A NEW SPECIES OF PLECTOCARPON (ROCELLACEAE, LICHENISED ASCOMYCETES) FROM INDIA

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A new gall-inducing and lirellate lichenicolous fungus, Plectocarpon diedertzianum Y. Joshi, Upadhyay et Chandra, is described from Kumaun Himalayan regions of India colonising thallus of various parmeliod lichens (Flavoparmelia caperata, Myelochroa aurulenta, Parmotrema crinitum, P. melanotherix, P. reticulatum, Punctelia subrudecata). The new species is characterised by black, epruinose rounded to lirellate ascomata with a carbonised surface and a ±lunate pseudomargin, as well as a carbonised, sterile stromatic tissue, 4-spored asci and 3-septate hyaline ascospores.

Key words: Arthoniales, lichens, lichenicolous fungi, parmeliod, taxonomy

INTRODUCTION


Since the monograph of Ertz et al. (2005) six new species have been described in the genus Plectocarpon: five lichenicolous species on hosts belonging to Dirinaria (Ertz and van den Boom 2012), Hypogymnia (Zhurbenko et al. 2008), cf. Siphula (Etayo and Sancho 2008), Stereocaulon (Kukwa et al. 2012)
and Usnea (Etayo 2007), and one lichenised species, P. syncesioides Cáceres et Lücking (Cáceres 2007).

Generally most of the species of this genus parasitises members of Lobariaceae and Nephromataceae (Peltigerales; Kukwa et al. 2012), but members of Cladoniaceae, Ramalinaceae, Parmeliaceae, Physciaceae and Sphaerophoraceae (Lecanorales; Diederich and Etayo 1994, Ertz et al. 2005, Etayo 2007, Etayo and Sancho 2008, Ertz and van den Boom 2012, Zhurbenko et al. 2008) are also parasitised by species of this genus.

Till now only six species of this genus have been reported on members of Parmeliaceae: Plectocarpon encausticum (Nyl.) R. Sant. (on Brodoa intestiniformis), P. hypogymniae (on Hypogymnia bitteri), P. melanohaleae Christnach, Ertz et Diederich (on Melanohalea ushuaiensis), P. usnea Dieberich et Etayo (on Usnea exasperata), P. usneaustralis Etayo (on Usnea sp.) and an undescribed species on Usnea (Ertz et al. 2005, Zhurbenko et al. 2008). In the present manuscript, we are describing a new species of Plectocarpon from India, apparently parasitising various species of parmelioi lichens, thus raising the number of Plectocarpon species to 39 and number of infected Parmeliaceae members to 7.

MATERIALS AND METHODS

The samples were collected from Binsar Wildlife Sanctuary, Dhaua Devi, Futsil and Tapogiri forests situated in Almora, Nainital and Pithoragarh districts of Kumaun Himalaya, Uttarakhand. The methods of study are same as those of Ertz et al. (2005). Morphological features of specimens were analysed by using a stereozoom dissecting microscope (Olympus SZ2-ILST), while anatomy was studied on hand-cut sections mounted in water, 10% KOH solution (K) and Lugol’s solution without (I) or with (K/I) KOH pre-treatment under Olympus CX21iLEDFS1 microscope. Spores were measured in water using Olympus CX21iLEDFS1 microscope. Measurements are given as follows: (minimum–) mean-standard deviation – mean – mean+standard deviation (~maximum) followed by the number of measurements (n). For other characters, the minimum and the maximum values are given.

RESULTS AND DISCUSSION

Plectocarpon diedertzianum Y. Joshi, Upadhyay et Chandra, spec. nova
(Fig. 1A–G)

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Similar to Plectocarpon opegraphoideum, but differs in having 4-spored asci, narrower ascospores ((2.5–)3.0–3.5 μm) and different host.

