



UNVEILING HELVELLACEAE DIVERSITY IN THE WESTERN HIMALAYA: MORPHOLOGICAL AND MICROSTRUCTURAL CHARACTERIZATION OF TWO *Helvella* SPECIES (MACROFUNGI) FROM KISHTWAR, JAMMU & KASHMIR, INDIA

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ABSTRACT

The present study documents two species of Helvellaceae, *Helvella crispa* and *Helvella elastica*, from Kishtwar district of the Western Himalaya. Field investigations were conducted across diverse forest habitats. Specimens were collected and analyzed using detailed morphological and microscopic techniques. *Helvella crispa* was recorded from Chingam, Nagseni and Sarthal, while *H. elastica* was observed in Chatroo, Chingam and Nagseni. Diagnostic features such as apothecial morphology, stipe characteristics, asci and ascospore structure were examined for accurate identification. *H. crispa* was found to be edible, whereas *H. elastica* is considered non-edible. Both species are new records from the study area. The findings highlight the rich yet underexplored macrofungal diversity of Kishtwar and emphasize the need for further systematic mycological studies in the region.

KEYWORDS: *Helvellaceae*, Western Himalaya, Kishtwar, macrofungi, morphology, microscopy.

INTRODUCTION

Macrofungi constitute a diverse assemblage of heterotrophic fungi distinguished by the formation of conspicuous fruiting bodies and are readily visible to the unaided eye. These fungi are composed of microscopic, thread-like hyphae that collectively form an extensive mycelial network within the substrate. Under favourable environmental conditions, particularly optimal moisture and temperature, this mycelium gives rise to reproductive structures known as fruiting bodies (Roody, 2003). Although macrofungi are cosmopolitan in distribution, their occurrence is strongly influenced by ecological parameters such as substrate type, vegetation and seasonal climatic conditions. The monsoon period, in particular, provides ideal conditions for their growth and proliferation across diverse forest habitats (Pushpa and Purushothama, 2012).

Macrofungi exhibit a wide range of ecological strategies, including saprophytic, parasitic and symbiotic modes of nutrition. Many species contribute significantly to nutrient cycling through the decomposition of organic matter, while others form mutualistic mycorrhizal associations with forest trees, thereby enhancing nutrient uptake and ecosystem functioning (Das, 2010; Dwivedi *et al.*, 2017). Taxonomically, macrofungi are primarily represented within the phyla Ascomycota and Basidiomycota, which together account for the majority of known fungal diversity (Kirk *et al.*, 2008). Despite extensive taxonomic efforts, it is estimated that only a small proportion of global fungal diversity has been described till date, indicating the vast scope for further exploration (Antonelli *et al.*, 2020).

The Himalayan region, particularly the Union Territory of Jammu and Kashmir, is well known for its rich biodiversity and diverse macrofungal flora. Several studies have documented fungal diversity in this region (Abraham and Kaul, 1985, 1988; Kumar and Sharma, 2011), yet many areas remain underexplored. Kishtwar district, characterized by dense forests comprising both coniferous and broad-leaved vegetation, along with favourable climatic conditions, represents a promising yet insufficiently studied region for macrofungal diversity.

Among macrofungi, the family Helvellaceae of Ascomycota holds particular taxonomic and ecological significance due to its distinctive cup shaped and saddle shaped fruiting bodies. However, reports of Helvellaceae from the Western Himalaya are limited. In this context, the present study aims to document two newly recorded species of Helvellaceae from Kishtwar district based on detailed morphological and microscopic characterization. The findings are expected to enrich the existing knowledge of fungal diversity in the region and provide a basis for further taxonomic and ecological investigations.



2. MATERIAL AND METHODS

2.1 Study Area

The present study was carried out at selected sites across Kishtwar district, including Chatroo, Chingam, Ikhala, Sarthal, and Nagseni. Located in the Jammu Division of the Union Territory of Jammu and Kashmir, Kishtwar was carved out of District Doda in 2007. The district spans approximately 7,737 km² and is bordered by Chamba (south), Anantnag and Doda (west) and Kargil (north and east). The Chenab River flows through the region, shaping the Chenab Valley. With elevations ranging from 1,500 to 6,500 meters and annual rainfall between 102–170 cm, the area features diverse terrain, soils and climatic conditions that support rich biodiversity.

