

The genera *Conocybe* and *Pholiotina* (Agaricomycotina, Bolbitiaceae) in temperate Asia

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Abstract: 44 taxa of *Conocybe* and *Pholiotina* are reported from Siberia, Georgia and some of the countries in Middle Asia mostly based on the authors own collections. Three of them are described as new species, viz. *C. semidesertorum* Hauskn. & Kalamees, *C. obliquopora* Hauskn. & Kalamees and *C. uralensis* Hauskn., Knudsen & Mukhin. A further two and a variety are probably also new but not validly described due to insufficient material. A number of species are new records for Asia, or for Siberia, or for one of the four countries, Georgia, Tadjikistan, Turkmenistan and Uzbekistan. A number of the species are rarely reported presumably due to their main distribution being in dry, grassy steppezones with soils of high pH values. This mycogeographical element includes e.g. *C. enderlei*, *C. graminis*, *C. herbarum*, *C. leporina* and *C. subxerophytica*, so far mostly or only known from the steppezone in eastern and central Europe through to Middle Asia. *Pholiotina altaica* and *P. procera* from Altaj are redescribed from the types. Several taxa are provided with macro- and/or microscopic data, taxonomic descriptions and drawings of microscopic features. The taxonomic reliability of the taxa presented in the literature up to the present time has been reviewed critically.

Kokkuvõte: Perekonnad *Conocybe* ja *Pholiotina* (Agaricomycotina, Bolbitiaceae) parasvõetmelises Aasias

Esitatakse andmed lehkseente senini väheuuritud perekondade *Conocybe* ja *Pholiotina* 44 taksoni kohta parasvõetmelises Aasias. Kirjeldatakse 3 teadusele uut liiki: *Conocybe obliquopora* Hauskn. & Kalamees, *C. semidesertorum* Hauskn. & Kalamees, *C. uralensis* Hauskn., Knudsen & Mukhin. Esitatakse taksonite makro- ja/või mikroskoopilised andmed, taksonoomilised märkused ning joonised mikroskoopiliste tunnuste kohta. Kriitiliselt on hinnatud senini kirjanduses ilmunud taksonite taksonoomilist usaldatavust.

INTRODUCTION

The saprotrophic agaric genera *Conocybe* and *Pholiotina* (Bolbitiaceae, Agaricomycotina) are wide-spread in temperate Asia, which, according to Brummitt (2001), consists of four biogeographic units (Transcaucasia, Middle Asia, Siberia and Russian Far East). Taxa of these genera are characterized by a very wide ecological amplitude. They have been recorded from open site types (grasslands, lawns, etc.) to forest and brushwood site types (mainly with deciduous trees and brushes), in parks and gardens, from damp places of rivers and brooks to dry grasslands on mountain slopes. They occur on a large variety of substrata: rich, often manured soils, humus, dung, rotten wood,

sawdust, woody debris, herbaceous or leaf litter, compost heads, etc.

The biogeographic units mentioned above were parts of the former Soviet Union. At present, the areas under discussion belong to the Russian Federation (Siberia and Far East), to the republics of Middle Asia (Kazakhstan, Tadjikistan, Turkmenistan, Uzbekistan) and Transcaucasia (Georgia).

The genera *Conocybe* and *Pholiotina* were little studied in temperate Asia. The reason lies in insufficient taxonomic investigations, the lack of literature, high macromorphological similarity and variability between the fruit bodies of different taxa, etc., which made precise identification

of taxa almost impossible (see the „Species list reviewed from literature“ presented below). However, it is noticeable that the genus *Conocybe* with a poorly known species composition up to now, is the most wide-spread genus of agarics in the semidesert and semisavanna site types of Middle Asia during the early spring raining period (March and April).

Hausknecht is responsible for the identifications and taxonomical notes to the material. The other authors of this paper have collected the material and made the field notes (cf. also Hausknecht, 2009).

MATERIAL AND METHODS

The 94 collections of *Conocybe* and *Pholiotina* treated in this paper was mainly collected by Estonian, Danish, Finnish and Slovakian mycologists in the above-mentioned regions of temperate Asia during field work in 1970–2008.

In Middle Asia (Kazakhstan, Tadjikistan, Turkmenistan, Uzbekistan), fungi were collected from March to June 1971–1990 by the Estonian mycologists (from Tartu) K. Kalamees, B. Kullman, I. Parmasto, A. Raitviir, L. Pihlik, M. Vaasma; in Russia (Siberia and Far East) from July to September 1970–1987 by K. Kalamees, B. Kullmann and M. Vaasma; in Transcaucasia (Georgia) in April 1977 by K. Kalamees.

The Finnish mycologist Y. Mäkinen (Turku) collected material from Uzbekistan in April 1992. In annual expeditions running from 1990 to 2006, „the Scandinavian-Russian Transsiberian Mycological Expeditions“, organized by V. Mukhin and H. Knudsen, the following mycologists made collections included in this paper: H.F. Gøtzsche, H. Knudsen and T. Læssøe (Denmark), S.-Å. Hanson (Sweden) and U. Peintner (Austria).

The Slovakian mycologist S. Adamčík collected material in Russia, near Lake Bajkal in Siberia in August and September 1994, the German mycologist P. Karasch in Russia, Altaj in July 2008.

From the earlier material, the exsiccates of *Conocybe echinata*, *Pholiotina altaica* and *P. procera* collected by R. Singer and L. Vasil'eva or R. Singer from the Altaj from July to September 1937 were studied. The specimen of *Pholiotina vestita* from Ab'khazet'i (Georgia) by O. Terney 1986 was also included in the paper. In addition, the finds of *Conocybe semidesertorum* by

P. Uotila in Afghanistan, May 1972, and of *C. halophila* by Gilli in Afghanistan in April 1951 were also studied.

Microscopical examination was performed with an Olympus BH-2 mikroskope, in ca. 5% KOH, ca. 25% ammoniac or for better visibility of outlines in preparation fluid L4K of Clémençon (with conogored). Microscopical drawings were made with the help of a drawing apparatus with an enlargement of 1:2500 (spores) or 1:1000 (other microstructures) und subsequent reduction to 80%.

The geographical place names and administrative divisions of the countries correspond to those used in Comprehensive Atlas of the World (Anonymous, 2005). Russian geographical place names have been transliterated into English according to the rules established by Butcher (2004).

SPECIES LIST REVIEWED FROM LITERATURE

Some taxa of the genera *Conocybe* and *Pholiotina* are reported from the region considered in earlier literature, mostly without macro- or microscopical descriptions and therefore difficult to interpret. Nevertheless, we want to cite all the records known to us even though we have not examined them.

CONOCYBE AMBIGUA (Kühner) Singer was listed from Russia, Siberia, Krasnoyarsk Terr. by Beglyanova (1972a) and from Far East, Sikhotealin' by Azbukina et al. (1984) as well as from Turkmenistan, Kopetdag by Batyrova (1985). This species has very particular spores, so a confusion could be possible only with *C. bispora* (Singer) Hauskn., which has smaller and darker coloured spores in KOH and a different stipitipellis without lecythiform caulocystidia. Until now *C. bispora* has not been reported from Asia.

CONOCYBE ANTIPUS (Lasch) Fayod was reported by Beglyanova (1972a) from Russia (Krasnoyarsk Terr.) and by Samgina (1985) from Kazakhstan. This species is so unique with its long radicate stipe and small, lentiform-submitriform spores, that there cannot be any doubt about its identification. *C. antipus* was described from North America and was found also in New Zealand. Therefore, it seems to have nearly world-wide distribution.

CONOCYBE BRUNNEOLA (Kühner) Kühner & Romagn. was reported by Nezdjominog (1973) and Petrov (1991) from Russia, Siberia, Pribajkal'ye, and by Samgina (1985) from Kazakhstan. This taxon, currently known as *C. microspora* (Velen.) Dennis var. *brunneola* (Kühner & Watling) Singer & Hauskn., is easily recognizable by its small, phaseoliform spores. Outside Europe it is reported only from South America (Brazil).

CONOCYBE CRYPTOCYSTIS (G. F. Atk.) Singer was reported by Batyrova (1985) from Turkmenistan and by Melik-Khachatryan et al. (1985, s. n. *C. eriptocystis*) from Georgia. As Hausknecht et al. (2004) stated, the true *C. cryptocystis* is known only from USA, California, and it is different from *C. subpubescens* P. D. Orton and *Galera tenera* ss. Ricken (given as synonyms by Batyrova, 1985). We think that the present collections represent *C. subpubescens*.

CONOCYBE LACTEA (J. E. Lange) Métrod was reported by Azbukina et al. (1984), Beglyanova (1972a) and Stolyarskaya (1989) from Russian Far East, by Samgina (1985) from Kyrgyzstan and by Melik-Khachatryan et al. (1985) from Georgia. As Hausknecht (1998) stated, the taxon has to be named *C. albipes* (G. H. Oth) Hauskn. It is easily recognisable even macroscopically and has a world-wide distribution.

CONOCYBE LEUCOPUS Kühner & Watling was reported by Batyrova (1985) from Turkmenistan. This taxon is only known from the type collection (Morocco) and from one Argentinean find by Singer (Hausknecht & Krisai-Greilhuber, 2006). Therefore, the report from Turkmenistan remains doubtful as long as no microscopical data are available.

CONOCYBE MAGNICAPITATA P. D. Orton was listed by Batyrova (1985) from Turkmenistan, Kopetdag. The current name is *Conocybe juniana* (Velen.) Hauskn. & Svrček and it is subdivided in three varieties. It is unknown which one of them has been collected in Kopetdag.

CONOCYBE MESOSPORA Kühner & Watling was reported by Vasil'eva & Nazarova (1967), Vasil'eva (1973) and by Kharkevich (1978) from the Primorye Terr., Russian Far East, by Beglyanova (1972a) from Krasnoyarsk, Siberia, by Azbukina et al. (1986) from the Russian Far East, and by Melik-Khachatryan et al. (1985) from Georgia. The knowledge of this taxon was based on Küh-

ner (1935), who distinguished several varieties, all of them now considered as independent species. Therefore, it is not possible to interpret the above records.

CONOCYBE MICROGRANULOSA Batyrova was described as new from Turkmenistan by Batyrova (1985). Unfortunately, it was not possible to get the holotype on loan and to study it. Following the Latin description, it is a member of sect. *Conocybe*. The microscopical data and the stipe basis (not rooting) as well as the habitat on bare soil lead to series *Tenera*, close to the group of *C. tenera*. The robust basidiocarps and the somewhat granulose pileus surface do not fit to one of the known taxa, but without microscopical examination nothing can be said on its true identity.

CONOCYBE PILOSELLA (Fr.) Kühner is reported twice from Russia, Far East by Azbukina et al. (1984, 1986). This species, microscopically easily recognizable by very small spores without germ-pore, has a nearly world-wide distribution.

CONOCYBE PUBESCENS (Gillet) Kühner was reported from Russia, Siberia, Pribajkal'ye, by Nezdjominog (1968, 1973) and Petrov (1991) and from Krasnoyarsk Terr. by Beglyanova (1972a). As most of dung inhabiting species in the past were determined as *C. pubescens* the identification of these finds remains doubtful.

CONOCYBE RICKENIANA Singer was reported from Russian Far East by Azbukina et al. (1986), from Georgia by Kanchaveli et al. (1986) and Melik-Khachatryan et al. (1985), from Turkmenistan by Batyrova (1985), and from Russia, Siberia, Pribajkal'ye by Petrov (1991). This member of sect. *Conocybe* series *Magnicapitata*, recognizable by its cheilo- and caulocystidia with very large capitula and small, thin-walled spores, has only been safely confirmed from Europe. It can easily be confused with small specimens of *C. juniana* (Velen.) Hauskn. & Svrček var. *subsejuncta* Hauskn. differing by somewhat larger, thicker-walled spores which are also darker in KOH. The latter was collected in Georgia by Kalamees (see below).

CONOCYBE RICKENII (Jul. Schäff.) Kühner. Two literature reports exist of this taxon from temperate Asia: Batyrova (1985) lists it from Turkmenistan and Vasil'eva & Nazarova (1967) from Russia, Far East, Primor'ye Terr. While collections from dung are easily recognizable it

is somewhat difficult to distinguish records on fertilised soils from *C. siliginea* (Fr.) Kühner – see also Hausknecht & Passauer (1997).

CONOCYBE SEMIGLOBATA (Kühner & Watling) Kühner is listed by Azbukina et al. (1984) from Russia, Far East, Sikhote-Alin' and by Batyrova (1985) from Turkmenistan. The taxa from the group of *C. semiglobata*-*C. tenera* are now taken in a more narrow sense and several new taxa are described since Kühner's monograph (1935). It is therefore impossible to say which of the new taxa could be involved. The collections cited by Kalamees (1989) from Uzbekistan were restudied and they represent *C. semiglobata* in the current, narrower sense.

CONOCYBE SIENOPHYLLA (Berk. & Broome) Singer was reported by Azbukina et al. (1984, 1986) from Russia, Far East and by Batyrova (1985) from Turkmenistan. Recent studies in this group (Hausknecht, 2005) resulted at least in three different and independent species formerly integrated in *C. sienophylla*. Therefore, an interpretation is impossible without microscopical data.

CONOCYBE SILIGINEA (Fr.) Kühner is along with *C. tenera* the most frequently cited taxon of the genus in the literature from temperate Asia (e.g. Azbukina et al., 1985, 1986; Batyrova, 1985; Beglyanova, 1972a; Kharkevich, 1978; Melik-Khachatryan et al., 1985; Nazarova & Vasil'eva, 1974; Petrov, 1991; Shalapugina, 1974 and Vasil'eva & Nazarova, 1964, 1972). The interpretation of these collections is almost as impossible as in *C. tenera*.

CONOCYBE SPICULA (Lasch) Fayod was listed by Nazarova (1986) from Russian Far East. *C. spicula* ss. Kühner (1935) is now called *Conocybe rickeniana* P. D. Orton, while *Agaricus spiculus* Lasch in the original sense is a totally different fungus not belonging to the *Bolbitiaceae* (Watling & Gregory, 1981).

CONOCYBE SUBOVALIS (Kühner) Kühner & Romagn. was reported by Melik-Khachatryan et al. (1985) from Georgia and by Petrov (1991) from Russia, Pribajkal'ye. The collection reported by Kalamees (1989) from Uzbekistan, Zaamin National Park, was restudied and turned out to be *C. semiglobata*. The collection listed in Kalamees & Vaasma (1981) as *C. subovalis* ss. Moser turned out to be an undescribed taxon, *C. semiglobata* var.

campanulata Hauskn. It will be published in Hausknecht (2009).

