

The first report of *Helvella crispa* (Ascomycota, Pezizales), a rare fungal species in Sri Lanka

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Striking fruiting bodies located in Hantana, bordering the Dunumadalawa Forest Reserve, were identified as *Helvella crispa* using morphological characteristics.



Apothecium: White and convex. **Cap,** pure whitish, bi-lobate and irregularly-shaped.



Stipe: Internally solid, fleshy and white color.



Stipe: Simple, ribbed or furrowed stipe (enlarged)

This is the first record of *H. crispa* or the genus *Helvella* in Sri Lanka.

Highlights

- Whitish fungal fruiting bodies were found in Hantana, bordering the Dunumadalawa Forest Reserve.
- Using morphology, irregularly saddle-shaped cap and ribbed stipe, the fungus was identified as *Helvella crispa*.
- This is the first report of the apothecial ascomycete, *H. crispa* or the Genus *Helvella*, in Sri Lanka.
- *Helvella* appears rare in Sri Lanka, as it was not known over the country's 230 year-long Mycology history.
- *Helvella* is, however, widespread in terrestrial biomes of Northern and Southern Hemispheres.

SHORT COMMUNICATION

The first report of *Helvella crispa* (Ascomycota, Pezizales), a rare fungal species in Sri Lanka

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Abstract: Two striking, stipitate fruiting bodies of a fungus were found in Hantana area, bordering the Dunumadalawa Forest Reserve within the Kandy District (Central Province) of Sri Lanka. The apothecium was capitate, cap whitish and irregularly saddle-shaped; the stipe simple, shallowly ribbed, tapering and internally solid. The fruiting bodies were identified, using morphological characteristics, as *Helvella crispa* belonging to the family Helvellaceae, Order Pezizales and Phylum Ascomycota. This is the first record of *H. crispa* or the genus *Helvella* in Sri Lanka. The genus could also be rather rare in Sri Lanka (then Ceylon) as it has not been encountered over 230 year-long history of mycological work in the country.

Keywords: Apothecial Ascomycete: New fungal record to Sri Lanka; Pezizomycetes; Saddle-shaped fungi.

INTRODUCTION

Sri Lanka is a small island of the Indian ocean, with a land area of 6,570,134 ha., located closer to the southern part of the Indian sub-continent, between 5° 54' and 9° 52' North Latitude and 79° 39' and 81° 53' East Longitude. The island comprises of central mountains with an elevation of up to 2524 m, surrounded by the lowlands. The overall climate is considered tropical and the average temperature ranges between 28-32°C. Despite its small size, Sri Lanka is blessed with a variety of ecosystems and high biological diversity. Sri Lanka's native fungal flora is believed to be around 25,000 species of which only about less than 12% is known (Adikaram, 2004; Adikaram and Yakandawala, 2020). The earliest record of fungi in Ceylon was as far back as 1783 by Houttuyn. Mycological studies initiated by British scientists in the country from 1780s to late nineteen forties. The work continued even after 1940's, though not in the same intensity. The fact that none of the species belonging to the genus *Helvella* were reported to be encountered in the country during the long period of continuous mycological work in the country (Petch and Bisby, 1950; Karunarathna et al. 2012) shows that *H. crispa* might have been a rare species in Sri Lanka.

Helvella is a genus of apothecial ascomycetes, widespread in terrestrial biomes of the Northern and Southern Hemispheres (Kirk et al., 2008). The species in the genus are characterized by sub-sessile or stipitate

fruiting body, cupulate to saddle-shaped and convex to campanulate apothecia, including species with folded and lobed caps seated on a simple ribbed or furrowed stipe (Skrede et al., 2017). The genus contains many of the macrofungi species of the order Pezizales and comprises a range of elaborate apothecia (Skrede et al., 2017).

The first record of a species of this genus was in 1753 by Linnaeus (1737, 1753) who proposed the genus *Elvela* (= *Helvella*, orth. var.) for *Elvela mitra* (= *Helvella crispa* ss. Fries (1822)). Fries (1822) introduced the family Elvellaceae, which was later referred to as Helvellaceae (Corda, 1842). Genus *Helvella* is diverse and includes 52 conformed taxa around the world (Kirk et al., 2008). Species Fungorum (2020) has 379 valid records of species epithets under the genus, after excluding subspecific epithets.

