

## FUNGI — ГРИБЫ

### A new for Russia species of *Lepiota* (Agaricaceae, Basidiomycota) from the Republic of Altai

I. A. Gorbunova

Central Siberian Botanical Garden of the Siberian branch of the Russian Academy of Sciences,  
Novosibirsk, Russia  
fungi2304@gmail.com

**Abstract.** *Lepiota farinolens* is recorded for the first time for Russia and North Asia on the basis of its collection from the Republic of Altai. Morphological description, data on its ecology and distribution are provided. The analysis of morphological features shows some insignificant differences of *L. farinolens* sample from the Republic of Altai from known European materials from France and Spain: the lack of the farinaceous smell and the presence of the 2-spored basidia.

**Keywords:** Agaricaceae, Basidiomycetes, *Lepiota farinolens*, *Ovisporae*, agaricoid fungi, taxonomy, Western Siberia.

### Новый для России вид рода *Lepiota* (Agaricaceae, Basidiomycota) из Республики Алтай

И. А. Горбунова

Центральный сибирский ботанический сад СО РАН, Новосибирск, Россия  
fungi2304@gmail.com

**Резюме.** Приводятся морфологическое описание, фотографии плодовых тел и микроструктур нового для России и Северной Азии вида *Lepiota farinolens* из Республики Алтай, а также сведения об его экологии и местонахождении. Сравнительный анализ морфологических признаков показал некоторые несущественные отличия образца *L. farinolens* из Республики Алтай от описаний вида по европейским материалам из Франции и Испании: отсутствие мучного запаха и присутствие 2-споровых базидий.

**Ключевые слова:** Agaricaceae, Basidiomycetes, *Lepiota farinolens*, *Ovisporae*, агарикоидные базидиомицеты, таксономия, Западная Сибирь.

The genus *Lepiota* (Pers.) Gray (Agaricaceae, Agaricales, Basidiomycota) has a worldwide distribution and is highly diverse (Pegler, 1972; Vellinga, 2003; Kirk *et al.*, 2008). Morphological and molecular studies have shown that *Lepiota* forms a monophyletic group together with *Cystolepiota* Singer, *Echinoderma* (Locq. ex Bon) Bon, *Melanophyllum* Velen., and *Pulverolepiota* Bon (spores white, rarely green, never with a germ pore, trama regular, pileus covering hymenidermal, epithelial, cutis-like, or trichodermal, clamp-connections present in most species, habit agaricoid, very rarely secotioid) (Vellinga, 2004). These white-gilled mushrooms are not well-studied in Siberia (Asian Rus-

sia) and a full revision of *Lepiota* species in the region has not been conducted. By now, nearly 20 species of lepiotaceous fungi have been reported for the Western Siberia (Lebedeva, 1949; Kovalenko, 1992; Karatygin *et al.*, 1999; Perova, Gorbunova, 2001; Gorbunova, 2012, 2018; and others). In the current research of agaricoid fungi of the Republic of Altai unknown in Russia a species from sect. *Ovisporae* (J. E. Lange) Kuhner of the genus *Lepiota* was found. This section is morphologically characterized by ellipsoid spores and a trichodermal pileus covering. Two subsections are established based on structure and size of the pileus elements: subsect. *Helveolinae* Bon et Boiffard with a trichoderm made up of long pileus elements only, while subsect. *Felininae* Bon consists of long and basal short elements (Candusso, Lanzoni, 1990; Vellinga, 2001, 2003). The subsect. *Helveolinae* includes European species *Lepiota brunneoincarnata* Chodat et C. Martín, *L. farinolens* Bon et G. Rioussset, *L. parvannulata* (Lasch) Gillet, *L. subincarnata* J. E. Lange, the tropical species *L. elaiophylla* Vellinga et Huijser and species from Pakistan *L. himalayensis* Khalid et Razaq, *L. lahorensis* Qasim et Khalid, *L. vellingana* Nawaz et Khalid (Bon, 1992; Vellinga, 2001; Razaq *et al.*, 2012; Nawaz *et al.*, 2013; Qasim *et al.*, 2016).

## Material and methods

The material for this study was collected in 2015 in the Republic of Altai, on the territory of the Kosh-Agachsky District, near the village Chagan-Uzun, in the dry short-tussock grassland steppe, at an altitude of 2200 m a. s. l.

