

## New records of dung-inhabiting *Coprinus* species in Ukraine I. Section *Pseudocoprinus*

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Data on new records of fimicolous representatives of the section *Pseudocoprinus* (Kühner) P.D. Orton et Watling of the genus *Coprinus* Pers. in the territory of Ukraine are reported. As result of both field research and the use of moist-chambers 8 species belonging to the subsections *Glabri* J.E. Lange and *Setulosi* J.E. Lange have been found. *Coprinus bisporus* J.E. Lange, *C. brevisetulosus* Arnolds, *C. curtus* Kalchbr., *C. heterosetulosus* Watling and *C. pellucidus* P. Karst. were collected in Ukraine for the first time. For each species a description and drawings are provided.

**Key words:** Basidiomycetes, fimicolous mushrooms, *Agaricales*, *Coprinaceae*, *Glabri*, *Pseudocoprinus*, *Setulosi*.

Prydiuk M. P. (2010): Nové nálezy koprofilních druhů rodu *Coprinus* na Ukrajině I. Sekce *Pseudocoprinus*. – Czech Mycol. 62(1): 43–58.

Jsou publikovány nové nálezy koprofilních hnojníků ze sekce *Pseudocoprinus* na Ukrajině. Jedná se jak o nálezy z přírody, tak o druhy vyrostlé ve vlhkých komůrkách. Druhy *Coprinus bisporus* J.E. Lange, *C. brevisetulosus* Arnolds, *C. curtus* Kalchbr., *C. heterosetulosus* Watling a *C. pellucidus* P. Karst. byly na Ukrajině sbírány poprvé. Každý z 8 druhů zařazených do článku je popsán a vyobrazen.

### INTRODUCTION

The genus *Coprinus* Pers. as a whole, and its fimicolous representatives in particular, have hard attracted special attention of Ukrainian mycologists. These species are usually only mentioned in general floristic lists of mushrooms of this country excepting for a few articles (Batyrova 1989, 1990). Therefore, only 11 dung-inhabiting species of the genus were known in Ukraine before this investigation. As result of this study 17 dung-inhabiting *Coprinus* species were recorded, 9 of them belonging to the section *Coprinus* (will be treated in the next part of the article) and the remaining 8 representatives of the section *Pseudocoprinus* (Kühner) P.D. Orton et Watling. Most of them (*Coprinus bisporus* J.E. Lange, *C. brevisetulosus* Arnolds, *C. curtus* Kalchbr., *C. heterosetulosus* Watling and *C. pellucidus* P. Karst.) were found in Ukraine for the first time. Three species

[*Coprinus congregatus* (Bull.) Fr., *C. ephemerus* (Bull.: Fr.) Fr. and *C. miser* P. Karst.] were collected at new localities. All 8 species are presented in details below.

#### MATERIALS AND METHODS

Though a molecular phylogeny of coprinoid fungi has indicated that the genus *Coprinus* Pers. is polyphyletic (Hopple and Vilgalys 1999, Moncalvo et al. 2002) and has been finally subdivided into several genera (Redhead et al. 2001), for practical reasons (in particular uncertain position of some species, for example, *Coprinus cordisporus* Gibbs), this paper uses the classical concept of this genus.

This article is based on study of both collections made by author and selected specimens kept in the Herbarium of the M.G. Kholodny Institute of Botany, National Academy of Sciences of Ukraine, Kiev, Ukraine (KW). Many *Coprinus*-specimens were collected in the field but a considerable part of them was grown in moist-chambers from earlier gathered samples of dung. The classical method (Richardson 2001) was used with minor changes: the dung samples were placed into transparent plastic cups covered by somewhat larger ones and incubated on several layers of moist filter paper under natural light at room temperature (18–20 °C) during several weeks. The specimens obtained in the moist-chambers are marked with an asterisk (\*).

Microscopic structures were observed in dried material. Microscopic sections of lamellae were made at about 1/2 radius of the pileus and examined in 3 % KOH. The spores were studied in water.

The values of spore size are based on at least 20 spore measurements per basidiocarp from one habitat. For basidia, cystidia and veil elements the mean of the smallest and the largest ones per basidiocarp is given based on 10 measurements in each case.

All the collections are deposited in the National Herbarium of the M. G. Kholodny Institute of Botany (KW).

In the descriptions the following abbreviations are used: av. B = average width of the spores in frontal view; av. L = average length of the spores; L = number of lamellae reaching stipe; l = number of short lamellae (not reaching stipe) between two long ones; Q = length divided by width; av. Q = average Q.

RESULTS AND DISCUSSION

Subsection *Glabri* J.E. Lange

*Coprinus miser* P. Karst., Bidr. Känn. Finl. Nat. Folk, 37: 236, 1882. Fig. 1

*Coprinus subtilis* sensu Joss., Ann. Soc. Linn. Lyon, 77: 107, 1933. – *Parasola miser* (P. Karst.) Redhead, Vilgalys et Hopple, Taxon, 50: 236, 2001.

Pileus at first 2–5 × 2–3 mm, ovoid, ellipsoid or cylindric-ellipsoid, then campanulate to convex, finally applanate, 5–8 mm wide, radially plicate, pinkish red, pinkish brown, then grey or grey brown, at centre slightly darker, brown or reddish brown. Lamellae free, without pseudocollarium, L = 15–20, l = 0–1, whitish, then grey, finally black-spotted. Stipe up to 33 × 0.5 mm, cylindrical, with clavate base, white or greyish, hyaline, glabrous. Flesh whitish, taste and smell indistinct. Spore print black.

Spores 8.0–11.0(–11.5) × 7.0–10.0 × 6.0–7.0 μm, Q = 1.0–1.15, av. L = 9.6 ± 0.83 μm, av. B = 9.1 ± 0.77 μm, av. Q = 1.06 ± 0.05; flattened, rounded-triangular, heart-shaped to rounded-pentagonal, with convex to rounded base and rounded apex in frontal view, ellipsoid in lateral view, germ pore eccentric, up to 1.5 μm, dark red-brown. Basidia 15–20 × 7.0–8.5 μm, 2-spored, surrounded by 3–5 pseudoparaphyses. Cheilocystidia 16–25 × 15–22 μm, subglobose or ellipsoid. Pleurocystidia absent. Veil absent. Pileipellis hymeniform, composed of sphaeropedunculate and clavate cells 24–29 × 15–22 μm in size. Clamp-connections present.