In most of the past taxonomic circumscriptions, a broad species concept has been applied, allowing greater morphological variation among *Helvella* species that were accepted in their investigations (Afzelius, 1783; Fries, 1822; Dissing, 1966a, b; Weber, 1972, 1975; Abbott and Currah, 1997). This has also resulted in listing a number of heterotypic synonyms for many *Helvella* species, mostly assessed based on character similarities of published descriptions rather than as a result of comparative studies of type specimens (Skrede et al., 2017).

Skrede et al. (2017) have found the occurrence of a "crispa lineage", consisting of *H. crispa*, *H. maculata* and *H. leucophaea*, constituting a species assemblage of their own, in a combined morphological and molecular study, conducted using 183 *Helvella* specimens selected from 432 specimens, collected mostly from the Europe and a small sample from other regions of the world. Conversely, Zhao et al. (2015) concluded that the Chinese *H. crispa*-like samples represented a species complex, containing at least six phylogenetic species. *Helvella* species have also been reported from Europe (Skrede et al., 2017) and North America (Kempton and Wells, 1970). Sixteen species of *Helvella* are recorded in India (Jamaluddin et al., 2004; Dorjey et al., 2013) of which eleven species have been reported from Jammu and Kashmir (Dorjey et al., 2013) with a temperate climate. Apothecial ascomycete (Pezizomycetes), *H. crispa*, is commonly known as white

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saddle, elfin saddle or false morel over the world.

There were no records of any of the members of the genus *Helvella* or even the Family Hevellaceae in Sri Lanka. The present study reports a species belonging to the genus *Helvella* Family Hevellaceae collected from Hantana, Kandy for the first time in Sri Lanka (Central Province).

MATERIALS AND METHODS

Specimen collection

Two identical fruiting bodies of a macrofungus were found close to each other (4 cm apart) on 25th July 2015, located in Hantana, at a site just opposite and in close proximity to the boundary of the Dunumandalawa Forest Reserve (N 07° 27.4848', E 080° 63.9493', 700 -1000 m elevation which was previously known as the Walker Estate, in the Kandy District (Central Province of Sri Lanka). The fruiting bodies, aboveground, were first examined, described and photographed at its natural habitat. Further observations and photographs of the fruiting bodies, with their underground portion, were made after uprooting.

Habitat

The collection site of the two stipitate fruiting bodies was located in Hantana area (Kandy District, Central Province, Sri Lanka), at an elevation of 700 – 1000 m during the rainy season (South Western monsoon). They were growing on

bare, sand-rich, soil with sparse ground cover closer to the vegetation of the lower montane forest. The conditions were slightly wet with moderate temperature, 25±2° C, and 90% relative humidity.

Spore print

The fruiting body was longitudinally halved and examined for internal features and photographed, the observations were recorded. A spore print was obtained by keeping a longitudinally half-cut and exposed cap of the fruiting body, horizontally over a white paper for 6 h. The specimen was identified using morphological characteristics described by Fries (1822).

Specimen deposition

Specimen was deposited in a fungal collection at the Department of Botany, University of Peradeniya, Sri Lanka, the accession number is DB/UPDN/2015/03.

RESULTS

Identification

Using morphological characteristics of the ascocarps, the fungus was unambiguously identified as *Helvella crispa* (Scop.) Fr. belonging to the *crispa* lineage.