Macroscopic descriptions are based on the observations made from fresh material. Microscopic structures were observed in preparations of parts of dried basidiomata mounted in 3% KOH or 1% Congo Red in 10% NH<sub>4</sub>OH. All measurements were performed in 3% KOH, color reactions – with Melzer's reagent. Basidiospore were measured without the hilar appendix. In those measurements, Q refers to the length divided by the width of an individual spore. Forty five individual spores were measured from a single sample. Mean L represents the mean length, mean W represents the mean width, and mean Q represents the mean of the length divided by the width of all basidiospores measured. Specimens are deposited in the M. G. Popov Herbarium (NSK) at the Central Siberian Botanical Garden of the Siberian branch of the Russian Academy of Sciences (CSBG SB RAS, Novosibirsk, Russia).

Scanning electronic microphotographs (SEM) were taken using a Carl Zeiss EVO-40 XVP in the Science Center of the CSBG SB RAS. Microscopic measurements were carried out in the specialized program Scandium 5.0.

## Results and Discussion

A *Lepiota* species with oblong spores, clavate cheilocystidia and elongated pileus elements – features that are typical for the subsect. *Helveolinae*, section *Ovisporae*, was discovered. The research on the members of the subsection resulted in identification of the specimen as *Lepiota farinolens*. This species was described in 1992 from France (Bon, 1992) and until now was known only in Europe from France, Spain, and Greece (Bon, 1992; Salom, Siquier, 2001; Loizides, 2016). Below a description of the species is presented, based on the analysis of the specimen collected in the Republic of Altai.

***Lepiota farinolens*** Bon et Riousset, 1992, *Docums Mycol.* 22(85): 65. (Plate I)

Pileus 0.5–2.5 cm diam., hemispherical, broadly convex to plano-convex, with obtuse central disc, sometimes centrally depressed, with cracked skin; margin smooth or wavy; surface dry, white with pinkish to pinkish brown appressed small scales on white background on central disc or across the surface, fading towards margins; sometimes splitting open at maturity, with remnants of cortina. Context thin, white. Lamellae free, moderately crowded, white, ventricose, with 2–3 tiers lamellulae, with denticulate edge. Stipe 0.5–1.7 × 0.1–0.2 cm, central, cylindrical, sometimes thinned or curved at the base, pale pink to pinkish brown below annulus or annular zone, white at the apex, hollow, surface smooth to white fibrillose, with white annulus or fibrillose annular zone. Odor and taste not recorded.

Basidiospores 5.5–9.6 × 3.4–5.8 μm,  $avL \times avW = 7.0 \times 4.7 \mu m$ ,  $Q = 1.4–1.6$ ;  $avQ = 1.5$ ; ellipsoid to ovoid, colourless, reddish brown in Melzer's reagent, dextrinoid, smooth, thin-walled. Basidia 28.5–35.1 × 8.5–10.8 μm, 4-spored, occasionally 2-spored, subclavate to clavate, hyaline, thin-walled. Pleurocystidia absent. Chei-