2.2 Collection of Specimens

Field explorations were carried out in selected forested areas of Kishtwar district to collect the species of family Helvellaceae. Standard procedures for collection and documentation of macrofungi were followed (Atri *et al.*, 2003; Kumar *et al.*, 1990; Smith *et al.*, 1981). Fruiting bodies of *Helvella crispa* and *Helvella elastica* were carefully collected using sterile knives and trowels to preserve intact morphological features. In situ photographic documentation was performed using a DSLR camera. Ecological parameters, including habitat, associated vegetation, altitude and substrate, were recorded at the time of collection. Macromorphological characteristics such as shape, size, colour, surface texture and structural features were noted in the field. Colour descriptions were standardized following Kornerup and Wanscher (1978). Fresh specimens were also subjected to chemical tests using KOH, NH₄OH, and FeSO₄ to observe diagnostic colour reactions. Collected specimens were dried under controlled conditions, and preserved in labelled paper packets for further analysis.

2.3 Morphological and Microscopic Examination

Detailed morphological examination was conducted with emphasis on diagnostic characters of *Helvella* species, including apothecial configuration, hymenial surface, stipe morphology and context. For microscopic analysis, dried specimens were rehydrated in ethanol and treated with 3% KOH. Thin sections were prepared and stained using Congo red, lactophenol, iodine solution and Melzer's reagent to study microstructures. Observations were carried out using an Olympus CH20i microscope, and measurements were recorded with a calibrated ocular micrometer. Microscopic features such as asci, ascospores, paraphyses and hyphal elements were examined in detail. Spore dimensions were expressed as mean values and the spore quotient (Q) was calculated to describe spore shape. Camera lucida drawings were prepared to illustrate key diagnostic features.

2.4 Identification

Identification of species of *Helvella* was accomplished using standard taxonomic keys, monographs, and relevant literature (Smith, 1951; Yao *et al.*, 1998; Bates *et al.*, 2009; Bougher and Matheny, 2011). Nomenclature was verified using Index Fungorum, and classification followed Kirk *et al.* (2008). The identifications were further authenticated through expert consultation.

3. RESULTS

A total of five (5) collections of macrofungi were made from various selected locations of Kishtwar district, including Chatroo, Chingam, Sarthal, Nagseni, and Ikhala. Among the collected specimens, two species belonging to the genus *Helvella* of family Helvellaceae (order Pezizales) were identified, namely *Helvella crispa* and *Helvella elastica*. Both species represent new distributional records for the study area. The table [1] below contains the list of taxa identified along with their order, family and site of location.

S.No	Macrofungal species	Site of location
Phylum	Ascomycota	
Order	Pezizales	
Family	Helvellaceae	
1.	<i>Helvella crispa</i> (Scop.) Fr.	Chingam, Nagseni, Sarthal
2.	<i>H. elastica</i> Bull.	Chatroo, Chingam, Nagseni

3.1. Taxonomic description of two *Helvella* species collected and identified from the study area .

Phylum *Ascomycota*

Order *Pezizales*

Family *Helvellaceae*

A. *Helvella crispa* (Scop.) Fr., Syst. mycol. (Lundae) 2(1): 14 (1822) [Figure 1]

Specimen examined: India, Jammu and Kashmir, District Kishtwar, Chingam, Nagseni, scattered, growing in association with *Cedrus deodara* and *Picea smithiana*. Faisal Mushtaq. Collection number FM22-001.



Pileus 28-48 mm long, 2-5 lobed, Light creamish to light grey (1A1-1C1), irregular shaped with wrinkled surface, margins rolled inwards, undulate and minutely contorted; **Stipe** 42-76 × 12-26 mm, off white (8A1), hollow from inside, width narrows towards apex, dry, ribbed and furrowed; **Asci** 218.0-258.0 × 14.0-29.2 µm, 8 spores in each ascus, smooth, thin-walled, hyaline; **Ascospores** 9.1-13.5 × 7.8-11.6 µm (avL=11.3, avW=9.7, Q = 1.16), broadly ellipsoidal, hyaline, placed obliquely, smooth, thin-walled, with no oil droplet; **Paraphyses** 7.8-11.5 µm wide, with pointed apex, septate smooth and hyaline; **Stipe hyphae** 2.4-5.2 µm wide, clear and smooth.