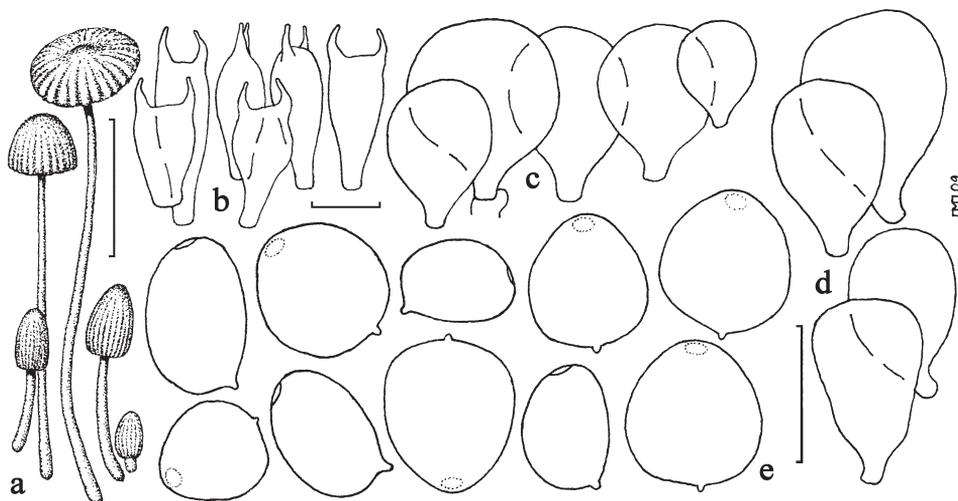


Fig. 1. *Coprinus miser* (KW 36808): a – basidiocarps, b – basidia, c – cheilocystidia, d – cells of pileipellis, e – spores. Bars = 1 cm for basidiocarps and 10 μm for microstructures.

**Habitat and distribution.** Solitary or in small groups on dung of herbivorous animals, in forests, meadows and pastures. Known from Europe, Iceland and New Zealand (Uljé and Bas 1988, Cacialli et al. 1999, Urbonas 1999, Uljé 2005, Vesterholt 2008b). In Ukraine it was earlier known from the Kaniv Nature Reserve (Chercasy Region) (Solomakhina and Prydenko 1998). Apparently rare or overlooked.

**Notes.** This species is easily recognizable due to its minute basidiocarps, habitat exclusively on dung, heart-shaped spores and the absence of pleurocystidia. The spores of our specimen (with 2-spored basidia) were somewhat longer and relatively narrower [ $8.0\text{--}11.0(-11.5) \times 7.0\text{--}10.0 \mu\text{m}$  in frontal view] than many authors indicated for this species:  $7.0\text{--}10.0 \times 7.0\text{--}9.0 \times 5.5\text{--}6.5 \mu\text{m}$  (Kühner and Romagnesi 1953);  $6.5\text{--}10.5 \times 7.0\text{--}10.5 \mu\text{m}$  (Doveri 2004);  $7.0\text{--}10.5 \times 6.5\text{--}10.0 \mu\text{m}$  (Uljé 2005, Vesterholt 2008b).

**Specimen examined.** Ukraine: Kherson Region, Hola Prystan District, Chornomorsky Biosphere Reserve, Solonoozerna, on cow dung,  $46^{\circ} 27' 12.72'' \text{N}$ ,  $32^{\circ} 00' 33.54'' \text{E}$ , 13 October 2006, leg. M.P. Prydiuk (KW 36808)\*.

### Subsection *Setulosi* J.E. Lange

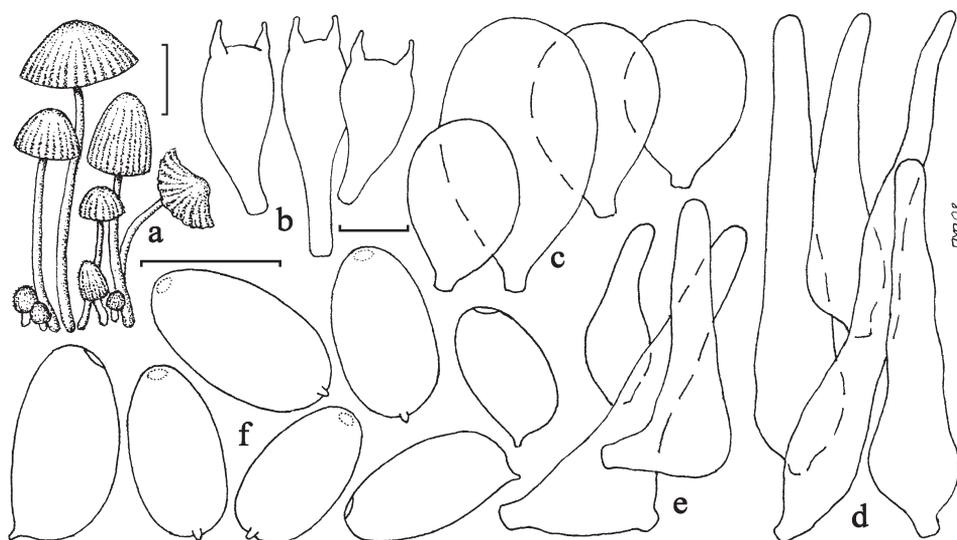
***Coprinus bisporus*** J.E. Lange, Dansk Bot. Ark., 2(3): 50, 1915; non sensu Buller, Trans. Brit. Mycol. Soc., 6: 363, 1920 (= *C. bisporiger*). Fig. 2

*Coprinellus bisporus* (J.E. Lange) Vilgalys, Hopple et Johnson, Taxon, 50: 233, 2001.

Pileus at first  $3\text{--}9 \times 3\text{--}4 \text{ mm}$ , ovoid or ellipsoid, then obtusely conical to convex, finally appanate to flat, up to 20 mm, slightly ribbed, ochre or pale brown at centre, paler towards margins. Lamellae free or almost free,  $L = 25\text{--}30$ ,  $l = 1\text{--}3$ , at first whitish then dark grey, finally almost black. Stipe  $30\text{--}50 \times 1\text{--}2 \text{ mm}$ , cylindrical, base somewhat clavate, whitish, minutely pubescent. Flesh thin, whitish. Taste and smell indistinct. Spore print black.

Spores  $11.0\text{--}14.5 \times 6.5\text{--}8.2 \mu\text{m}$ ,  $Q = 1.57\text{--}1.90$ , av.  $L = 13.1 \pm 1.12 \mu\text{m}$ , av.  $B = 7.4 \pm 0.48 \mu\text{m}$ , av.  $Q = 1.77 \pm 0.09$ ; ellipsoid to ovoid, basis and apex rounded, germ pore eccentric,  $1.5\text{--}1.8 \mu\text{m}$  wide, dark red-brown. Basidia  $25\text{--}31 \times 10\text{--}11 \mu\text{m}$ , 2-spored, surrounded by 4–6 pseudoparaphyses. Cheilocystidia  $24\text{--}40 \times 16\text{--}23 \mu\text{m}$ , subglobose, ovoid, ellipsoid to broadly utriform. Pleurocystidia absent. Pileocystidia  $25\text{--}80 \times 9\text{--}13 \mu\text{m}$ , lageniform with tapering neck,  $3\text{--}8 \mu\text{m}$  wide at apex. Sclerocystidia absent. Caulocystidia  $26\text{--}50 \times 10\text{--}15 \mu\text{m}$ , lageniform with cylindrical or tapering neck,  $3\text{--}5 \mu\text{m}$  wide at apex. Clamp-connections absent.

**Habitat and distribution.** Solitary on dung of herbivorous animals, in meadows. Known from Europe and America (Cacialli et al. 1999, Arnolds et al. 2005, Vesterholt 2008a). Its distribution in Ukraine is still insufficiently known.