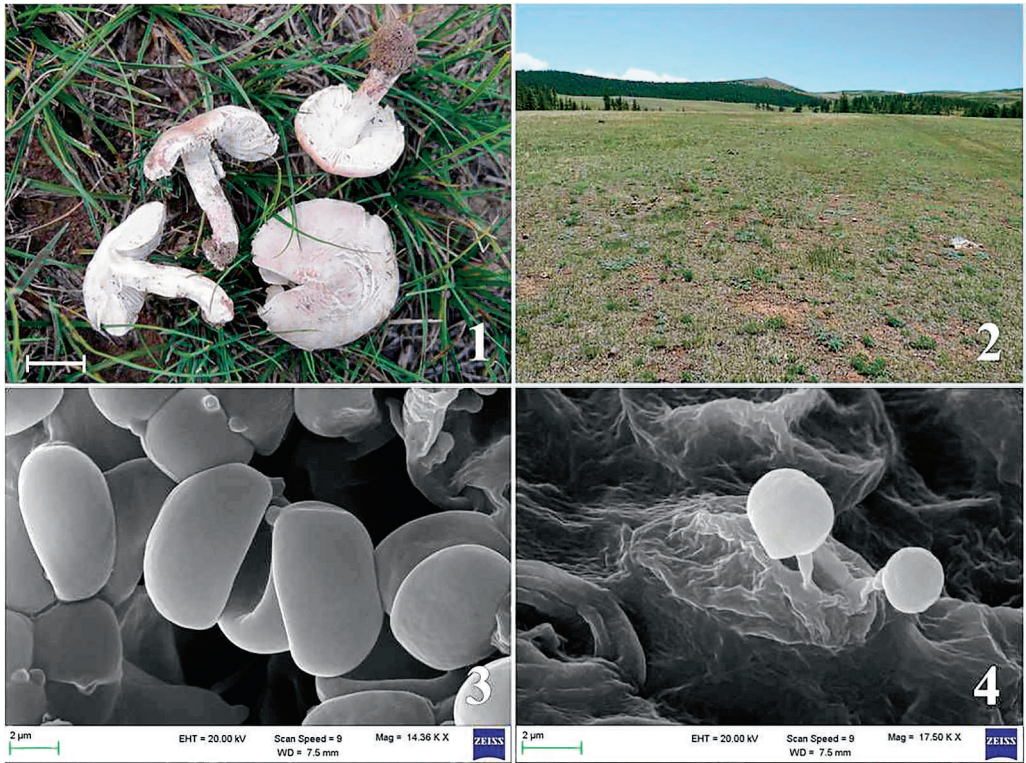


Plate I. *Lepiota farinolens* (1006663 NSK).  
1 – basidiocarps; 2 – habitat; 3 – basidiospores; 4 – 2-spored basidia.  
Scale bars: 1– 1 cm; 3, 4 – 2 μm.

locystidia 20.8–25.5 × 6–7.5 μm, hyaline, thin walled, subclavate. Pileus covering a trichoderm, erect or ascending, hyaline to light brown, without internal septa or, more rarely, with an internal, non-clamped septum, clamped terminal elements, 70–175 × 9.5–15.0 μm, cylindrical to slightly widened, with thickened apices, without any shorter elements at the base. Clamp connections present in all tissues.

Solitary or scattered; growing on soil in dry short-tussock grassland steppe.

Specimen examined: **Russia**, Republic of Altai, Kosh-Agachsky district, near village Chagan-Uzun, dry short-tussock grassland steppe, on soil, 50°04'03"N, 88°14'33"E, 2200 m a. l. t., 21 VI 2015, Gorbunova (*Горбунова*), 1006663 NSK.

The specimen of *Lepiota farinolens* from the Republic of Altai is characterized by rather small basidiomata with pinkish to pinkish brown pileus, a trichodermal pileus covering composed of light brown to hyaline and elongated clavate elements, oblong spores, and clavate cheilocystidia. Our sample is similar to a type specimen of *L. farinolens*, collected from grassy localities in southern France (Bon, 1992), which has a small pale cream-pinkish pileus 0.7–3.5 cm diam., as well as an annulus on a white or pale pinkish smooth or fibrillose stipe. The farinaceous smell, which is characteristic of the species and especially distinct after rubbing of the basidiocarps (Bon, 1992), was not mentioned in the sample from the Republic of Altai. The presence or lack of the characteristic smell in specimens of *L. farinolens* remains to be subject of the future research. Moreover, 2-spored basidia were observed only in the samples from the Republic of Altai. The presence of a small amount of 2-spored basidia is not a distinctive feature for differentiation of this species. Possibly these differences resulted from peculiarities of the habitats of the *L. farinolens*. The species in the Republic of Altai grows in alpine steppes with a harsh climate, on poor soils. The size of spores and cheilocystidia also varies slightly in different samples (Table 1). The aforementioned differences demonstrate an infraspecific variability of *L. farinolens*.

Table 1

**The size of microstructures in *Lepiota farinolens* samples**

Samples	Country (province)	Basidiospores		Basidia, μm	Cheilocystidia, μm
		L × W, μm	avQ		
<i>Lepiota farinolens</i> 1006663 NSK	Russia (Republic of Altai)	5.5–9.6 × 3.4–5.8	1.5	28.5–35.1 × 8.5–10.8; (2)4-spored	20.8–25.5 × 6–7.5
<i>L. farinolens</i> (holotype, after Bon, 1992)	France	(7)8–9(10) × (4)4.5–5(5.5)	1.75	25–30 × 6–10, 4-spored	22(30)–45(60) × (7.5)9–12(17)
<i>L. farinolens</i> (after Salom, Siquier, 2001)	Spain	7.2–9.6(11.2) × 4.8–5.4(6)	1.76	20.4–26.4 × 8.4–9.6; 4-spored	(22.8)30–40 × 6–8.4(9.6)

## Acknowledgements

The work was carried out as a part of the State Task to the Central Siberian Botanical Garden, the Siberian Branch of the Russian Academy of Sciences (project AAAA-A17-117012610055-3).