Distribution: Firstly Malik *et al.*, in 2017, reported it from Jammu and Kashmir.

Edibility: Edible in the study area.

Remarks: Creamish pileus with wrinkled surface and ribbed stipe make this species unique and different from *Helvella elastica*. New report from the study area.

B. *Helvella elastica* Bull., herbier de la France 6:tab.242(1785) [Figure 2]

Specimen Examined: India, Jammu and Kashmir, District Kishtwar, Chatroo, Chingam, Nagseni, scattered, growing in association with *Cedrus deodara* and *Pinus wallichiana*. Faisal Mushtaq. Collection number FM22-004.

Pileus: 28-42 × 5-16 mm wide, light brown to brown (7D4-7E4), under surface creamish white to light brown (7A1-7D6), saddle or irregular shaped with incurved margins, smooth, **Stipe:** 18-48 × 8-24 mm, smooth, white (6B1), hollow from inside, non-ribbed, soft and equal; **Asci:** 204-238 × 12.4-16.6 µm, eight spored, apex obtuse, clear; **Ascospores:** 13.8-18.8 × 9.0-12.3 µm (avL=16.3, avW=10.65, Q = 1.53), narrowly ellipsoidal, uniseriate, sub-hyaline, smooth, guttulate having oil droplet; **Paraphyses:** 4.8-17.5 µm wide, hyaline, with septae and granular contents, apices club shaped.

Distribution: Firstly reported from West Bengal by Kar and Maity, 1970.

Edibility: Not consumed in the study area.

Remarks: The stipe of *H. elastica* is smooth and non ribbed as compare to that of *H. crispa*. It is new report from the study area.

