New records of the annulate Pluteus in European and Asian Russia

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New records of the annulate Pluteus were made by the authors in Central Russia (Zhigulevsky Nature Reserve) and Western Siberia (Yagansky Nature Reserve). The description of the species based on these records is presented. The taxonomic value of such features as the presence of velum and the color of lamellae edge as well as the similarity between Chamaeaeta and Pluteus are discussed and the new combination Pluteus fœnsilis is proposed.

Key words: Chamaeaeeta, Pluteaceae, Pluteus fœnsilis, Central Russia, Western Siberia, nature reserves

INTRODUCTION

For more than 100 years the generic name Chamaeaeeta (W.G. Sm.) Earle has been in use for designation the Pluteus-like species with annulus.

The genus Chamaeaeeta is one of the poorly investigated taxa of agaricoid fungi. At present the volume of the genus is uncertain. It totals 9 species according the Index Fungorum (http://www.indexfungorum.org), as soon as only two species on the data of the last issue of the Dictionary of Fungi (Kirk et al. 2001). The species distribution, ecology and morphology remain unknown because this genus was not studied on a global scale. There are some information about records of the species of Chamaeaeeta in Europe, Asia, Northern and Central America (Singer 1978; Ying 1995; Minnis et al. 2001). Probably, the genus as a whole is cosmopolitan (Singer 1978) and its species grow on all continents except for Antarctica, though the records are very rare. Till now the representatives of Chamaeaeeta has been recorded on the territory of Russia (the Caucasus) only once by Singer (1978). Unfortunately, those specimens were not kept. The species of this genus inhabit usually large fallen trunks and rotten wood of deciduous trees.
The taxonomic position of *Chamaeota* was changed repeatedly because of the reformulation of the system of *Agaricales*. It was initially considered (together with *Pluteus* Fr. and *Volvariella* Spog.) within *Agaricaeae* Chevall., then within *Amanitaceae* R. Heim ex Pouzar, and after the segregation of *Pluteaeae* Klotz. et Pouzar in 1972 up to the present, within *Pluteaceae*. The basic criteria used to distinguish the genus remain constant. The character of velum is recognized as the main of them. However, the problem of relevance of the genus and its similarity to *Pluteus* was repeatedly raised. So Singer (1975) noted strong resemblance of *Chamaeota* species known to him. *Ch. mammillata* (Long.) Murray, *C. sphacelopora* (Peck) Kauffman, and *C. fuscata* (Schulzer) Singer, to the representatives of *Pluteus* (section *Haplopterus* Noyd) by the micromorphological characteristics. In his earlier papers (Singer 1958) he emphasized that character of velum, as well as its presence or absence, are not the sufficient criterion for delimitation of genera in many groups of agaricoid fungi. He gave as an instance the genus *Russula* Pers., that was remained stable despite of inclusion of several tropical species with the velum. Besides, anamalate *P. atrorubescens* Murray was described from South America. Singer has also described two South-American species of *Pluteus* with rudimental velum (*P. trichophaea* Singer, *P. circumcisca* Singer) in cited paper. It confirms his position in this problem. However, he refrained from any nomenclatural changes concerning the genus *Chamaeota* because of scarcity of the available descriptions, absence of the type material, rarity of records.

The taxonomic value of such feature as velum is considered in detail by Gorovoj (1990). He has studied ontogenesis of many agaricoid taxa and has made a conclusion about low taxonomic weight of the features of the basidiocarp development and covering structures. These features are subject substantially to parallel variability in many related and phylogenetic remote groups. Moreover detailed study of ontogenesis of *Pluteus* species (Reijnders 1963; Gorovoj 1990) has shown that pilanoricous and spathuligloceous types of basidiocarp development are attributes of several species (*P. adunabulis* Peck, *P. chrysochrous* Berk. et Ravenel, Sacc.). The new data based on the molecular research are the most serious reason for the instability of the genus *Chamaeota* concept. According to the recent paper devoted to the study of the American species with application of the molecular methods (Minnis et al. 2000), *Chamaeota* does not form an independent clad, as against *Volvariella*, but is nested inside *Pluteus* clad. Species *Ch. mammillata* studied occupies a very close position to *P. ephebeus* (Fr.: Fr.) Gillet on cladogram. Moreover both species are very similar to each other in their micromorphological characteristics. Therefore, new combination *P. mammilatus* (Long.) Minnis, Sundb. et Mestrup seems reasonable to us. The further morphological studies of *Chamaeota* species (especially of those with cellular plitipellis) supported by the molecular data, could clear their taxonomic position as well as volume of the genus.

