Taiwania 70(4): 699–702, **2025**
DOI: 10.6165/tai.2025.70.699

Opegrapha acarosporae, a new lichenicolous fungus from India

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(Manuscript received 1 June 2025; Accepted 14 October 2025; Online published 21 October 2025)

ABSTRACT: A new species of lichenicolous fungus from India – *Opegrapha acarosporae*, colonising the thallus of *Acarospora fusca* is described from the alpine region of Central Himalaya. The taxon is characterized by warty ascomata bearing 4-spored asci having uniseriately arranged 3-septate hyaline ascospores measuring (15–)18–23(–25) × (5–)7–8(–8.5) µm with a brown granular perispore.

KEY WORDS: *Acarospora fusca*, Arthoniales, Himalaya, new taxon, *Opegrapha pulvinata*, Opegraphaceae.

INTRODUCTION

The cosmopolitan, heterogeneous and polyphyletic genus *Opegrapha* Ach., belonging to the order Arthoniales Henssen ex D. Hawksw. & O.E. Erikss., comprises c. 300 species, and includes both lichenised and non-lichenised, lichenicolous and saprotrophic taxa (Ertz *et al.*, 2009; Frisch *et al.*, 2014; Diederich *et al.*, 2018). The genus is characterised by lirellate, non-stromatic, epruinose ascomata, an ascolocular hamathecium, a fully or partially carbonised excipulum, asci of the *Opegrapha vulgata*-type, and hyaline, pluriseptate, inamyloid ascospores often surrounded by gelatinous perispore which becomes brown and granulose at maturity (Ertz and Egea, 2007).

To date, 79 species of lichenicolous *Opegrapha* have been documented globally (Diederich *et al.*, 2018; Joshi, 2018, 2019; Navarro-Rosinés and Romero, 2020; Coppins *et al.*, 2021; Ertz *et al.*, 2021; Berger and Zimmermann, 2022), excluding *O. blakii* Ertz & Diederich which is now synonymised under *O. chionographa* Nyl. (Ertz *et al.*, 2023). The lichenicolous species of this genus usually exhibit narrow host specificity often being confined to a particular species, genus or family of lichen hosts (Vondrák and Kocourková, 2008).

During our lichenological surveys in alpine regions of Uttarakhand, we encountered a specimen of *Acarospora fusca* B. de Lesd. collected from Cold Deserts of Uttarakhand infected by a previously undescribed lichenicolous taxon referable to *Opegrapha*. Among the 79 known lichenicolous species of *Opegrapha*, none has been reported on hosts belonging to the family Acarosporaceae Zahlbr., including the genus *Acarospora* A. Massal. The species described herein differs from all known lichenicolous *Opegrapha* species and is thus proposed as new to science. This finding increases the number of lichenicolous *Opegrapha* species to 80.

MATERIAL AND METHODS

The specimen is preserved in the herbarium of the Rajasthan University Botanical Laboratory (RUBL). Macroscopic examinations were conducted using a Stereozoom dissecting microscope (Olympus SZX10). For microscopic analysis, an Olympus BX53 microscope fitted with Olympus differential interference contrast optics and an Olympus camera was used. Thin razor-blade hand cut sections for studying microscopic characters were prepared under a Stereozoom dissecting microscope. The chemistry of the ascomata was assessed using 10% potassium hydroxide (K), Lugol's iodine (I), and K followed immediately by I (K/I). The length, breadth and length/breadth ratio (l/b) of asci, ascospores are given as: (minimum–){$\bar{X}$–SD}–$\bar{X}$–{$\bar{X}$+SD}(–maximum), where "minimum" and "maximum" are the extreme values observed, $\bar{X}$ mean value, and SD the corresponding standard deviation, followed by the number of measurements (n). Measurements reported were made on material mounted in water or lactophenol cotton blue.

TAXONOMIC TREATMENT

Opegrapha acarosporae Y. Joshi, ***sp. nov.***

Fig. 1A-G

MycoBank No.: MB 861001

Type: **INDIA,** Uttarakhand, Chamoli district, Gamshali village, on way to Gamshali bugyal, alt. 3749 m, 30°46'10"N, 79°47'55"E, on thallus of *Acarospora fusca*, 13 October 2023, *S. Bisht* 00150 (holotype RUBL 21456).

Diagnosis: Similar to *Opegrapha pulvinata* in having ascomata in wart-like clusters, asci bearing 3-septate ascospores of similar dimensions [(18–)20–24(–26) × 6–8 µm]. However, the new taxon differs by the distinctly 4-spored asci vs 8-spored asci and host preference i.e.