CONOCYBE TENERA (Fr.) Kühner was reported from several areas in Russia, Kazakhstan, Kyrgyzstan, Turkmenistan, Armenia and Georgia by Samgina (1985) as well as by other authors (e.g. Azbukina et al., 1986; Batyrova, 1985; Beglyanova, 1972a, 1972b; Kanchaveli et al., 1986; Melik-Khachatryan et al., 1985; Nakhutsrishvili, 1964, 1975; Nazarova, 1976; Nezdjominogo, 1968, 1970; Perova, 1972; Petrov, 1991; Petrova, 1983 and Vasil'eva & Nazarova, 1977). However, since this taxon has been strongly redefined and now is taken much more narrowly, we think that these records cannot be considered here before restudying them. In the experience of Hausknecht more than ¾ of all determinations of *C. tenera* from before 1982 (Watling, 1982) are wrong.

CONOCYBE TENERA f. MINOR J.E. Lange was reported by Batyrova (1985) from Turkmenistan. This is a later synonym of *Conocybe juniana* (Velen.) Hauskn. & Svrček, a species now divided in three varieties. It is impossible to say which one was found in Turkmenistan.

GALERA SILIGINEA Fr. from Russia, Pribajkal'ye reported by Karsten (1909), most likely represents *C. fuscimarginata* (Murrill) Singer. A few collections from Finland determined by Karsten as *G. siliginea* and restudied by Hausknecht turned out to be *C. fuscimarginata*.

GALERA TENERA (Schaeff.) Fr. was reported by Karsten (1909) from Russia, Pribajkal'ye. Hausknecht studied altogether six collections from Finland determined by Karsten as *G. tenera*(a). They represent five different taxa of *Conocybe*, therefore it is impossible to know which one Karsten had from Russia.

GALERA TENEROIDES Pers. ss. Lange is reported by Nakhutsrishvili (1958) from Georgia. This is *Conocybe rickeniana* P. D. Orton – see above.

GALERELLA PLICATELLA (Peck) Singer was reported by Nezdjominogo (1973) and by Petrov (1991) from Russia, Pribajkal'ye, by Batyrova (1985) from Turkmenistan, and by Melik-Khachatryan et al. (1985) from Georgia. In the interpretation of this taxon up to 2003 these collections represent probably *Pholiotina sulcata* Arnolds & Hauskn. (Arnolds & Hausknecht, 2003). The true *Galerella plicatella* as described from

North America has a more southern distribution and was found only once in Europe, in Italy (Hausknecht & Contu, 2003).

PHOLIOTINA ABERRANS (Kühner) Singer is reported by Kharkevich (1978) from Russian Far East. Following Hausknecht (2007) the correct name of the taxon is *P. filipes* (G. F. Atk.) Singer. This species seems not to be rare in temperate Asia (see below).

PHOLIOTINA APOROS (Kits van Wav.) Cléménçon is listed by Petrova (1983) from Uzbekistan. The combination of annulate stipe and spores without germ-pore is unique in the genus therefore we have no reason to doubt the correctness of the determination.

PHOLIOTINA BLATTARIA (Fr.) Fayod is the most reported taxon of the genus in temperate Asia, e. g. Batyrova (1985), Beglyanova (1972a), Petrov (1991), Kanchaveli et al. (1986), Kharkevich (1978), Melik-Khachatryan et al. (1985) and Nezdjominogo (1970). If it is used in the sense of Cooke (1891), Ricken (1915), and Kühner (1935), these collections refer to *P. arrhenii* (Fr.) Singer, a common species in the northern hemisphere. *Pholiotina blattaria* ss. Fayod is now *P. vexans* P. D. Orton, also a common species. This was reported by Singer (1931) from the Svanetiya (Georgia).

PHOLIOTINA BRUNNEA (J. E. Lange & Kühner) Singer was reported by Kovalenko & Nezdjominogo (1989) from Russian Far East. This taxon is recognizable by its peculiar cheilocystidia reminding of a *Conocybe* species, so there is no reason to doubt the identity of this collection.

PHOLIOTINA COPROPHILA (Kühner) Singer is reported by Melik-Khachatryan et al. (1985) from Georgia. There is no reason to doubt the identity of this easily determinable species.

PHOLIOTINA CYANOPUS (G. F. Atk.) Singer is reported by Azbukina et al. (1984) from Russia, Far East, Sikhote-Alin' Mountains. This is the third collection known to us from East Asia (see below).

PHOLIOTINA (CONOCYBE) EXANNULATA (Kühner) Kühner & Romagn. was reported from Russian Far East by Kharkevich (1978), Azbukina et al. (1984, 1986) and Nazarova in Vasil'eva (1973) as well as by Batyrova (1985) from Turkmenistan. As this taxon is extremely rare and has been redefined recently in a narrower sense

(Hausknecht, 2009), the Russian records are considered not interpretable.

PHOLIOTINA FIBRILLOSIPES (Watling) Singer was reported by Kovalenko & Nezdjominogo (1989) from Russian Far East. The taxon is considered to be a synonym of *P. brunnea* (Watling) Bon by Hausknecht et al. (2004).

PHOLIOTINA (CONOCYBE) FILARIS was reported several times from temperate Asia, e. g. by Azbukina et al. (1984), Beglyanova (1972a), Kharkevich (1978) and Kovalenko & Nezdjominogo (1989). The current name of this species is *P. rugosa* (Peck) Singer (following Arnolds, 2005), but it is also possible that *P. arrhenii* (Fr.) Singer is included.

PHOLIOTINA INTERMEDIA (A. H. Sm.) Singer was listed by Azbukina et al. (1986) and by Kovalenko & Nezdjominogo (1989) from Russian Far East. The epithet "intermedia" was used in the past partly for an annulate taxon and also for a species with appendiculate veil. As no information is given about veil conditions, interpretation is impossible.

PHOLIOTINA PYGMAEOAFFINIS (Fr.) Singer was reported by Melik-Khachatryan et al. (1985) and by Kanchaveli et al. (1986) from Georgia. The spores given in the key by the latter are 8.5–10×5.5×6 µm so we have no reason to doubt that this is *P. pygmaeoaffinis* in the actual sense.

PHOLIOTINA SEPTENTRIONALIS (A. H. Sm.) Singer was reported by Azbukina et al. (1984), Nazarova in Vasil'eva (1973), Kharkevich (1978) and Melik-Khachatryan et al. (1985), probably based on Singer's interpretation of the taxon in 1951. He (1951) distinguished several subspecies with annulate or appendiculate veil respectively. Two of these subspecies are currently distinguished at species level. As we do not know the veil conditions in the collections mentioned above no interpretation is possible.

PHOLIOTINA SUBNUDA (Kühner) Singer was reported by Azbukina et al. (1984) from Russia, Far East, Sikhote-Alin' Mountains. This taxon should now be called *P. dasypus* (Romagn.) P.-A. Moreau (Moreau, 2005) and is known from Europe and Asia.

PHOLIOTINA TOGULARIS (Fr.) Fayod was reported by Vasil'eva et al. (1963), Kharkevich (1978), Bulakh (1984) and Azbukina et al. (1984) from

Russian Far East, and by Beglyanova (1972a) from Siberia. If the epithet “togularis” is used in the sense of Kühner (1935), this is *P. vexans* P. D. Orton, but if not no actual interpretation is possible.

PHOLIOTINA TOGULARIS (Fr.) Fayod f. BISPORA Singer is reported from Russian Far East by Azbukina et al. (1984) and Kharkevich (1978). This is *P. teneroides* (J. E. Lange) Singer in actual interpretation (Hausknecht, 2009) and was found once also in the Ural Mountains (see Hausknecht, 2009).

PHOLIOTINA VESTITA (Fr.) Singer was listed by Nazarova & Vasil'eva (1974) from Russia, Amur Prov. It is known to occur in Europe, Asia and Africa.

SPECIES LIST FROM MATERIAL

The classification and the nomenclature follow Hausknecht & Krisai-Greilhuber (2006, 2007).

CONOCYBE Fayod, Sect. *Conocybe* series *Tenera*

CONOCYBE MACROCEPHALA Kühner & Watling

This well defined species is common in Europe. Outside Europe, the only known records come from Uzbekistan.

Spore size, stipe covering and pileipellis fit well with material from Europe.

Material examined: Uzbekistan. Toshkent Prov., Tyan'-Shan' Mts., Chatkal Range, Nevich, Chatkal Nature Reserve by Bashkizyl-Saj River, in brushwood with *Populus*, *Crataegus* and *Prunus divaricata*, 19. 5. 1990, K. Kalamees & M. Vaasma (TAAM 144623, 144625).

CONOCYBE SEMIGLOBATA Kühner & Watling var. SEMIGLOBATA

The species occurs frequently in open grassland, from lowland to alpine elevations. It is one of the most common taxa worldwide.

Some collections from Middle Asia have cystidia with a bit larger capitula than European material and absolutely negative ammonia reaction, but this is within the variability of this taxon.

Material examined:

Russia. Siberian Federal Okrug, Tajmyr Peninsula, Bol'shaya Kheta, on debris and clay along a river, 2. 8. 1992, H. Knudsen (C 17271).
Kazakhstan. Southern Kazakhstan, Shymkent, Stepnoye, in floodplain grassland with *Tamarix* and *Salix*,

20. 4. 1982, K. Kalamees (TAAM 122310, 122313, 122315).

Tadjikistan. Gorno-Badakhshon, Darvoz Range, Qal'aikhum Pass, on alpine meadow, 3300 m s. m., 24. 6. 1982, M. Vaasma (TAAM 114720).

Uzbekistan. Jizzax Prov., Pamiro-Alaj Mts., Turkestan Range, Zomin, Zomin National Park by Kul'-Saj River, 1100 m s. m., in Juniperetum, 24. 5. 1980, K. Kalamees (TAAM 121320), in *Salix* floodplain shrubland, 24. 5. 1980, K. Kalamees (TAAM 121336, as *C. subovalis* ss. Watling; see Kalamees, 1989); – by Tuyuk-Saj River, 2800 m s. m., in floodplain meadow, 30. 5. 1980, K. Kalamees (TAAM 121387), in Juniperetum, 30. 5. 1980, K. Kalamees (TAAM 121390). Navoiy Prov., Aqtau Range, Langar, 1500 m s. m., on humid grassy slope, 14. 5. 1980, K. Kalamees (TAAM 121236), in garden, in grass, 15. 5. 1980, K. Kalamees (TAAM 121239).

CONOCYBE SEMIGLOBATA Kühner & Watling var. CAMPANULATA Hauskn.

Fig. 1 a–d.

Pileus 20–30 mm wide, campanulate, yellowish brown, hygrophanous, translucently striate when moist. Lamellae adnate, moderately crowded, yellowish brown. Stipe up to 150 mm long, 1–2 mm wide, evidently not rooting in exsiccatum, brighter yellowish brown than pileus, becoming darker brown near the base; surface completely pubescent. Exsiccatum: pileus, lamellae and stipe yellowish brown. Spores 13–17×6.5–9.5 µm, average 14.9–16.1×7.9–8.3 µm, Q=1.7–2.1, elongate ellipsoid, not lentiform, thick-walled with up to 2 µm broad germ-pore, red-brown in KOH. Basidia 4-spored, 21–31×12–16 µm. Clamp connections frequent. Cheilocystidia lecythiform, 15–22×6.5–10 µm, with 3–5 µm wide capitula. Ammonia reaction negative. Stipitipellis consisting of lecythiform caulocystidia similar to cheilocystidia (14–25×8–15 µm, with capitula 3.5–5.5 µm wide), in one collection intermixed with scattered cylindrical to ellipsoid non-lecythiform elements. Pileipellis hymeniform, consisting of sphaeropedunculate elements, no pileocystidia seen.

The macroscopical description is taken from TAAM 113018. This variety, described as new by Hausknecht (2009), differs from var. *semiglobata* by essentially larger, elongate ellipsoid spores and often also by a more campanulate pileus. It seems to have its centre of distribution in boreal Europe. The two collections from Kamchatka are the only known from outside of Europe and are microscopically nearly identical with the type collection from Germany.

Material examined: Russia. Far East Federal Okrug, Kamchatka Prov., Esso, Uksichan, in meadow, 3. 8. 1997, H. Knudsen (C 60664); – Mil'kovo, Kimitino, in floodplain deciduous forest, 27. 7. 1978, K. Kalamees, B. Kullman & M. Vaasma (TAAM 113018; see Kalamees & Vaasma 1981, as *C. subovalis* ss. Moser 1978).

CONOCYBE SUBXEROPHYTICA Singer & Hauskn.

var. SUBXEROPHYTICA

Fig. 1 e–h.

Spores 10–12×6.5–7.5×6–6.5 μm, average 11.0×6.8×6.2 μm, Q=1.6–1.8, ellipsoid, ovoid-ellipsoid, not angular or hexagonal, slightly to distinctly lentiform, thick-walled with up to 1.5 μm wide germ-pore, orange-rubiginous in KOH. Basidia 4-spored, 15–20×8–11 μm. Clamp connections present. Cheilocystidia lecythiform, 15–21×7–10 μm, with 3–5.5 μm wide capitula. Ammonia reaction negative. Stipitipellis consisting of lecythiform caulocystidia (14–20×7–10 μm, with capitula up to 4 μm wide). Pileipellis hymeniform, consisting of sphaeropedunculate elements; pileocystidia similar to cheilocystidia present.

The single small basidiocarp of *C. subxerophytica* was isolated from collection TAAM 143561, therefore no macroscopical description is available. The exsiccatum with small basidiocarp, greyish-beige pileus, quite distant lamellae and brownish stipe fit well with material from Austria, and the microscopical characters are also similar, except that the spores are less distinctly lentiform.

C. subxerophytica is a species of dry meadows, south-exposed loess slopes or semi-steppes on sandy or gravelly soil. It is known from Europe, South America and now from Siberia.

Material examined: Russia. Siberian Federal Okrug, Krasnoyarsk, Khakasiya Rep., Abakan, in steppe, 31. 8. 1987, K. Kalamees (TAAM 143002).

CONOCYBE OBLIQUOPORA Hauskn. & Kalamees sp. nova

Fig. 3 f–j.

Species sectionis Conocybe, seriae Tenera prope Conocybem subxerophyticam var. subxerophyticam vel var. brunneam ab eis sporis 8.5–12×6.5–8×5–6.5 μm, in medio 10.9×7.4×6.2 μm, Q=1.3–1.6, poro germinativo distincte excentrico munitis habitationeque in silvis differt.

Holotype: Uzbekistan. Toshkent Prov., Tyan'-Shan' Mts., Parkent, Kumyshkon, in deciduous grove with *Juglans*, *Malus* and *Prunus divaricata*, 13. 5. 1990, K. Kalamees & M. Vaasma (TAAM 144500).

