

The genus *Helvella* in Iran

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Abstract: This study is a review on the genus *Helvella* (*Pezizales*, *Helvellaceae*) in Iran. Study on Iran fungal herbarium specimens along with the fresh materials collected in this survey revealed that seven species of *Helvella* viz. *H. acetabulum*, *H. atra*, *H. crispa*, *H. elastica*, *H. ephippium*, *H. lacunosa* and *H. leucopus* (as *H. monachella*) have already been reported from Iran. Three other species viz. *H. costifera*, *H. latispora* and *H. leucomelaena* are reported here newly for Iran. Re-examination of specimen named as *H. cf. pezizoides* showed it is belong to *H. ephippium*. Short description and photographs of the new records along with distribution map and fruiting frequency of Iranian species are provided. Analyses of sampling date of some 70 specimens showed that all of the species reported from Iran, have been collected from North and North-West of country and most of the ascocarps are found in autumn, last summer and fall (October). An identification key to the *Helvella* species collected in Iran is presented.

Key words: *Ascomycetes*, *Helvellaceae*, *Leptopodia*

INTRODUCTION

Linné in 1753 established a generic name as "*Elvela*" to accommodate "*Elvela mitra*" without delimitation of the genus. Later, Afzelius in 1783 described genus with three new species. Fries in 1823 re-defined genus and established family *Elvellaceae* and then Dumortier in 1829 introduced the name *Helvellaceae*.

Nannfeldt in 1937 modified the name *Helvella* as a valid taxonomical name (Abbott & Currah 1997, Dissing 1966). The genus *Helvella* L. (*Pezizales*, *Helvellaceae*) includes a group of terrestrial or stipitate *Discomycetes* with operculate asci, cupulate, auriculoid, saddle shape, convex, irregularly lobed pileus, generally uniguttulate and ellipsoid spores. Thus far 52 species have been identified in the genus *Helvella* (Kirk et al. 2008).

So far four species of *Helvella* namely; *H. acetabulum* (L.) Quél., *H. crispa* (Scop.) Fr., *H. lacunosa* Afzel., and *H. monachella* (Scop.) Fr. (*H. leucopus*) have previously been recorded from Iran (Asef et al. 2010, Daneshpazhouh 1991, Saber & Mehravaran 2004, Saber & Zangene 2004). Three

other species, *Leptopodia atra* (J. König) Boud., *L. elastica* (Bull.) Boud. and *L. ephippium* (Lév.) Boud. also have been reported from genus *Leptopodia* Boud. (Daneshpazhouh 1991, Saber & Zangene 2004). All of these species have been transferred to the genus *Helvella* as, *H. atra* J. König, *H. elastica* Bull. and *H. ephippium* Lév. respectively. The aim of this study was to review the poorly known fungi belonged to the genus *Helvella* in Iran.

MATERIALS AND METHODS

Fungal specimens used in this study originated from field samples collected from Iran as well as specimens from the Iran fungal herbarium in the Iranian Research Institute of Plant Protection (IRAN).

Specimens were examined in distilled water, Lugol, cotton blue and Melzer's reagents and were described based on characters observed in fresh and dried ascocarps. Microstructures were studied using an Olympus microscope. Measurements were made for 20–30 ascospores, asci, excipular hyphae, and paraphyses. Distribution of *Helvella* species recorded in Iran, are given from data gathered from Iran fungal herbarium. All of the collected samples were kept in the fungus collection of the Iran fungal herbarium (IRAN). For the taxonomic treatments and identification Abbott & Currah (1997) and Dissing (1966) were followed.

RESULTS

In this study, 10 species of *Helvella* were characterized based on morphological features in Iran. Of these, seven species viz. *H. acetabulum*, *H. atra*, *H. crispa*, *H. elastica*, *H. ephippium*, *H. lacunosa* and *H. leucopus* have already been reported from Iran. The remaining three species; *H. costifera*, *H. latispora* and *H. leucomelaena* are introduced and illustrated here as new records for Iranian mycobiota. Moreover, a simple practical key to the *Helvella* species collected in Iran is provided.