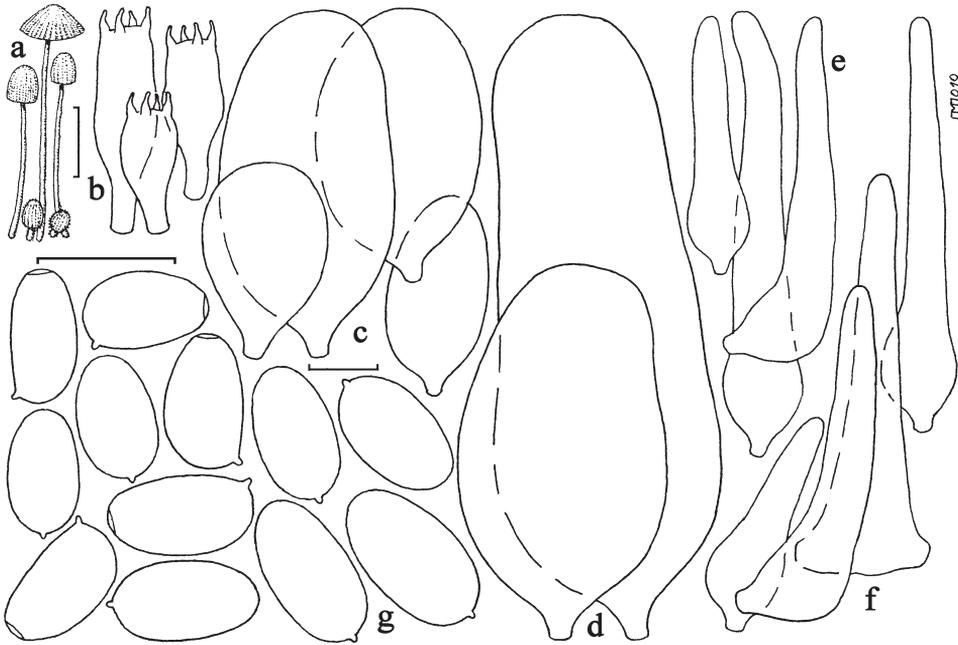
**Fig. 2.** *Coprinus bisporus* (KW 36773): **a** – basidiocarps, **b** – basidia, **c** – cheilocystidia, **d** – pileocystidia, **e** – caulocystidia, **f** – spores. Bars = 1 cm for basidiocarps and 10  $\mu$ m for microstructures.

**Notes.** *Coprinus bisporus* can be easily distinguished by its 2-spored basidia, subglobose or ellipsoid cheilocystidia, the absence of pleurocystidia and sclerocystidia, as well as its habitat on dung. The morphologically very close *C. bisporiger* P.D. Orton does not grow on dung and possesses pleurocystidia. It must be mentioned that the spores of our specimen are somewhat larger and relatively narrower than some authors indicate: (9.0–)9.4–12.3  $\times$  (5.0–)5.2–6.3(–6.5)  $\mu$ m (Doveri 2004); 9.5–13.5  $\times$  6.0–8.5  $\mu$ m (Uljé et Bas 1991, Arnolds et al. 2005). However, they are rather similar to those cited by other mycologists: 9.5–14.5  $\times$  5.5–7.5  $\mu$ m (Kühner and Romagnesi 1953), (11.0–)12.6–14.1  $\times$  (6.2–)6.8–7.5(–7.8)  $\mu$ m (Cacialli et al. 1999), 10–14  $\times$  5.5–7.5  $\mu$ m (Vesterholt 2008a).

**Specimen examined.** Ukraine: Ternopil Region, Gusiатыn District, about 0.5 km south-east of the village of Glibiv, on cow dung, 49° 20' 21.20" N, 25° 59' 47.20" E, 12 October 2008, leg. M.P. Prydiuk (KW 36773).

***Coprinus brevisetulosus*** Arnolds, Ecol. Coenol. Macrofungi Grassl. Heathl. Drenthe, Netherlands, 2: 309, (1982) 1983. Fig. 3

*Coprinellus brevisetulosus* (Arnolds) Redhead, Vilgalys et Moncalvo, Taxon, 50: 233, 2001. – *Coprinus stellatus* sensu M. Lange, Dansk Bot. Ark., 14(6): 119, 1952; sensu Cacialli et al., Schede Micol., 1: 183, 1995; non sensu Buller in Bisby, Buller and Dearness, Fungi of Manitoba and Saskatchewan: 119–120, 1929. – *Coprinus bulleri* Cacialli, Caroti et Doveri, Contr. Cogn. Coprin.: 236, 1999.



**Fig. 3.** *Coprinus brevisetulosus* (KW 36919): **a** – basidiocarps, **b** – basidia, **c** – cheilocystidia, **d** – pleurocystidia, **e** – pileocystidia, **f** – caulocystidia, **g** – spores. Bars = 1 cm for basidiocarps and 10 µm for microstructures.

Pileus at first 4–6 × 3–4 mm, subglobose, ovoid or ellipsoid, then obtusely conical to convex, finally appanate to flat, up to 15 mm, slightly ribbed, at centre ochre-brown or dark brown, paler towards margins. Lamellae free or almost free, L = 12–20, l = 0–1(–3), at first whitish then blackish brown, finally almost black. Stipe 20–45 × 0.5–1.5 mm, cylindrical with somewhat clavate base, whitish, minutely pubescent. Flesh thin, whitish. Taste and smell indistinct. Spore print black.

Spores 9–12 × 5.5–6.5 µm, Q = 1.5–1.9, av. L = 10.4 ± 0.89 µm, av. B = 6.1 ± 0.36 µm, av. Q = 1.69 ± 0.10; ovoid to ellipsoid, basis and apex rounded, germ pore central, up to 1.5 µm wide, dark red-brown. Basidia 17–31 × 8–10 µm, 4-spored, surrounded by 4–5(–6) pseudoparaphyses. Cheilocystidia 35–60 × 18–29 µm, subglobose, ovoid, ellipsoid, sometimes utriform. Pleurocystidia 50–95 × 15–30 µm, ellipsoid, ovoid, cylindrical ellipsoid or slightly utriform. Pileocystidia 38–65 × 9–12 µm, lageniform with tapering neck, 3.5–5.0 µm wide at apex. Sclerocystidia absent. Caulocystidia 34–55 × 9–14 µm, lageniform with tapering neck, 2.5–5.0 µm wide at apex. Clamp-connections absent.

**Habitat and distribution.** Solitary or in small groups on cow or horse dung, in meadows and pastures. Known from Europe, Africa, Asia and America

(Cacialli et al. 1999, Arnolds et al. 2005, Vesterholt 2008a). Its distribution in Ukraine is still insufficiently known.