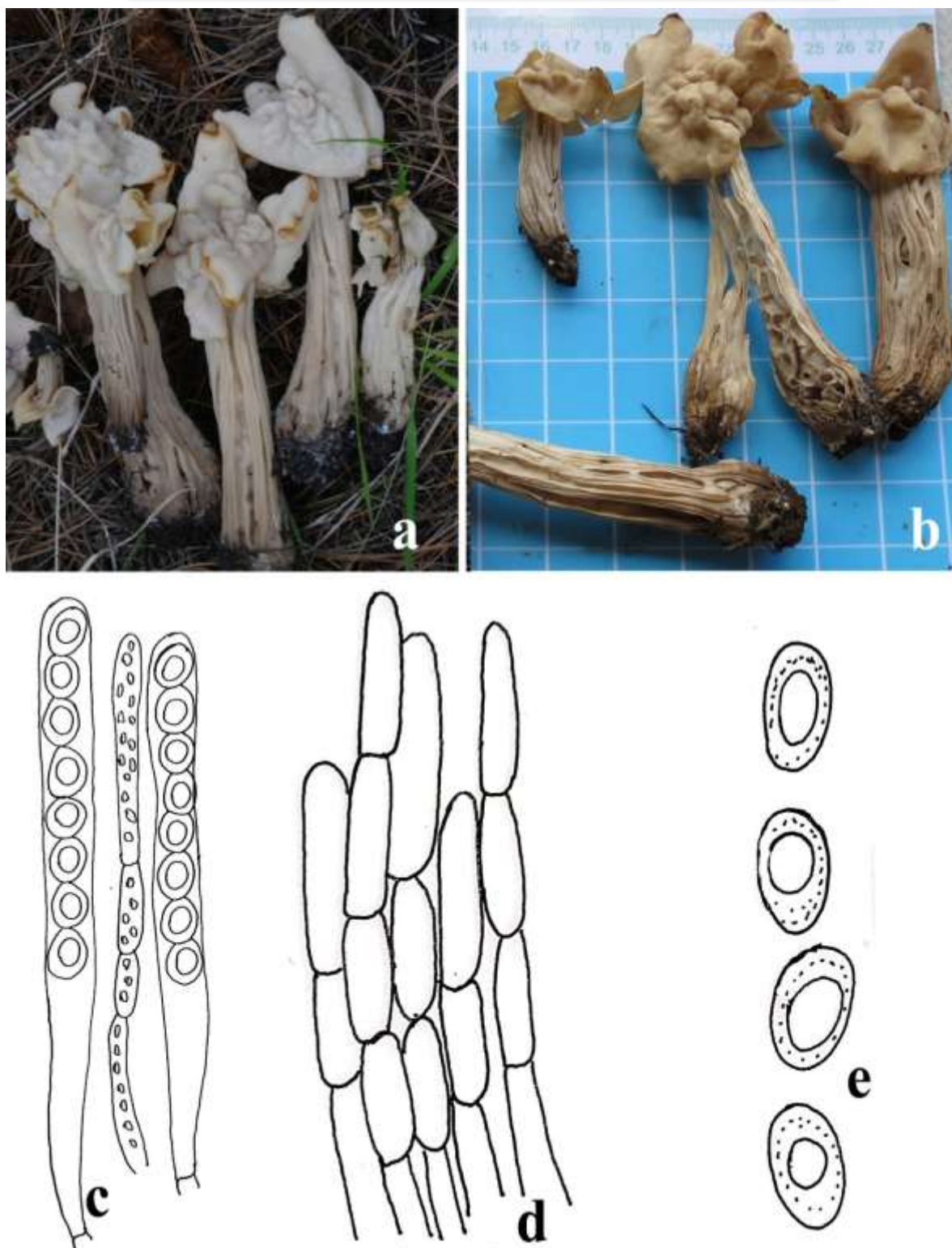


Fig 1: *Helvella crispa*

a-b Fresh Ascomata in the forest; c. Asci; d. Paraphyses; e. Ascospores;
(Scale bars: a-b = 50 mm; c-e=10 μ m.)