Specimen description

Helvella crispa (Scop.) Fr., Syst. mycol. (Lundae) 2(1):14

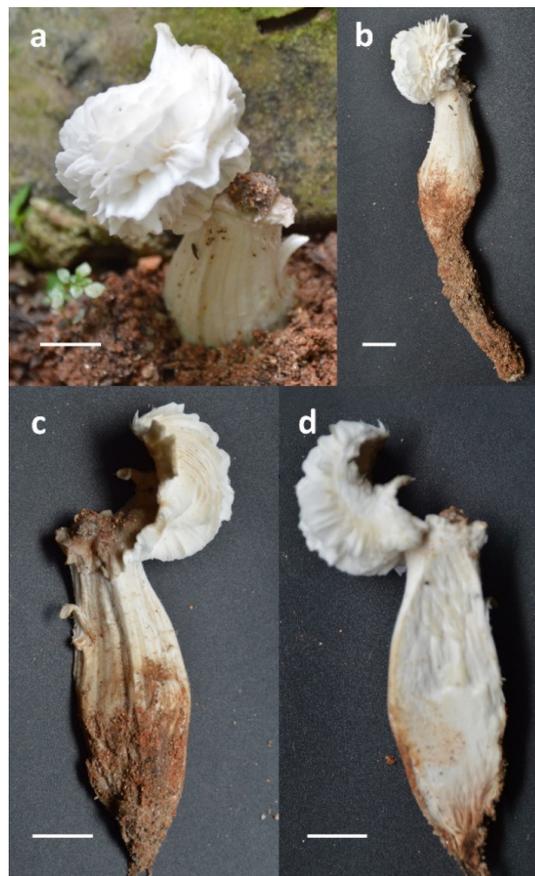


Figure 1: *Helvella crispa*, (a) Fresh fruiting body, as visible above ground, after emerging out in the sparse ground cover, (b) Entire fruiting body, with both above- and underground growth, (c) Vertically-halved fruiting body, showing a portion of the receptacle and distinctly ribbed stipe, and (d) Internally solid stipe of a vertically-halved fruiting body. Bar = 2 cm.



Figure 2: (Left) A detailed view of the ascocarp and the free cap edge which is not fused with the stipe; (Right) Beige color spore print taken from *H. crispa*.

(1822) Figs 1,2 Index Fungorum number: IF 186148.

Apothecium distinctly stipitate, white, capitate, convex and saddle-shaped; *pileus*, pure whitish, bi-lobate, irregularly-shaped externally, 5.3 - 5.5 cm in diameter and 3.8 – 4.0 cm high (Fig. 1), the outer surface irregularly arranged, the periphery made up of petal-like projections, each with serrated margins. Internally *pileus*, multi-layered (Fig. 1, 2), the lowest whorl of petal-like projections in the cap curved or bent inwards and downwards towards the stipe; cap edge free of and not fused with the stipe (Fig. 1). *Hymenium* surface brownish-yellow, receptacle surface (apothecial underside) brown color, softly pubescent to villose. *Asci* cylindrical and 8-spored; *ascospores* ellipsoid and hyaline, paraphyses hyaline and septate; spore print beige color (Fig. 2).

The stem or the stipe prominent, the aboveground portion 5.5 cm in height and white color, the outer surface shallowly ribbed over the entire length, continuing to the receptacle margin, the stipe internally solid, fleshy and white color. Stipe, at its broadest point at soil level, 4.2 cm in diameter, and tapering to about 2.2 cm at the cap level. Stipe extends to 7 cm underground (Fig. 1), brown color and broader to begin with at ground level and tapers down over the initial 1/3rd to 2 cm and continues with the same diameter (Fig. 1).

Taxonomy

The current taxonomic rank of the fungus is Kingdom Fungi, Phylum Ascomycota, Subphylum Pezizomycotina, Class Pezizomycetes, Subclass Pezizomycetidae, Order Pezizales, Family Hevellaceae, Genus *Helvella*, Species *Helvella crispa* (Scop.) Fr. (Systema Mycologicum (Lundae) (1822)

Synonymy

Numerous species names that have been used in the taxonomic history of *H. crispa* which are now listed as synonyms (Species Fungorum, 2020):

Phallus crispus Scop., *Fl. carniol.*, Edn 2 (Wien) 2 475 (1772)

Costapeda crispa (Scop.) Falck, Śluzowce monogr., *Suppl. (Paryz)* 3:401 (1923)

Helvella mitra sensu Bolton [Hist. Fung. Halifax (1789: pl. 95)]; fide Cannon, Hawksworth & Sherwood-Pike

(1985)

Helvella atra Oeder, *Fl. Danic.* 3(9): tab. 534, fig. 2 (1770)

Helvella nigricans var. *atra* Pers., *Syn. Meth. Fung.* (Göttingen) 2:617 (1801)

Helvella nigricans Schaeff. [as 'Elvela'], *Fung. Bavar. Palat. Nasc.* (Ratisbonae) 4:102 (1774)

Phallus costatus Batsch, *Elench. Fung.* (Halle):129 (1783)

Helvella crispa var. *fulva* Bull., *Hist. Champ. Fr.* (Paris) 1(2):293 (1791)