The given morphological study of the European species *C. fuscatus* very closed to *P. mammilatus* also has permitted to find out the features of its similarity with the representatives of the genus *Pluteus* and to classify it as the *Pluteus*. 
The study was based on the material collected by the authors in 2000-2006 in the territory of two nature reserves: the Zhigulevsky (3 collections) and the Yagninsky (4 collections).

The Zhigulevsky Nature Reserve occupies the central part of the Zhiguli - a broken highland in East of Privolzhskaya plateau, on the right bank of Volga River (Samara region). The Zhiguli consists of exposed carbonate rocks covered by loam layer in lower part. The climate is continental with annual precipitation 500 mm. The natural vegetation over the hills is represented by open pine forests (Pinus sylvestris L.) in combination with steppes, in ravines - by broad-leaved forests of Tilia - Nemoreta type (Klepov 1990). In stands Tilia cordata Mill., Acer platanoides L., Quercus robur L., Ulmus glabra Huds., Corylus avellana L. are predominante.

The Yagninsky Nature Reserve is located in the basin of Bolshoy Yagan River (Tumen region). The geological structure is formed by the Quaternary deposits, mainly by the Pleistocene ones covered with loamy and clay soils. The climate of this area is moderately continental. The annual precipitation totals 650 mm. The main types of vegetation are coniferous forests (Pinus sibirica Du Tour, Abies sibirica Ledeb., Picea obovata Ledeb.) and secondary deciduous-coniferous forests (with Populus tremula L. and Betula pendula Roth) with mossy or grassy cover. The different types of swamps occupy 20-30% of the territory.

The collections were made, documented and preserved with standard methods (Bondartsev, Singer 1955). Macroscopic description is based on the study of the material in fresh and dried condition as well as on the analysis of the photos. The dried material was examined using standard microscopic techniques. Spores, basidia and cystidia were observed in squash preparations of small parts of the lamellae in 5% KOH. The pleuropilos was examined in the preparation of the radial section of the pileus. Microscopic measurements and drawings were made at 600x with Micmed 2-2 microscope. Basidiospore dimensions are based on observation of 30 spores per each of 8 collections, cystidia dimensions - on observation of at least 10 structures per collection. Spore length to width ratios are reported as Q. Mean values for Q are designated as Q±.

The collected material is deposited in Mycological Herbarium of the Komarov Botanical Institute (LE).

RESULTS AND DISCUSSION

Below we propose a new combination. The description of the species is based on the study of specimens collected by the authors in the territory of Central Russia and Western Siberia.

Pluteus fenzlii (Schulzer) E. Malycheva, Morozova et Zyagina comb. nov.
Synonyms: Amanitella fenzlii (Schulzer) Gillet, 1876; Chamaeusa fenzlii (Schulzer) Singer, 1979.
Pileus 17-70 mm in diam., initially obtuse-conical to become campanulate-convex, convex and flattened, usually with broad umbo, with entire, involute at first margin, sometimes cracked when old, not hygrophanous, translucently striate at the
margin only, dry, vividly yellow or with orange tinge, slightly darker at centre, radially fibrillose sometimes becoming frainose at margin (with visible white background), covered by distinct yellow to brownish appressed squamules or hairs, erected over the center. Appearance of pleus looks like ones of *Vivariella* species (Figs 1, 2). Lamellae free, crowded to subdistant (approximately 12 on ceramidene near margin), with lamellose, thin, ventricose, up to 5 mm broad, pale pink to grayish pink, with entire edge which can be concolorous, white or distinctly yellow (yellow hue can disappear with age) (Fig. 3). Stipe 25–50 × 4–10 mm, central to slightly excentric, cylindrical, slightly broadened towards base but without basal bulb, smooth, whitish to pale yellow above a ring zone, with longitudinal yellow to brown-yellow fibrils in the lower part, with white basal setules. Annulus entire, sheathing, fluffy or flake like, but often fragmentary and evanescent, remains an e ring zone, while to yellowish white disposed on central or lower part of stipe. Flesh of pleus and stipe solid, white, slightly yellow under pleus-cuticle. Odor and taste not distinctive.