Pileus 5–10 mm wide, convex to campanulate, yellowish rusty brown when dry, surface radially wrinkled. Lamellae adnate, distant, rusty brown. Stipe 50 mm long, up to 1 mm thick, cylindrical, filiform, with bulbous base with white mycelial tomentum, yellowish rusty brown, completely fine pubescent. Exsiccatum: pileus and stipe yellowish brown, lamellae distinctly darker, ferruginous. Spores 8.5–12×6.5–8×5–6.5 μm, average 10.9×7.4×6.2 μm, Q=1.3–1.6, ellipsoid, distinctly lentiform, thick-walled with distinctly eccentric germ-pore, rusty brown in KOH. Basidia 4-spored, 20–23×10–13 μm. Clamp connections numerous. Cheilocystidia lecythiform, 14–18×7.5–11 μm, with capitula 3–4 μm wide. Ammonia reaction negative. Stipitipellis composed of only lecythiform caulocystidia similar to cheilocystidia (14–20×8–10 μm, with capitula 3–5 μm wide). Pileipellis hymeniform, composed of sphaeropedunculate elements (18–33×11–20 μm), mixed with numerous lecythiform pileocystidia similar to cheilocystidia, but longer and more slender and with thicker walls.

This taxon with its stipitipellis consisting of only lecythiform caulocystidia, large, distinctly lentiform and dark coloured spores is placed in sect. *Conocybe* series *Tenera*, near *Conocybe subxerophytica*. The taxon differs from *C. subxerophytica* in having spores with eccentric germ-pore, darker coloured pileus and stipe, and the habitat in deciduous forests. *Conocybe subxerophytica* var. *brunnea* has the colours of pileus and stipe in common with the new species, but differs in lamellae being less distant, more stout basidiocarps, habitat and above all in the distinctly eccentric germ-pore. Since an eccentric germ-pore is considered a decisive discriminating character in *Conocybe*, similar to *Coprinus*, we decided to describe the Uzbekistan collection as a new species.

CONOCYBE sp. 1

Fig. 1 i–l.

Spores 11.5–14×7–8.5×6.5–7.5 μm, average 12.8×7.8×7.2 μm, Q=1.5–1.7, irregularly ellipsoid, often subcylindrical or angular, slightly lentiform, thick-walled with wide germ-pore, reddish brown in KOH. Basidia 4-spored, 25–32×10–13 μm. Clamp connections present. Cheilocystidia lecythiform, 16–21×6.5–9 μm, with capitula 3–4.5 μm wide. Ammonia reaction negative. Stipitipellis with lecythiform caulocystidia (20–32×7–10 mm, with capitula

3–4.5 µm wide), not mixed with hairs or non-lectythiform elements. Pileipellis hymeniform, composed of sphaeropedunculate elements. No pileocystidia seen.

Examined collection has much similarity to *C. subxerophytica*, except for the subcylindrical or angular spores never observed in that species. Also, the colour of the exsiccatum is different. This could be an undescribed taxon, but the material is too poor to be used as type material.

Material examined: Russia. Ural Federal Okrug, Yamalo-Nenets Aut. Okrug, Yamal Peninsula, Yada-Yakhady-Yakha, on moist clay with mosses in meadow, 31. 7. 1992, H. Knudsen (C 17260).

Sect. *Conocybe* series *Leucopus*

CONOCYBE AMMOPHILA M. Lange

This species, originally described from Greenland, was discovered 2005 in Central Asia, Mongolia, by P. Karasch (see Hausknecht & Karasch 2008). A recent find was recorded by the same collector in the Altaj Republic in Russia, too.

C. ammophila is one of the largest and stoutest members of the genus and evidently extremely rare. Up to now, it is only known from Greenland, Mongolia and now from Russia.

Material examined: Russia. Siberian Federal Okrug, Altaj Rep., Altaj Mts., Kosh-Agach, Beltir, in pastured lawn, 28. 7. 2008, P. Karasch (herb. Karasch).

Sect. *Conocybe* series *Mesospora*

CONOCYBE MICROSPORA (Velen.) Dennis

Pileus 10 mm wide, yellow, surface with salt layer, evidently desiccated, no striation visible. Lamellae decurrent with a tooth, dark yellow. Stipe 40×1 mm, light yellowish white. Exsiccatum beige yellow. Spores 5–7.5×3–4.5 µm, average 6.2×3.9 µm, Q=1.3–1.8, ellipsoid to slightly amygdaliform, not lentiform, with slightly double wall and small, often hardly visible germ-pore, ochre-yellow in KOH. Basidia 4-spored, 13–17×7–9 µm. Clamp connections present. Cheilocystidia lecythiform, 14–20×6.5–8.5 µm, with capitula 4–5 µm wide. Ammonia reaction negative. Stipitipellis with only lecythiform caulocystidia (16–20×6–9 µm, with 3–4.5 µm wide capitula). Pileipellis hymeniform, made up of sphaeropedunculate elements (22–35×15–24 µm), no pileocystidia seen.

Examined material differs from European collections only in somewhat paler colours and the spores with smaller, hardly visible germ-

pore. This taxon is rare in Europe and outside of Europe known only from India and now also from Tadjikistan.

Material examined: Tadjikistan. Khatlon Prov., Jilikül, Tigrovaya Balka Nature Reserve, in salt steppe with *Populus pruinosa* and *Elaeagnus*, 1. 4. 1977, M. Vaasma (TAAM 95277), 2. 4. 1977, M. Vaasma (TAAM 95285).

Sect. *Conocybe* series *Enderlei*

CONOCYBE ENDERLEI Hauskn. var. ENDERLEI

Fig. 2 a–d.

Pileus 10 mm wide, yellowish brown, darker in centre, conical, completely covered with salt layer, no striation seen. Lamellae adnate, light brown. Stipe cylindrical with slightly curved base, light yellowish brown. Exsiccatum brownish (bad condition). Spores 7.5–9.5×4.5–5 µm, average 8.4×4.9 µm, Q=1.5–1.8, ellipsoid, thick-walled without any germ-pore or callus, brownish orange in KOH. Basidia 4-spored, ca. 25×10 µm. Clamp connections present. Cheilocystidia lecythiform, 16–22×7.5–9 µm, with capitula 4–5 µm wide. Ammonia reaction negative. Stipitipellis made up of lecythiform caulocystidia similar to cheilocystidia, 10–20×7–9 µm, with capitula 3.5–5 µm wide. Pileipellis hymeniform consisting of sphaeropedunculate elements; pileocystidia absent.

The spore size of the Tigrovaya Balka collection is somewhat aberrant being in average about 1 µm larger than in European material. As all other characters are in concordance, there is no doubt that this is *C. enderlei*.

This rare taxon is known from Europe and from two collections from Asia (Afghanistan, Tadjikistan). No collections are known from other continents.

Material examined: Tadjikistan. Khatlon Prov., Jilikül, Tigrovaya Balka Nature Reserve, in salt steppe with *Populus pruinosa*, 30. 3. 1977, M. Vaasma (TAAM 95255).

Sect. *Conocybe* series *Magnicapitata*

CONOCYBE ECHINATA (Velen.) Singer

Within the holotype material of *Conocybe albocinerea* Singer (doubtful species, see Hausknecht 1998, 2009) there was one basidiocarp with the typical characters of *C. echinata*. Typical for it are the sordid brown colours of the basidiocarps and the large cheilo- and caulocystidia with very wide capitula.

Material examined: Russia. Siberian Federal Okrug, Altaj Rep., Altaj Mts., Kuraj, 9. 8. 1937, R. Singer (LE 17609II, part of holotype of *Conocybe albocinerea*).

CONOCYBE JUNIANA (Velen.) Hauskn. & Svrček var. SUBSEJUNCTA Hauskn.

Pileus 15 mm wide, acutely conical, completely yellowish brown when dry. Lamellae adnate, light brown. Stipe 100×2 mm, brownish in exsiccatum, surface completely pubescent. Exsiccatum: pileus and stipe pale rusty brown, stipe brownish, not radicans. Spores 7.5–10.5×4–6 µm, average 9.0–9.3×4.8–5.6 µm, Q=1.5–1.9, ellipsoid, not lentiform, thick-walled with distinct germ-pore, ochre-yellow to ferruginous in KOH. Basidia 4-spored, 15–20×8–11 µm. Clamp connections present. Cheilocystidia lecythiform, 15–30×8–16 µm, with capitula 5–9 µm wide. Ammonia reaction negative. Stipitipellis with exclusively lecythiform caulocystidia (22–36×12–20 µm, with capitula 5.5–10 µm wide). Pileipellis hymeniform, consisting of sphaeropedunculate elements. Pileocystidia similar to cheilocystidia present.

Macroscopical description is taken from TAAM 83570. The material from Tadjikistan fits perfectly with European collections. The material from Georgia has narrower, often sub-cylindrical, not so distinctly thick-walled spores that are also dark coloured in KOH. The spore characters and also the colour of the exsiccatum (pale rust brown) exclude conspecificity with the closely related *C. echinata*, but there are some resemblances in size of basidiocarps with *C. rickeniana*.

Material examined:

Georgia. Imerethi, K'ut'aisi, Ajamet'is Nature Reserve, in Quercetum, 30. 4. 1977, K. Kalamees (TAAM 83570).

Tadjikistan. Khatlon Prov., Jilikül, Tigrovaya Balka Nature Reserve, in salt steppe with *Populus pruinosa*, 31. 3. 1977, M. Vaasma (TAAM 95267).

Sect. *Conocybe* series *Graminis*

CONOCYBE GRAMINIS Hauskn.

Fig. 2 e–h.

Pileus 10–13 mm wide, up to 8 mm high, hemispherical to flat convex, young specimens cream near margin, yellow-brown in centre, later very pale yellow-brown, hygrophanous, but not striate; surface greasy. Lamellae narrowly adnate, moderately distant, ferruginous. Stipe 25–35×1 mm, without or with broken pseudorrhiza, pale whitish, surface nearly smooth. Smell and taste

not recorded. Exsiccatum: pileus and stipe ochre yellow, lamellae ferruginous, moderately distant. Spores 7–10×4–7 µm, average 8.1–9.0×5.0–5.7 µm, Q=1.5–1.8, ellipsoid to sublimoniform, not lentiform, with distinct germ-pore, orange yellow to yellow in KOH. Basidia 4-spored, 15–20×8.5–11 µm. Clamp connections present, but often rare. Cheilocystidia lecythiform, 18–25×7–9 µm, with 2.5–4.5 µm wide capitula. Ammonia reaction negative. Stipitipellis predominantly with lecythiform caulocystidia similar to cheilocystidia, but near the apex mixed with ellipsoid to elongate-ellipsoid elements. Pileipellis hymeniform, composed of sphaeropedunculate elements, without pileocystidia.

Description is taken from C 45276. In Europe, *C. graminis* is a species of poor and dry meadows, exposed loess slopes, on gravelly, sandy or loess underground. It was found also in North Africa (Hausknecht 2009). Most of the European collections come from the eastern and south-eastern Europe with a continental climate. Therefore, its discovery in Central Asia is not a big surprise and this may well be the true centre of its distribution.

The Asian material is typical in all characters. The pseudorrhiza is sometimes lacking when the basidiocarp rises directly from grass roots. In the Uzbekistan material, a pseudorrhiza is distinctly visible also in the exsiccatum.

Material examined:

Russia. Far East Federal Okrug, Sakha Rep. (Yakutiya), Khangalasskij Ulus, Oktyomtsy, in steppe, near (but not on) dung, 16. 8. 1999, H. Knudsen (C 45276). Uzbekistan. Jizzax Prov., Jizzax, in semisavanna, 3. 5. 1974, K. Kalamees (TAAM 80591). Navoiy Prov., Nurota, in *Iris* semidesert, in grassy path, 4. 4. 1979, K. Kalamees (TAAM 120580).

CONOCYBE HERBARUM Hauskn.

Fig. 2 i–m.

Pileus 8–20 mm wide, broadly conical, campanulate to convex, ochre-yellow to yellowish brown, hygrophanous, translucently striate or not when moist, surface glabrous. Lamellae slightly distant in exsiccatum, narrowly adnate, slightly decurrent along the stipe, bright brown. Stipe 30–50×1–2 mm, pale, whitish to dirty brown, in exsiccatum distinctly radicans, completely granular-pubescent, especially at the top. Exsiccatum: pileus and stipe yellowish brown, lamellae slightly darker. Spores 7.5–10×5.5–6.5 µm, average 8.1×5.9 µm, Q=1.4–1.6, broadly ellipsoid to almond shaped, not lentiform, with thick wall

and small, sometimes indistinct, central germ-pore, orange yellow in KOH. Basidia 4-spored, 18–25×9–12 µm. Clamp connections present. Cheilocystidia lecythiform, 17–22×6.5–8.5 µm, with 3–4.5 µm wide capitula. Ammonia reaction negative. Stipitipellis with lecythiform caulocystidia (15–22×5–8 µm, with capitula up to 4 µm), at the apex of the stipe mixed with scattered hair-like elements (up to 30×4 µm). Pileipellis hymeniform made up of large sphaeropedunculate elements (35–65×17–26 µm), without pileocystidia.

Conocybe herbarum is a very rare species up to now found only in Austria and France. The Turkmenistan material differs microscopically only in spore characters (the germ-pore is smaller, often indistinct). Macroscopically, the deeply radicate stipe (also in the exsiccatum) is typical.

Material examined: Turkmenistan. Mary Prov., Kala-I-Mor, Badkhyz Nature Reserve, Pinkhamchesme, in semisavanna with *Pistacia*, 8. 4. 1971, K. Kalamees (TAAM 79485), 10. 4. 1971, K. Kalamees (TAAM 79514).

CONOCYBE SEMIDESERTORUM Hauskn. & Kalamees sp. nova

Fig. 3 a–e.

Ad Conocybem graminis Hauskn. vel Conocybem herbarum Hauskn. accedens sed ab eis sporis majoribus (7–11.5×5–7.5 µm, medio 8.3–10.2×6.1–6.9 µm, Q=1.3–2.1), crassetunicatis poro germinativo distincte excentrico differt. Habitatio in apertis, praecipue savannis desertsque inter gramina et Artemisias.

Holotype: Uzbekistan. Navoiy Prov., Nurota, Baymurad, in grassy plain in semidesert, 5. 4. 1979, K. Kalamees (TAAM 120604).

Pileus in exsiccatum 6–12 mm wide, up to 6 mm high, always semiglobose to broadly convex, without umbo, pale yellowish brown, ochre brown to pale greyish brown; no information about hygrophanity and striation. Lamellae adnate, moderately distant, often darker than pileus and stipe in exsiccatum. Stipe in exsiccatum 18–25 mm long (without pseudorrhiza), about 1 mm thick, pseudorrhiza up to 12 mm long; pale brownish to greyish brown in exsiccatum. Smell and taste not recorded. Spore print rusty brown. Spores 7–11.5×5–7.5 µm, average 8.3–10.2×6.1–6.9 µm, Q=1.3–2.1, ellipsoid, broadly ellipsoid, not or only indistinctly lenticiform, sometimes subphaseoliform, thick-walled

with distinct, often eccentric germ-pore, brownish yellow to orange-brown in KOH. Basidia 4-spored, 15–25×8.5–12 µm. Clamp connections present. Cheilocystidia lecythiform, 15–24×6–10 µm, with 2.5–5 µm wide capitula. Ammonia reaction negative. Stipitipellis with predominantly lecythiform caulocystidia similar to cheilocystidia (15–25×4–12 µm, with capitula 2–6 µm), in between also few non-lecythiform, subcylindrical to hair-like elements present. Pileipellis hymeniform, composed of sphaeropedunculate to subpyriform elements (25–45×13–20 µm), without pileocystidia.

