

## New records of the genus *Lepiota* for Iran, including two deadly poisonous species

M. R. Asef 

Department of Botany, Iranian Research Institute of Plant Protection, Agricultural Research, Education and Extension Organization (AREEO), Tehran, Iran

**Abstract:** In the framework of the collection and identification of agaric fungi of Iran, three species of the genus *Lepiota*, viz. *Lepiota brunneoincarnata*, *L. echinella* and *L. subincarnata* are reported as new records for mycobiota of Iran. Two species, *L. brunneoincarnata* and *L. subincarnata* are deadly poisonous taxa. Up to now, two species of *Amanita*, *A. phalloides* and *A. verna*, and one from *Galerina*, *G. marginata*, have been reported from Iran as deadly poisonous fungi. *Lepiota brunneoincarnata* and *L. Subincarnat*, both collected from northern forests of the country, are introduced as fatal dangerous poisonous fungi.

**Key words:** Agaricaceae, biodiversity, forest fungi, mushroom poisoning

### INTRODUCTION

The genus *Lepiota* (Pers.: Fr.) Gray (Agaricaceae, Agaricales), comprises saprotroph agarics with scaly pileus, free gills, white spore print and stipe with ring or ring zone. About 400 *Lepiota* species have been reported from all over the world (Kirk et al. 2008). Some species of the genus contain amanitin toxin and are known as lethal poisonous. Because of the controversial taxonomy of toxic and non-toxic species, no *Lepiota* species is recommended as edible (Asef 2009, Sgambelluri et al. 2014).

Up to now, 17 *Lepiota* species, *L. acutesquamosa* (Weinm.) P. Kumm., *L. americana* (Peck) Sacc., *L. anthomyces* (Berk. & Broome) Sacc., *L. aspera* (Pers.) Qué., *L. brunnea* Farl. & Burt, *L. castanea* Qué., *L. cepaestipes* (Sowerby) Sacc., *L. clypeolarioides* Rea, *L. cristata* (Bolt.) P. Kumm., *L. felina* (Pers.) P. Karst., *L. helveola* Bers., *L. holospilota* (Berk. & Broome) Sacc., *L. leprica* (Berk. & Broome) Sacc., *L. lilacea* Bres., *L. metulaespora* (Berk. & Broome) Sacc., *L. micropholis* (Berk. & Broome) Sacc., *L. naucina* (Fr.) P. Kumm., *L. roseoalba* P. Henn., *L. serena* (Fr.) Sacc. and *L. subalba* Kühner ex P.D. Orton have been reported from Iran (Asef and Muradov 2012, Fallahyan 1973, Mohammadi

Goltepeh 2002, Saber 1994, Saber & Esmaeili Taheri 2002, Saber & Zangeneh 2002).

Eight of the reported species, *L. acutesquamosa*, *L. americana*, *L. aspera*, *L. brunnea*, *L. cepaestipes*, *L. holospilota*, *L. naucina* and *L. serena* have been transferred to genera *Chlorophyllum*, *Echinoderma*, *Leucoagaricus* and *Leucocoprinus* as *Echinoderma asperum* (Pers.) Bon, *Leucoagaricus americanus* (Peck) Vellinga, *Echinoderma asperum*, *Chlorophyllum brunneum* (Farl. & Burt) Vellinga, *Leucocoprinus cepistipes* (Sowerby) Pat., *Leucocoprinus holospilotus* (Berk. & Broome) D.A. Reid, *Leucoagaricus leucothites* (Vittad.) Wasser and *Leucoagaricus serenus* (Fr.) Bon & Boiffard, respectively. The objective of this study was to introduce new records of the genus *Lepiota* for Iran.

