

Morphological Characterization of Four Species of the Corticioid Genus *Aleurodiscus* sensu lato from Shimla District of Himachal Pradesh, India

Maninder Kaur¹, Ramandeep Kaur², Avneet Pal Singh^{3*} and Gurpaul Singh Dhingra³

¹PG Department of Botany, Dev Samaj College for Women, Ferozepur City - 152 002, Punjab, India.

²Department of Botany, Baba Farid College, Bathinda - 151 001, Punjab, India.

³Department of Botany, Punjabi University, Patiala - 147 002, Punjab, India.

*Corresponding author Email: avneetbot@gmail.com; avneet@pbi.ac.in

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ABSTRACT

Four species of the corticioid genus *Aleurodiscus* Rabenh. (*Russulales*, *Stereaceae*) namely, *A. cerussatus* (Bres.) Höhn. & Litsch., *A. himalaicus* K. Maninder, Avneet P. Singh, Dhingra & Ryvardeen, *A. lapponicus* Litsch. and *A. lividocoeruleus* (P. Karst.) P.A. Lemke are characterized based on their morphological features. All the four species are new records for Shimla district of Himachal Pradesh, India. Of these, *Aleurodiscus cerussatus* is being described for the first time from the state of Himachal Pradesh. It is pertinent to mention here that one species i.e. *A. himalaicus* has already been published as a new species by the authors previously.

Keywords: Fungi, *Basidiomycota*, diversity, taxonomy, wood rot, Himalaya.

INTRODUCTION

Aleurodiscus Rabenh. is a globally distributed genus of the wood inhabiting corticioid fungi. The members of this genus are peculiar in having resupinate, effuse, effused-reflexed or pulvinate basidiocarp with pinkish, orange, grey, creamish or white coloured hymenial surface (Wu *et al.*, 2001). The hymenial surface generally varies from smooth to tuberculate to somewhat cracked. The hyphal system is monomitic or dimitic with nodose or simple-septate generative hyphae and skeletal hyphae. The members of the genus are further characterized by the presence or absence of different types of ancillary structures (gloeocystidia, acanthophyses/acanthocystidia, dendrophyses, pseudocystidia, etc.), medium to large sized, clavate, 4-sterigmate basidia and smooth to ornamented, thin or thick-walled, amyloid basidiospores (Núñez and Ryvardeen, 1997; Rajchenberg *et al.*, 2021). The morphology as well as DNA sequence based molecular phylogenetic studies (Núñez and Ryvardeen, 1997, Wu *et al.*, 2001; Hibbet *et al.*, 2007; Kirk *et al.*, 2008; Rajchenberg *et al.*, 2021; MycoBank, 2024), have supported the placement of the genus in the family *Stereaceae* of order *Russulales* (*Agaricomycetes*, *Agaricomycotina*, *Basidiomycota*). The genus has been reported worldwide and about two hundred legitimate names have been listed in the online repository

Mycobank (2024). As far India is concerned, the genus has been documented with eleven species from different parts of Eastern Himalaya, Himachal Pradesh, Maharashtra and Uttarakhand (Thind and Rattan, 1973; Rattan, 1977; Ranadive *et al.*, 2011; Ryvardeen *et al.*, 2012; Sharma, 2012; Dhingra *et al.*, 2011; 2014; Kaur *et al.*, 2014; Samita, 2014 & Sanyal, 2014).

During the exhaustive fungal forays conducted across the length and breadth of Shimla district of Himachal Pradesh from 2012 to 2014, we collected a large number of specimens of the corticioid fungi. Of the collected basidiocarp specimens, sixteen specimens were identified as four species of the genus *Aleurodiscus sensu lato* based on their morphological features and comparison with the literature (Rattan, 1977; Bernicchia and Gorjón, 2010; Sharma, 2012; Priyanka, 2012; Dhingra *et al.*, 2014; Kaur *et al.*, 2014; Samita, 2014; Sanyal, 2014; Kaur, 2018). All the four species described i.e. *Aleurodiscus cerussatus* (Bres.) Höhn. & Litsch., *A. himalaicus* K. Maninder, Avneet P. Singh, Dhingra & Ryvardeen, *A. lapponicus* Litsch. and *A. lividocoeruleus* (P. Karst.) P.A. Lemke are being recorded and described for the first time from Shimla district (Himachal Pradesh). Among these *Aleurodiscus cerussatus* is being described for the first time from the state of Himachal Pradesh. All the specimens have been deposited at the

Herbarium, Department of Botany, Punjabi University, Patiala (PUN). The colour codes used in the descriptions are as per Kornerup and Wanscher (1978).