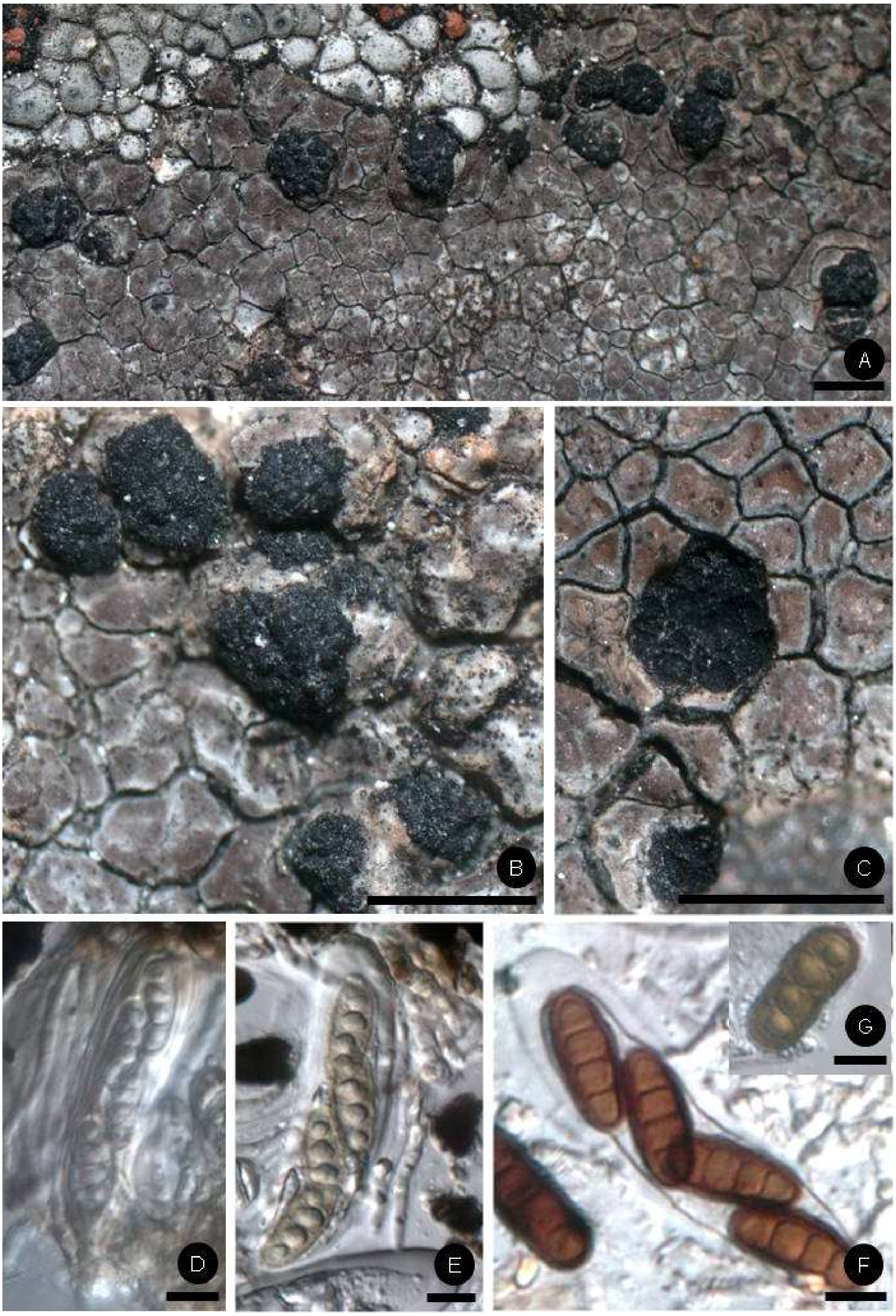

Fig. 1. ***Opegrapha acarosporae.*** **A.** Thallus of ***Acarospora fusca*** infected with ***O. acarosporae***; **B & C.** Magnified view of the thallus showing ascomata in groups; **D.** Tetraspored asci with immature, hyaline ascospores; **E & F.** Tetraspored asci with pale to dark brown verruculose sculptured ascospores; **G)** Mature ascospore with pale to olive brown verruculose sculpture. Scale bars: **A–C** = 1 mm; **D–G** = 10 μm.

Acarospora fusca vs *Catapyrenium* spp., *Dermatocarpon* spp., *Endocarpon miniatum*, *Staurothele* spp.