**Notes.** This species is very similar to *Coprinus pellucidus* P. Karst., but differs by larger and wider spores, larger ellipsoid cheilocystidia and the presence of pleurocystidia. Uljé (Uljé and Bas 1991) indicated for this species larger basidiocarps than those of *C. pellucidus* but our specimens had about the same size. Spores of our specimen were slightly larger than some other authors indicated:  $8.0\text{--}11.5 \times 5.0\text{--}6.5 \mu\text{m}$  (Uljé 2005, Vesterholt 2008a) but corresponded fairly well to Doveri's data (Doveri 2004).

**Specimens examined.** Ukraine: Rivne Region, Dubno District, about 1 km east of the village of Martynivka, on horse dung,  $50^{\circ} 13' 13.83''$  N,  $25^{\circ} 50' 5.92''$  E, 11 August 2009, leg. M.P. Prydiuk (KW 36919)\*; Zdolbuniv District, near the village of Bushcha, on cow dung,  $50^{\circ} 14' 25.79''$  N,  $25^{\circ} 49' 31.55''$  E, 14 August 2009, leg. M.P. Prydiuk (KW 36920)\*.

***Coprinus congregatus*** (Bull.) Fr., *Epicrisis*: 249, 1838.

Fig. 4

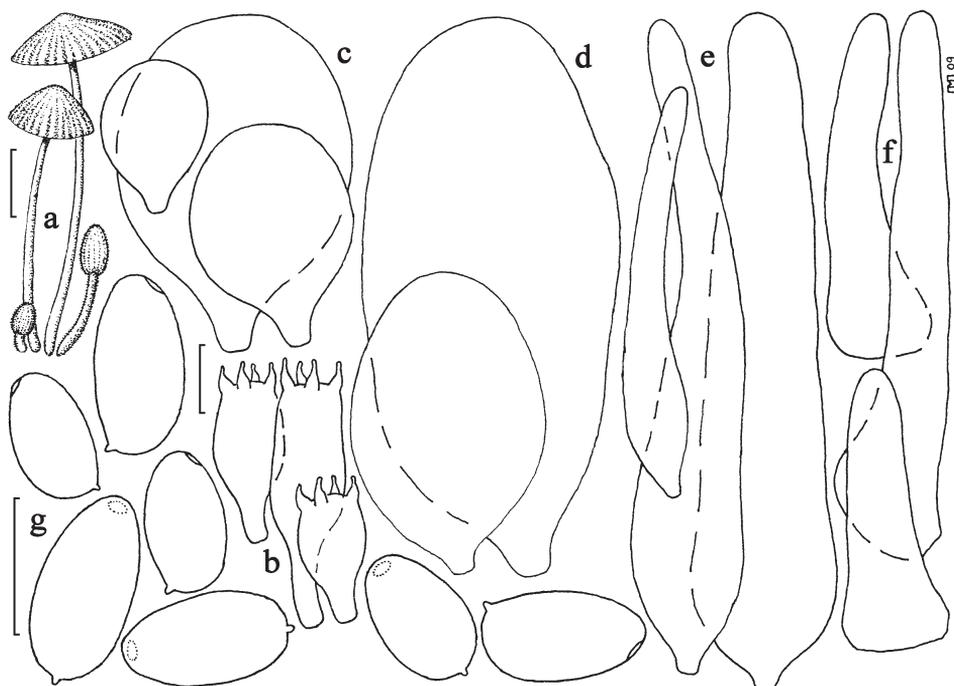
*Agaricus congregatus* Bull., *Herb. Fr.*: pl. 94, 1781–1782. – *Coprinellus congregatus* (Bull.) P. Karst., *Ryssl., Finl. Skand. Halföns Hattsvamp.*: 543, 1879.

**Pileus** at first  $4\text{--}15 \times 3\text{--}14$  mm, ovoid or ellipsoid, then obtusely conical, finally applanate to flat, up to 20 mm, slightly ribbed, cream-coloured, at centre ochre-brown to light brown, then yellowish greyish. Lamellae free,  $L = 20\text{--}36$ ,  $l = 1\text{--}3$ , at first whitish then brown, finally brown-black. Stipe  $15\text{--}60 \times 0.5\text{--}2.5$  mm, cylindrical or slightly tapering upwards, with somewhat clavate base, whitish, minutely pubescent. Flesh thin, whitish. Taste and smell indistinct. Spore print black.

**Spores**  $11.0\text{--}14.5 \times 6.5\text{--}7.5 \mu\text{m}$ ,  $Q = 1.61\text{--}2.0$ , av.  $L = 12.7 \pm 1.14 \mu\text{m}$ , av.  $B = 7.0 \pm 0.58 \mu\text{m}$ , av.  $Q = 1.83 \pm 0.1$ ; ovoid or ellipsoid, basis and apex rounded, germ pore eccentric,  $1.5\text{--}1.8 \mu\text{m}$  wide, dark red-brown. Basidia  $19\text{--}30 \times 9.5\text{--}11.0 \mu\text{m}$ , 4-spored, surrounded by 4–5 pseudoparaphyses. Cheilocystidia  $22\text{--}50 \times 15\text{--}36 \mu\text{m}$ , subglobose, ovoid, ellipsoid, sometimes utriform. Pleurocystidia  $43\text{--}90 \times 29\text{--}40 \mu\text{m}$ , ellipsoid, cylindrical-ellipsoid or utriform. Pileocystidia  $60\text{--}100 \times 7.5\text{--}25 \mu\text{m}$ , lageniform with tapering neck,  $4\text{--}11 \mu\text{m}$  wide at apex. Sclerocystidia absent. Caulocystidia  $41\text{--}80 \times 15\text{--}17 \mu\text{m}$ , lageniform with tapering neck,  $6\text{--}8 \mu\text{m}$  wide at apex. Clamp-connections absent.

**Habitat and distribution.** Solitary or in small groups on dung of herbivorous animals, in forests, steppes, meadows and pastures. Known from Europe, Asia and North America (Uljé and Bas 1991, Cacialli et al. 1999, Uljé 2005, Vesterholt 2008a). In Ukraine it was earlier known from the Poltava Region (Ganzha 1960a, 1960c), apparently rather common but overlooked.

**Notes.** The species is very similar to *Coprinus ephemerus*, but the latter one differs by the presence of clamp-connections, slightly larger spores and the form of pleurocystidia [in *C. congregatus* they are “ellipsoid, oblong to slightly



**Fig. 4.** *Coprinus congregatus* (KW 36924): **a** – basidiocarps, **b** – basidia, **c** – cheilocystidia, **d** – pleurocystidia, **e** – pileocystidia, **f** – caulocystidia, **g** – spores. Bars = 1 cm for basidiocarps and 10  $\mu\text{m}$  for microstructures.

utriform”, while *C. ephemerus* possesses “subglobose, broadly ellipsoid, obovoid to broadly cylindrical” ones (Uljé 2005)].