TAXONOMIC DESCRIPTIONS

1. *Aleurodiscus cerussatus* (Bres.) Höhn. & Litsch., Sitzungsberichte der Kaiserlichen Akademie der Wissenschaften Math.-naturw. Klasse Abt., **1116**:760-807, 1907.

– *Corticium cerussatum* Bres., Fungi Tridentini, **2(8-10)**:37, 1892. **Figure 1**

Basidiocarp resupinate, adnate, effused, up to 260 μm thick in section; hymenial surface smooth to somewhat cracked, orange white to pale orange to greyish orange when fresh and pale red to greyish red on drying; margins pruinose, paler concolorous, or indeterminate.

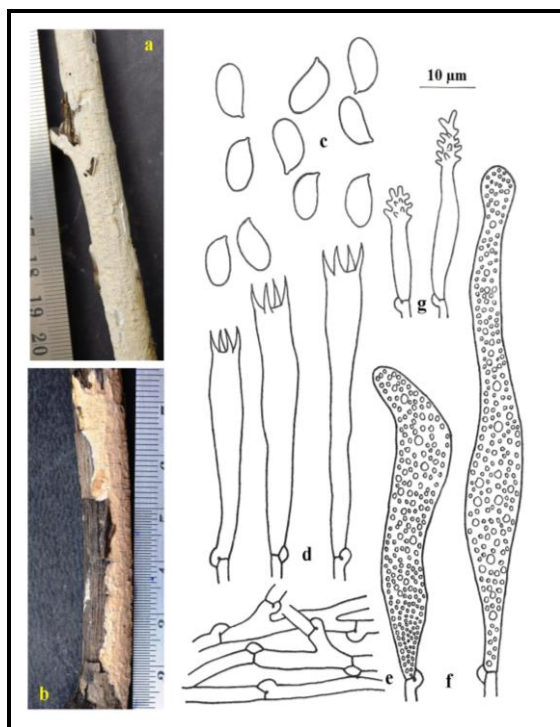


Figure 1: *Aleurodiscus cerussatus*. **a**, Basidiocarp showing fresh hymenial surface; **b**, Basidiocarp showing dried hymenial surface; **c-g**, Line diagrams showing outline of basidiospores (**c**), basidia (**d**), generative hyphae (**e**), gloeocystidia (**f**) and acanthophyses (**g**).

Hyphal system monomitic. Generative hyphae up to 3 μm wide, nodose-septate, branched, thin-walled. Subicular hyphae horizontal. Subhymenial hyphae vertical. Sterile elements of two types. Gloeocystidia subfusiform, 55–93 \times 9–

11 μm , thin-walled, with oily contents stained in sulphovanilin, nodose-septate at the base. Acanthophyses abundant, hyphoid, with protuberances at the apex, nodose-septate at the base. Basidia clavate, 31–50 \times 5–7 μm , somewhat sinuous, nodose-septate at the base; sterigmata 4 up to 5.6 μm long. Basidiospores ellipsoid, 6.7–9 \times 4–5.2 μm , smooth, thin-walled, smooth, amyloid, acyanophilous.

Material examined: India, Himachal Pradesh - Shimla, about 4 km from Chail towards Kufri, on angiospermous wood, Maninder 8984 (PUN), August 3, 2013.

Remarks: It is being described for the first time from Himachal Pradesh. The only previous report from India is by Samita (2014) from Uttarakhand.

2. *Aleurodiscus himalaicus* Maninder K., Avneet P. Singh, Dhingra & Ryvarden, Synopsis Fungorum, **32**:5, 2014. **Figure 2**