New records of genus *Helvella*

Helvella costifera Nannf., **Fungi Exsicc. Suec., Fasc. XLI-XLII (sched.): 37 (1953)**

Ascocarps cup-shaped, in some specimens become more or less flat with age, 1.5-5.5 cm broad. Margin initially curved; upper surface cream to gray-brown, bald to powdery, undersurface whitish to grayish, if

grayish, whitish near the stipe, finely pubescent, undersurface covered with ribs that are forked, whitish, rounded, blunt-edged that extend from the stem.

Stipe 0.5-2.5 cm high, 0.5-1.5 cm thick and broader near the cap, deeply ribbed, white to pale- gray, smooth to finely hairy.

Spores 16.5-20 × 10.5-12.5 µm, smooth, elliptical, with one large droplet in the center. Asci 250-350 × 15-20 µm, 8-spored. Paraphyses cylindrical with clavate apices, 3.5-7 µm wide, hyaline, brownish in mass (Fig 1a-b). Excipular surface elements hyaline to brownish, septate, terminal cells clavate to pyriform.

Specimens examined: Iran, Golestan, Gorgan, Shastkala, 400 m, on soil, 2011/05/14, Asef & Torabi (IRAN 15367 F); East Azarbaijan, Arasbaran, Kalaleh, on soil, 2003/06/25, Asef (IRAN 16126 F).

Helvella costifera is a closely related species to *H. acetabulum* but can be distinguished with generally rounded and blunt-edged ribs, whereas in *H. acetabulum* ribs are sharp edged. *H. costifera* has a gray cap, rather than yellow-brown in *H. acetabulum* (Landeros et al. 2012). Comparison of Iranian specimens showed that these two species are also differed by ascocarp color and shape and color of ribs. The fungus grows alone or gregariously on soil under hardwoods spring through fall. *H. costifera* has wide distribution in Europe, North American and East Asia (Abbott & Currah 1997, Han et al. 2010, Landeros et al. 2012, Zhuang 2004).

***Helvella latispora* Boud., Bull. Soc. mycol. Fr. 14: 16 (1898)**

Ascocarp 1-2 cm broad, 1-1.5 cm high, irregularly lobed to more or less saddle-shaped, margin inrolled initially, becoming reflexed at maturity. Upper surface bald, smooth, pale brown to brown, undersurface finely pubescent to pubescent, cream.

Stipe 3-6 cm long, 2-10 mm thick, more or less equal, in old specimens fluted, finely pubescent to pubescent, whitish to pale cream.

Spores 19-21 × 11.5-13.5 µm, broadly ellipsoid to ellipsoid, smooth, thin-walled, with a large single oil droplet. Asci 300-320 × 13-16 µm. Paraphyses clavate, gradually enlarge to apex, 5-10 µm (Fig 1c-e).

Specimens examined: Iran, Mazandaran, Chamestan, Vaz, on soil 2010/10/13, Asef & Torabi (IRAN 16131 F); Mazandaran, Flourd to Sangdeh, on soil 2010/10/10, Asef & Torabi (IRAN 16130 F).

Specimens of H. latispora were found scattered under *Quercus* sp. with probably mycorrhizal relationship. *H. latispora* is a species in subgenus *Elasticae* along with closely related species reported from Iran including *H. ephippium* and *H. ealstica*. *Helvella ealstica* has glabrous excipolar surface

whereas excipolar surface in *H. latispora* is finely pubescent to pubescent. *H. ephippium* is a smaller species with gray brown stipe that is whitish to pale cream in *H. latispora*.

H. latispora also is closely related to *H. stevensii* Peck (*Leptopodia stevensii* (Peck) Le Gal). Dissing (1966) retained *H. stevensii* as a distinct species on the basis of spore measurement, but Häffner (1987) and Abbott & Currah (1997) considered *H. stevensii* as a synonym of *H. latispora*.