### MATERIALS AND METHODS

Fungal specimens used in this study were collected from northern forests of Iran during some fungal surveys. Specimens were studied in distilled water and Melzers reagent and were described based on the characters observed in fresh and dried basidiocarps. Microstructures were studied using an Olympus microscope and spore prints were obtained by placing pilei over sterile paper. All of the microstructures range was obtained by measuring about 30-40 structures. Specimens identified using Vellinga (2001), Hansen & Knudsen (1992), Knudsen & Vesterholt (2008) and Moser (1983). All of the collected samples were kept in the Fungus Collection of the Iranian Ministry of Jihad-e Agriculture (IRAN), located at the Iranian Research Institute of Plant Protection, Tehran, Iran.

### RESULT AND DISCUSSION

Identification of collected samples of the genus *Lepiota* showed that three species are new for Iran mycobiota. Details of studied materials along with short description are as follows:

*Lepiota brunneoincarnata* Chodat & C. Martín, Bull. Soc. bot. Genève, 2 sér. 5: 222 (1889) (Fig. 1).

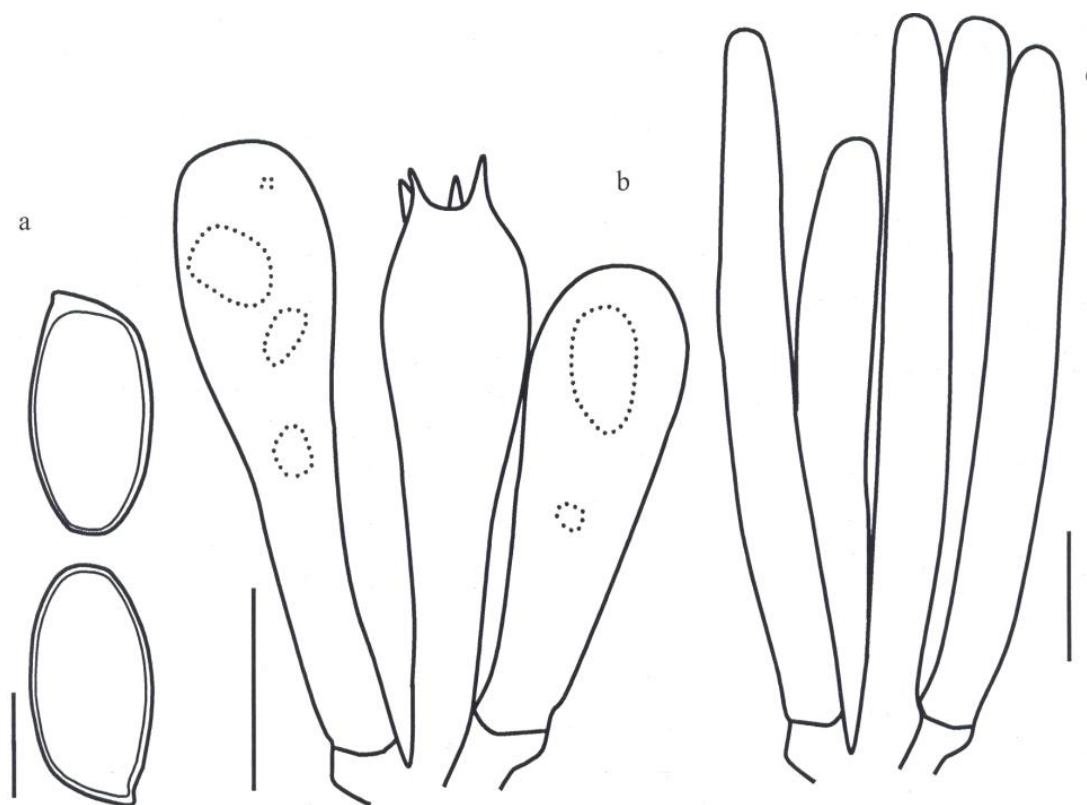
Pileus 2-5.5 cm, convex, then expanded and umbonate and finally depressed with age, whitish-pink covered by concentric vinaceous-brown scales. Lamellae free, medium spaced, whitish.

Stipe 2-6 × 0.5-1 cm, cylindrical, white above the inconspicuous ring, whitish-pink covered by brown scales below the ring zone.