Basidiocarp resupinate, adnate, effused-reflexed, up to 700 μm thick in section; hymenial surface smooth, orange red to greyish red when fresh and brownish orange to light brown on drying; margins paler concolorous, generally reflexed. Abhymenial surface velvety due to projecting basal hyphae, yellowish white when fresh and no noticeable change on drying; margins paler concolorous generally reflexed. Hyphal system monomitic. Generative hyphae nodose-septate or simple-septate, branched; subicular hyphae horizontal, compactly arranged, hyphae next to substrate up to 4.3 μm wide, thick-walled, simple-septate, somewhat projecting out in the reflexed region; followed by another zone of parallel hyphae with oily contents, nodose-septate; subhymenial hyphae vertical, loosely interwoven, up to 3.1 μm wide, thin-walled, with oily contents, nodose. Sterile elements of three types. Cystidia subfusiform, 48–83 \times 6–10 μm , moniliform towards apical region, nodose-septate at the base. Dendrohyphidia scattered in the hymenium, irregularly branched. Acanthophyses 32–50 \times 8–10 μm , abundant in the hymenium, with oily contents and protuberances at the tip, nodose-septate at the base. Basidia clavate, up to 140 \times 30 μm , with oily contents, nodose-septate at the base; sterigmata 4, up to 25 μm long. Basidiospores ovoid to subfusiform, 25–42 \times 16–24 μm , thick-walled, echinulate (spines visible only in Melzer's reagent), amyloid, apiculate with prominent apiculus, acyanophilous.

Material examined: India, Himachal Pradesh - Kufri, on fallen stick of *Quercus leucotrichophora*, Avneet 5985 (PUN), August 1, 2013; Kufri, on fallen stick of *Q. leucotrichophora*, Dhingra 5986 (PUN), August 1, 2013; about 1 km from Shogli towards Tara devi temple, on stump of *C. deodara*, Avneet 7363 (PUN), August 1, 2013.

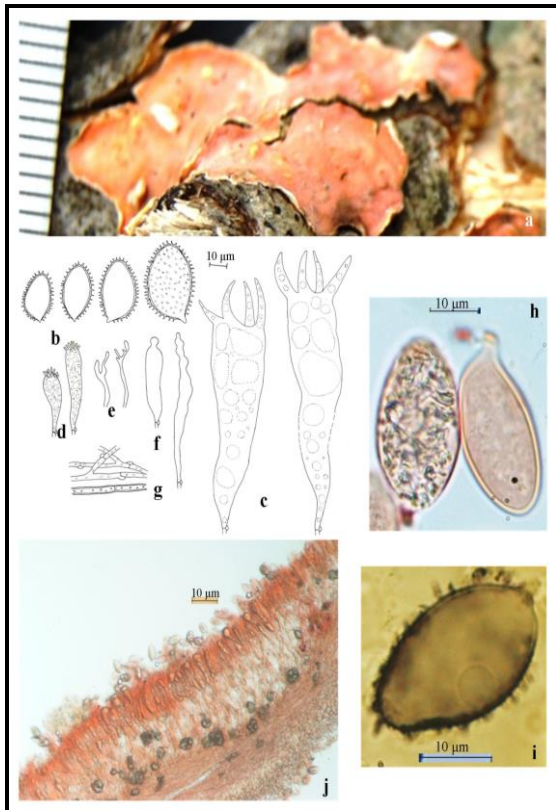


Figure 2: *Aleurodiscus himalaicus*. **a**, Basidiocarp showing hymenial surface; **b-g**, Line diagrams showing outline of basidiospores (**b**), basidia (**c**), acanthophyses (**d**), dendrohyphidia (**e**), cystidia (**f**) and generative hyphae (**g**); **h-j**, Photomicrographs showing basidiospores (**h**), basidiospore in melzer's reagent (**i**) and vertical section of the basidioma showing hymenium and subhymenium (**j**).

Remarks: This species is already published by the authors as new species in Synopsis Fungorum (Kaur *et al.*, 2014). It resembles *A. gigasporus* Ginns & Bandoni, known only from China, in having large-sized basidiospores, basidia, cystidia and dendrohyphidia. However, is different from the same in the color of the hymenial surface (orange red to greyish red in comparison to ochraceous), ovoid to subfusiform basidiospores in comparison to broadly ellipsoid, visibility of spines only in Melzer's reagent, acanthophyses with protuberances only at and tip.

3. *Aleurodiscus lapponicus* Litsch., Annales Mycologici 42(1-2): 11, 1944. **Figure 3**

Basidiocarps resupinate, loosely adnate, effused, up to 500 μm thick in section; hymenial surface smooth, pale orange to greyish orange when fresh and no drastic change on drying; margins pruinose, paler concolorous, or indeterminate.