Herbarium specimens from the Bioresources scientific collection (USU 440537) M.G. Popov Herbarium (NSK) and the equipment of the Core Facilities Center Microscopic analysis of biological objects of CSBG SB RAS were used.

Light microphotographs were taken using the equipment of the Core Facility Center “Cell and Molecular Technologies in Plant Science” (CSBG SB RAS).

## References

- Bon M. 1992. Clé analytique des cortinaires alpins (avec quelques incursions dans la rhodoraie et l'aulnaie verte) [Analytical key of the alpine *Cortinarius* (with some forays into rhododendron and green alder)]. *Documents Mycologiques* 22(87): 43–67. (In France).
- Candusso M., Lanzoni G. 1990. *Lepiota s. l. Fungi Europaei* 4. Saronno: 743 p. (In Italian).
- Gorbunova I. A. 2012. New species from family *Agaricaceae* in the mycobiota of Siberia. *Rastitel'nyi Mir Aziatskoi Rossii* 1(9): 11–15 (In Russ. with Engl. abstract).
- Gorbunova I. A. 2018. New information about agaricoid basidiomycetes of the Tigirek State Nature Reserve (Altai Territory). *Turczaninowia* 21(2): 160–171. (In Russ. with Engl. abstract). <https://doi.org/10.14258/turczaninowia.21.2.16>
- Lebedeva L. A. 1949. *Opredelitel shlyapochnykh gribov* [Handbook of the mushrooms]. Moscow, Leningrad: 548 p. (In Russ.).
- Loizides M. 2016. Macromycetes within Cistaceae-dominated ecosystems in Cyprus. *Mycotaxon* 131(1): 255–256. <https://doi.org/10.5248/131.255>
- Karatygin I. V., Nezdoiminogo E. L., Novozhilov Yu. K., Zhurbenko M. P. 1999. *Griby Rossiyskoy Arctiki* [Russian Arctic fungi]. St. Petersburg: 212 p. (In Russ.).
- Kirk P. M., Cannon P. F., Minter D. W., Stalpers J. A. 2008. *Ainsworth and Bisby's Dictionary of the Fungi*. 10th ed. Wallingford: 771 p. <https://doi.org/10.1079/9780851998268.0000>
- Kovalenko A. E. 1992. To the flora of agaric mushrooms of the Altai Reserve. *Novosti sistematiki nizshikh rastenii* 28: 61–67. (In Russ.).
- Nawaz R., Khalid A. N., Hanif M., Razaq A. 2013. *Lepiota vellingana* sp. nov. (Basidiomycota, Agaricales) a new species from Lahore, Pakistan. *Mycological Progress* 12: 727–732. <https://doi.org/10.1007/s11557-012-0884-0>
- Pegler D. N. 1972. A revision of the genus *Lepiota* from Ceylon. *Kew Bulletin* 27(1): 155–202. <https://doi.org/10.2307/4117880>
- Perova N. V., Gorbunova I. A. 2001. *Macromitzety yuga Zapadnoy Sibiri* [Macromycetes of the south of Western Siberia]. Novosibirsk: 158 p. (In Russ.).
- Qasim T., Khalid A. N., Vellinga E. C. 2016. A new species of *Lepiota*, *Lepiota lahorensis*, from Lahore, Pakistan. *Turkish Journal of Botany* 40: 419–426. <https://doi.org/10.3906/bot-1507-31>.
- Razaq A., Khalid A. N., Vellinga E. C. 2012. *Lepiota himalayensis* (Basidiomycota, Agaricales), a new species from Pakistan. *Mycotaxon* 121: 319–325. <https://doi.org/10.5248/121.319>
- Salom J. C., Siquier J. L. 2001. Contribució al coneixement de la família Lepiotaceae roze a les Illes Balears [Contribution to the knowledge of the Lepiotaceae roze family in the Balearic Islands]. II. *Revista Catalana Micologia* 23: 109–120. (In Spain).
- Vellinga E. C. 2001. *Lepiota* (Pers. : Fr.) S.F. Gray. *Flora Agaricina Neerlandica. Critical Monographs on Families of Agarics and Boleti Occurring in the Netherlands*. Vol. 5. Rotterdam: 109–151.

