Zeiss, Göttingen, Germany) with digital camera using AnalySIS® software (Münster, Germany) were used for morphological studies of mycelia and anamorphic structures. Taxonomic significance of mycelial and anamorphic structures was evaluated. So far mostly still neglected, we expect that taxonomically relevant mycelial, particularly anamorphic characters will assist modern systematics within Basidiomycetes similar in addition to descriptions of mushroom features used already for long in Basidiomycetes taxonomy.

Hyphal branching is one criterion as how fungal cultures can be specified and species distinguished. Mostly in the basidiomycetes, side branches originate at one side from below a hyphal septum. The growth angle of the sidebranch in relation to the parental hyphae can vary between the homokaryon and the dikaryon of a species. Possibly due to the formation of a clamp cell, by space limitation the angle of branching is smaller. In species forming hyphal strands, the growth angle of a sidebrach can be so sharp that the sidebranch runs parallel to the parental hyphae. Within cultures, there can be also very specific branching patterns. In Ganoderma cultures, particularly *G. lucidum* and *G. adspersum* dichotomous branching patterns were regularly observed.

In most cultures of dikaryons, single clamp cells were observed at the septa. Clamp cells between species differed in size, shape and numbers – small or giant, oval or round, numerous or rare, with or without an inner loophole formed by the backwards arching clamp cells. Clamps were not observed in culture of Ph. robustus. Cylindrical, from slightly curved to rounded forms of hyaline oidia were observed in *F. elastica*, *F. velutipes*, *F. rossica*, *F. fomentarius*, *F. pinicola*, *G. lucidum*, *H. fasciculare*, *L. sulphureus*, *Ph. alnicola* and *Ph. aurivella* cultures. Chlamydospores were observed mainly in substrate mycelia in aging cultures of three Flammulina species, *G. lucidum*, *G. resinaceum*, *L. sulphureus*, *L. tigrinus*, *P. stipticus*, *Ph. alnicola*, *Ph. destruens*, *P. ostreatus* and *S. commune*. Depending on the strain, they were rare or numerous, round, oval or of lemon shapes, appeared singly

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or in chains, apical and intercalary within hyphae. Abundantly produced species-specific apical and intercalary formed chlamydospores of *G. resinaceum* have been called gasterospores, while those thick-walled spores formed on conidiophores by aerial mycelium of *L. sulphureus* (called also terminal aleuriospores) in laboratory conditions are known under the anamorphic name Sporotrichum versisporum. Species specific tubercules (toxocysts-like structures erected from the hyphae at 90o) are a typical mycelial character of *S. commune*. Hyphal loops and loop formation phenomena by coiling of the apical part of hyphae have repeatedly been observed in *F. fomentarius*, *H. fasciculare*, *G. applanatum*, *L. tigrinus*, in rare numbers also in *Ph. robustus*, *Ph. destruens*, *P. varius* and *S. commune* cultures. Cuticular cells are terminal, lateral or intercalary swellings or complexes of swellings, with thin or thickened, hyaline or brownish walls forming a pseudoparenchymatous crust [1]. In literature, they were described from cultures of several Basidiomycetes fungi (*Polyporus squamosus*, *Xerula radicata*, *Collybia fusipes*, *Hymenochaete rubiginosa*, *H. tabacina*, *Armillaria mellea* and closely related species, etc.) as pseudosclerotial plate, mycelial crust or mycelioderm [16]. In 25 further species from the genera *Clitocybe*, *Clitopilus*, *Entoloma*, *Galerina*, *Lactarius*, *Psathyrella*, *Lepista*, *Leophyllum*, *Marasmius*, *Mycena*, *Pholiota*, *Xerula*, *Melanoleuca* and *Tubaria* formation of culticular cells was mentioned in literature but without morphological details [16]. In our collection, cuticular cells have been observed for the first time in aging cultures of four species: *F. fomentarius*, *G. adspersum*, *G. lucidum* and *P. betulinus*. In strain Ff-9 of *F. fomentarius* cuticular cells were rare, round, hyaline and thin-walled. In the Armenian Ga-9 strain of *G. adspersum*, they were numerous and also round, hyaline and thin-walled, while in the Iranian strain 1016 they were round, thick-walled and brownish. In the Chinese strain GLU13 of *G. lucidum*, cuticular cells were also round, thick-walled and brownish. Numerous, long, ellipsoid cuticular cells were typical for P. betulinus cultures. Crystals of different sizes and shapes occurred in many species of the studied collection. Mainly small, formless crystals were observed on the surface of hyphae of *F. elastica*, *F. rossica*, *G. applanatum*, *G. lucidum*, *L. tigrinus*, *P. stripticus*, *Ph. aurivella*, and *P. varius*, while larger octahedral crystals were present in agar medium of G. applanatum, *L. tigrinus*, *Ph. destruens*, *P. varius*, and *P. condolleana* cultures.

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МОРФОЛОГИЧЕСКАЯ ХАРАКТЕРИСТИКА ВЕГЕТАТИВНОГО МИЦЕЛИЯ И АНАМОРФ У РАЗЛИЧНЫХ КОЛЛЕКЦИЙ КСИЛОТРОФНЫХ БАЗИДИАЛЬНЫХ ГРИБОВ

Изучение морфологических особенностей вегетативного мицелия, в частности анаморф базидиальных грибов является необходимым для исследования их биологии и таксономии. Были проведены морфологические исследования мицелия 27 дикариотических штаммов 22 видов ксилотрофных базидиальных грибов принадлежащих к 15 родам (*Flammulina elastica*, *F. velutipes*, *F. rossica*, *Fomes fomentarius*, *Fomitopsis pinicola*, *Ganoderma adspersum*, *G. lucidum*, *G. resinaceum*, *Hypholoma fasciculare*, *Laetiporus sulphureus*, *Lentinus tigrinus*, *Panellus stipticus*, *Phellinus igniarius*, *Ph. robustus*, *Pholiota alnicola*, *Ph. aurivella*, *Ph. destruens*, *Piptoporus betulinus*, *Pleurotus ostreatus*, *Polyporus varius*, *Psathyrella condolleana*, *Schyzophyllum commune*). У исследованных коллекций были описаны наличие и морфологические особенности гифальных пряжек и петель, анаморф, в частности оидий и хламидоспор, кристаллов, а также кутикулярных клеток. Оценена таксономическая значимость выявленных мицелиальных структур.

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ON THE PHENOLOGY OF LARGER FUNGI IN RAISED BOGS: FIRST YEAR PERMANENT PLOTS MONITORING RESULTS

Introduction. Fungal communities play significant roles in biogeochemical cycling in peatlands globally. Thus, understanding their compositions and community dynamics is crucial towards the sustainable use of these ecosystems. The main roles of fungi in peatlands include the formation of mycorrhizas with most plant species, including trees, shrubs, and some herbaceous plant species, and the decomposition of various organic materials, i.e. litters and organic soil (peat) components. To date, more than 700 taxa of fungi have been described from peatlands globally [10]; however, two bogs in close proximity of each other may contain as many as 350 fungal taxa (unpublished data). Previ-