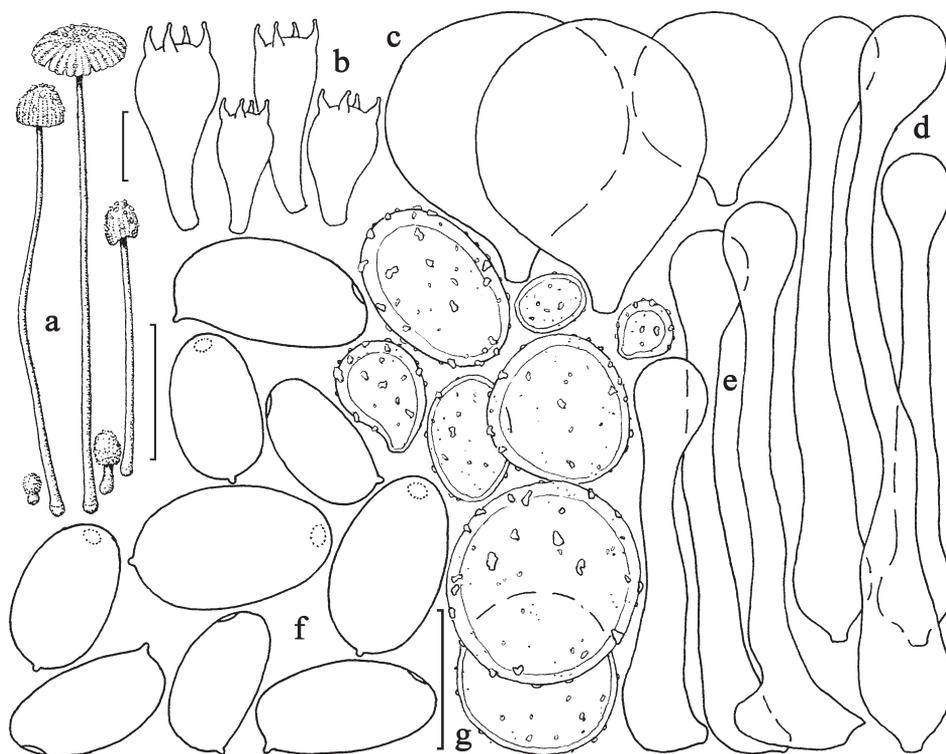
Specimens examined. Ukraine: Sumy Region, Lebedyn District, Ukrainian Steppe Nature Reserve, part called “Mykhailivs’ka tsilyna”, on unidentified dung, 50° 45' 9.81" N, 34° 11' 29.02" E, 18 September 1957, leg. M.Y. Zerova, (KW 10784). Kherson Region, Gola Prystan District, Chornomorsky Biosphere Reserve, Ivano-Rybalchans’ka, about 0.5 km south-west of the forester’s house, on cow dung, 46° 26' 3.8" N, 32° 05' 33.66" E, 14 October 2006, leg. M.P. Prydiuk (KW 36774)\*. Rivne Region, Zdolbuniv District, near the village of Bushcha, on cow dung, 50° 14' 24.91" N, 25° 49' 33.05" E, 14 August 2009, leg. M.P. Prydiuk (KW 36924)\*.

***Coprinus curtus*** Kalchbr. in Thüm., Flora, 59: 424, 1876.

Fig. 5

*Coprinellus curtus* (Kalchbr.) Vilgalys, Hopple et Johnson, Taxon, 50: 233, 2001. – *Coprinus plicatilloides* Buller, Trans. Br. Mycol. Soc., 6: 364, 1920.

Pileus at first 3–7 × 2–5 mm, subglobose, ovoid or ellipsoid, then obtusely conical, finally flat, up to 15 mm, ribbed, pale ochre, then becomes pale grey towards margins, covered (particularly at centre) by scattered granular-flocculose yellow-



**Fig. 5.** *Coprinus curtus* (KW 36780): **a** – basidiocarps, **b** – basidia, **c** – cheilocystidia, **d** – pileocystidia, **e** – caulocystidia, **f** – spores, **g** – elements of veil. Bars = 1 cm for basidiocarps and 10  $\mu$ m for microstructures.

brown or ochre-brown veil. Lamellae free,  $L = 15\text{--}20$ ,  $l = 0\text{--}1$ , at first whitish then greyish, finally blackish. Stipe  $12\text{--}20 \times 0.5$  mm, cylindrical with somewhat clavate or slightly root-like base, whitish, minutely pubescent. Flesh thin, whitish. Taste and smell indistinct. Spore print brownish-black.

Spores  $9.5\text{--}14.5 \times 6.5\text{--}9.0 \times 6.0\text{--}7.5$   $\mu$ m,  $Q = 1.3\text{--}1.83$ , av.  $L = 12.1 \pm 0.97$   $\mu$ m, av.  $B = 7.8 \pm 0.79$   $\mu$ m, av.  $Q = 1.57 \pm 0.12$ ; flattened, ovoid, ovoid-ellipsoid or widely-ellipsoid with rounded basis and apex in frontal view, ellipsoid in lateral view, germ pore eccentric,  $1.5\text{--}1.8$   $\mu$ m wide, dark red-brown. Basidia  $23\text{--}30 \times 10\text{--}13$   $\mu$ m, 4-spored, surrounded by 4–7 pseudoparaphyses. Cheilocystidia  $29\text{--}45 \times 24\text{--}36$   $\mu$ m, subglobose. Pleurocystidia absent. Pileocystidia  $72\text{--}144 \times 12\text{--}14$   $\mu$ m, lageniform with cylindrical or slightly tapering neck  $4.5\text{--}5.5$   $\mu$ m wide and subcapitate to capitate apex  $10.5\text{--}14.5$   $\mu$ m wide. Sclerocystidia absent. Caulocystidia  $60\text{--}82 \times 10\text{--}17$   $\mu$ m, similar to pileocystidia, apex  $10\text{--}13$   $\mu$ m wide. Veil consisting of globose, subglobose and ellipsoid thick-walled ( $0.7\text{--}3.5$   $\mu$ m) cells up to 31  $\mu$ m in diameter,

often fairly strongly encrusted, pale yellowish brown to light brown. Clamp-connections absent.

**Habitat and distribution.** Solitary or in small groups on dung of herbivorous animals, in forests, meadows and pastures. Known from Europe, Africa, Asia, North America and South America (Cacialli et al. 1999, Richardson 2001, Uljé 2005, Vesterholt 2008a). Its distribution in Ukraine is still insufficiently known.

**Notes.** The species can be fairly easily identified due to the presence of a granular veil consisting of globose thick-walled brownish cells as well as capitate pileo- and caulocystidia. On the whole the features of our specimens correspond rather well to data of many authors (Kühner and Romagnesi 1953, Bender et al. 1984, Moser 1983, Uljé and Bas 1991, Dissing and Lundquist 1992, Vesterholt 2008a), although the spores were larger than some other authors indicated: 10–11 × 5.5–6.2 µm (Orton and Watling 1979); (11–)12–13 × (7.5–)8.0–8.5 µm (Doveri 2004). Our specimens were remarkable by the presence of extraordinary thick-walled (up to 3.5 µm) veil cells being similar to the ones indicated by Bender et al. (1984).