Spores 4.2–7.6 × 4.06–5 µm, Q = 1.06–1.33 (Q = 1.17), broad-ellipsoid to subglobose to slightly obrate in profile and face view, with a small hilar appendix and single large central oil drop, sometimes with granular contents (when oil drop is numerous), smooth, thin-walled to slightly thick-walled, hyaline to pale yellow in KOH, non-amyloid. Basidia 4-spored, 16–25 × 6.5–10 µm,unate, often with tapering apex, hyaline, thin-walled. Cheilocystidia 22–73 × 8–31 µm, very abundant, often aggregated to continuous layer, variable in appearance, clavate, narrow-fusoid to clavate-ventricose, fusoid-ventricose and broad-lageniform, with short or slightly lengthened necks, narrow at base, hyaline in KOH, thin-walled or thick-walled, usually with granular yellow contents and drops on apex. Pleurocystidia 32–81 × 10–32 µm, abundant, mainly lageniform, rarely fusoid-ventricose, strongly inflated, with short or long (to 2 µm) length and 8 µm wide necks, narrow at base, hyaline in KOH, thin-walled, with oil drops on apex Lamellae trama spherose. Pileus-epidermis consisting of pericentral basal cylindrical hyphae (5–5.8 µm wide) with obliquely to fully erect hypylial ends. Basal hyphae thin-walled, containing yellow-brown intracellularly or slightly incrusting pigment. Superficial hypylial ends consist of chains of short or lengthened inflated (up to 12 µm) cells, thin-walled, with brown intracellular pigment. These hypyliae dispose in bundles forming squamules (Fig. 4). Stipitpellis a cutis consisting of cylindrical hyphae, parallel to a surface, thin-walled, 5.5–8 µm wide, with or without brown intracellular pigment. Clamp connections absent.

Habitat on wood of deciduous trees, particularly on *Tilia, Acer* and *Betula*, solitary or in small groups.

Fig. 1(a, b). *Pluteus fraxinellii* (LE 246084).
Fig. 2. *Pleurotus fregili* (LE 256083). Phot. A. E. Kovalenko.

Fig. 3. The variation of the lamella edge color in the different specimens of *Pleurotus fregili*.
(a, b) The lamellae with yellow edge in the mature (a) and the young (b) basidiocarps (LE 256083).
(c) The lamellae with ocreaceous with white or slightly yellowish edge (LE 256085).
(d) The lamellae with white edge (LE 256084).
Fig. 4. *Phlebus fendli* (LE 246083): A – pileipellis, B – basidiospores, C – basidium, D – cheilocystidia, E – pleurocystidia; scale bars A-C = 10 μm, D-E = 15 μm.
Plutus fenelli (LE 246083): A - cheilocystidiagram, B - pleurocystidiagram; slide bar = 10 μm.

(Fig. 5) - Bank cr Entel'zuyr river, in Popylra tremula forest, on fallen trunk of Betula, 18 VIII 2006, coll. and det. E. A. Zvyagina (LE 235471). - Bank of Entel'zuyr river, in Popylra tremula-Betula pendula forest (with P. obvo-sau and Abies sibirica), on fallen trunk of Betula, 17 VIII 2006, coll. and det. E. A. Zvyagina (LE 235470). - Bank of Kolokshenskii river, in swamp Betula pendula forest, on fallen trunk of Betula, 18 VII 2006, coll. and det. E. A. Zvyagina (LE 235469).

Plutus fenelli is similar to the American annulate species P. matrullus in its habitus, pileus-color, type of pileipellis and form of cheilocystidia. It differs from the latter only by presence of yellow lamellae edge. The similarity of these species has been mentioned by Stingel (1975).