Spores 8-10.5 × 4-5 μm, elliptical to amygdaloid, smooth. Spore print white, cheilocystidia 20-40 × 5-10 μm, cylindrical to narrowly clavate, sometimes

septate, pleurocystidia absent, pileipellis a trichoderm from cylindrical cells. Clamp connections present.

*Specimens examined.* IRAN, Gilan, Asalem to Khalkhal, on soil, 30 Sept. 2003, Asef & Sadeghi, IRAN 16229 F; Gilan, Gisom forest, on soil, 30 June 2005, Asef & Sadeghi, IRAN 16230 F.



**Fig. 1.** *Lepiota brunneoincarnata*. **a.** Spores — Scale bar = 5 μm; **b.** Basidium and cystidia — Scale bar = 10 μm; **c.** Pileipellis — Scale bar = 30 μm.

The species is characterised by pileus and scales color, size of spores and pileipellis structure. *L. brunneoincarnata* can cause fatal poisonings due to their content of amatoxins, such as α-amanitin, β-amanitin, amanin, and amaninamide. Amatoxins are a group of bicyclic octapeptides produced by some species of mushrooms (Sgambelluri et al. 2014). There are various reports of poisoning and death by *L. brunneoincarnata* throughout the world, e.g. France, Spain, Tunisia and Turkey (Ben et al. 2009, Herráez et al. 2002, Kose et al. 2015, Varvenne et al. 2015). *Lepiota brunneoincarnata* has already been reported from all over the Europe and from temperate Asia in China, India, Pakistan and Turkey (Afyon & Yağiz 2004, Razaq et al. 2014, Vrinda et al. 2011).

*Lepiota echinella* Qué. & G.E. Bernard, Bull. Soc. mycol. Fr. 4: pl. 1, fig. 2 (1888) (Fig. 2).

Pileus 1.5-4.5 cm, convex to plane and slightly umbonate, whitish color covered by brown erect

scales concentrated toward the center. Lamellae free, crowded, creamy whitish.

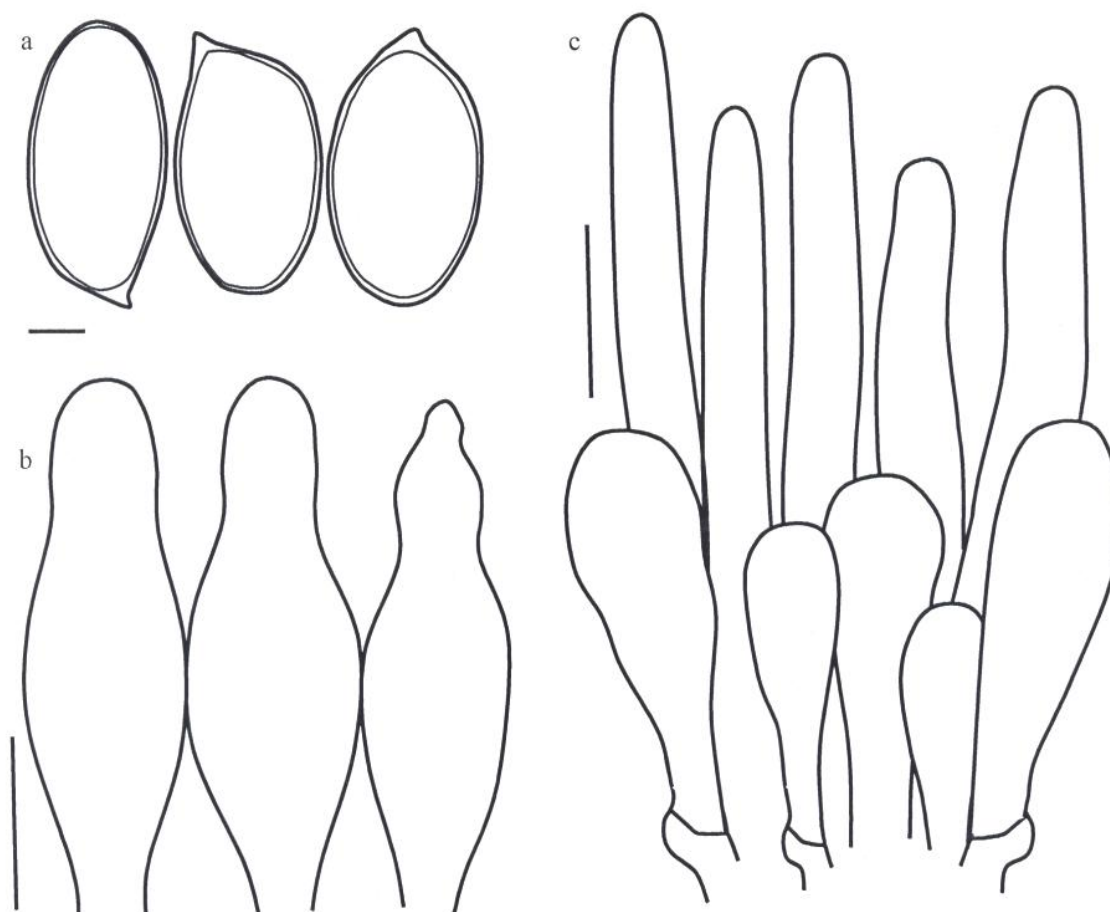
Stipe 2-6 × 0.5-0.7 cm, cylindrical or clavate at base, pale brown, covered by white fibrils. Sometimes with a fibrillose ring zone.