***Helvella leucomelaena* (Pers.) Nannf., in Lundell & Nannfeldt, Fungi exsicc. upsal. 21: 952 (1941)**

Ascocarp sessile to substipitate, 1-6 cm broad, 3-3.5 cm high, deeply cupulate, margin expanding at maturity and becoming split, denticulate and reflexed, hymenium pale cream, cream, gray, grey-brown to dark-brown, glabrous. Stipe when present, very short, white, finely pubescent, consisting blunt and rounded ribs; context thin, brittle.

Spores 20-25 × 11-14 µm, broadly ellipsoid to ellipsoid, smooth, thin-walled, with a single droplet at maturity (guttulate) (Fig 1. f, g). Asci 210-320 × 15-20 µm, aporhynchus. Paraphyses clavate, 5-10 µm, broad at apex, pale brown.

Specimens examined: Iran, East Azarbaijan, Arasbaran, on soil, 2004/05/24, Tavanaei & Ahmad-Zadeh (IRAN 3626 F); East Azarbaijan, Arasbaran, Kalaleh, on soil, 2007/06/07, Asef (IRAN 16123 F); East Azarbaijan, Arasbaran, Ainalou, on soil, 2005/10/07, Asef (IRAN 16122 F).

This species grows solitary to gregarious in soil and has a widespread distribution in North and South America, Europe, North Africa, Australia and Asia (Abbott & Currah 1997, Calonge & Arroyo 1990, Dissing 1966).

Examined specimens of previously recorded *Helvella* spp. in Iran:

***Helvella acetabulum* (L.) Qué.**

Specimens examined: Iran, Golestan, Gorgan, Shastkala, on soil, 2011/05/14, Asef & Torabi (IRAN 15367 F); Gilan, Asalem, on soil, 1991/10/13, Daneshpazhuh, & Delghandi (IRAN 10278 F); Gilan, Fuman, Masal, Shalma, on soil, 2008/10/14, Asef & Torabi (IRAN 13613 F).

***Helvella atra* J. König**

Specimen examined: Iran, Mazandaran, Chamestan, Vaz, on soil, 2010/10/13, Asef & Torabi (IRAN 16131 F).

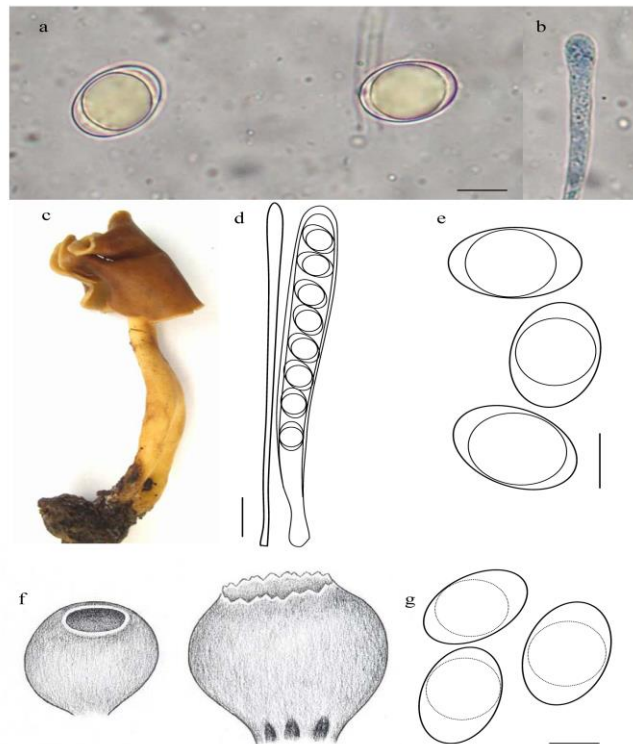


Fig. 1. *Helvella costifera*. **a.** Spores; **b.** Tip of paraphyses (Scale bar = 10 μ m), *H. latispora*. **c.** Apothecium; **d.** Ascus and paraphyses (Scale bar = 30 μ m); **e.** spores (Scale bar = 10 μ m), *H. leucomelaena*. **f.** Apothecia; **g.** Spores (Scale bar = 10 μ m).