A NEW SPECIES OF PLECTOCARPON FROM INDIA


Ascomata “apothecia”, gall-inducing, developing apically on upper surface of the thallus, dispersed to more often confluent, strongly convex, rounded to angular, prominent, blackish-brown, surface matt, cracked and epruinose, surface from the very beginning coarsely wrinkled, later with distinct labyrinth form or lirellate ornamentation (Fig. 1A–C), 42.5–62.5 (100) μm in diameter, thalline margin restricted to the basal part. Stroma multilocular (Fig. 1D), globose, single to confluent, surrounded by orange-brown to black (in thick sections) sterile prosoplectenchymatous stromatic tissue, K+ olive-brownish, N+ reddish brown, without immersed crystals (pigment: Atra-brown, see Ertz et al. 2005, Meyer and Printzen 2000); (50–)66.81–75.50–84.18 (100) × (62.5–122.42–134–145.57 (212.5) μm (n = 50), with carbonised surface (Fig. 1D–E). Hymenium not or slightly exposed, hyaline, I+ blue, K/ I+ blue, entirely filling the loculi, 100–130 μm high, usually divided in several loculi separated by sterile stromatic tissue (Fig. 1D); hymenial gel K/I+ blue. Ephymenium brownish, I+ blue, K/I+ blue. Paraphyses abundant, richly branched and anastomosing, septate, 1.5–3.0 μm thick, apical cells slightly swollen. Asci Opegrapha-type, clavate, (2–)4-spored, (65–)70–90 (100) × 15–20 μm, distinct apical K/I+ blue ring, wall K/I– (Fig. 1F). Ascospores overlapping in 2–3 rows in an ascus, hyaline, fusiform to narrowly skittle-shaped, smooth, (1–)3-septate, slightly constricted at the septa, all cells are more or less equal in length, (10–)10.88–14.72–18.55 (20) × (1.5–2.50–3.33–5.0 (5.15) μm (n = 50), perispore distinct (especially in young ascospores), hyaline, up to 1 μm thick (better seen in K), brown pigmentation not observed (Fig. 1F–G). Pycnidia not observed.

Distribution and habitat: The species is reported from temperate regions of Kumaun Himalaya, Uttarakhand, where it is growing in Quercus-dominated Binsar Wildlife Sanctuary, Dhaula Devi, Futsil and Tapogiri forests on thallus of Flavoparmelia caperata, Myelochroa aurulenta, Parmotrema crinitum, P. melanthrix, P. reticulatum and Punctelia subrudecta.

Remarks: The new species is mainly characterised by black coloured lirellate ascomata having carbonised stromatic tissue and narrow ascospores ((2.5–)3.22–3.42–4.07 (5.0)). Plectocarpon opegraphoides Christnach, Ertz, Diederich et Wedin and P. aff. pseudosticta Féé, two closely related species differ from the new taxon in having I+ blue quickly turning red hymenium, (4–)6-spored ascis, having broader ascospores ((4–)4.3–5.1 (5.5) and 5.1–5.9 μm, respectively) and different hosts (Pseudocyphellaria homeocephylla and P. multifida for Plectocarpon opegraphoidem, while Pseudocyphellaria intricata and P. thouarsii for Plectocarpus aff. pseudosticta).

In having rounded and warty ascomata, the new taxon resembles *Plectocarpon encausticum* (Nyl.) R. Sant., *P. latisporum* Ertz, Diederich et Wedin and *P. bunodophori* Wedin, Ertz et Diederich, but these species differ from the new taxon in having different hymenium I-test, number of spores in asci and ascospore size (see Ertz et al. 2005).

The six previously known lichenicolous species of this genus (*Plectocarpon encausticum, P. hypogymniae, P. melanohaleae, P. usneae, P. usneaustralis* and

![Fig. 1. *Plectocarpon diedertzianum* holotype. A = Thallus with gall (scale bar = 1 mm), B = enlarged view of gall (scale bar = 1 mm), C = lirellate apothecia (scale bar = 1 mm), D = transversal section of stroma (scale bar = 50 μm), E = enlarged view, vertical section through apothecium (scale bar = 100 μm), F = spores in ascus (scale bar = 10 μm), G = spores (scale bar = 10 μm)
## Table 1