Spores 4.5-6.5 × 2.5-4 μm, elliptical, smooth. Spore print white, cheilocystidia 15-35 × 10-15 μm, lageniform, pileipellis of elongate cells intermixed with clavate cells.

*Specimens examined.* IRAN, Golestan, Gorgan, Rango Forest, on soil, 15 May 2011, Asef & Torabi, IRAN 15415 F.

Erected brown scales, size and shape of spores and intermixed pileipellis make *L. echinella* typical. *Lepiota echinella* is a widespread but rare species in Asia and Africa (Kosakyan et al. 2008) and has already been reported from European country such as Netherlands, Poland and Czech Republic (Vellinga, 2001, Wojewoda, 2003, Zelený, 2006).

*Lepiota subincarnata* J.E. Lange, Fl. Agaric. Danic. 5 (Taxon. Consp.): V (1940) (Fig. 3).



**Fig. 2.** *Lepiota echinella*. **a.** Spores. — Scale bar= 1  $\mu$ m); **b.** Cheilocystidia — Scale bar= 10  $\mu$ m; **c.** Pileipellis — Scale bar= 10  $\mu$ m.

Pileus 1.5-5.5 cm across, convex, then expanded with umbonate disc, white to pinkishwhite covered by reddish brown to pinkish brown scales concentrated toward the center. Lamellae free, crowded, white to cream.

Stipe 2-6  $\times$  0.3-0.6 cm, cylindrical, broadened towards base, white to pinkish, surface smooth to scaly with fibrillose scales below the ring zone.

Spores 5-7.5  $\times$  3-4  $\mu$ m, oblong ellipsoid to ovoid, some of the basidia with 2 spores, dextrinoid, spore print white. Cheilocystidia 15-40  $\times$  6-12  $\mu$ m, clavate. Pleurocystidia absent. Pileipellis a trichoderm with hyaline to light brown clavate elements. Clamp connection present.