Helvella crispa (Scop.) Fr.,

Specimens examined: Iran, East Azarbaijan, Arasbaran, Kalaleh, on soil, 2006/11/08, Asef & Torabi (IRAN 16129 F); Mazandaran, Amol, Siahbisheh, Zardman, on soil, 2007/07/19, Asef, Amini-Rad & Sadeghi (IRAN 10298 F); Mazandaran, Amol, Siahbisheh, Zardman, on soil, 2007/07/19, Asef, Amini-Rad & Sadeghi (IRAN 8601 F); Gilan, Masuleh, on soil, 1994/09/19, Karavar (IRAN 10748 F); Gilan, Masuleh to Khalkhal, on soil, 2008/10/13, Asef & Torabi (IRAN 13614 F); East Azarbaijan, Arasbaran, Ainalou, on soil, 2005/10/07, Asef (IRAN 16122 F); East Azarbaijan, Arasbaran, Kalaleh, on soil, 2007/06/08, Asef (IRAN 16123 F); East Azarbaijan, Arasbaran, Ainalou, on soil, 2005/10/07, Asef (IRAN 16124 F).

Helvella elastica Bull.

Specimens examined: Iran, West Azarbaijan, Ghushchi Village, on soil, 1993/05/19, Daneshpazhuh (IRAN 8236 F); Golestan, Toskaestan, on soil, no date, Daneshpazhuh (IRAN 8166 F); East Azarbaijan, Arasbaran, Makidi, on soil, 2007/06/08, Asef (IRAN 16128 F); East Azarbaijan, Arasbaran, Kalaleh, on soil, 2003/06/25, Asef (IRAN 16126 F); East Azarbaijan, Arasbaran, Kalaleh, on soil, 2003/06/25, Asef (IRAN 16125 F); Golestan, Shastkala, on soil, 2011/05/15, Asef & Torabi (IRAN 16127 F); West Azarbaijan,

Piranshahr to Oshnavieh, Soofian, on soil, 2009/05/20, Asef (IRAN 14720 F); East Azarbaijan, Arasbaran, on soil, 2004/06/20, Tavanaei (IRAN 3169 F); Gilan, Asalem, on soil, 1991/10/03, Daneshpazhuh & Delghandi (IRAN 8143 F); Mazandaran, Noor Park, on soil, 1992/10/19, Karavar, Ghanbari & Tehrani (IRAN 8346 F); Gilan, Asalem forests, on soil, 1988/10/08, Daneshpazhuh & Fatehi (IRAN 6970 F); Golestan, Gorgan, on soil, 1976/09/01, Ershad, D. (IRAN 6758 F).

Helvella ephippium Lév.

Specimens examined: Iran, Golestan, Gorgan, Golzar, on soil, 1993/06/16, Matin (IRAN 9299 F); East Azarbaijan, Arasbaran, on soil, 2004/05/24, Tavanaei & Ahmadi-Zadeh (IRAN 3626 F); West Azarbaijan, Naghadeh to Oshnavieh, on soil, 2010/05/15, Aghaalinejad & Ozzar (IRAN 14717 F); Gilan, Asalem forests, on soil, 1988/10/08, Daneshpazhuh & Fatehi (IRAN 6969 F); West Azarbaijan, Oshnavieh to Piranshahr, on soil, 2009/05/20, Asef (IRAN 14719 F); West Azarbaijan, Piranshahr to Sardasht, on soil, 2009/05/11, Asef & Torabi (IRAN 14721 F); West Azarbaijan, Piranshahr to Jaldian, on soil, 2009/05/20, Asef (IRAN 14722 F); West Azarbaijan, Orumieh, on soil, 2009/05/21, Asef (IRAN 14723 F).

Helvella lacunosa Afzel.