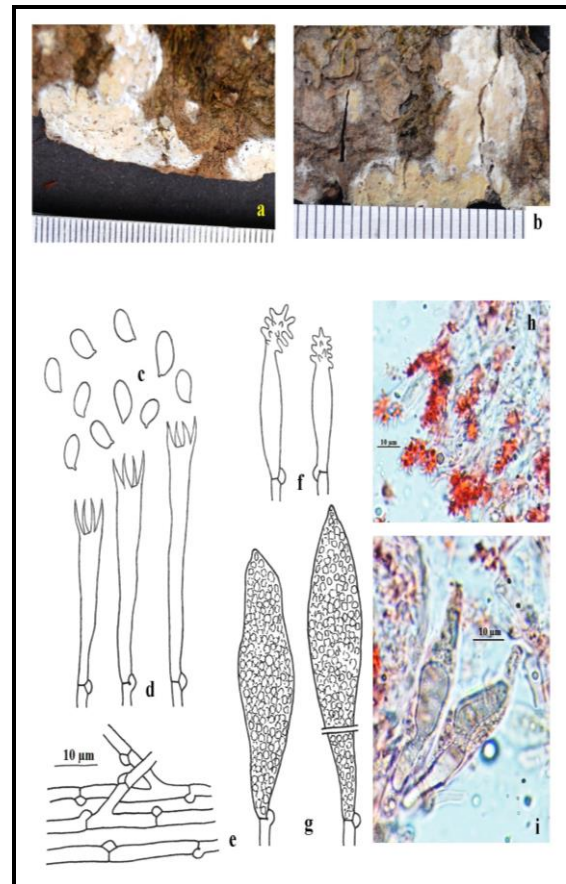


Figure 3: *Aleurodiscus lapponicus*. **a**, Basidiocarp showing fresh hymenial surface; **b**, Basidiocarp showing dried hymenial surface; **c-g**, Line diagrams showing outline of basidiospores (**c**), basidia (**d**), generative hyphae (**e**), acanthophyses (**f**), gloeocystidia (**g**); **h-i**, Photomicrographs showing acanthophyses (**h**) and gloeocystidia (**i**)

Hyphal system monomitic. Generative hyphae up to 3.4 μm wide, nodose-septate, branched, thin-walled. Subicular hyphae horizontal. Subhymenial hyphae vertical. Sterile elements of two types. Gloeocystidia subfusiform, 43–60 \times 9–12 μm , numerous, sinuous, embedded, thin-walled, with oily contents stained in sulphovanilin, nodose-septate at the base. Acanthophyses abundant, hyphoid, apically with numerous finger-like protuberances, nodose-septate at the base. Basidia narrowly clavate, 24–39 \times 4.3–5.6 μm , nodose-

septate at the base; sterigmata 4, up to 8 µm long. Basidiospores ellipsoid to broadly ellipsoid, 5.2–7.5 × 3.7–5 µm, smooth, thin-walled, amyloid, acyanophilous.

Material examined: India, Himachal Pradesh - Shimla, Chaupal, on sticks of *Pinus wallichiana*, Dhingra 7283 (PUN), August 16, 2012; Chaupal, on sticks of *P. wallichiana*, Maninder 8983 (PUN), August 16, 2012; about 4 km from Chaupal towards Khirki, on bark of *P. wallichiana*, Maninder 7281 (PUN), August 17, 2012; about 4 km from Chaupal towards Khirki, on sticks of *Berberis vulgaris*, Avneet 7285 (PUN), August 17, 2012; Seoni, on angiospermous sticks, Maninder 7284 (PUN), July 30, 2013; Hattu peak, on stump of *Cedrus deodara*, Maninder 7282 (PUN), September 2, 2014.

Remarks: It is being described for the first time from district Shimla. Previously it was reported from district Kinnaur of Himachal Pradesh (Kaur, 2012 & Dhingra *et al.*, 2014) and Uttarakhand (Samita, 2014).

4. *Aleurodiscus lividocoeruleus* (P. Karst.) P.A. Lemke, Canadian Journal of Botany, **42**:253, 1964.

= *Corticium lividocoeruleum* Karsten, Notiser ur Sällskapetets pro Fauna et Flora Fennica Förhandlingar, **9**:370, 1868.