**Specimens examined.** Ukraine: Donetsk Region, Novoazovsk District, Ukrainian Steppe Nature Reserve, part called “Khomutovs'kyj Step”, on unidentified dung, 47° 17' 13.88" N, 38° 10' 53.25" E, 4 June 1970, leg. S.P. Wasser (KW 4620). Rivne Region, Dubrovitsya District, near the village of Krupove, on horse dung, 51° 34' 7.63" N, 26° 28' 28.7" E, 10 July 2000, leg. M.P. Prydiuk (KW 36777); about 1 km west of the village of Krupove, on horse dung, 51° 33' 38.74" N, 26° 27' 13.62" E, 03 August 2006, leg. M.P. Prydiuk (KW 36779); Dubno District, about 2 km west of the village of Bushcha, on hare dung, 50° 14' 28.94" N, 25° 48' 9.77" E, 5 August 2009, leg. M.P. Prydiuk (KW 36931)\*. Kherson Region, Hola Prystan District, Chornomorsky Biosphere Reserve, Solonoozerna, on hare dung, 46° 27' 24.24" N, 32° 01' 16.51" E, 13 October 2006, leg. M.P. Prydiuk (KW 36780)\*. Sumy Region, Seredyna-Buda District, “Desnians'ko-Starohuts'kyj” National Nature Park, near the village of Ochkyne, on horse dung, 52° 14' 11.23" N, 33° 22' 25.32" E, 4 August 2009, leg. Y.I. Golubtsova (KW 36930).

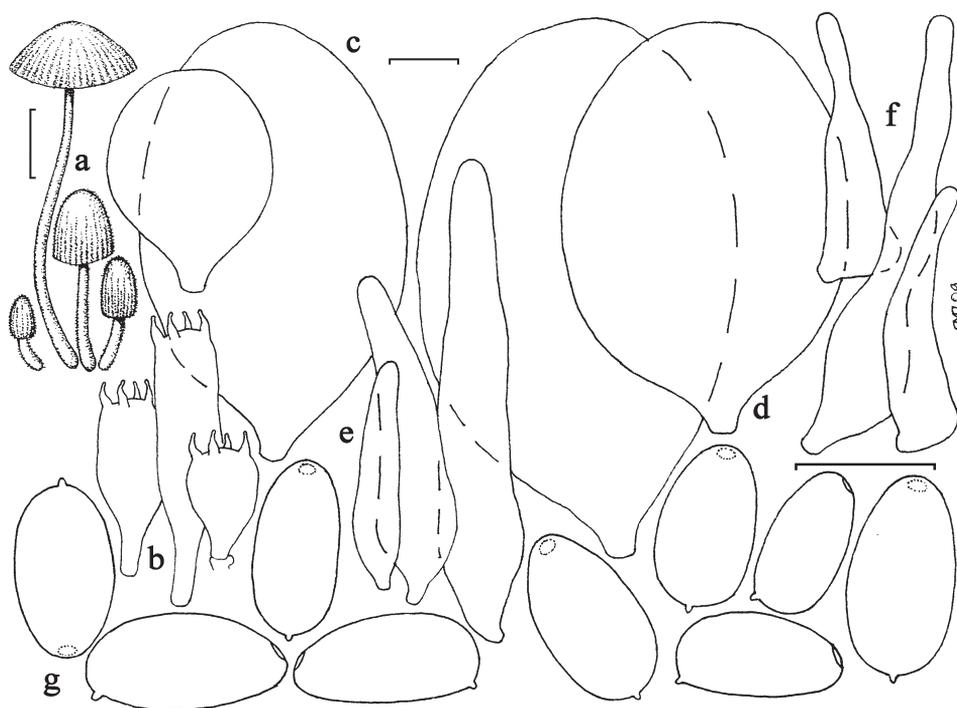
***Coprinus ephemerus*** (Bull.: Fr.) Fr., *Epicrisis*: 252, 1838.

Fig. 6

*Agaricus ephemerus* Bull., *Hist. Champ. Fr.*: Tav. 542, 1791. – *Agaricus ephemerus* Pers., *Syn. Meth. Fung.*: 406, 1801. – *Agaricus ephemerus* Bull.: Fr., *Syst. Mycol.*, 1: 313, 1821. – *Agaricus momentaneus* Bull., *Hist. Champ. Fr.*: Tav. 128, 1791. – *Coprinellus ephemerus* (Bull.: Fr.) Redhead, *Vilgalys et Moncalvo, Taxon*, 50: 233, 2001.

Pileus at first 5–15 × 4–13 mm, ovoid, ellipsoid, then obtusely conical, campanulate to convex, finally applanate, up to 20–25 mm, slightly ribbed, ochre-brown, dark-brown at centre, paler towards margins. Lamellae free or almost free, L = 25–35, l = 1–3, at first whitish, then brown, finally black. Stipe 25–75 × 1–3 mm, slightly tapering upwards, with somewhat clavate base, whitish, minutely pubescent. Flesh thin, whitish. Taste and smell indistinct. Spore print black.

Spores 11.0–14.5 × 6.0–8.0 µm, Q = 1.61–2.0, av. L = 12.6 ± 1.03 µm, av. B = 6.9 ± 0.42 µm, av. Q = 1.82 ± 0.10; ovoid, ovoid-ellipsoid or ellipsoid, basis and apex rounded, germ pore eccentric, up to 1.8 µm wide, dark red-brown. Basidia 19–33 ×



**Fig. 6.** *Coprinus ephemerus* (KW 36791): **a** – basidiocarps, **b** – basidia, **c** – cheilocystidia, **d** – pleurocystidia, **e** – pileocystidia, **f** – caulocystidia, **g** – spores. Bars = 1 cm for basidiocarps and 10  $\mu\text{m}$  for microstructures.

8.5–12.0  $\mu\text{m}$ , 4-spored, surrounded by 4–6 pseudoparaphyses. Cheilocystidia 19–55  $\times$  17–29  $\mu\text{m}$ , subglobose, ovoid, broadly ellipsoid or ellipsoid. Pleurocystidia 50–96  $\times$  21–45  $\mu\text{m}$ , ovoid, broad-ellipsoid or broadly cylindrical. Pileocystidia 33–95  $\times$  7–20  $\mu\text{m}$ , lageniform with tapering neck, 5.0–8.5  $\mu\text{m}$  wide at apex. Sclerocystidia absent. Caulocystidia 22–65  $\times$  9–14  $\mu\text{m}$ , lageniform with cylindrical or slightly tapering neck, 3–4  $\mu\text{m}$  wide at apex. Clamp-connections present.

**Habitat and distribution.** Solitary or in small groups on dung of herbivorous animals, in forests, meadows and pastures. Known from Europe, Africa, Asia, North America and Australia (Uljé and Bas 1991, Cacialli et al. 1999, Urbonas 1999, Uljé 2005, Vesterholt 2008a). In Ukraine it is known from many regions: Chercasy (Solomakhina and Prudenko 1998), Crimea (Sarkina 2004), Kyiv (Solomakhina and Smitska 1984), Poltava (Ganzha 1960a, 1960b), Sumy (Borščow 1869) and Ternopil (Bobyak 1907, Batyrova 1989). It is apparently rather common.