Merulius undulatus var. *fulvus* (Bull.) Mérat, *Nouv. Fl. Environs Paris* 1:48 (1821)

Helvella crispa var. *fusca* Bull., *Hist. Champ. Fr.* (Paris) 1(2):293 (1791)

Merulius undulatus var. *fuscus* (Bull.) Mérat, *Nouv. Fl. Environs Paris* 1: 48 (1821)

Helvella crispa var. *alba* Fr., *Syst. Mycol.* (Lundae) 2(1):14 (1822)

Helvella crispa var. *lutescens* Fr., *Syst. Mycol.* (Lundae) 2(1):14 (1822)

Helvella crispa var. *grevillei* J. Kickx f., *Fl. Crypt. Flandres* (Paris) 1:504 (1867)

Helvella crispa f. *grevillei* (J. Kickx f.) Masee, *Brit. Fung.-Fl.* (London) 4:459 (1895)

Helvella pithyophila Boud., *J. Bot.*, Paris 1:218 (1887)

Helvella crispa var. *pithyophila* (Boud.) Donadini, *Bull. Soc. linn. Provence* 28:75 (1975)

Helvella barlae Boud. & Pat., *J. Bot.*, Paris 2:445 (1888)

Helvella crispa var. *barlae* (Boud. & Pat.) Boud., *Hist. Class. Discom. Eur.* (Paris):35 (1907)

DISCUSSION

Helvella is known as a highly diverse genus with a wide geographical distribution. *Helvella crispa* is characterized by white or pale bi- to tri-lobate apothecia, with a pubescent to villose receptacle surface and in-rolled to inflexed margin when young, and a white ribbed stipe (Weber, 1972). Historically, species identification in *Helvella*, has relied upon a morphological species concept mostly drawing

on macroscopic characteristics of the apothecium, shape, color and outer surface characteristics, the hymenium, excipulum and stipe.

While most of the morphological features of the cap, stipe or the receptacle of the specimens used in the present study tallied entirely with the currently available records and descriptions, certain features, such as the “flower-like appearance” of the cap, was complex and even difficult to be accurately described. These features could not be compared with any of the existing records of *H. crispa*. This again reiterates the greater morphological diversity within the species. A recent and extensive study, that gathered morphology and phylogenetic evidence from 4 loci, hsp, tef, rpb2 and LSU of *Helvella* species, using large numbers of samples from Europe and smaller sample numbers from other regions of the world, had shown very little “within species divergence” (Skrede *et al.*, 2017). Nevertheless, some species showed more intraspecific diversity than others. Among them, *H. costifera* and *H. crispa* had highest “within-species diversity” (Skrede *et al.*, 2017).

Morphological features and the habitat-ecology of the two species (Skrede *et al.*, 2017), *H. maculata* and *H. leucophaea*, that make a “cripa lineage”, together with *H. crispa*, were distinct from the fungal specimens subjected to the present study. *Helvella leucophaea* resembles *H. crispa* in size and stature, the stipe is whitish but appears deeply ribbed. *Helvella maculata* is a temperate species that features an elaborately ribbed and pocketed stem, a brownish cap that is loosely lobed, and a fuzzy, whitish undersurface. The species appears under conifers and hardwoods from Alaska to California, usually in fall, but also over winter or in spring in coastal areas (Weber, 1972).

Phylogenetic analyses of combined ITS, nrLSU, tef1- α , rpb2 and mcm7 sequence data from *H. crispa*-like specimens collected within China revealed that *H. crispa* represents a species complex, containing at least six phylogenetic species (Zhao *et al.*, 2015). Skrede *et al.* (2017), however, found an assemblage of three species. *H. crispa*, *H. maculata* and *H. leucophaea*, forming “cripa lineage”.

Neither any species belonging to the genus *Helvella* nor the genus itself has been recorded in Sri Lanka during its 230-year long history of intense Mycological investigations. The occurrence of the specimens described in the present paper in the country could be considered rare.

CONCLUSIONS

Fungal fruiting bodies collected from Hantana, Kandy, Sri Lanka were morphologically identified as *Helvella crispa*. This is the first record of *H. crispa* or the genus *Helvella* in Sri Lanka.

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DECLARATION OF CONFLICT OF INTEREST

Authors declare that they have no conflict of interest.

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