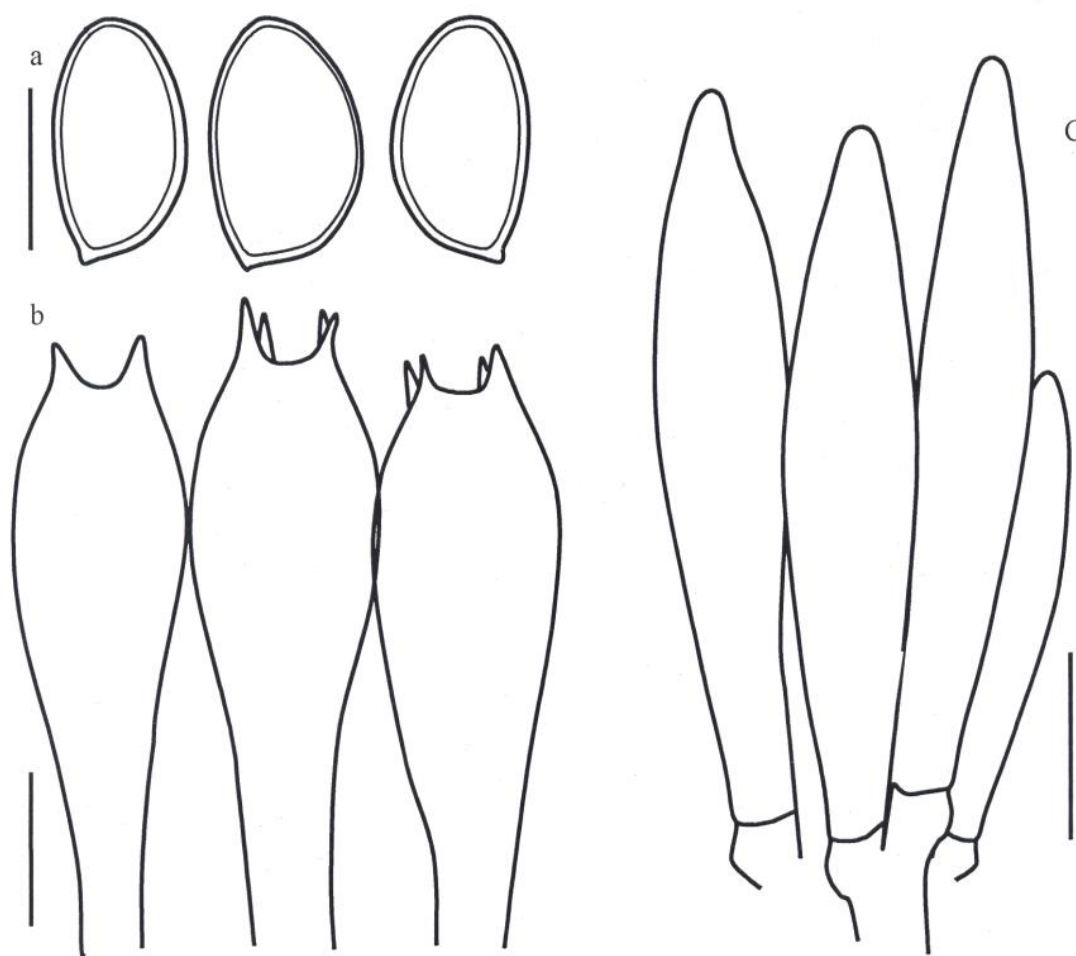
*Specimens examined.* IRAN, Mazandaran, Ruyan to Pool, on soil, 9 Oct. 2009, Asef & Torabi, IRAN 14410 F; Mazandaran, Pool to Baladeh, on soil, 9 Oct. 2009, Asef & Torabi, IRAN 14411 F; Mazandaran, Noor, Vaz Forest, on soil, 6 Oct. 2009, Asef & Torabi, IRAN 14412 F.

*L. subincarnata* can be identified by pileus and scales color, size and shape of spores and pileipellis elements. The species is deadly poisonous, because of containing  $\alpha$ -amanitin and  $\gamma$ -amanitin. Sgambelluri et al. (2014) showed that *L. subincarnata* (= *L.*

*josserandi*) has the highest level of  $\alpha$ -amanitin, about three times higher than the amount found in *Amanita* species. Some cases of poisoning by *L. subincarnata* have been reported (Haines et al. 1986, Mottram et al. 2010). In one poisoning case, fulminant hepatic failure was reported after consuming fungus (Mottram et al. 2010). *L. Subincarnata* has been reported from North and South America, Europe and Africa. In Asia, there are reports from occurrence of fungus in China, India, Israel and Pakistan (Yang 1990, Kosakyan et al. 2008, Arun Kumar & Manimohan 2009, Niveiro & Albertó 2013, Razaq et al. 2013, Ouabbou et al. 2015).