**Notes.** *Coprinus ephemerus* is very similar to *C. congregatus* and differs mainly by the absence of clamp-connections. Besides, many authors indicate that

spores of *C. ephemerus* are slightly larger than those of *C. congregatus* (Kühner and Romagnesi 1953, Orton and Watling 1979, Moser 1983, Dissing and Lundquist 1992, Uljé 2005, Vesterholt 2008a). However, our collections of both species possess spores of practically identical size. It must be mentioned, however, that Doveri (2004) even indicated for this species a slightly smaller spore size ( $12.1\text{--}13.5 \times 7.2\text{--}8.1 \mu\text{m}$ ) than was observed in our specimens. Orton and Watling (1979) as well as Doveri (2004) observed that basidiocarps of *C. ephemerus* grow mainly gregariously, while those of *C. congregatus* are often caespitose. Doveri also observed some lageniform cheilocystidia in *C. ephemerus*, which were absent in *C. congregatus* (Doveri 2004).

Specimens examined. Ukraine: Rivne Region, Dubrovytsia District, about 1.5 km south-east of the village of Mochulyshche, on cow dung,  $51^{\circ} 34' 53.09''$  N,  $26^{\circ} 29' 45.83''$  E, 3 August 2006, leg. M.P. Prydiuk (KW 36791). Ternopil Region, Gusiatoryn District, about 0.5 km south-east of the village of Glibiv, on cow dung,  $49^{\circ} 20' 21.20''$  N,  $25^{\circ} 59' 47.20''$  E, 12 October 2008, leg. M.P. Prydiuk (KW 36792)\*.

***Coprinus heterosetulosus*** Watling in P.D. Orton, Notes R. Bot. Gdn Edinb., 35: 153, 1976. Fig. 7

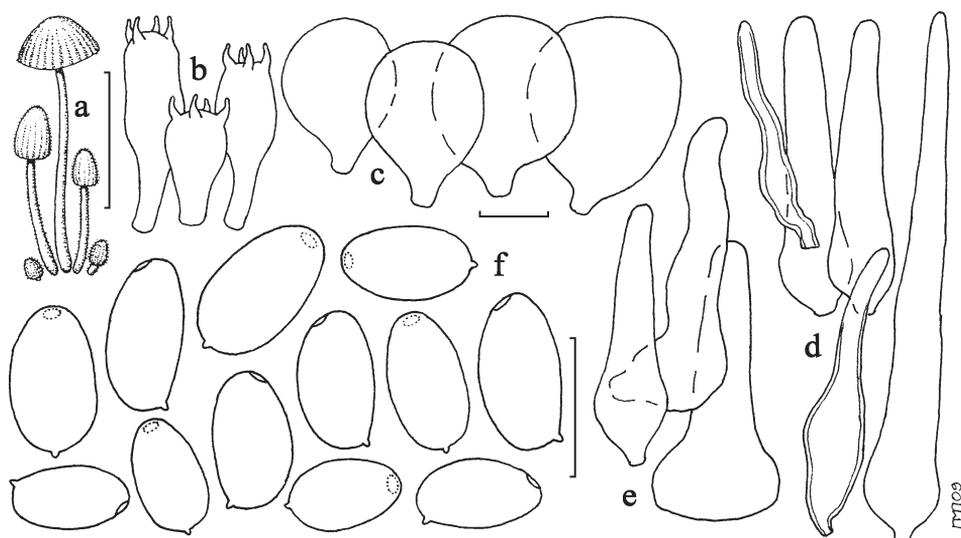
*Coprinellus heterosetulosus* (Watling) Vilgalys, Hopple et Johnson, Taxon, 50: 234, 2001. – *Coprinus heterosetulosus* Locq., Bull. Trimest. Soc. Mycol. Fr., 63: 78, 1947 (invalid).

Pileus at first  $3\text{--}5 \times 2\text{--}4$  mm, ovoid, ellipsoid to elongate-ellipsoid, then campanulate to convex, finally applanate, up to 10 mm, slightly ribbed, brown, greyish brown to dark brown, becoming paler towards margin, up to light brown, then grey, remaining brown at centre. Lamellae free or almost free,  $L = 10\text{--}15$ ,  $l = 0\text{--}1$ , at first whitish then blackish-brown, finally nearly black. Stipe  $15\text{--}45 \times 0.3\text{--}0.8$  mm, cylindrical with somewhat clavate base, whitish, hyaline, minutely pubescent. Flesh thin, whitish. Taste and smell indistinct. Spore print black.

Spores  $8.5\text{--}11.5 \times 5.0\text{--}6.5 \mu\text{m}$ ,  $Q = 1.45\text{--}2.0$ , av.  $L = 10.0 \pm 0.86 \mu\text{m}$ , av.  $B = 5.8 \pm 0.51 \mu\text{m}$ , av.  $Q = 1.73 \pm 0.10$ ; ovoid, ellipsoid-ovoid or ellipsoid, basis and apex rounded, germ pore eccentric,  $1.3\text{--}1.5 \mu\text{m}$  wide, dark red-brown. Basidia  $18\text{--}29 \times 8.5\text{--}9.0 \mu\text{m}$ , 4-spored, surrounded by 4–6 pseudoparaphyses. Cheilocystidia  $21\text{--}26 \times 15\text{--}21 \mu\text{m}$ , subglobose and ovoid. Pleurocystidia absent. Pileocystidia  $24\text{--}82 \times 5\text{--}12 \mu\text{m}$ , lageniform with tapering neck,  $2.5\text{--}6.0 \mu\text{m}$  wide at apex. Sclerocystidia  $31\text{--}48 \times 5\text{--}10 \mu\text{m}$ , lageniform to fusoid-lageniform, with tapering neck  $2.5\text{--}3.0 \mu\text{m}$  wide at apex. Caulocystidia  $38\text{--}42 \times 11\text{--}19 \mu\text{m}$ , lageniform with tapering neck  $5\text{--}6 \mu\text{m}$  wide at apex. Clamp-connections present.

Habitat and distribution. Solitary or in small groups on dung of horse and cow, in forests, meadows and pastures. Known from Europe and North America (Uljé and Bas 1991, Cacialli et al. 1999, Uljé 2005, Vesterholt 2008a). In Ukraine apparently rather rare.

Notes. The main distinguishing features of *Coprinus heterosetulosus* are the small basidiocarps (pileus up to 10 mm in diameter), habitat on dung, presence of



**Fig. 7.** *Coprinus heterosetulosus* (KW 36933): **a** – basidiocarps, **b** – basidia, **c** – cheilocystidia, **d** – pileocystidia (including sclerocystidia), **e** – caulocystidia, **f** – spores. Bars = 1 cm for basidiocarps and 10  $\mu$ m for microstructures.