Specimens examined: Iran, West Azarbaijan, Orumieh, Heidarloo, on soil, 2009/05/20, Asef (IRAN 14724 F); West Azarbaijan, Salmas to Orumieh, 25 km from Salmas, on soil, 2009/05/21, Asef (IRAN 14725 F); West Azarbaijan, Salmas, Sadaghian, on soil, 2009/05/21, Asef (IRAN 14726 F); West Azarbaijan, Piranshahr to Jaldian, on soil, 2009/05/20, Asef (IRAN 14781 F); Kordestan, Marivan, Negel, on soil, 2006/05/05, Asef (IRAN 14780 F); East Azarbaijan, Arasbaran, Makidi, on soil, 2007/06/08, Asef (IRAN 14779 F); West Azarbaijan, Naghadeh to Oshnavieh, Behesht-e Parandegan, on soil, 2010/05, Aghaalinejad & Ozzar (IRAN 14727 F); West Azarbaijan, Oshnavieh, Dizaj, on soil, 2009/05/20, Asef (IRAN 14718 F); Gilan, Rezvanshahr, Shafarood forests, on soil, 1988/10/09, Daneshpazhuh & Fatehi (IRAN 6971 F); East Azarbaijan, Arasbaran, Kalaleh, on soil, 2003/06/25, Asef, M. R. (IRAN 11900 F); West Azarbaijan, Orumieh, Ghatarchi, on soil, 1998/10/02, Mehravaran, H. (IRAN 11708 F); Mazandaran, Noshahr, Kheirudkenar, on soil, 2005/10/13, Bahram, M. (IRAN 5735 F); Gilan, Asalem Forest, on soil, 1991/10/12, Daneshpazhuh (IRAN 8255 F); East Azarbaijan, Arasbaran, Kalaleh, on soil, 2003/06/25, Asef, M. R. (IRAN 11885 F).

Helvella leucopus Pers. as *H. monachella*

Specimen examined: Iran, West Azarbaijan, Orumieh, on soil, 1998/10/02, Mehravaran (IRAN 11708 F).

Helvella cf. *pezizoides* (IRAN 8472 F)

There is one specimen in Iran fungal herbarium named as *H. cf. pezizoides*. (IRAN 8742), collected in 1990 from Mazandaran province. Review of literature on Iranian fungi, showed this name has not been published or reported earlier. Reidentification of specimen showed it belong to *H. ephippium*.

Key to the *Helvella* species from Iran

- 1a. Apothecium cupulate..... *H. leucomelaena*
- b. Apothecium convex to irregularly lobed..... 2
- 2a. Stipe ribbed..... 3
- b. Stipe terete..... 6
- 3a. Excipular surface glabrous..... *H. lacunosa*
- b. Excipular surface pubescent or villose near the margin..... 4
- 4a. Hymenium and stipe whitish..... *H. crispa*
- b. Hymenium pale brownish to brownish..... 5
- 5a. Ribs with sharp edge, expanding up to the middle part of the apothecium *H. acetabulum*
- b. Ribs with blunt edge, expanding up to the most of the apothecium..... *H. costifera*
- 6a. Apothecium and stipe very dark brown to black..... *H. atra*
- b. Apotheciun and stipe not very dark brown to black..... 7
- 7a. Excipular surface glabrous..... 8
- b. Excipular surface pubescent to villose..... 9
- 8a. Spore dimensions 18-21 × 11-13 μm.... *H. elastica*
- b. Spore dimensions 21-24×13-15 μm *H. leucopus*
- 9a. Apothecium upto 1.5 cm, stipe grey-brown..... *H. ephippium*
- b. Stipe white to cream *H. latispora*

Geographical distribution and frequency of *Helvella* species in Iran

All of the species reported from Iran, have been collected from North and North-West (Fig. 2) of the country. Most of the specimens of all recorded species have been collected from broad leaf forest-type localities in Golestan, Mazandaran, Guilan and Eastern Azarbaijan (Arasbaran forests). Specimens of *H. elastica*, *H. ephippium* and *H. lacunosa* were collected from non-forest localities in Western Azarbaijan (Orumieh, Piranshahr to Oshnavieh, Naghadeh to Oshnavieh, Oshnavieh to Piranshahr, Piranshahr to Sardasht, Salmas to Orumieh, Piranshahr to Jaldian) and Kurdistan provinces (Marivan).