One more species - Plutus leoninus (Schaeff. Fr.) P. Kumm. - has some morphological resemblance to P. fenelli. It differs by absence of annulus, by less squamulose pileus and by possessing of pleurocystidia with excrescences. In the case of P. fenelli with the reduced annulus these species can be confused in the field.

All specimens of P. fenelli examined in the present work showed considerable variation of most important diagnostic features, even within a single specimen (Tab. 1). So, the annulus can be fugacious, fibulose, presenting in the mature basidiospore only as a poor visible ring zone, or well differentiated, almost membranous, at first entire, later breaking into patches. The yellow color of the edge of lamellae can be differently distinct - from almost invisible (located only in the edge of pileus or...
<table>
<thead>
<tr>
<th>Specimens</th>
<th>Spores</th>
<th>Annulus</th>
<th>Color of lamellae edge</th>
<th>Cheilostoma</th>
<th>Plicostomia</th>
</tr>
</thead>
<tbody>
<tr>
<td>length min-max (mean)</td>
<td>width min-max (mean)</td>
<td>Q</td>
<td>Q'</td>
<td></td>
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</tr>
<tr>
<td>LE 24682</td>
<td>4.6-7.6 (6.4)</td>
<td>4.6-6.5 (5.5)</td>
<td>1.00-1.31</td>
<td>1.17</td>
<td>fibrillose</td>
</tr>
<tr>
<td>LE 24685</td>
<td>5.3-7.0 (6.2)</td>
<td>4.8-6.2 (5.3)</td>
<td>1.00-1.29</td>
<td>1.15</td>
<td>ring zone</td>
</tr>
<tr>
<td>LE 24682</td>
<td>5.5-7.8 (6.5)</td>
<td>4.4-5.3 (5.0)</td>
<td>1.00-1.49</td>
<td>1.28</td>
<td>ring zone</td>
</tr>
<tr>
<td>LE 24684</td>
<td>4.2-7.6 (4.5)</td>
<td>4.6-6.2 (5.0)</td>
<td>1.00-1.30</td>
<td>1.16</td>
<td>well developed, almost membranous</td>
</tr>
<tr>
<td>LE 23547</td>
<td>4.6-7.4 (5.9)</td>
<td>4.0-6.0 (5.1)</td>
<td>1.00-1.42</td>
<td>1.16</td>
<td>fibrillose, fugacious</td>
</tr>
<tr>
<td>LE 23547</td>
<td>6.3-6.8 (6.0)</td>
<td>4.4-6.7 (5.2)</td>
<td>1.00-1.35</td>
<td>1.15</td>
<td>fibrillose, fugacious</td>
</tr>
<tr>
<td>LE 23546</td>
<td>4.6-7.0 (5.7)</td>
<td>4.6-5.6 (5.0)</td>
<td>1.00-1.42</td>
<td>1.16</td>
<td>fibrillose, fugacious</td>
</tr>
</tbody>
</table>

Explanations: Microscopic dimension of host tissues, all other dimensions based on observation of 10 spores. Q = length/width; Q' = mean length of Q.
in a few lamellae) to entirely clear and vivid, especially in the young basidiocarps. The micromorphological characteristics are varying too. The size of spores, the form and the size of cheloid- and pleurocystidia strongly vary in the single basidiocarp (Fig. 5). A range of intermediate states is characteristic for analyzed features as well as there isn't any correlation between these states.

Polymerorphism of cystidia size and lamellae pigmentation shows that these features have little value by themselves for delimitation of the species. So, the low taxonomic value of the lamellae color for *Pilatus* species has been demonstrated by Veilinga (Veilinga 1990), who considered *P. latemarginatus* Rolland with the yellow-marginate lamellae as a synonym of *P. leonina*.

Taking into account all of this, it can be supposed that P. *fennica* and *P. mamillatus* are the same species. However, the populations growing in the different continents can possess some genetic differences. The additional genetic studies could answer to the question about similarity of the American and the European species of annulate *Pilatus*.

Acknowledgments: The authors would like to thank Dr. Evgeny Popov for critical review and valuable comments and to Dr. Alexander Kovalenko for kind permission to use the photo and for helpful discussion. This study was supported in part by Russian Foundation for Basic Research (project № 07-04-04008-a).

REFERENCES