Figure 4

Basidiocarps resupinate, adnate, effused, up to 1 mm thick in section; hymenial surface smooth to somewhat tuberculate, cracked, brownish grey when fresh and bluish grey on drying; margins pale yellow, or determinate. Hyphal system monomitic. Generative hyphae nodose-septate, thin-walled; subicular hyphae horizontal, up to 4 µm wide, less branched; subhymenial hyphae vertical, up to 3.3 µm wide, more branched. Sterile elements of two types. Gloeocystidia numerous, subcylindrical, 69–132 × 7–11 µm, often sinuous, thin-walled, with oily contents stained in sulphovanilin, nodose-septate at the base. Acanthophyses numerous, hyphoid, with short apical protuberances, nodose-septate at the base. Basidia clavate to narrowly clavate, 20–41 × 4.7–5.2 µm, nodose-septate at the base; sterigmata 4, up to 5.5 µm long. Basidiospores subcylindrical, 5.5–9 × 3–4 µm, smooth, thin-walled, amyloid, acyanophilous.

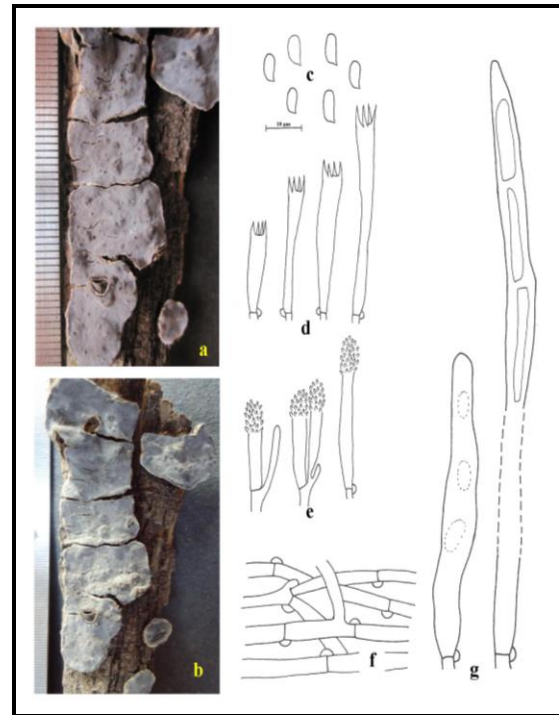


Figure 4: *Aleurodiscus lividocoeruleus*. **a.** Basidiocarp showing fresh hymenial surface; **b.** Basidiocarp showing dried hymenial surface; **c-g.** Line diagrams showing outline of basidiospores (**c**), basidia (**d**), acanthophyses (**e**), generative hyphae (**f**) and gloeocystidia (**g**).

Material examined: India, Himachal Pradesh - Shimla, about 4 km from Baghi towards Narkanda, on decaying stump of *Cedrus deodara*, Maninder 7286 (PUN), August 19, 2012; about 4 km from Baghi towards Narkanda, on stump of *Abies pindrow*, Maninder 7455 (PUN), August 19, 2012; about 4 km from Baghi towards Narkanda, on stump of *Abies pindrow*, Avneet 7456 (PUN), August 19, 2012; about 4 km from Baghi towards Narkanda, on stump of *Abies pindrow*, Maninder 7457 (PUN), August 19, 2012; about 4 km from Kufri towards Chail, on sticks of *Cedrus deodara*, Avneet 7288 (PUN), August 1, 2013; Kufri, on stump of *Quercus leucotrichophora*, Dhingra 7287 (PUN), September 4, 2014.

Remarks: This species is being redescribed from district Shimla. Previously, it was reported (from Himachal Pradesh) by Dhingra *et al.* (2014) as *Acanthophysellum lividocoeruleum*.

Key to the species of genus *Aleurodiscus* from Shimla district

- 1. Hyphae without clamps.....2
- 1. Hyphae with clamps.....3

2. Basidiomata greyish orange to dark brown..... *A. amorphous**
2. Basidiomata reddish white to pale red to orange grey..... *A. oakesii**
3. Basidiospores echinulate4
3. Basidiospores smooth5
4. Basidiospores ovoid to subfusiform..... *A. himalaicus*
4. Basidiospores broadly ellipsoid to ovoid.....*A. taxicola**
5. Basidiospores subcylindrical.....*A. lividocoeruleus*
5. Basidiospores ellipsoid.....6
6. Basidiospores ellipsoid, 6.7-9 × 4-5.2.....*A. cerussatus*
6. Basidiospores ellipsoid to broadly ellipsoid, 5.2-7.5×3.7-5.....*A. lapponicus*

*Species reported by earlier workers from Shimla district but not encountered during the course of

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