Description: ***Ascomata*** scattered, forming dense wart-like clusters, 0.5–1.0 mm across and 0.1–0.2 mm high (n = 10). Individual ascomata often difficult to discern, mainly pressed together in compact rounded wart-like clusters of 3–5, black, small, (0.2–)0.3–0.4(–0.5) mm in diam., semi-immersed, with widely exposed, rough, dark brown disc and a rough, often delicately fissured, black margin. ***Exciple*** well developed, entire, in longitudinal section 30–50 µm in diam., dark brown, K+ black. ***Epithecium*** well developed, 15–20 µm tall, K–, I+ first blue, then quickly red. ***Hymenium*** hyaline, 70–80 µm high, hymenial gel hemiamyloid, K/I+ blue. ***Subhymenium*** 15–25 µm high, hyaline to pale brownish, K−. ***Paraphyses*** sparingly branched and anastomosed, 1.5–2.5 µm in diam., apically enlarged to pigmented tips measuring 3.5–5 µm in diam. and covered with brownish granular pigments. ***Asci*** broadly cylindrical to subclavate, shortly pedicellate, 4-spored, (45–)53.5–*65.1*–76.7(–90) × (7–)10.3–*12.9*–15.5(–18) µm (n = 50), wall I–, K/I– except for an apical ring that is K/I+ blue around the top of the ocular chamber and fading in the adjacent parts of the endoascal wall. ***Ascospores*** uniseriately arranged, hyaline, 3-septate, (15–)18.9–*21.1*–23.2(–25) × (5–)7.0–*7.7*–8.3(–8.5) µm, l/b (1.9–)2.5–*2.8*–3 (n = 125), with a distinct perispore sheath c. 1 µm thick, giving rise to a pale to brown verruculose sculpture with age. ***Conidiomata*** not observed.

Host: On the thallus of *Acarospora fusca.* The new species induces distinct wart-like clusters and does not visibly damage the host; therefore, it is considered a commensalist.

Ecology and distribution: Although in Uttarakhand, *Acarospora fusca* is a quite common crustose lichen found on rocks in exposed and open habitats of the upper montane to the alpine belt in the Himalayas. However, the infections by *O. acarosporae* remained very rare and this is for the first time that the authors have reported a specimen, despite examining hundreds of freshly collected specimens of *A. fusca* as well as those lodged in herbarium of LWG.

Etymology: Named after *Acarospora*, the host lichen genus.

Remarks: The new taxon is very close to *Opegrapha pulvinata* Rehm in having ascomata in wart-like clusters and asci bearing 3-septate ascospores of similar dimensions [(18–)20–24(–26) × 6–8 µm]. However, it differs in having 4-spored asci and host preference. *Opegrapha pulvinata* has generally 8-spored asci, however, occasionally 4–6 spored asci have also been reported, but it colonises mainly on *Dermatocarpon* spp., as well as on *Catapyrenium* spp., *Endocarpon* and *Staurothele* spp. (Coppins, 1987; Clauzade *et al.*, 1989; Hafellner, 1994; Puntillo, 1996; Orange, 1998; Kondratyuk and Kudratov, 2002; Brackel, 2014; Nimis, 2016; Navarro-Rosinés and Romero, 2020; Roux *et al.*, 2020), while the new taxon has distinctly 4-spored asci and colonises *Acarospora fusca.*

Opegrapha opaca Nyl. which also has ascomata in wart-like clusters, and 4-spored asci with 3-septate ascospores differs in the host choice (*Verrucaria* Scop. vs *Acarospora*), a smaller hymenium (48–55 vs 70–80 µm), smaller and narrower asci and ascospores [42–50 × (11.5–)12.5–14.5 vs (45–)53.5–*65.1*–76.7(–90) × (7–)10.3–*12.9*–15.5(–18) µm; and (12.5–)13.4–15.3(–19) × (3.4–)3.8–4.8(–6) vs (15–)18.9–*21.1*–23.2(–25) × (5–)7.0–*7.7*–8.3(–8.5) µm, respectively] (Cannon *et al.*, 2021; Coppins *et al.*, 2021).

Opegrapha brevis Coppins has also 4-spored asci but differs from the new species in having rarely clustered ascomata, smaller ascospores [(14–)15–18 × 4.5–5(–6) µm] and host preference (*Crutarndina petractoides* (P.M. Jørg. & Brodo) Parnmen, Lücking & Lumbsch) (Coppins *et al.*, 2021).

Opegraphoidea staurothelicola Fink, described from the USA on *Willeya diffractella* (Nyl.) Müll. Arg. differs in having slightly smaller ascospores [(15–18 × 5–6(–7) µm when hyaline, or 16.5–19 × 6.5–7 µm when brown] and host preference (Hedrick, 1933; Navarro-Rosinés and Romero, 2020).

ACKNOWLEDGMENTS

The authors would like to thank Dr. Paul Diederich and an anonymous reviewer for their kind suggestions and critical reviewing. They would also like to thank The Head, Department of Botany, University of Rajasthan, Jaipur, Rajasthan for providing laboratory facilities. Financial support for this research was graciously provided by the Science and Engineering Research Board (Special Call for Proposals) [SCP/2022/000072]. YJ and SB extend their appreciation to the Principal Chief Conservator of Forests (HoFF), Uttarakhand, for granting permission to collect samples, as per the official communication referenced in Letter no. 2634/5-6 dated 16 May 2023.

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