A comparative analysis of seven *Plectocarpon* species colonising parmelioi lichens

<table>
<thead>
<tr>
<th>Characteristic features</th>
<th><em>P. dieder-tziànium</em></th>
<th><em>P. encausticum</em></th>
<th><em>P. hypo-gymniae</em></th>
<th><em>P. melanohaleae</em></th>
<th><em>P. usneae</em></th>
<th><em>P. usneaustrialis</em></th>
<th><em>P. sp.</em></th>
</tr>
</thead>
<tbody>
<tr>
<td>Gall-forming</td>
<td>yes</td>
<td>yes</td>
<td>no</td>
<td>yes</td>
<td>no</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>Thalline pseudomargin</td>
<td>±present</td>
<td>present (thick)</td>
<td>absent</td>
<td>no</td>
<td>absent</td>
<td>±present</td>
<td>present</td>
</tr>
<tr>
<td>Ascomatal surface</td>
<td>warded to liliate</td>
<td>warded</td>
<td>warded to liliate</td>
<td>smooth to rarely warded</td>
<td>smooth</td>
<td>warty</td>
<td>smooth</td>
</tr>
<tr>
<td>I reaction of hymenium</td>
<td>blue</td>
<td>red</td>
<td>red</td>
<td>blue</td>
<td>red</td>
<td>red</td>
<td>red</td>
</tr>
<tr>
<td>I reaction of epithecium</td>
<td>blue</td>
<td>blue</td>
<td>blue</td>
<td>blue turning red</td>
<td>red</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Atra-brown pigment</td>
<td>present</td>
<td>present</td>
<td>present</td>
<td>present</td>
<td>absent</td>
<td>present</td>
<td>present</td>
</tr>
<tr>
<td>Number of spores per ascus</td>
<td>4</td>
<td>6</td>
<td>(5–)8</td>
<td>(6–)8</td>
<td>4–8</td>
<td>6–8</td>
<td>8</td>
</tr>
<tr>
<td>Number of septa</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>(5–)6(–7)</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Pigmentation in perispore</td>
<td>hyaline</td>
<td>±brown</td>
<td>hyaline</td>
<td>hyaline</td>
<td>hyaline</td>
<td>hyaline to brown</td>
<td>brown</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(at maturity)</td>
<td></td>
</tr>
<tr>
<td>Spore size (μm)</td>
<td>(12.5–)15.2–17.2(–20.0) × (2.5–3.0–3.5)</td>
<td>20.0–29.0 × 4.5–6.0</td>
<td>(12.0–)13.0–15.5(–17.0) × (3.0–)3.5–4.0 (–4.5)</td>
<td>15.0–21.5 × 4.5–6.0</td>
<td>26.0–30.0 × 4.0–5.0</td>
<td>18.0–26.0 × 6.0–8.0</td>
<td>20.0–27.5 × 5.0–6.0</td>
</tr>
<tr>
<td>Host genus</td>
<td><em>Flavoparmelia</em>, <em>Myelochroa</em>, <em>Parmotrema</em>, <em>Punctelia</em></td>
<td><em>Brodoa</em></td>
<td><em>Hypogymnia</em></td>
<td><em>Melanohalea</em></td>
<td><em>Usnea</em></td>
<td><em>Usnea</em></td>
<td><em>Usnea</em></td>
</tr>
<tr>
<td>Distribution</td>
<td>India</td>
<td>France, Norway, Russia, Sweden, Switzerland</td>
<td>Russia</td>
<td>Chile</td>
<td>Rwanda</td>
<td>Chile</td>
<td>Papua New Guinea</td>
</tr>
</tbody>
</table>
Plectocarpon sp.) colonising members of Parmeliaceae, differ from the new taxon in several characters (Table 1).

Etymology: The species is named in honour of Drs Paul Diederich and Damien Ertz for their monographic work on Plectocarpon and describing several new species belonging to this genus. Four initials of both Diederich and Ertz were combined to form diedertiianum.


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