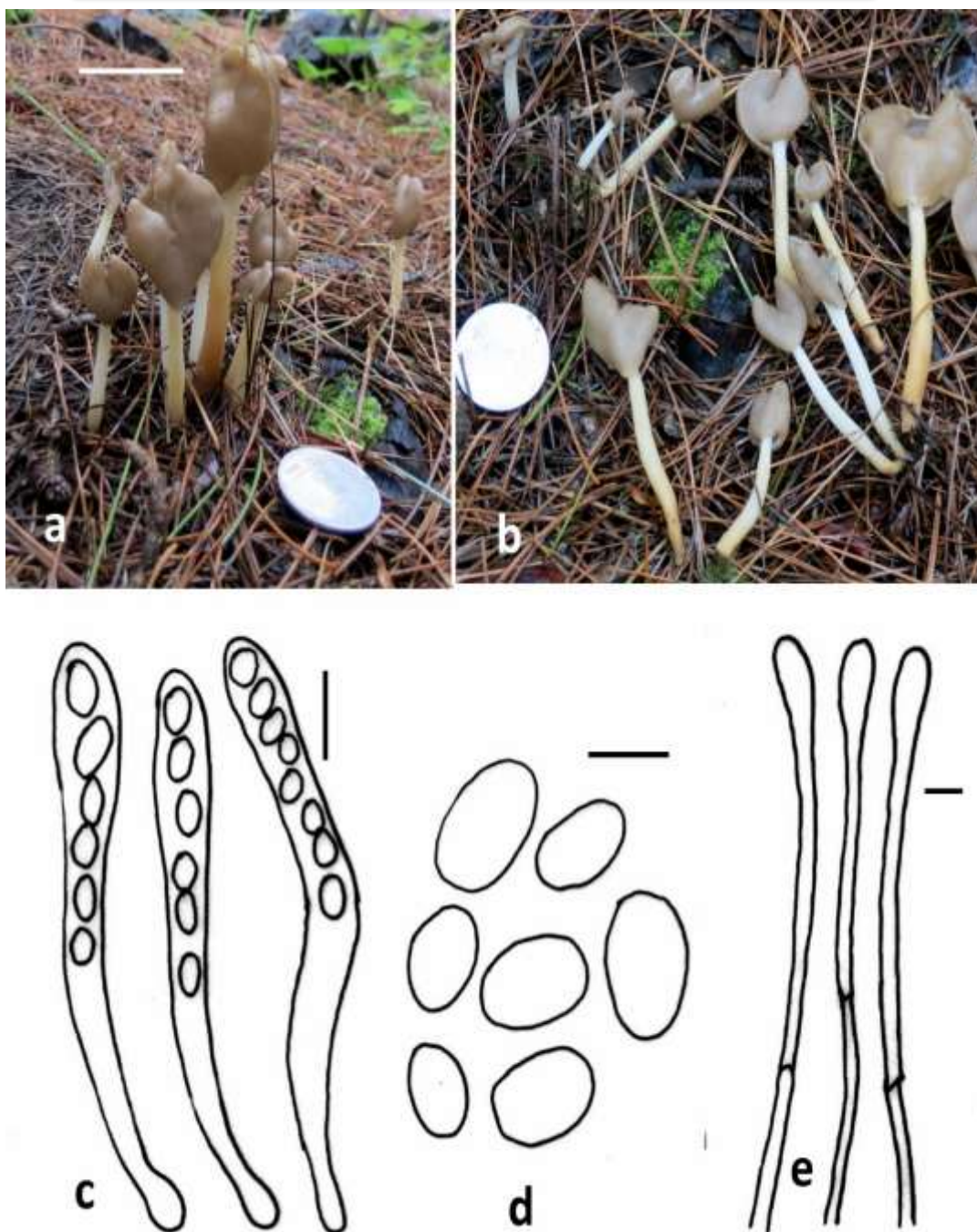


Fig 2 : *Helvella elastica*

a-b. Fresh Ascomata in the forest; c. Asci; d. Ascospores; e. Paraphyses
(Scale bars: a-b = 50 mm; c-e =10 μ m)

4. DISCUSSION

The present study reports *Helvella crispa* and *Helvella elastica* as new distributional records from Kishtwar district, thereby extending the known range of these taxa within the Western Himalaya. *Helvella crispa* was recorded from Chingam, Nagseni and Sarthal, whereas *Helvella elastica* was observed in Chatroo, Chingam and Nagseni, indicating their occurrence across multiple localities and highlighting their adaptability to diverse microhabitats within temperate forest ecosystems. Both species were found



in habitats rich in organic matter and with favourable moisture conditions, consistent with the ecological preferences of Helvellaceae members.

Morphological and microscopic analyses revealed distinct diagnostic features that facilitated accurate identification. *Helvella crispa* exhibited a characteristic ribbed stipe and irregularly lobed apothecia while *Helvella elastica* was distinguished by its slender, elastic stipe and comparatively smoother structure. Microscopic traits, including ascus morphology and ascospore characteristics, further supported their taxonomic delimitation. From an ethnomycological perspective, *Helvella crispa* is considered edible whereas *Helvella elastica* is generally regarded as non-edible, adding practical significance to their identification. The findings underscore the importance of integrated morpho-microscopic approaches in resolving species identities and highlight the rich yet underexplored fungal diversity of the Kishtwar region, warranting further systematic investigations.

5.CONCLUSION

The present investigation documents two species of Helvellaceae, *Helvella crispa* and *Helvella elastica*, as new records from Kishtwar district of Jammu and Kashmir. The study underscores the significance of systematic field surveys and detailed morpho-microscopic analyses in uncovering hidden fungal diversity in underexplored regions. The occurrence of these species in diverse forest habitats reflects the ecological richness and suitability of the region for macrofungal growth.

These findings contribute to the existing knowledge of macrofungal diversity in the Western Himalaya and provide a baseline for future taxonomic and ecological studies. Furthermore, the study highlights the potential of Kishtwar district as a promising area for mycological exploration. Continued investigations integrating advanced techniques such as molecular characterization could further enhance species delimitation and phylogenetic understanding. Documentation of such taxa is essential not only for biodiversity assessment but also for conservation planning and sustainable utilization of fungal resources.

Declaration

The authors have no competing interests to disclose.

Author's contributions: JP devised the study, framed the draft. FM edited the manuscript, collected, analysed the data and wrote the manuscript. BPS interpreted the data and revised the manuscript.

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