The combination of a radicate stipe (well visible in herbarium material of many collections) together with a stipitipellis of sect. *Conocybe* and spores with eccentric germ-pore is unique in the genus. *Conocybe halophila* with an equally eccentric germ-pore was recorded also from Middle and Central Asia, but it is a species of sect. *Pilosellae* with a totally different stipitipellis. The closely related *C. graminis* and *C. herbarum* differ by smaller, somewhat differently sized spores with a central germ-pore.

Material examined:

Afghanistan. Samangān Prov., Pule-Khumri, Kotal-i-Mirza Atbili Pass, in silt, 14. 5. 1972, P. Uotila (H).

Tadjikistan. Gorno-Badakhshon, Pamir Mts., Vanj, Qamolzon, in Vanj River valley near Medvezhye glacier, 3200 m s. m., in grassy area with *Ferula* and *Prangos*, 10. 6. 1978, A. Raitviir, I. Parmasto & M. Vaasma (TAAM 95930, 95931).

Turkmenistan. Mary Prov., Kala-I-Mor, Badkhyz Nature Reserve, Pinkhamchesme, in semisavanna with *Pistacia*, 8. 4. 1971, K. Kalamees (TAAM 79481), 9. 4. 1971, K. Kalamees (TAAM 79507), 10. 4. 1971, K. Kalamees (TAAM 79513).

Uzbekistan. Navoiy Prov., Nurota, in grassy path in *Iris* semidesert, 4.4.1979, K. Kalamees (TAAM 120576). – G'oz'gon, in *Artemisia* semidesert and in garden, 1. 4. 1979, K. Kalamees (TAAM 120525, 120628); – Konimex, Karatau Range, in humid *Artemisia* semidesert with *Amygdalis*, 2. 4. 1979, K. Kalamees (TAAM 120541); holotypus (TAAM 120604)

Sect. *Mixtae* series *Pubescens*

CONOCYBE SUBPUBESCENS P. D. Orton

This common and widespread species is known from all continents except Australia. It is easily recognized by a stipitipellis with numerous lecythiform elements mixed with hairs, and spores in average up to 14×8 µm.

Material examined:

Russia. Far East Federal Okrug, Khabarovsk Terr., Arsen'ovo, in mixed forest with *Picea*, *Pinus sibirica*

and *Abies*, 19. 9. 1979, K. Kalamees & M. Vaasma (TAAM 120966).

Georgia. Imerethi, Tsqaltubo, in *Carpinetum*, 26. 4. 1977, K. Kalamees (TAAM 83551).

CONOCYBE PULCHELLA (Velen.) Hauskn. & Svrček

This is a quite rare member of sect. *Mixtae*, differing from the former by smaller, more slender basidiocarps with often campanulate to tingle-shaped pileus and larger spores. It prefers grassland or grassy sites and is known from Europe and one collection from higher altitudes in Africa. This taxon was reported also from Kazakhstan by Samgina (1985) as *C. pseudopilosella* (Kühner) Kühner & Romagn.

Material examined: Russia. Ural Federal Okrug, Yamalo-Nenets Aut. Okrug, Yamal Peninsula, Yada-Yakhady-Yakha, in grass and *Equisetum arvense*, 26. 7. 1992, H. Knudsen (C 17068).

CONOCYBE PUBESCENS (Gillet) Kühner

This is a world-wide distributed and widespread dung-inhabiting taxon. It has larger spores than the two former and 4-spored basidia, differing in this respect from *C. macrospora*.

Material examined:

Russia. Far East Federal Okrug, Sakhalin Prov., Kunashir Island, Goryachij Plyazh, in meadow near the sea, 8. 8. 1970, K. Kalamees (TAAM 78818).

Uzbekistan. Navoiy Prov., Aqtau Range, Langar, in garden on dung, 15. 5. 1980, K. Kalamees (TAAM 121220, 121240).

CONOCYBE MACROSPORA (G. F. Atk.) Hauskn.

This taxon, formerly known as *C. rubiginosa* Watling, is as widespread as *C. pubescens*. It differs from *C. pubescens* in the presence of 2-spored basidia and larger spores with central germ-pore.

Material examined: Russia. Siberian Federal Okrug, Irkutsk Prov., by Baykal Lake, Burtuj, on horse dung, 3. 9. 1994, S. Adamčík (BRA CR 8823); – Svjatoj Nos, on horse dung, 8. 8. 1994, S. Adamčík (BRA CR8822).

Tadjikistan. Varzob, Gissar Range, Kondara, Kvak, on grassy slope with *Juniperus seravschanica*, *Lonicera*, *Acer*, 27. 5. 1978, A. Raitviir, I. Parmasto & M. Vaasma (TAAM 95800, 95802), on tall herbs slope with *Juglans* and *Acer*, 28. 5. 1978, A. Raitviir, I. Parmasto & M. Vaasma (TAAM 95817).

Uzbekistan. Toshkent Prov., Tyan'-Shan' Mts., Parkent, Kumyshkon, in deciduous grove with *Juglans*, *Malus*, *Prunus divaricata*, 13. 5. 1990, K. Kalamees & M. Vaasma (TAAM 144301).

Sect. *Mixtae* series *Ambigua*

CONOCYBE URALENSIS Hauskn., Knudsen & Mukhin sp. nova

Fig. 4 a–e.

Pileus 9–15 mm *latus*, *campanulatus*, *ochro-albidus ad griseus*, *hygrophanus*, *striatus*. *Lamellae adnatae*, *ferrugineae*. *Stipes* 30–40 mm *altus*, *ad 1 mm latus*, *pallide brunneus*, *filiformis*, *pubescens*, *basi bulbosus*. *Sporae* 12–17×7–9 μm, *in medio* 14.2–14.3×7.9–8.4 μm, Q=1.7–2.0, *ellipsoideae*, *crassetunicatae* *poro germinativo distincto munitae*. *Basidia* 4(–2–3)-*spora*. *Cheilocystidia lecythiformia*, 14–25×5–11 μm, *capitula* 2.5–5 μm *lato*. *Stipitipellis sectionis Mixtae*. *Pileipellis hymeniformis*, *cellulis sphaeropedunculatis* (28–60×16–25 μm) *composita pileocystidiis filiformibus immixtis*. *Habitatio inter muscos*.

Holotype: Russia, Ural Federal Okrug, Yamalo-Nenets Aut. Okrug, Labytnangi, in mosses on clay and sand and along gravelly road, 29. 7. 1990, H. Knudsen (C 16287).

Pileus 9–15 mm wide, campanulate without or with broad, low umbo, up to 8 mm high, greyish, whitish with ochre tinge, hygrophanous, striate when wet, surface smooth. *Lamellae adnatae*, moderately distant, rusty brown. *Stipe* 30–40×1 mm, cylindrical to filiform, base in one specimen slightly bulbous, pale brown to greyish brown, pubescent with long hairs. Smell and taste not recorded. *Exsiccatum*: *pileus* in both collections greyish ochre, cream to whitish, *stipe* darker up to rubiginous.

Spores 12–17×7–9 μm, average 14.2–14.3×7.9–8.4 μm, Q=1.7–2.0, ellipsoid, not lentiform, not angular or hexagonal, thick-walled with up to 2.5 μm wide central germ-pore, orange brown in KOH. *Basidia* 4-spored mixed with a few 2- or 3-spored, 22–25×10–14 μm. Clamp connections not observed. *Cheilocystidia* lecythiform, 14–25×5–11 μm, with *capitula* 2.5–5 μm wide. *Ammonia* reaction negative. *Stipitipellis* a mixture of small lecythiform caulocystidia, numerous at *stipe* apex (15–25×3–6 μm, with *capitula* only 2–3 μm wide) and long hairs up to 60×2.5 μm, sometimes with slightly enlarged top with slime caps, situated merely in the middle and on the base of the *stipe*. *Pileipellis* hymeniform, composed of sphaeropedunculate elements (28–60×16–25 μm), with scattered hair-like pileocystidia in between.

The new species can be placed in sect. *Mixtae* series *Ambigua*, due to the specific pattern of

the caulocystidia. They differ from *C. ambigua* by partly 3- or 4-spored basidia and thicker-walled, differently sized spores which are also darker in KOH. The small caulocystidia with very small capitulum also resembles a species group around *C. alboradicans* Arnolds, but they all have a radicate stipe and no hair-like caulocystidia, furthermore, the basidia are strictly 2-spored. *Conocybe lobauensis* Singer & Hauskn. has evenly 2-, 3- or 4-spored basidia and the stipitipellis of sect. *Mixtae*, but its spores are distinctly smaller and lack a distinct germ-pore. The South American *C. alba* Singer differs in colours (totally white), and smaller, thinner-walled, lentiform spores. Another taxon of this group, *C. acutoconica* Watling from Zaire, has strictly hexagonal spores arising from 4-spored basidia. Finally, also *C. siligineoides* R. Heim, found on a living trunk in Mexico, differs by colours, smaller, partly angular spores arising from 2-spored basidia and a different pattern of the caulocystidia.

Material examined: Russia. Ural Federal Okrug, Yamalo-Nenets Aut. Okrug, Labytnangi, in mosses on clay and sand and along gravelly road, 29. 7. 1990, H. Knudsen (C 16286, 16287, holotype).

Sect. *Pilosellae* series *Sienophylla*

CONOCYBE ROSTELLATA (Velen.) Hauskn. & Svrček

This taxon was for a long time misinterpreted as *C. sienophylla* (Berk. & Broome) Singer. It is the most frequent representative of the series in Europe and known also from America and Africa, differing from the true *C. sienophylla* by thinner-walled, paler, more amygdaliform spores.

Material examined: Russia. Far East Federal Okrug, Khabarovsk Terr., Vyazemskij, Vtoraya, in mixed forest, 19. 8. 1998, H. Knudsen (C 59517).

CONOCYBE HALOPHILA Singer

Fig. 3 k–n.

Pileus up to 30 mm broad in exsiccatum, plane-campanulate to conico-campanulate, brownish yellow to greyish yellow, hygrophane, drying to nearly whitish, very often covered by a thick salt layer. Lamellae adnate, greyish yellow to brownish. Stipe 30–50 mm long, 3–5 mm wide, with bulbous base in exsiccatum, yellowish grey to greyish, pubescent and often covered by a salt layer. Exsiccatum ochre-beige to pale yellow, only lamellae more brownish. Spores 8.5–10.5×6–7×5.5–6.5 μm, average 9.3–9.7×6.5–

6.6×5.9–6.0 μm, Q=1.4–1.7, broadly ellipsoid, slightly lentiform, with distinct, often eccentric germ-pore, thick-walled, ochre yellow in KOH. Basidia 4-spored, 17–20×9.5–11 μm. Clamp connections not seen. Cheilocystidia lecythiform, 14–18×6–8.5 μm, with capitula 3–4 μm wide. Ammonia reaction negative. Stipitipellis mostly collapsed, in one specimen well differentiated hair-like caulocystidia (up to 40×5 μm) present, lecythiform elements on stipe not seen. Pileipellis hymeniform, composed of sphaeropedunculate elements; pileocystidia absent.

Very rare taxon, restricted to salt habitats and up to now known from Middle and Central Asia and Italy. It is the only representative of sect. *Pilosellae* with eccentric germ-pore and was described from Italy as *C. juncicola* Hauskn. (Hausknecht 2001), but later it became clear that the Italian collections are conspecific with *C. halophila* from Afghanistan (Hausknecht 2005).

Material examined:

Afghanistan. Nangarhār Prov., Nimla, Butschak, 22. 4. 1951, Gilli (MICH, holotype).

Tadjikistan. Khatlon Prov., Jilikül, Tigrovaya Balka Nature Reserve, in salt steppe with *Tamarix*, 30. 3. 1977, M. Vaasma (TAAM 95257), 31. 3. 1977, M. Vaasma (TAAM 95263, 95271), in salt steppe with *Populus pruinosa*, *Eleagnus*, *Erianthus*, 1. 4. 1977, M. Vaasma (TAAM 95274), by Vakhsh River in floodplain area, 31. 3. 1977, M. VAASMA (TAAM 95260).

CONOCYBE OCHROSTRIATA Hauskn.

Like *C. rostellata*, it was for a long time misinterpreted as *C. sienophylla* in Europe. It differs from the latter in the larger spores and is known from all continents except Australia.

Material examined:

Russia. Far East Federal Okrug, Kamchatka Prov., Ust'-Bol'sheretsk Distr., Pruzhetka, in Alnetum, 14. 8. 1978, B. Kullman & M. Vaasma (TAAM 113071).

Tadjikistan. Tavildara, Peter I Range, in tall herbs grassland with *Rosa*, *Acer*, *Lonicera*, 21. 6. 1982, M. Vaasma (TAAM 114686).

CONOCYBE MOSERI Watling

This taxon is characterised by having a dark, sordid pileus colour, spores of medium size from 4-spored basidia, stipe covering of sect. *Pilosellae* and the exsiccatum is distinctly bi-coloured (pileus greyish, stipe with distinct wine-red hue). It is not uncommon in Europe, but very rare elsewhere.

Material examined: Russia. Siberian Federal Okrug, Irkutsk Prov., by Baykal Lake, Svjatoj Nos, 20. 8. 1994, S. Adamčík (BRA CR8820).

CONOCYBE sp. 2

Fig. 5 a–d.

Pileus in exsiccatum less than 10 mm broad (fragments), in the material dark brown in dry condition, surface smooth. Lamellae adnate, rusty cinnamon-brown. Stipe (in exsiccatum) about 20 mm long and 2 mm wide, dark brown, pubescent at places. Fragments of exsiccatum dark brown. Spores 8–11×5–6.5 µm, average 8.9–9.5×5.5–5.9 µm, Q=1.5–2.0, ellipsoid, not lentiform, with slightly double wall and central, small, but distinct germ-pore, orange yellow in KOH. Basidia 4-spored, 20–24×8.5–10 µm. Clamp connections present. Cheilocystidia lecythiform, 15–22×7–9 µm, with capitula 2.5–5.5 µm wide. Ammonia reaction negative. Stipitipellis with numerous hairs and non-lecythiform elements, mixed with about 10–20% lecythiform caulocystidia similar to cheilocystidia. Pileipellis hymeniform, made up of sphaeropedunculate elements (mostly collapsed); no pileocystidia seen.

In the definition of Watling (1982) and later Hausknecht (2003), the number of lecythiform elements is too small to insert this record in sect. *Mixtae*. In nearly all the microscopical characters the material is close to *C. sienophylla*, but with a too high number of lecythiform caulocystidia (in *C. sienophylla*, lecythiform caulocystidia are absent or only present sporadically on the top of the stipe). Also the colours of the pileus and stipe are too dark compared to *C. sienophylla*.

As the material is too scarce and in bad state, further investigations are needed to decide the true status of the two Tadjikistan collections.