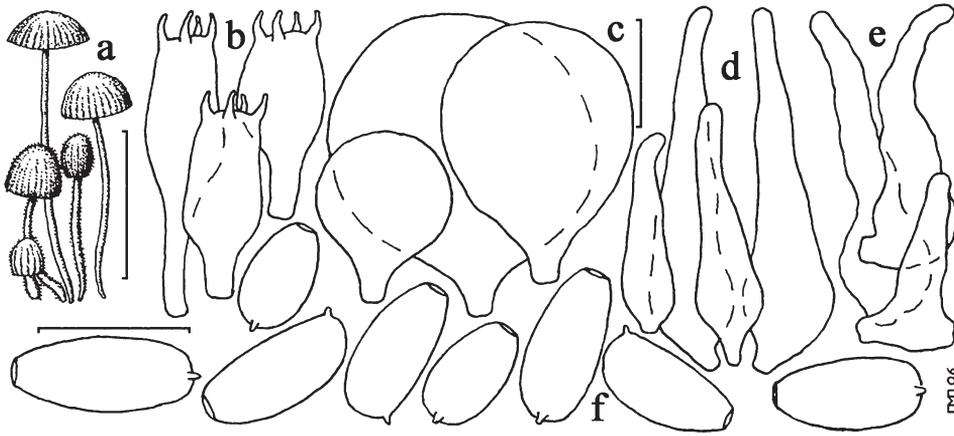
numerous sclerocystidia on the pileus, as well as the spores having an eccentric germ pore. The closest species is *C. pellucidus* possessing smaller spores with central germ pore and no sclerocystidia. Spores of our specimens were slightly longer than some authors indicated: 8.0–11.0  $\times$  5.0–6.5  $\mu$ m (Uljé and Bas 1991, Uljé 2005, Vesterholt 2008a), 9.5–11.0(–12.0)  $\times$  5.5–6.5(–7.0)  $\mu$ m (Orton and Watling 1979). Spore sizes were closer to Doveri's data: (9.4–)10.0–12.0  $\times$  5.7–6.3  $\mu$ m (Doveri 2004). Moreover, Kühner and Romagnesi (1953) quoted for this species even larger spores: 8.0–12.8  $\times$  4.8–6.6  $\mu$ m.

**Specimens examined.** Ukraine: Rivne Region, Dubrovytsia District, about 1 km north of the village of Mochulyshche, on cow dung, 51° 35' 52.65" N, 26° 28' 42.22" E, 3 August 2006, leg. M.P. Prydiuk (KW 36793)\*; Zdolbuniv District, near the village of Bushcha, on horse dung, 50° 14' 31.09" N, 25° 49' 28.61" E, 14 August 2009, leg. M.P. Prydiuk (KW 36934)\*. Chernigiv Region, Korop District, "Mezyns'kyj" National Nature Park, south-western margin of the village of Smile, on cow dung, 51° 45' 52.22" N, 33° 01' 17.38" E, 27 May 2009, leg. M.P. Prydiuk (KW 36933)\*.

***Coprinus pellucidus*** P. Karst., Meddn Soc. Fauna Fl. Fenn., 9: 61, 1882. **Fig. 8**

*Coprinellus pellucidus* (P. Karst.) Redhead, Vilgalys et Moncalvo, Taxon, 50: 234, 2001.

Pileus at first 2–5  $\times$  1.5–3 mm, ellipsoid or acorn-like, then obtusely conical, campanulate to convex, finally applanate, up to 7 mm, slightly ribbed, ochre, light-brown, then becoming pale grey towards margin. Lamellae free or almost free, L =



**Fig. 8.** *Coprinus pellucidus* (KW 29843): **a** – basidiocarps, **b** – basidia, **c** – cheilocystidia, **d** – pileocystidia, **e** – caulocystidia, **f** – spores. Bars = 1 cm for basidiocarps and 10 µm for microstructures.

18–20,  $l = 0–1$ , at first whitish then blackish brown. Stipe 12–20 × 0.5 mm, cylindrical with somewhat clavate or slightly root-like base, whitish, minutely pubescent. Flesh thin, whitish. Taste and smell indistinct. Spore print brownish-black.

Spores 7.7–10.8 × 4.5–5.0 µm,  $Q = 1.65–2.20$ ,  $L = 9.2 \pm 0.9$  µm,  $av. B = 4.8 \pm 0.15$  µm,  $av. Q = 1.9 \pm 0.15$ ; elongate-ellipsoid to cylindrical-ellipsoid, basis and apex rounded, germ pore central, up to 1.5 µm wide, dark red-brown. Basidia 17–22 × 7.0–8.5 µm, 4-spored, surrounded by 3–5 pseudoparaphyses. Cheilocystidia 20–25 × 14–22 µm, subglobose. Pleurocystidia absent. Pileocystidia 20–25 × 14–22 µm, lageniform with tapering neck, 2.5–3.0 µm wide at apex. Sclerocystidia absent. Caulocystidia 24–43 × 7–12 µm, lageniform with slightly tapering neck, 3–5 µm wide at apex. Clamp-connections absent.

**Habitat and distribution.** Solitary or in small groups on dung of herbivorous animals, in forests, meadows and pastures. Known from Europe, Africa, Asia, North America, South America and Australia (Uljé and Bas 1991, Cacialli et al. 1999, Richardson 2001, Uljé 2005, Vesterholt 2008a). Its distribution in Ukraine is still insufficiently known.

**Notes.** This species is very similar to *Coprinus brevisetulosus* but differs by its smaller and narrower spores with central germ pore and the absence of sclerocystidia. It must be mentioned, that the spores of our specimens are somewhat larger than some authors indicated for this species: 6.3–9.4 × 3.2–4.2 µm (Uljé and Bas 1991, Uljé 2005); 8.1–9.2(–9.4) × 4.2–4.7(–5.0) µm (Doveri 2004); 6.5–9.5 × 3–4 µm (Vesterholt 2008a). Thus, the length of spores of our specimens is rather close to that of *C. brevisetulosus* though the latter are noticeably wider. Besides, many other authors quoted for *C. pellucidus* a larger spore size: 6.5–11.5 ×

3.0–5.0  $\mu\text{m}$  (Kühner and Romagnesi 1953); (7.0–)8.0–10.0(–11.0)  $\times$  (3.5–)4.0–5.0  $\mu\text{m}$  (Orton and Watling 1979); 6.7–11.0  $\times$  3.4–6.0  $\mu\text{m}$  (Krieglsteiner et al. 1982), 6.4–11.4  $\times$  3.1–5.1  $\mu\text{m}$  (Moser 1983), 6.5–11.5  $\times$  3–5  $\mu\text{m}$  (Dissing and Lundquist 1992).

Specimens examined. Ukraine: Luhans'k Region, Stanychno-Luhans'ke District, about 0.5 km north-west of the town of Stanychno-Luhans'ke, on cow dung, 48° 41' 4.93" N, 39° 25' 27.29" E, 16 September 2004, leg. M.P. Prydiuk (KW 29843). Chernihiv Region, Korop District, "Mezyns'kyj" National Nature Park, village of Mezyn, on cow dung, 51° 49' 31.29" N, 33° 04' 45.27" E, 26 May 2009, leg. M.P. Prydiuk (KW 36935)\*; about 1 km south-west of the village of Sverdlovka, on cow dung, 51° 46' 56.58" N, 33° 02' 14.83" E, 28 May 2009, leg. M.P. Prydiuk (KW 36936)\*.

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