## REFERENCES

- Afyon A, Yağiz D. 2004. Macrofungi of Sinop Province. Turkish Journal of Botany 28: 351–360.
- Arun Kumar TK., Manimohan P. 2009. The genus *Lepiota* (Agaricales, Basidiomycota) in Kerala State, India. Mycotaxon 107: 105-138.
- Asef MR, Muradov P. 2012. Lepiotaceous fungi (Agaricaceae) in the Iranian part of Caucasia. Turkish Journal of Botany 36: 289-294.



**Fig. 3.** *Lepiota subincarnata*. **a.** Spores — Scale bar = 5  $\mu$ m); **b.** Basidia — Scale bar = 15  $\mu$ m; **c.** Pileipellis — Scale bar = 30  $\mu$ m).

Asef MR. 2009. Poisonous mushrooms of Iran. Iran-shenasi publishing, Tehran, Iran, 214 pp.

Ben KM, Zhioua M, Bakir O, Allouche M, Gloulou F, Banasr A, Haouet S, Hedhili A, Hamdoun M. 2009. Four cases of deadly intoxication by *Lepiota brunneoincarnata*. *Annales de biologie Clinique* 68: 561-567.

Fallahyan F. 1973. L'étude de quelques champignons toxiques et comestible d'Azerbayjan-Iran. Bll. Faculty of Science, Tehran University Press 5: 93-94.

Haines JH, Lichstein E, Glickerman D. 1986. A fatal poisoning from an amatoxin containing *Lepiota*. *Mycopathologia* 93: 15-17.

Hansen L., Knudsen H (eds.) 1992. Nordic Macromycetes (Vol. 2), *Polyporales, Boletales, Agaricales, Russulales*. Nordsvamp, Copenhagen, Denmark.

Herráez GJ, Sánchez FA, Contreras SP. 2002. Fatal *Lepiota brunneoincarnata* poisoning. *Anales de medicina interna* 19: 322.

Kirk PM, Cannon PF, Minter DW, Spatafora JA. 2008. Dictionary of the fungi. 10<sup>th</sup> edition. CAB International, Wallingford, UK.

Knudsen H, Vesterholt, J. 2008. Funga Nordica: Agaricoid, boletoid and cyphelloid genera. Nordsvamp, Copenhagen, Denmark.

Kosakyan A, Didukh M, Ur Y, Wasser SP, Nevo E. 2008. *Lepiota* (Agaricaceae, Basidiomycota) species diversity in Israel. *Mycotaxon* 105: 355-377.

Kose M, Yilmaz I, Akata I, Kaya E., Guler K. 2015. A Case Study: Rare *Lepiota brunneoincarnata* poisoning. *Wilderness & Environmental Medicine* 26: 350-354.

Mohammadi Goltapeh E. 2002. Identification of five species of *Lepiota* from Iran. *Rostaniha* 3: 39-46.

Moser M. 1983. Keys to Agarics and Boleti (Polyporales, Boletales, Agaricales, Russulales). 4th edn, translated to English by Simon Plant. Roger Phillips Publisher, London.

Mottram AR, Lazio MP, Bryant SM. 2010. *Lepiota subincarnata* JE Lange induced fulminant hepatic failure presenting with pancreatitis. *Journal of Medical Toxicology* 6: 155-157.

Niveiro N, Albertó E. 2013. Checklist of the Argentine Agaricales 5. Agaricaceae. *Mycotaxon* 122: 491-491.