Material examined: Tadjikistan. Khatlon Prov., Jilikül, Tigrovaya Balka Nature Reserve, in salt steppe with *Populus pruinosa*, 30. 3. 1977, M. Vaasma (TAAM 95253), 1. 4. 1977, M. Vaasma (TAAM 95277a).

Sect. *Pilosellae* series *Anthracophila*

CONOCYBE VELUTIPES (Velen.) Hauskn. & Svrček

This taxon with preference for poor soil in deciduous and coniferous forests, in grassy habitats, in meadows and in dry grassland is not uncommon in Europe. It also occurs in all other continents except Australia. The Asian collections fit perfectly with European material.

Conocybe velutipes is distinguished from closely related taxa by the relatively large, thick-walled, lentiform but not hexagonal spores.

Material examined:

Russia. Far East Federal Okrug, Sakha Rep. (Yakutiya), Khangalasskij Ulus, Oktyomtsy, in grassland, 15. 8. 1999, H. Knudsen (C 45248).

Uzbekistan. Navoiy Prov., Karatau Range, between Navoiy and Langar, Sarmysh, in moist meadow by a stream, 8. 5. 1976, K. Kalamees (TAAM 80949).

Sect. *Pilosellae* series *Microrrhiza*

CONOCYBE LEPORINA (Velen.) Singer

Fig. 4 f–i.

Spores 9.5–13×7–8 µm, average 11.1×7.4 µm, Q=1.3–1.7, in frontal view ellipsoid, in lateral view distinctly fusiform-limoniform, with double wall and relatively small germ-pore, not lentiform, ochre yellow in KOH. Basidia 2-spored, 22–30×9–12 µm. Clamp connections not seen. Cheilocystidia lecythiform, 14–22×7–9 µm, with capitula 2.5–5 µm wide. Ammonia reaction negative. Stipitipellis only with hair-like to elongate-fusiform or lageniform elements (up to 40×10 µm), lecythiform caulocystidia not observed. Pileipellis hymeniform made up of sphaeropedunculate elements (up to 40×20 µm), no pileocystidia present.

The Russian collection differs from the type in presence of only 2-spored basidia and lack of scattered lecythiform caulocystidia on the top of the stipe, but the presence of a pseudorrhiza and the size and shape of the spores from 2-spored basidia are typical.

C. leporina is one of the rarest species in the genus, known up to now only from the type locality in the Czech Republic, one locality in Hungary and from three collections from Austria. One of the Austrian collections is also only 2-spored.

Material examined: Russia. Far East Federal Okrug, Sakha (Yakutiya), Khangalasskij Ulus, Oktyomtsy, in steppe, 16. 8. 1999, H. Knudsen (C 45278).

Sect. *Pilosellae* series *Siliginea*

CONOCYBE FUSCIMARGINATA (Murrill) Singer

This almost cosmopolitan species from dung or fertilized soils is one of the most common representatives of the genus, distinguished from the two following taxa by smaller spores from 4-spored basidia.

Material examined: Uzbekistan. Navoiy Prov., Aqtau Range, Langar, 1500 m s. m., in garden, in clayey

grassy shore of a stream, 16. 5. 1980, K. Kalamees (TAAM 121262).

CONOCYBE SILIGINEA (Fr.) Singer

C. siliginea has a world-wide distribution, but prefers poorer soils and has smaller basidiocarps than *C. rickenii* with a different colour of pileus in young stages.

Material examined:

Russia. Far East Federal Okrug, Kamchatka Prov., Mil'kovo, Kimitino, in *Larix* forest, 27. 7. 1978, K. Kalamees, B. Kullman & M. Vaasma (TAAM 113001). Siberian Federal Okrug, Irkutsk Prov., by Baykal Lake, Kadil'naya Biol. Stat., in steppe, 7. 9. 2000, S.-Å. Hanson (C 64591). Ural Federal Okrug, Yamalo-Nenets Aut. Okrug, Labytnangi, on clay along road, 14. 8. 1990, H. Knudsen (C 16574).

Uzbekistan. Navoiy Prov., Karatau Range, between Navoiy and Langar, Sarmysh, in the valley of a stream, on moist clayey ground in grass, 6. 5. 1976, K. Kalamees (TAAM 94816), in humid brushwood with *Salix* and *Crataegus*, 7. 5. 1976, K. Kalamees (TAAM 94852, 94853).

CONOCYBE RICKENII (Jul. Schäff.) Kühner

This is one of the most frequent fimicolous species of the genus with world wide distribution. It is distinguished from the equally frequent *C. pubescens* by the non-striate, paler pileus and the structure of the stipitipellis.

Material examined:

Turkmenistan. Mary Prov., Kala-I-Mor, Badkhyz Nature Reserve, Pinkhamchesme, in semisavanna with *Pistacia*, 10. 4. 1971, K. Kalamees (TAAM 79510).

Uzbekistan. Navoiy Prov., Aqtau Range, Langar, 1500 m s. m., on humid grassy slope of a river, 14. 5. 1980, K. Kalamees (TAAM 121217), 1300 m s. m., on humid grassy slope of a river, on ground and on dung, 17. 5. 1980, K. Kalamees (TAAM 121280).

CONOCYBE sp. 3

Spores 12.5–17×7.5–9.5 µm, average 14.9×8.5 µm, Q=1.6–1.8, ellipsoid, not lentiform, thick-walled with wide, central germ-pore, rusty orange in KOH. Basidia 2-spored, mostly collapsed. No clamp connections seen. Cheilocystidia lecythiform, 15–19×6–9 µm, with capitula 3–4 µm wide. Stipitipellis only with hair-like elements, 20–40×3.5–5 µm. Pileipellis hymeniform, composed of sphaeropedunculate elements. No pileocystidia seen.

The collection is microscopically indistinguishable from *C. siliginea*, but the colour of the exsiccatum is totally different (cap greyish brown, stipe fuliginous). It is possible that this discoloration is caused by inappropriate drying of the basidiocarps.

Material examined: Uzbekistan. Toshkent Prov., Tyan'-Shan' Mts., Ugam Range, on *Juglans regia* slope, 29. 4. 1992, Y. Mäkinen (TUR).

Sect. *Pilosellae* series *Murinacea*

CONOCYBE SINGERIANA Hauskn.

Although this taxon was described only ten years ago, it seems to be one of the most common representatives of the series *Murinacea*. *Conocybe singeriana* is known from all continents except America. The species grows mostly directly on dung, but also on compost or fertilized soils or rotting leaf litter.

Material examined: Uzbekistan. Navoiy Prov., Karatau Range, between Navoiy and Langar, Sarmysh, in the valley of a stream, in grass under *Crataegus*, 7. 5. 1976, K. Kalamees, L. Pihlik & M. Vaasma (TAAM 94844).

CONOCYBE MAGNISPORA (Murrill) Singer

Fig. 5 e–h.

Pileus in exsiccatum 7–11 mm broad, hemispherical, yellowish brown. Lamellae adnate, yellowish brown. Stipe in exsiccatum 30–45 mm long, up to 1 mm wide, base cylindrical, not bulbous, in fresh condition yellowish brown. Exsiccatum: all parts pale ochre-brown. Spores 13–18.5×8–10 µm, average 16.2×8.3 µm, Q=1.6–1.8, ellipsoid, neither lentiform nor hexagonal, thick-walled with up to 2.5 µm wide, predominantly central germ-pore, fuliginous in KOH. Basidia 4-spored, 22–30×13–16 µm. Clamp connections present. Cheilocystidia lecythiform, 16–21×9–12 µm, with capitula 3–4 µm wide. Ammonia reaction negative. Stipitipellis only with hair-like caulocystidia (up to 40×6 µm). Pileipellis hymeniform, composed of pyriform to sphaeropedunculate elements up to 35×20 µm; no pileocystidia seen.

C. magnispora grows mostly directly on dung, but also on fertilised soils. This taxon, described from North America, was only recently discovered in Europe (Arnolds & Hausknecht 2003). It seems that it was often misinterpreted in the past as one of the other dung-inhabiting, large-spored taxa.

The present collection fits well with the type material and European records. The germ-pore in nearly all spores is central, but there are also few spores with slightly eccentric germ-pore. For the moment, no taxonomic value is given to this aberrant character.

The only representative of series *Murinacea* with eccentric germ-pore is *C. gigasperma* (see

below), but this taxon has considerably larger spores from 2-spored basidia.

Material examined: Russia. Far East Federal Okrug, Khabarovsk Terr., Arsen'ovo, in meadow, 18. 9. 1979, K. Kalamees (TAAM 120954).

CONOCYBE GIGASPERMA Enderle & Hauskn.

This species is easily recognised by the olive tints of the young pileus and the largest spores in the genus. It is known only from Europe and Asia.

Material examined: Russia. Far East Federal Okrug, Sakha Rep. (Yakutiya), Khangalasskij Ulus, Oktyomtsy, in steppe, 16. 8. 1999, H. Knudsen (C 45272). Siberian Federal Okrug, Krasnoyarsk Terr., Khakasiya Rep., Abakan, in steppe, 31. 8. 1987, K. Kalamees (TAAM 143561a).

Sect. *Pilosellae* series *Lenticulospora*

CONOCYBE BRUNNEIDISCA (Murrill) Hauskn.

In literature, *C. brunneidisca* is better known as *C. lenticulospora* Watling. It is a widespread species occurring in Europe, America and Northern Asia. Conspecificity of *C. brunneidisca* with *C. lenticulospora* was proposed by Hausknecht & Contu (2007).

Material examined: Russia. Far East Federal Okrug, Kamchatka Prov., Mil'kovo, Kimitino, near *Larix*, 27. 7. 1978, K. Kalamees, B. Kullman & M. Vaasma (TAAM 113003).

PHOLIOTINA Fayod

Sect. *Cyanopodae* series *Cyanopus*

PHOLIOTINA CYANOPUS (G. F. Atk.) Singer

Fig. 5 i-l.

Pileus about 10 mm wide, plano-convex, bi-coloured with pale margin and darker centre, hygrophorous, striate when moist. Lamellae adnate, moderately distant, rusty brown. Stipe up to 40×1 mm, cylindrical, whitish, greyish below, base bluish-green, surface pubescent. Spores 7–9×4.5–6 μm, average 8.1×5.2 μm, Q=1.4–1.6, ellipsoid, not lentiform, with slightly thickened wall and distinct germ-pore, orange yellow in KOH. Basidia 4-spored, 17–21×8–9.5 μm. Clamp connections not seen. Cheilocystidia 20–50×8.5–11 μm, lageniform, sometimes with more swollen body and subcapitate apex. Stipitipellis with fasciculate caulocystidia similar to cheilocystidia but larger (up to 60×15 μm). Pileipellis hymeniform, composed of sphaeropedunculate elements mixed with some cylindrical to sublageniform pileocystidia (up to 35×6 μm).

Phliotina cyanopus is easily recognised by the base of the stipe staining bluish when bruised; sometimes, this staining can be delayed or even very weak, then the combination of microscopical characters makes it possible to arrive at a correct determination.

This species is described from North America and found in many European countries. The Asian collections seem to be the “missing link” in the distribution area.

Material examined: Russia. Far East Federal Okrug, Sakha Rep. (Yakutiya), Yakutsk, Churchur-Muran, along road in grass, 14. 8. 1999, H. Knudsen (C 45168); – Myachej-Sise, on moist soil under *Salix*, 8. 8. 1999, H. Knudsen (C 45053).

Sect. *Piliferae* series *Coprophila*

PHOLIOTINA COPROPHILA (Kühner) Singer

This is a *Phliotina* species distributed in temperate regions worldwide. It is recognised by the lack of a veil, somewhat greasy surface of cap, large spores and lageniform to subutriform cheilocystidia.

Material examined: Russia. Far East Federal Okrug, Sakha Rep. (Yakutiya), Khangalasskij Ulus, Oktyomtsy, on dung in steppe, 15. 8. 1999, U. Peintner (C45236).

Sect. *Piliferae* series *Filipes*

PHOLIOTINA FILIPES (G. F. Atk.) Singer

In the past the taxon was mainly known as *P. sulcatipes* (Peck) Bon or *P. aberrans* (Kühner) Singer. For the correct nomenclature, see Hausknecht 2007.

Material examined: Russia. Far East Federal Okrug, Kamchatka Prov., Mil'kovo, Dolinovka, in mixed forest with *Populus*, *Picea*, *Larix* and *Betula*, 26. 7. 1978, K. Kalamees, B. Kullman & M. Vaasma (TAAM 84699); – Sakhalin Prov., Kunashir Island, Yuzhno-Kuril'sk, by Lesnaya River, in *Abietinum*, 11. 8. 1970, K. Kalamees (TAAM 78893).

Sect. *Verrucisporae* series *Utriformis*

PHOLIOTINA DASYPUS (Romagn.) P.-A. Moreau

The species is easily recognised by spores with somewhat uneven, verrucose wall in LM as well as utriform cheilocystidia.

Following Moreau (2005) this is the correct name of the fungus previously called *P. utriformis* (P. D. Orton) Bon or *P. subnuda* (Kühner & Watling) Bon. It is widely distributed in Europe, but the Tadjikistan records are the first from Asia.

Material examined: Tadjikistan. Tavildara, Peter I Range, in tall herbs grassland with *Rosa*, *Acer* and *Lonicera*, 21. 6. 1982, M. Vaasma (TAAM 114684, 114685).

Sect. *Vestitae* series *Vestita*

PHOLIOTINA VESTITA (Fr.) Singer

The exsiccatum in C with remnants of an appendiculate veil on pileus margin and small, thin-walled spores without germ-pore could easily be determined as *P. vestita*. Only the habitat, an old fire place, is a bit uncommon. It is the only known collection from the Asian continent.

Material examined: Georgia. Ab'khazet'i, Gagra, by Ritsa Lake, on old fire place, 30. 9. 1986, O. Terney (C).

Sect. *Vestitae* series *Appendiculata*

PHOLIOTINA VELATA (Velen.) Hauskn.

Although no veil was seen in the exsiccatum, the small spores with indistinct double wall and distinct germ-pore as well as the lageniform cheilocystidia with cylindrical, often undulate neck exclude all known taxa with veil or annulus and points to this collection as *P. velata*. It is the first record in Asia.

Material examined: Russia. Siberian Federal Okrug, Krasnoyarsk Terr., Khakasiya Rep., Abakan, in steppe, 31. 8. 1987, K. Kalamees (TAAM 143561).

Sect. *Pholiotina* series *Vexans*

PHOLIOTINA VEXANS (P. D. Orton) Bon

Arnolds (2005) demonstrated that the correct name of the fungus called *Pholiotina blattaria* ss. Kits van Waveren has to be *P. vexans*. It is a common annulate species in Europe, but rare elsewhere.

Material examined: Russia. Far East Federal Okrug, Kamchatka Prov., Esso, Bystraya, in river valley, 9. 8. 1997, T. Læssøe (C 64190). Ural Federal Okrug, Yamalo-Nenets Aut. Okrug, Labytnangi, on clay along road, 14. 8. 1990, H. Knudsen (C 16573).