Fig. 2. Geographical distribution of *Helvella* species in Iran.

Analyses of sampling date of some 70 specimens showed that most of the ascocarps of *Helvella* are found in spring (May and June), last summer (September) and fall (October) and only three apothecia have been collected in other dates (Fig. 3).

Considering the geographical extent and climatic variation, there are certainly more species of *Helvella* in Iran, that require more comprehensive studies and extensive sampling.

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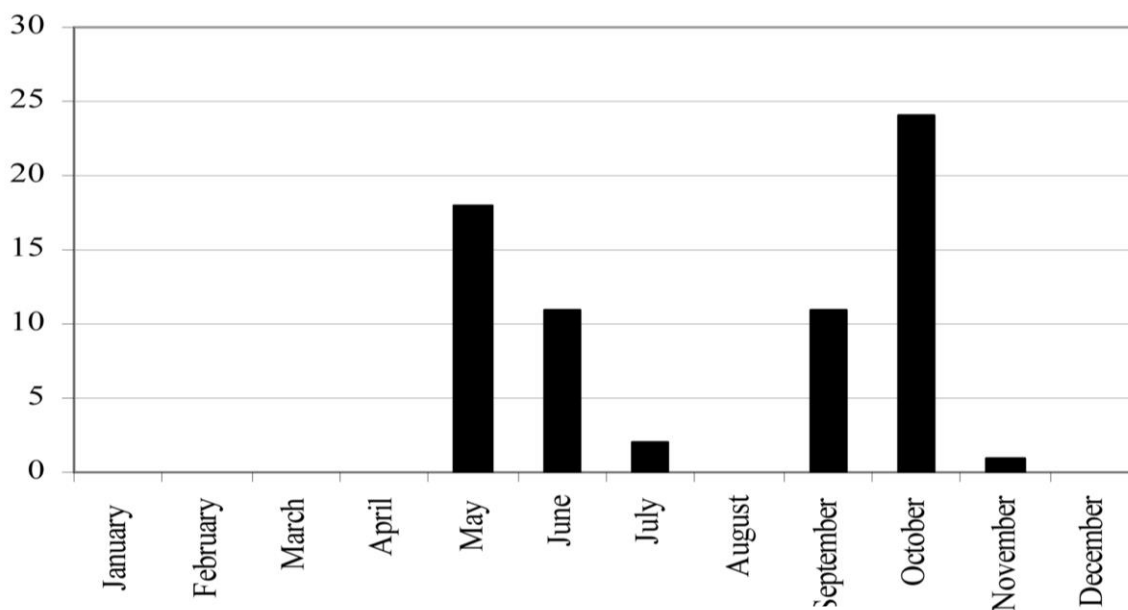


Fig. 3. Frequency of *Helvella* species in Iran

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جنس *Helvella* در ایران

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چکیده: در این تحقیق با مروری بر جنس *Helvella*، آخرین وضعیت تاکسونومیکی این جنس در ایران مطالعه شده است. نتایج بررسی نمونه‌های موجود در مجموعه قارچ‌های ایران، همچنین نمونه‌های جمع‌آوری شده در این تحقیق، نشان داد هفت گونه از این جنس شامل *H. acetabulum*، *H. atra*، *H. crispa*، *H. elastica*، *H. lacunosa*، *H. leucopus* و *H. leucomelaena* (با نام *H. monachella*) پیش از این از ایران گزارش شده و سه گونه جدید به اسامی *H. costifera*، *H. latispora* و *H. leucomelaena* به عنوان گونه جدید برای فلور قارچ‌های ایران معرفی می‌گردد. بازنگری نمونه‌ای تحت نام *H. cf. pezizoides* در مجموعه قارچ‌های ایران نشان داد این نمونه متعلق به گونه *H. ephippium* می‌باشد. توصیف مورفولوژیکی گونه‌های جدید، نقشه پراکنش و زمان ظهور، به همراه کلید شناسایی گونه‌های *Helvella* در ایران ارائه شده است.

واژه های کلیدی: *Leptopodia* و *Helvellaceae* Ascomycetes