- Ouabbou A, Saifeddine EK, Touhami AO, Benkirane R, Douira A. 2015. Study of some new Lepioteae for the Morocco's fungal flora. *Int. J. Pure App. Biosci* 3: 28-34.
- Razaq A, Vellinga EC, Ilyas S, Khalid AN. 2013. *Lepiota brunneoincarnata* and *L. subincarnata*: distribution and phylogeny. *Mycotaxon* 126: 133–41.
- Saber M. 1994. Contribution to the knowledge of Agaricaceae (Agaricales) collected in Iran. Fifth International Mycological Congress Abstracts. August 14–21, Vancouver, British Columbia, Canada.
- Saber M, Esmaeili Taheri A. 2002. A report on Basidiomycete fungi from Kashan. Proceedings of the 15<sup>th</sup> Iranian Plant Protection Congress, vol. II, 7-11 Sept., Kermanshah, Iran: 171-172.
- Saber M, Zangeneh S. 2002. New records of Agaricales from Iran. Proceedings of the 15<sup>th</sup> Iranian Plant Protection Congress, vol. II, 7-11 Sept., Kermanshah, Iran: 172-173.
- Sgambelluri RM, Epis S, Sasseria D, Luo H, Angelos ER, Walton JD. 2014. Profiling of amatoxins and phallotoxins in the genus *Lepiota* by liquid chromatography combined with UV absorbance and mass spectrometry. *Toxins* 6: 2336-47.
- Varvenne D, Retornaz K, Metge P, De Haro L, Minodier P. 2015. Amatoxin-containing mushroom (*Lepiota brunneoincarnata*) familial poisoning. *Pediatric emergency care* 31: 277-278.
- Vellinga EC. 2001. *Lepiota* (Pers.: Fr.) S. F. Gray. In: *Flora Agaricina Neerlandica* 5. (Noordeloos, ME, Kuiper, TW, Vellinga & EC, eds): 109–151. A.A. Balkema, Rotterdam, Netherlands.
- Vrinda KB, Pradeep CK, Varghese SP, Thomas MV. 2011. Occurrence of two deadly lepiotas in Western Ghats of Kerala. *Mushroom Research* 20: 125-128.
- Wojewoda W. 2003. Checklist of Polish larger Basidiomycetes. (In:) Z. Mirek (ed.). *Biodiversity of Poland* 7. W. Szafer Institute of Botany, Polish Academy of Sciences, Kraków.
- Yang ZL. 1990. Several noteworthy higher fungi from southern Yunnan, China. *Mycotaxon* 38: 407–416.
- Zelený L. 2006. Taxonomic literature on the genus *Lepiota* s.l. in the Czech Republic. *Czech Mycol*, 58: 225-265.

## گزارش گونه‌های جدیدی از جنس *Lepiota*، شامل دو گونه سمی کشنده برای ایران

محمد رضا آصف ✉

بخش تحقیقات رستنیها، مؤسسه تحقیقات گیاه‌پزشکی کشور، سازمان تحقیقات، آموزش و ترویج کشاورزی، تهران، ایران

**چکیده:** در چارچوب جمع‌آوری و شناسایی قارچ‌های آگاریک ایران، سه گونه از جنس *Lepiota* به اسامی *Lepiota subincarnata* و *L. echinella brunneoincarnata* برای نخستین بار از ایران گزارش می‌گردند. دو گونه *L. subincarnata* و *brunneoincarnata* به عنوان گونه‌های سمی و کشنده شناخته شده‌اند. تاکنون تنها دو گونه از جنس *Amanita* شامل *A. Verna* و *A. phalloides* و یک گونه از جنس *Galerina*، تحت عنوان *G. marginata* به عنوان گونه‌های کشنده از ایران معرفی شده‌اند و در این مقاله دو گونه سمی و خطرناک *L. subincarnata* و *L. brunneoincarnata* نیز به این لیست اضافه می‌گردد.

**واژه‌های کلیدی:** آگاریکاسه، تنوع زیستی، قارچ‌های جنگل، مسمومیت قارچی