Sect. *Pholiotina* series *Teneroides*

PHOLIOTINA TENEROIDES (J. E. Lange) Singer

This taxon is easily recognised by the combination of 2-spored basidia, large spores and utriform cheilocystidia. It is the only known collection from Asia.

Material examined: Russia. Ural Federal Okrug, Yamalo-Nenets Aut. Okrug, Labytnangi, Krasnyj Khamej, on fire place, 20. 7. 1992, H. F. Götzsche (C 16961).

PHOLIOTINA ALTAICA Singer

Fig. 6 a–d.

Pileus ochraceous, somewhat darker (fuscous) centrally, hygrophanous, slightly slimy, in the dry state it varies from buff to pallid, in exsiccate it is ochraceous with a fuscous centre; in the humid state it is somewhat striate, 10–19 mm in width, cone-shaped, then convex or flat, but umbonate. Gills rusty-coloured with a pale-coloured margin, crowded, less often almost sparse, narrow (almost to 2 mm in width), less often fairly wide (3–4 mm), adnate. Stipe at the top whitish or of the same colour as pileus; below the annulus it is fibrous and commonly ranges from fuscous to brown; it is cylindrical, 30–60/1–4 mm. Annulus on the upper side gently sulcate, whitish, pendent, easily falling off, thick, but not double. Thin-fleshed. The flesh has a faint farinaceous odour and is sweetish.

Spores 9–14×5–7.5 μm, average 11.6×6.0 μm, Q=1.7–2.2, ellipsoid, subluniform, with double wall and large, central germ-pore, rusty brown in KOH. Basidia 2(–4)-spored, 20–22×9–10 μm. Clamp connections present. Cheilocystidia 22–45×8–15 μm, thin-walled, versiform, from fusiform-cylindrical to subutiform, some with distinct undulate long neck, at the top partly with crystals (similar to *Inocybe* species). Stipitipellis above the annulus with very scattered caulocystidia similar to cheilocystidia. Pileipellis hymeniform, composed of sphaeropedunculate elements (40–65×20–35 μm), pileocystidia not seen.

The above macroscopical description is taken from Singer (1951, translated from Russian) and the microscopical data are from the examination of the type material by Hausknecht. Singer's data of microscopical characters differ hardly from the observations of Hausknecht. The collection LE 11274 is not included in the microscopical description, because this collection differs in having only 4-spored basidia and smaller spores.

The presence of cheilocystidia with crystals on the top is unique in the genus. Furthermore, *P. altaica* differs from the similar *P. teneroides* by considerably more variable cheilocystidia.

Material examined: Russia. Siberian Federal Okrug, Altaj Rep., Altaj Mts., Kuraj, under *Larix* and *Picea*, 28. 7. 1937, R. Singer & L. N. Vasil'eva (LE 11274); – 12. 8. 1937, R. Singer & L. N. Vasil'eva (LE 17689, holotype).

PHOLIOTINA PROCERA Singer

Fig. 6 e–h.

Pileus aqueous-ferruginous to honey-coloured, smooth, naked, gently tuberculate or free of umbo, finely transparent-striated in the humid state, convex, about 50 mm in width. Gills somewhat fuscous, markedly emarginated, moderately broad (5.5 mm). Stipe sordid yellow-fuscous, shining, somewhat expanded at the bottom or subcylindrical; it ultimately grows hollow and is close to 70/6–7 mm. Flesh pale fuscous-yellow, at the base of the stipe it is dark fuscous; it is moderately fragile, with a faint farinaceous odour.

Spores 9.5–11.5×5–6.5 µm, average 10.7×5.8 µm, Q=1.7–1.9, ellipsoid to subcylindrical-ellipsoid, not lentiform, with slightly double wall and small, but distinct germ-pore, yellow in KOH. Basidia 4-spored, 22–30×7–10 µm. Clamp connections present. Cheilocystidia 27–45×10–18 µm, of two types: predominantly vesiculose or elongate-ellipsoid, mixed with scattered claviform, fusiform to subutriform elements. Caulocystidia not found. Pileipellis hymeniform, made up of sphaeropedunculate elements (25–35×13–21 µm), pileocystidia absent.

The above macroscopical description is taken from Singer (1951, translated from Russian). The microscopical data were obtained by examination of the type material by the Hausknecht and are in concordance with the data given by Singer (1951).

Pholiotina procera is close to *P. utricystidiata* Enderle & Hübner with the following differences: the basidiocarps are larger, the spores are paler in KOH with a somewhat thinner wall. The most important difference lies in the size of the cheilocystidia: mostly utriform in *P. utricystidiata*, versiform with predominantly vesiculose elements in *P. procera*. *Pholiotina indica* K. A. Thomas, Hauskn. & Manim., described from Kerala, India (Thomas et al., 2001) has a similar pattern of cheilocystidia, but differs in much smaller basidiocarps, smaller, sublentiform spores and growing on elephant dung.

Material examined: Russia. Siberian Federal Okrug, Altaj Rep., Ojrotiya, Artybash, at the base of a trunk outside of forest, 17. 9. 1937, R. Singer (LE 17690, holotype).

MYCOGEOGRAPHICAL IMPLICATIONS

Although many papers published in recent years have brought much new evidence concerning the taxonomy of *Conocybe* and *Pholiotina* and also partly the distribution of many species, the genera are still among the less investigated in many parts of the world. Thus, drawing too many conclusions from the material presented here would be premature. However, some features are so distinctive that they should be emphasized as a basis for further research. First, it is obvious that the genus has many representatives in the dry, grassy, savanna- and steppe-like vegetation areas in Middle Asia. Due to the low rainfall and high temperatures the soils are often rich in alkaline salts resulting from the high evaporation from the soil surface. In Europe many species also occur in soils with a high pH, either being naturally calcareous or clayey or in mull-rich forests. Thus, the general preference of species in the genus to prefer soils with a high pH value is strengthened by the records from the dry, open areas of different types in Middle Asia. A few species, *C. semidesertorum* and *Conocybe* sp. 2 are so far only known from Middle Asia, and *C. halophila* only from Middle Asia and mediterranean Italy, but the following group of species have their main, known distribution ranging from eastern Europe (Czech Rep., Hungary, Austria) to Middle Asia: *C. enderlei*, *C. graminis* (also in northern Africa), *C. herbarum*, *C. leporina* and *C. subxerophytica*.

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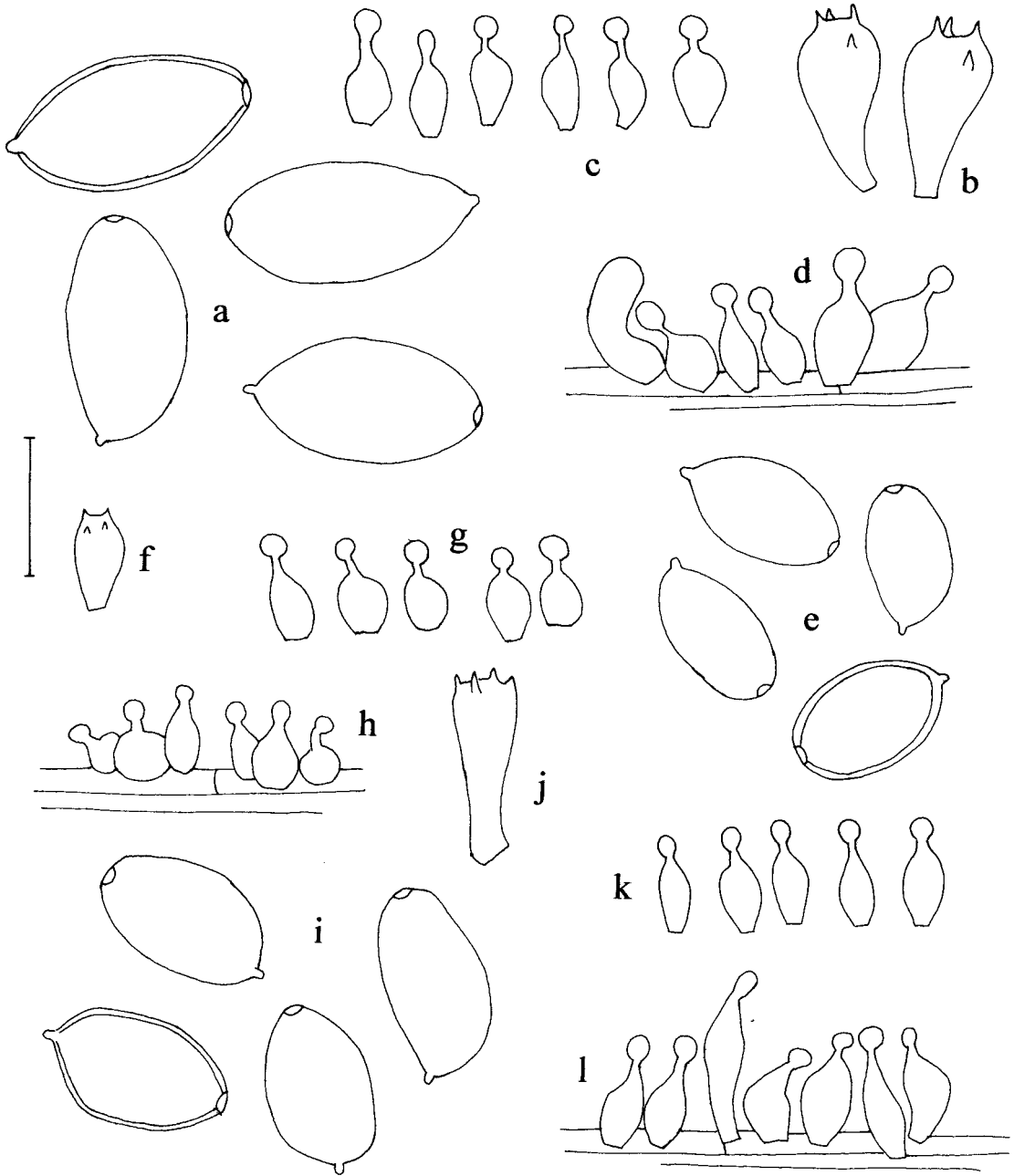


Fig. 1. *Conocybe semiglobata* var. *campanulata* (a – spores, b – basidia, c – cheilocystidia, d – stipitipellis), *Conocybe subxerophytica* (e – spores, f – basidium, g – cheilocystidia, h – stipitipellis), *Conocybe* sp. 1 (i – spores, j – basidium, k – cheilocystidia, l – stipitipellis). Bar – 25 μ m, 10 μ m for spores.

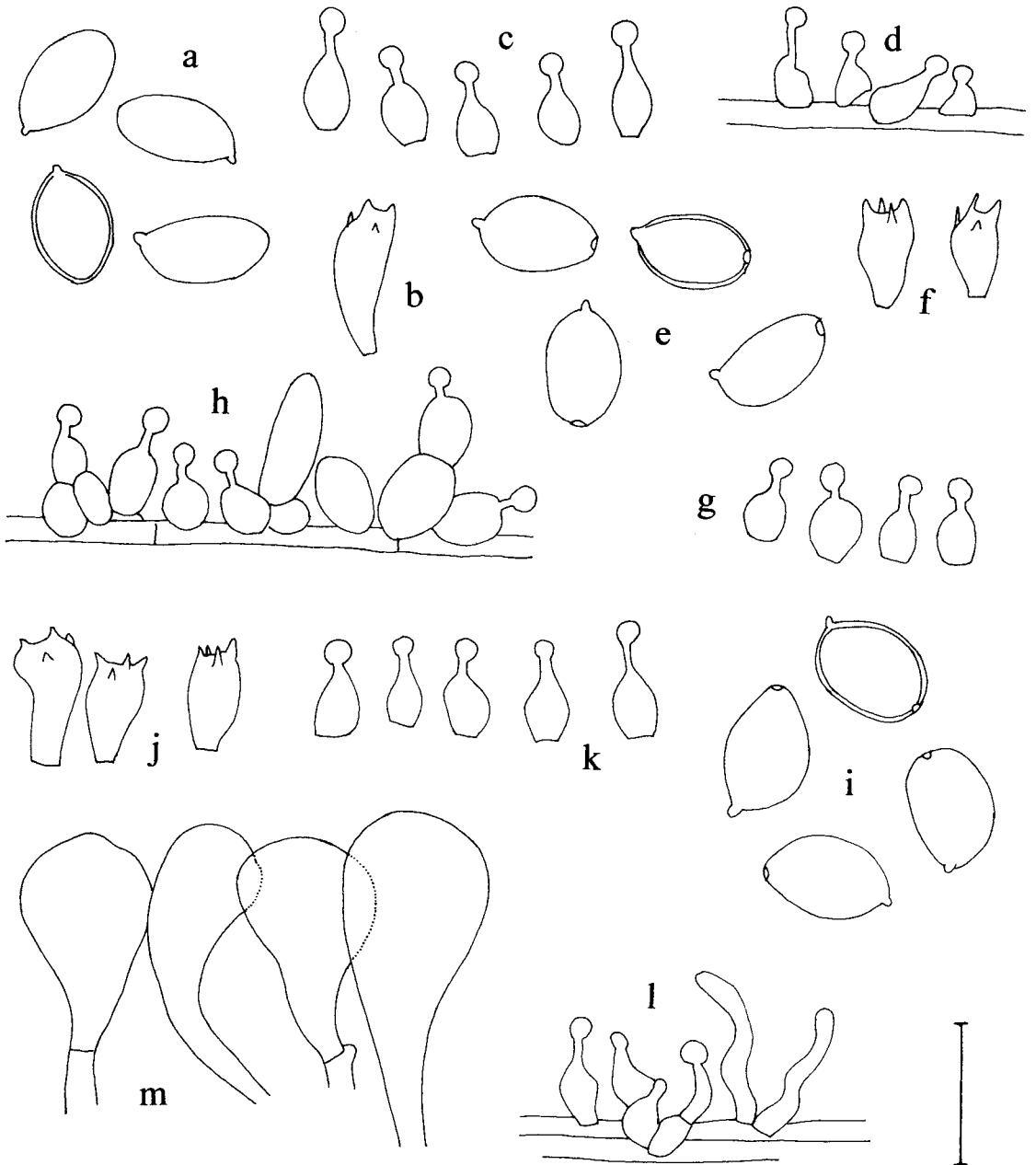


Fig. 2. *Conocybe enderlei* (a – spores, b – basidium, c – cheilocystidia, d – stipitipellis), *Conocybe graminis* (e – spores, f – basidia, g – cheilocystidia, h – stipitipellis), *Conocybe herbarum* (i – spores, j – basidia, k – cheilocystidia, l – stipitipellis, m – pileipellis). Bar – 25 μ m, 10 μ m for spores.

