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Pyrenula awasthii sp. nov., containing Lichexanthone and Anthraquinone from India

Gaurav Kumar Mishra*, Sanjeeva Nayaka, Dalip Kumar Upreti and Rajesh Bajpai

Lichenology Laboratory, CSIR-National Botanical Research Institute, Rana Pratap Marg, Lucknow-226001, Uttar Pradesh, India

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Corresponding author:
e-mail: gmishrak@gmail.com

ABSTRACT

Pyrenula awasthii is described as new to science. The new species is characterized by the corticate UV+ yellow thallus, yellow to orange K+ red medulla, solitary perithecia immersed in thalline warts, non-inspersed hamathecium and muriform 40–57 × 17.5–25 µm ascospores. The new species is so far known from Arunachal Pradesh and Manipur states.

INTRODUCTION

Pyrenulaceae is one of the well-studied, diverse and large microlichen families of lichenized Ascomycota. The genus *Pyrenula* forms the core genus of the family, comprising more than 220 species of which 85 are known to occur in India (Aptroot 2012; Aptroot et al. 2013; Mendonca et al. 2016; Mishra et al. 2020). The genus is characterized by whitish, brownish to yellowish, corticated or ecorticate, UV + yellow or UV– thallus, with or without pseudocyphellae, presence or absence of lichexanthone and anthraquinones; trentepohlioid alga; whitish to yellow-orange or red pigmented medulla; perithecioid ascomata. The perithecia may be single or aggregated with a uniformly carbonized wall; when aggregated may have common walls, separate ostiole or common ostioles; hamathecium with or without oil globules; asci uniseriate or biseriate; ascospores elongate, ellipsoid or fusiform, grey to brown, with or without cilia, transversely septate to sub-muriform or muriform with rounded or pointed ends, rounded lumina, diamond-shaped or elongated, directly against the exposed wall or sometime by layer of endospore, and presence or absence of dark bands between the septa (Aptroot 2012; Mendonca et al. 2016; Gueidan et al. 2016). *Pyrenula* is widespread and usually found on smooth, shaded bark in tropical and subtropical regions. Some taxa also grow abundantly in lower temperate regions, as in the case of the Himalayas.

India, a mega-diversity country, exhibits rich diversity of lichens and has a large number of endemic species (Singh and Sinha 2010). The pyrenocarpous lichens form a major portion of the lichen biota of India, with 382 species under 49 genera and 12 families. Within India, Western Ghats and North-eastern India have a rich diversity of pyrenocapous lichens represented by 210 and 295 species, respectively. A large number of *Pyrenula* specimens collected from different parts of the country are mentioned in revisionary and monographic studies (Upreti, 1990, 1991a,b, 1992, 1993, 1998). During recent field trips in different localities of North-eastern India, many pyrenocarpous lichens were collected. Out of these few specimens exhibited UV+ yellow and KOH+ reddish thallus. Such a combination is rare in this group of lichens and detailed investigation resulted in a hitherto undescribed species. It can be notedw that Aptroot (2012), Aptroot et al. (2013) and Mendonca et al. (2016) described several taxa of *Pyrenula* based on KOH+ purple or UV+ yellow thallus.

MATERIALS AND METHODS

The lichen specimens included in the present study were collected from Arunachal Pradesh and Manipur during the year 2018-19 and preserved in LWG. The morphological and anatomical characters were examined using stereo zoom Leica S8APO and light DM2500 microscopes attached with the camera. All anatomical measurements were recorded in plain water, 10% KOH was used for a detailed study of asci and ascospores and UV fluorescence was observed in the UV cabinet under a long wavelength. For the spot tests, the routine reagents of K, C and P were used. Identification of lichens substances was done by thin layer chromatography

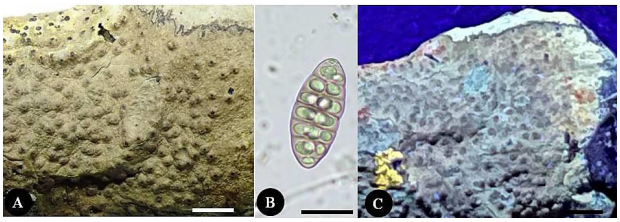

Fig 1. A-C, *Pyrenula awasthii* (holotype, LWG). A. Habit, B. Ascospores, C. Habit with UV. Scale bar: A–C = 0.5 mm; B = 50 µm

(TLC) in solvent system C following Orange et al. (2001).

***Pyrenula awasthii* G.K. Mishra, S. Nayaka & Upreti sp. nov. Fig. 1(A-C)**

MycoBank No.: MB 842349

Diagnosis: *Pyrenula awasthii* has UV+ yellow and K+ reddish thallus, yellow to orange medulla, immersed solitary perithecia in thalline warts, non-inspersed hamathecium, brown, muriform, 40–57 × 17.5–25 µm ascospores.

***Type*:** India, Manipur, Bishnupur district, Keibul Lamjao National Park guest house area, (N 24°28.724, E 93°48.135), on bark, alt. 786 m, 11-06-2018, *S. Nayaka, S. Joseph, R. Ngangom* 18-028568 (LWG-holotype).

Thallus corticolous, crustose, brownish to grey, uneven, verruculose due to presence of packets of crystals, pseudocyphellate, corticate, lacking prothallus and pruina; medulla yellow to orange around perithecia; alga trentepohlioid. Perithecia many, dispersed, simple, immersed in thalline warts, subglobose to hemispherical, 0.5–0.8 mm diam., with thick thalline cover up to the ostiole; ostioles apical, black, without pruina. Perithecial wall uniform (60−70 µm thick), with packets of crystals, not spreading laterally; hamathecium not inspersed, K−, I−; asci 8-spored; ascospores brown, muriform, 8 × 2–4 locular, distoseptate, 7 eusepta, without constrictions at the septa, fusiform with rounded ends, 40–57 × 17.5–25 µm, lumina mostly rounded or irregularly elongated. Pycnidia not seen.

Chemistry: Thallus C−, K+ reddish, P−, UV+ yellow; unknown anthraquinone detected in TLC at Rf class 7.

Etymology: The species is named after Dr. Dharani Dhar Awasthi, a distinguished Indian Lichenologist, during his birth centenary celebration.

***Distribution and ecology*:** *Pyrenula awasthii* is distributed in the states of Arunachal Pradesh and Manipur, between altitudes of 700–1738 m where it grows on smooth barked trees.

Remarks: The new taxon is characterized by the corticate UV+ yellow thallus, yellow to orange K+ red medulla, solitary perithecia immersed in thalline warts, non-inspersed hamathecium and muriform 40–57 × 17.5–25 µm ascospores. The new taxon shows close resemblance with *Pyrenula endocrocea* Aptroot, which differs in having smooth thallus, lacking pseudocyphellae and lichexanthone, oil globules in hamathecium, with conical emergent perithecia and slightly smaller ascospores (30–50 × 13–19 µm) (Aptroot 2012). Apart from new taxon, *P. endocrocea* is the only other species in the genus having anthraquinone pigments in medulla while all the other species have anthraquinone either on thallus surface or on the perithecia (Aptroot et al. 2012; Aproort 2021).

Additional specimen examined: India, Arunachal Pradesh, Lower Subansiri district, Ziro valley, Manipoliang, (N 27°52’43.8”, E 93°86’62.6”), on bark, alt. 1738 m, 03-03-2019, *D.K. Upreti, R. Bajpai & B.N. Singh* 19-036291/B (LWG).

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