- Vellinga E. C. 2003. Phylogeny of *Lepiota* (Agaricaceae) – evidence from nrITS and nrLSU sequences. *Mycological Progress* 2: 305–322. <https://doi.org/10.1007/s11557-006-0068-x>
- Vellinga E. C. 2004. Genera in the family Agaricaceae: evidence from nrITS and nrLSU sequences. *Mycological Research* 108(4): 354–377. <https://doi.org/10.1017/S0953756204009700>

### Литература

- Bon M. 1992. Analytical key of the alpine *Cortinarius* (with some forays into rhododendron and green alder). *Documents Mycologiques* 22(87): 43–67. (In France).
- Candusso M., Lanzoni G. 1990. *Lepiota s.l. Fungi Europaei* 4. Saronno: 743 p. (In Italian).
- [Gorbunova] Горбунова И. А. 2012. Новые виды агариковых грибов (*Agaricaceae*) в микобиоте Сибири. *Растительный мир Азиатской России* 1(9): 11–15.
- [Gorbunova] Горбунова И. А. 2018. Новые сведения об агарикоидных базидиомицетах заповедника «Тигирекский» (Алтайский край). *Turczaninowia* 21(2): 160–171. <https://doi.org/10.14258/turczaninowia.21.2.16>
- [Lebedeva] Лебедева Л. А. 1949. *Определитель шляпочных грибов*. М., Л.: 548 с.
- Loizides M. 2016. Macromycetes within Cistaceae-dominated ecosystems in Cyprus. *Mycotaxon* 131(1): 255–256. <https://doi.org/10.5248/131.255>
- [Karatygin *et al.*] Каратыгин И. В., Нездойминого Э. Л., Новожилов Ю. К., Журбенко М. П. 1999. *Грибы Российской Арктики*. СПб: 212 с.
- Kirk P. M., Cannon P. F., Minter D. W., Stalpers J. A. 2008. *Ainsworth and Bisby's Dictionary of the Fungi*. 10th ed. Wallingford: 771 p. <https://doi.org/10.1079/9780851998268.0000>
- [Kovalenko] Коваленко А. Е. 1992. К флоре агариковых грибов Алтайского заповедника. *Новосты систематики низших растений* 28: 61–67.
- Nawaz R., Khalid A. N., Hanif M., Razaq A. 2013. *Lepiota vellingana* sp. nov. (Basidiomycota, Agaricales) a new species from Lahore, Pakistan. *Mycological Progress* 12: 727–732. <https://doi.org/10.1007/s11557-012-0884-0>
- Pegler D. N. 1972. A revision of the genus *Lepiota* from Ceylon. *Kew Bulletin* 27(1): 155–202. <https://doi.org/10.2307/4117880>
- [Perova, Gorbunova] Перова Н. В., Горбунова И. А. 2001. *Макромицеты юга Западной Сибири*. Новосибирск: 158 с.
- Qasim T., Khalid A. N., Vellinga E. C. 2016. A new species of *Lepiota*, *Lepiota lahorensis*, from Lahore, Pakistan. *Turkish Journal of Botany* 40: 419–426. <https://doi.org/10.3906/bot-1507-31>
- Razaq A., Khalid A. N., Vellinga E. C. 2012. *Lepiota himalayensis* (Basidiomycota, Agaricales), a new species from Pakistan. *Mycotaxon* 121: 319–325. <https://doi.org/10.5248/121.319>
- Salom J. C., Siquier J. L. 2001. Contribució al coneixement de la família Lepiotaceae roze a les Illes Balears [Contribution to the knowledge of the Lepiotaceae roze family in the Balearic Islands]. II. *Revista Catalana de Micologia* 23: 109–120. (In Spain).
- Vellinga E. C. 2001. *Lepiota* (Pers. : Fr.) S. F. Gray. *Flora Agaricina Neerlandica. Critical Monographs on Families of Agarics and Boleti Occurring in the Netherlands*. Vol. 5. Rotterdam: 109–151.
- Vellinga E. C. 2003. Phylogeny of *Lepiota* (Agaricaceae) – evidence from nrITS and nrLSU sequences. *Mycological Progress* 2: 305–322. <https://doi.org/10.1007/s11557-006-0068-x>
- Vellinga E. C. 2004. Genera in the family Agaricaceae: evidence from nrITS and nrLSU sequences. *Mycological Research* 108(4): 354–377. <https://doi.org/10.1017/S0953756204009700>