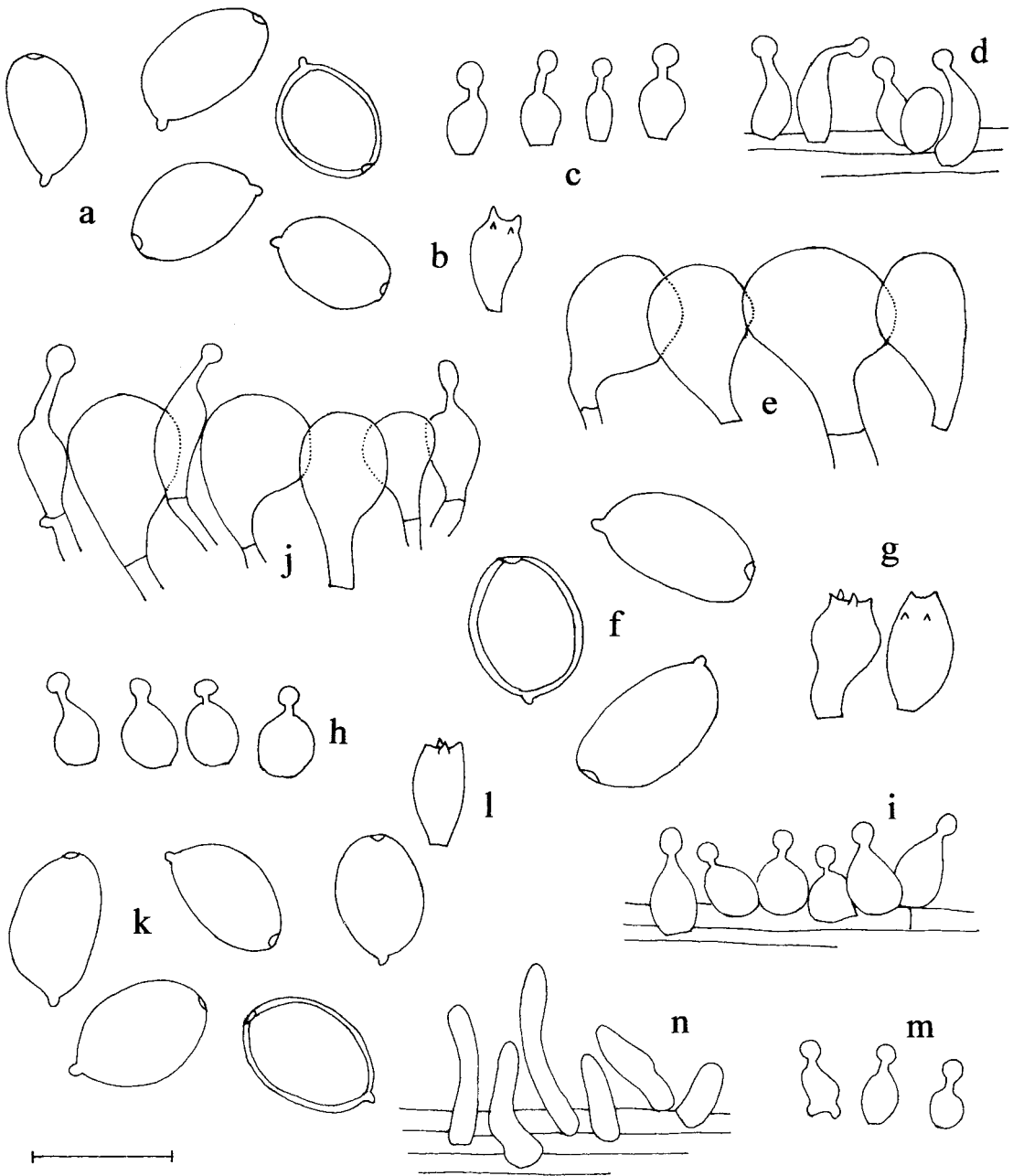


Fig. 3. *Conocybe semidesertorum* (a – spores, b – basidium, c – cheilocystidia, d – stipitipellis, e – pileipellis), *Conocybe obliquopora* (f – spores, g – basidia, h – cheilocystidia, i – stipitipellis, j – pileipellis with three pileocystidia), *Conocybe halophila* (k – spores, l – basidium, m – cheilocystidia, n – stipitipellis). Bar – 25 μ m, 10 μ m for spores.

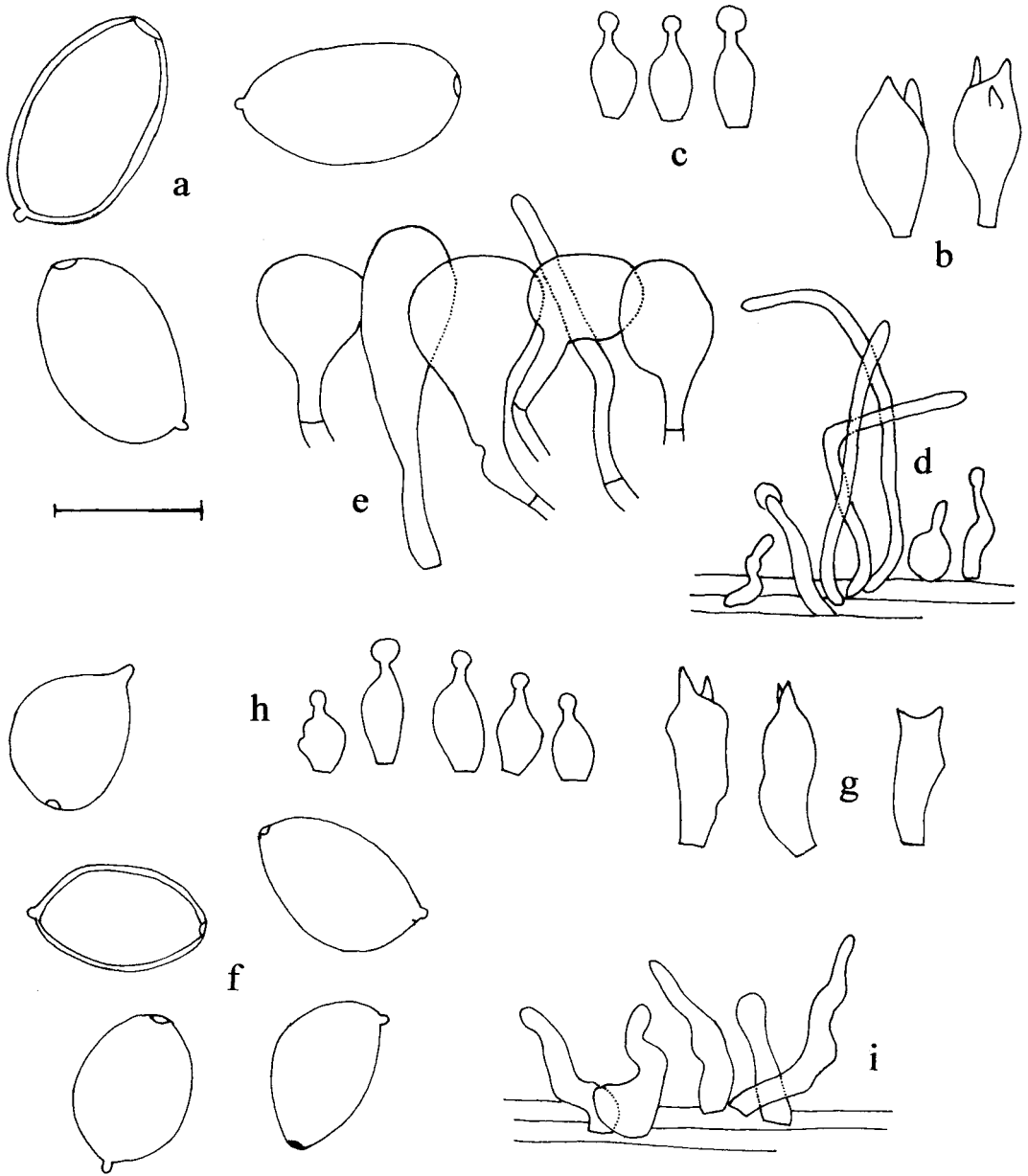


Fig. 4. *Conocybe uralensis* (a – spores, b – basidia, c – cheilocystidia, d – stipitipellis, e – pileipellis with hair-like pileocystidium), *Conocybe leporina* (f – spores, g – basidia, h – cheilocystidia, i – stipitipellis). Bar – 25 μ m, 10 μ m for spores.

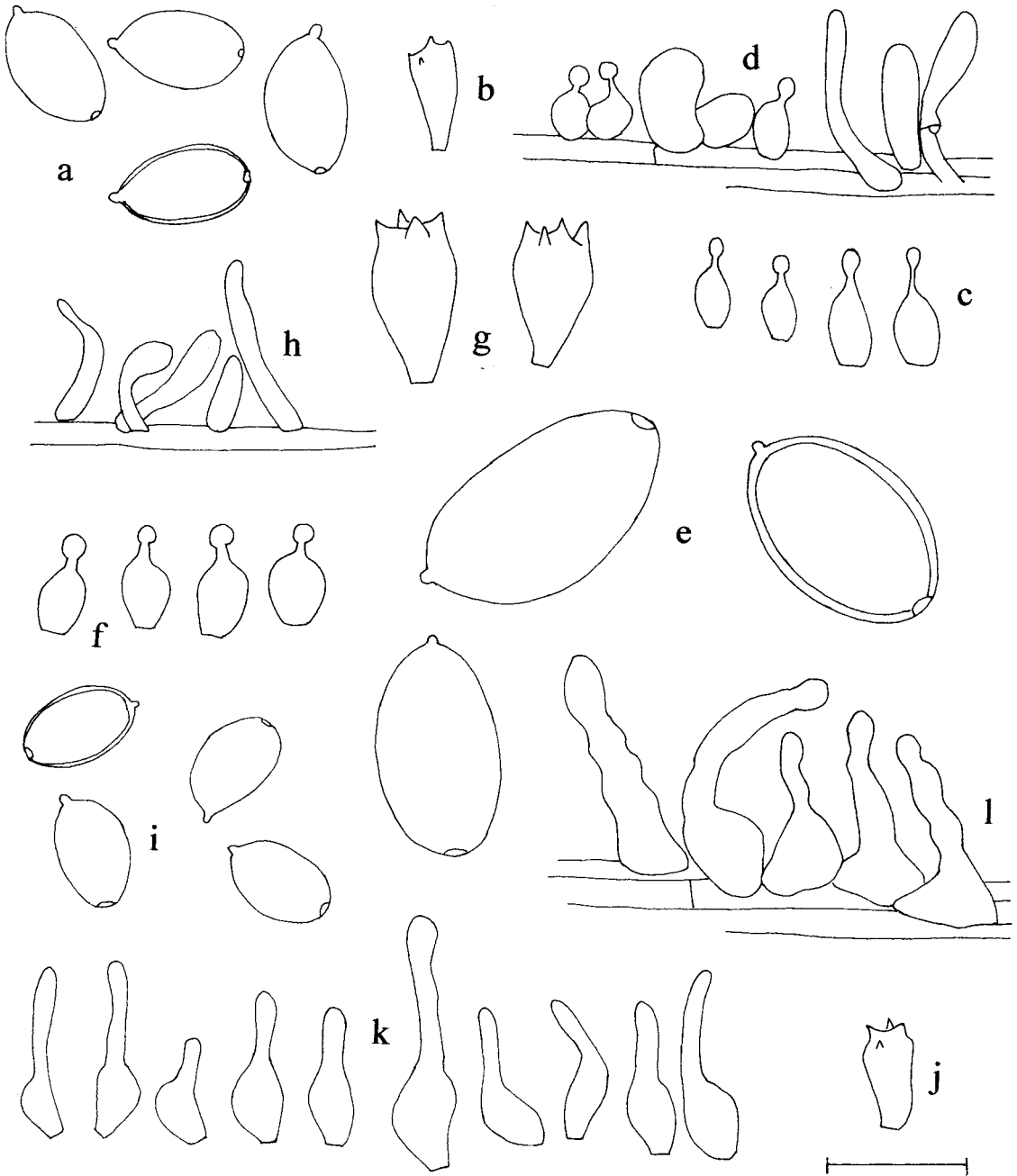


Fig. 5. *Conocybe* sp. 2 (a – spores, b – basidium, c – cheilocystidia, d – stipitipellis), *Conocybe magnispora* (e – spores, f – cheilocystidia, g – basidia, h – stipitipellis), *Pholiotina cyanopus* (i – spores, j – basidium, k – cheilocystidia, l – stipitipellis). Bar – 25 μ m, 10 μ m for spores.

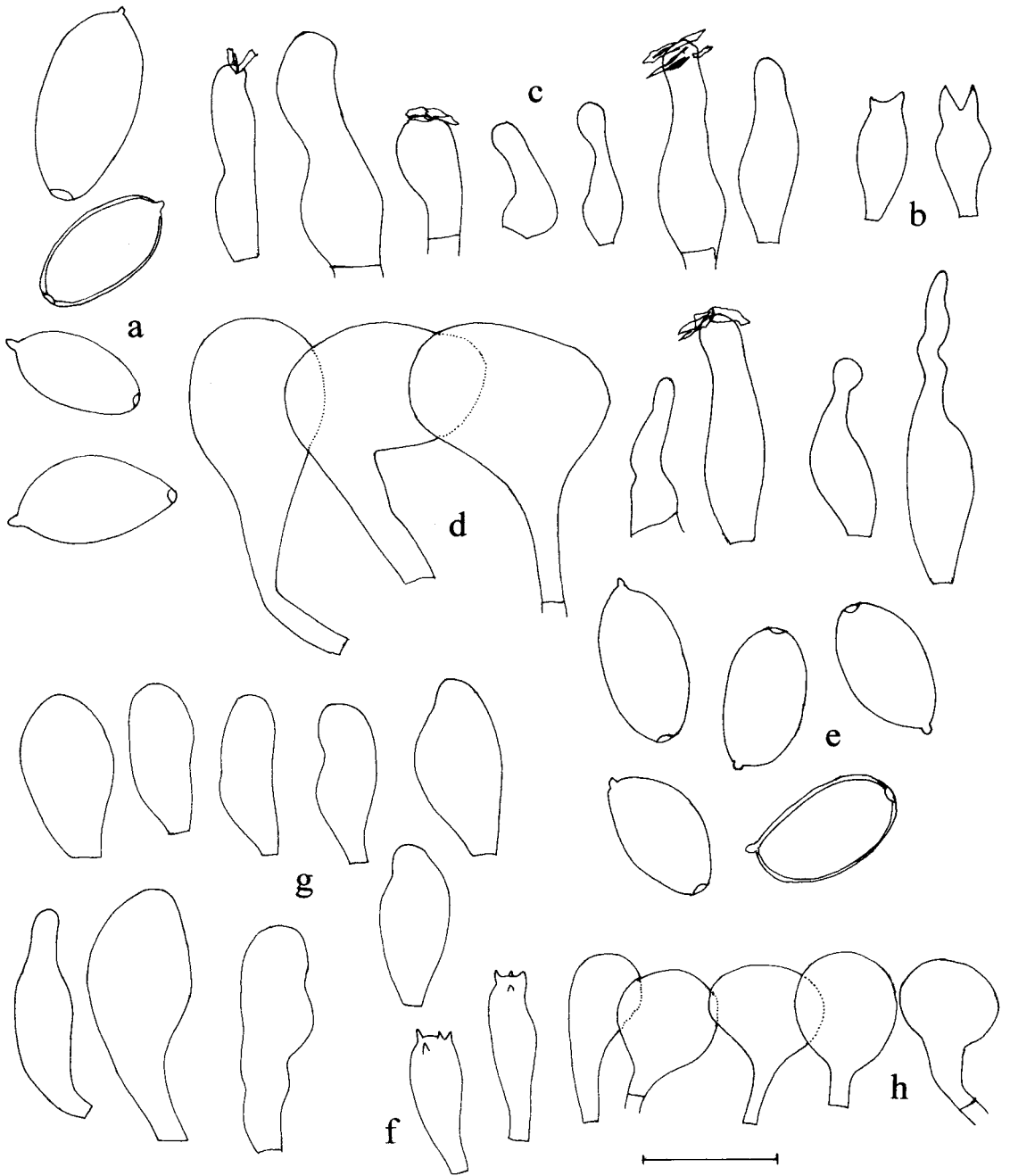


Fig. 6. *Pholiotina altaica* (holotype) (a – spores, b – basidia, c – cheilocystidia, d – pileipellis), *Pholiotina procera* holotype (e – spores, f – basidia, g – cheilocystidia, h – pileipellis). Bar – 25 μm , 10 μm for spores.

REFERENCES

- Anonymous. 2005. *Comprehensive Atlas of the World*. Times Books. London.
- Azbukina, Z. M., Parmasto, E. H., Bulakh, E. M., Egorova, L. N., Bunkina, I. A., Khazkina, O. K. & Oksenyuk, G. I. 1984. Griby. In: Azbukina, Z. M. & Kharkevich S. S. (eds). *Flora Verkhneussurijskogo stacionara*. Vladivostok, pp. 23–64.
- Azbukina, Z. M., Bulakh, E. M., Parmasto, E. H., Egorova, L. N., Vasil'eva, L. N., Govorova, O. K. & Oksenyuk, G. I. 1986. Griby. In: Azbukina, Z. M. & Kharkevich S. S. (eds). *Flora i rastitel'nost' Bol'shekhekhtsirskogo zapovednika (Khabarovskij kraj)*. Vladivostok, pp. 30–70.
- Arnolds, E. 2005. *Bolbitiaceae*. In: Noordeloos, M. E., Kuyper, T. W. & Vellinga, E. C. (eds). *Flora Agaricina Neerlandica* 6. Boca Raton, London, New York, Singapore: Taylor & Francis.
- Arnolds, E. & Hausknecht, A. 2003. Notulae ad Floram Agaricinam Neerlandicam – XLI. *Conocybe* and *Pholiotina*. *Persoonia* 18: 239–252.
- Batyrova, G. 1985. *Konspekt flory makromitsetov Kopetdaga*. Ashabad.
- Beglyanova, M. I. 1972a. *Flora agarikovykh gribov yuzhnoj chasti Krasnoyarskogo kraya*. I. Krasnoyarsk.
- Beglyanova, M. I. 1972b. K flore agarikovykh gribov Ojskogo khrebta Zapadnogo Sayana. In: Popova, T. G. & Vasil'eva, L. N. (eds). *Vodorosli i griby Sibiri i Dal'nego Vostoka*. Novosibirsk, pp. 108–112.
- Brummitt, R. K. 2001. *World geographical scheme for recording plant distributions*. Ed. 2. Pittsburgh.
- Bulakh, J. M. 1984. K flore agarikovykh gribov zapovednika „Kedrovaya Pad“. In: Cherdantseva, V. Y. et al. (eds). *Sistematiko-floristicheskie issledovaniya sporovykh rastenij Dal'nego Vostoka*. Vladivostok, pp. 70–71.
- Butcher, J. 2004. *Copy-editing: the Cambridge handbook for editors, authors and publishers*. 3rd edn. Cambridge.
- Cooke, M. C. 1891. *Illustrations of British Fungi (Hymenomyces)* 8. London.
- Hausknecht, A. 1998. Beiträge zur Kenntnis der *Bolbitiaceae* 4. Die Sektion *Candidae* und andere hellhütige Arten der Gattung *Conocybe*. *Österr. Z. Pilzk.* 7: 91–121.
- Hausknecht, A. 2001. Four new *Conocybe* taxa of Europe. *Österr. Z. Pilzk.* 10: 201–211.
- Hausknecht, A. 2003. Beiträge zur Kenntnis der *Bolbitiaceae* 9. *Conocybe* Sekt. *Mixtae*. *Österr. Z. Pilzk.* 12: 41–83.
- Hausknecht, A. 2005. Beiträge zur Kenntnis der *Bolbitiaceae* 10. *Conocybe* Sektion *Pilosellae*. *Österr. Z. Pilzk.* 13: 191–274.
- Hausknecht, A. 2007. Beiträge zur Kenntnis der *Bolbitiaceae* 11. Unberingte Arten der Gattung *Pholiotina*. *Österr. Z. Pilzk.* 16: 35–116.
- Hausknecht, A. 2009. *Bolbitiaceae*. A monograph of the genera *Conocybe* Fayod and *Pholiotina* Fayod in Europe. *Fungi Europaei* 11. Alassio: Candusso.
- Hausknecht, A. & Contu, M. 2007. Interesting species of *Conocybe* (*Agaricales*, *Bolbitiaceae*) from Gallura (NE Sardinia, Italy). *Österr. Z. Pilzk.* 16: 157–166.
- Hausknecht, A. & Karasch, P. 2008. Zwei interessante *Conocybe*-Arten aus der Mongolei. *Mycol. Bavar.* 10: 9–14.
- Hausknecht, A., Krisai-Greilhuber, I. & Voglmayr, H. 2004. Type studies in North American species of *Bolbitiaceae* belonging to the genera *Conocybe* and *Pholiotina*. *Österr. Z. Pilzk.* 13: 153–235.
- Hausknecht, A. & Krisai-Greilhuber, I. 2006. Infrageneric division of the genus *Conocybe* – a classical approach. *Österr. Z. Pilzk.* 15: 187–212.
- Hausknecht, A. & Krisai-Greilhuber, I. 2007. Infrageneric division of the genus *Pholiotina* – a classical approach. *Österr. Z. Pilzk.* 16: 133–145.
- Hausknecht, A. & Passauer, U. 1997. Was ist *Agaricus siliginus* im Sinne von Fries? *Österr. Z. Pilzk.* 6: 35–44.
- Kalamees, K. & Vaasma, M. 1981. Macromycetes of Kamchatka I. *Folia Cryptog. Estonica* 16: 1–8.
- Kalamees, K. 1989. On the Agaricales flora of the Zaamin National Park II. *Folia Cryptog. Estonica* 27: 1–24.
- Kanchaveli, K. G., Kukhaleishvili, L. K., Rukhalze, T. A., Chkhaidze, R. I., Gulmagarashvili, V. Kh., Meliya, M. P., Murmanishvili, I. K., Nakhutsrishvili, I. G., Inashvili, Ts. N. & Chikovani, N. V. In: Nakhutsrishvili, I. G. 1986. *Flora sporovykh rastenij Gruzii* (Konspekt). Metsniereva, Tbilisi, 885 pp.
- Karsten, P. A. 1909. Fungi in Transbaicalia imprimis prope oppidum Tchita ann. 1908 et 1909 a clar. P. Mikhno collecti. *Trudy Troitsko-Kyakht. Otd. Priamur. Otd. Ump. Russk. Geogr. Obsctch.* 12(1,2): 108–110.
- Kharkevich, S. S. (ed). 1978. *Flora i rastitel'nost' Usurijskogo zapovednika*. Moskva.
- Kovalenko, A. E. & Nezdjominogo, E. L. 1989. Dopolnenie k flore basidial'nykh makromitsetov zapovednika „Kedrovaya Pad“. In: Amirkhanov, A.M. (ed). *Vodorosli, tishajniki, griby i mokhoobraznye v zapovednikakh RSFSR*. Pp. 34–38.
- Kühner, R. 1935. *Le genre Galera (Fries) Quélet*. Paris: Lechevalier.
- Melik-Khachatryan, D. G., Nakhutsrishvili, I. G. & Sadykhov, A. S. 1985. *Opredelitel' agarikal'nykh gribov Zakavkaz'ya*. Tbilisi.
- Moreau, P.-A. 2005. A nomenclatural revision of the genus *Alnicola* (*Cortinariaceae*). *Fungal Diversity* 20: 121–155.
- Nakhutsrishvili, I. G. 1958. Materialy k izucheniyu shlyapochnykh gribov Zemo Imeretii. *Trudy Tbilisskogo Botanicheskogo Instituta* 19: 29–43.
- Nakhutsrishvili, I. G. 1964. Materialy o shlyapochnykh gribakh Vostochnoj Gruzii. *Trudy Tbilisskogo Botanicheskogo Instituta* 23: 63–84.

- Nakhutsrishvili, I. G. 1975. *Agarikal'nye griby Gruzii*. Tbilisi.
- Nazarova, M. M. 1976. K flore agarikovyxh gribov Magadanskoj oblasti. In: Vasil'eva, L. N. & Nazarova, M. M. (eds). *Nizshie rasteniya Dal'nego Vostoka*. Vladivostok, pp. 115–127.
- Nazarova, M. M. 1986. K flore makromitsetov bassejna reki Selemdzha (Amurskaya oblast'). In: Vasil'eva, L. N. (ed). *Flora i sistematika sporovykh rastenij Dal'nego Vostoka*. Vladivostok, pp. 93–100.
- Nazarova, M. M. & Vasil'eva, L. N. 1974. K flore agarikovyxh gribov i gasteromitsetov Amurskoj oblasti. *Trudy Biologo-Pochvennogo Instituta Dal'nevostochnogo Nauchnogo Tsentra Akademii Nauk SSSR. Novaya Seriya* 22(125): 56–70.
- Nezdojminogo, E. L. 1968. Vliyanie ekologicheskikh faktorov na raspredelenie gribov-makromitsetov po rastitel'nyh soobshtchestvam severo-vostochnogo poberezh'ya Bajkala. *Mikologiya i fitopatologiya* 2: 284–290.
- Nezdojminogo, E. L. 1970. Ad floram agaricalium litoris lacus Baikal septentrionali-orientalis. *Novitates systematicae plantarum non vascularium* 1969, 6: 146–158.
- Nezdojminogo, E. L. 1973. Ad floram agaricalium litoris lacus Baikal septentrionali-orientalis. II. *Novitates systematicae plantarum non vascularium* 1973, 10: 133–141.
- Onipchenko, V. G. & Kaverina, E. N. 1989. Makromitsety vysokogor'ya Teberdinskogo zapovednika. In: Amirkhanov, A. M. (ed). *Vodorosli, lishajniki, griby i mokhoobraznye v zapovednikakh RSFSR*. Moskva, pp. 28–34.
- Perova, N. V. 1972. Agarikovye griby pikhtovogo lesa yuga Tomskoj oblasti. In: Popova, T. G. & Vasil'eva, L. N. (eds). *Vodorosli i griby Sibiri i Dal'nego Vostoka*. Novosibirsk, pp. 178–182.
- Petrov, A. N. 1991. *Konspekt flory makromitsetov Pribajkal'ya*. Novosibirsk.
- Petrova, A. A. 1983. Novye dlya Uzbekskoj SSR vidy agarikovyxh gribov iz Zaaminskogo gorno-lesnogo zapovednika. In: *Ekologiya rastenij i zhivotnykh zapovednikov Uzbekistana*. Tashkent, pp. 33–36.
- Ricken, A. 1915. *Die Blätterpilze (Agaricaceae) Deutschlands und der angrenzenden Länder, besonders Österreichs und der Schweiz*. Leipzig: Weigel.
- Samgina, D. I. 1985. Agarikovye griby. Agaricales. In: *Flora sporovykh rastenij Kazakhstana* 13, 2. Alma-Ata.
- Shalapugina, E. M. 1974. Opyt izucheniya biomassy gribov makromitsetov v Primorskom krae. *Trudy Biologo-Pochvennogo Instituta Dal'nevostochnogo Nauchnogo Tsentra Akademii Nauk SSSR. Novaya Seriya* 22(125): 72–77.
- Samgina, D. I. 1985 *Flora sporovykh rastenij Kazakhstana* XIII. 2. Agarikovye griby, Agaricales. Alma Ata, Nauka.
- Singer, R. 1931. Pilze aus dem Kaukasus 2. Ein Beitrag zur Flora Swanetiens und einiger angrenzender Täler. *Beih. Bot. Centralblatt* 48(3): 513–542.
- Singer, R. 1951 (1950). *Naucoria* Fries i blizkie rody v SSSR. *Trud. Bot. Inst. Komarova Akad. Nauk SSSR* II/6: 402–498.
- Stolyarskaya, M. V. 1989. Pervye svedeniya o shlyapochnykh gribakh Nizhne-Svirskogo zapovednika. In: Amirkhanov, A.M. (ed). *Vodorosli, lishajniki, griby i mokhoobraznye v zapovednikakh RSFSR*. Moskva, pp. 119–124.
- Thomas, K. A., Hausknecht, A. & Manimohan, P. 2001. *Bolbitiaceae* of Kerala State, India: New species and new and noteworthy records. *Österr. Z. Pilzk.* 10: 87–114.
- Vasil'eva, L. N. 1973. Die Blätterpilze und Röhrlinge (Agaricales) von Primorsky Region. Leningrad.
- Vasil'eva, L. N. & Nazarova, M. M. 1972. Materialy k flore agarikovyxh gribov yuzhnogo Sakhalina. In: Popova, T. G. & Vasil'eva, L. N. (eds). *Vodorosli i griby Sibiri i Dal'nego Vostoka*. Novosibirsk, pp. 100–107.
- Vasil'eva, L. N. & Nazarova, M. M. 1967. Griby makromitsety kak komponenty lesnykh fitotseznozov yuga Primorskogo kraja. In: *Kompleksnyye stacionarnye issledovaniya lesov Primor'ya*. Pp. 122–164.
- Vasil'eva, L. N. & Nazarova, M. M. 1977. Griby stacionara „Snezhnaya dolina“. In: *Komponenty biogeotsenozov tundrolesij Severnogo Okhotomor'ya*. Pp. 57–61.
- Vasil'eva, L. N., Azbukina, Z. M., Bunkina, I. A. & Nelen, E. S. 1963. Griby Sikhote-Alinskogo zapovednika i prilējajushchej chasti Ternejskogo rajona. In: *Trudy Sikhote-Alinskogo gosudarstvennogo zapovednika. Vystup III*. Vladivostok, pp. 71–119.
- Watling, R. 1982. *Bolbitiaceae: Agrocybe, Bolbitius & Conocybe*. In: Henderson, D. M., Orton, P. M., Watling, R. (eds). *British fungus flora. Agarics and Boleti* 3. Edinburgh: Her Majesty's Stationery Office.

