

Polycoccum ochvarianum – a new species of Dothideomycetes from India

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Polycoccum ochvarianum, sp. nov., a lichenicolous fungus growing on the thallus of *Ochrolechia*, *Pertusaria* and *Varicellaria* species is described as new to science from India. The species is mainly distinct by its ascospore size and host selection. Additionally, four species of lichenicolous fungi growing on *Pertusaria* are reported as new to India.

Keywords: ascomycetes, commensalistic, lichenicolous, taxonomy.

Polycoccum Saut. ex Körb. (Körber 1865) is a genus of lichenicolous fungi mainly characterized by the dark perithecioid ascomata, pseudoparenchymatous exciple composed of dark, angular polyhedral cells, fissitunicate asci, brown 1-septate ascospores, and persisting branched and anastomosed intrascal filaments (Calatayud 2004). So far the genus is represented by 53 species most of which form commensalistic symbioses with their host lichens and are confined to one host species or genus (Lawrey & Diederich (2016), except 7 (viz. *P. arnoldii* (Hepp) D. Hawksw., *P. ochvarianum* Y. Joshi, *P. marmoratum* (Kremp.) D. Hawksw., *P. microsticticum* (Leight.) Arnold, *P. pulvinatum* (Eitner) R. Sant., *P. rugulosarium* (Linds.) D. Hawksw. and *P. versisporum* (Bagl. & Carestia) D. Hawksw.), that seem to be able to infest more than one host genus.

In continuation with our studies on lichenicolous fungi of India (Joshi et al. 2015a, b; 2016a, b, c) we found a lot of *Ochrolechia*, *Pertusaria* and *Varicellaria* samples infected by a pyrenomycete which turned to be an unknown species of *Polycoccum* described in this paper.

Material and methods

A total of 300 specimens of *Ochrolechia*, *Pertusaria* and *Varicellaria* were surveyed of which 44 were found infected with the new taxon. The type specimen of the new species along with its paratypes is deposited in LWG and were identified using standard microscopical techniques. Macroscopical

examination was carried out using a dissecting microscope (OLYMPUS SZ2-ILST), and microscopical studies of handmade sections were made using a CX21iLeDFS1 microscope. Sections were prepared by hand and examined in water and 10% KOH [K]. Amyloid reactions were tested using Lugol's iodine solution [I], with and without pre-treatment with KOH [K/I]. Ascospore measurements were made in water and are indicated as (minimum)–{X – SD}–{X + SD}–(maximum), followed by the number of samples measured (*n*).

Taxonomy

Polycoccum ochvarianum Y. Joshi, sp. nov. – Fig. 1.
Mycobank no.: MB 818559

Holotypus. – INDIA. Madhya Pradesh, Anoopur district, Amarkantak, Mai ki Bagia, alt. 612 m, on thallus of *Pertusaria subdepressa* colonizing *Shorea robusta* tree trunk, 23 March 2004, leg. D.K. Upreti, S. Nayaka & Satya 04-002431 (LWG 009917).

Diagnosis. – Similar to *Polycoccum squamarioides* in having a common host (*Pertusaria*) and narrower and shorter lower cells of the ascospores. However, *P. squamarioides* differs in having perithecia arising in groups, showing no coloration in Iodine, small asci (80 × 14–16 μm) and ascospores (9–25 × 5–9 μm). In contrast, the new species is characterized by solitary perithecia showing I+ orange coloration and bigger asci (75–100 × 10–15 μm) and ascospores [(17.5)20–22.5(25) × (7)7.5–10(11) μm] and some additional hosts (*Ochrolechia* and *Varicellaria*).

Etymology. – The name is derived by combining the initial three letters of two hosts – *Ochrolechia* and *Varicellaria*.

Description. – Lichenicolous fungus growing on the areoles of the thallus of *Ochrolechia*, *Pertusaria* and *Varicellaria*, apparently commensalistic. – Ascomata perithecioid, arising singly, erumpent to rarely immersed (specimen 217435), ± surrounded at the base by host's thallus, subglobose to obpyriform, black, somewhat shiny, 275–310 µm tall, 205–250 µm wide, with the ostiole up to 30–40 µm wide. – Ascomatal wall ca. 25–35 µm thick, pseudoparenchymatous, formed of radially compressed polyhedral cells, dark brown to light reddish brown to pale brown, cells hard to discern, K–. – Hamathecium of persistent, septate, scarcely branched and anastomosed interascal filaments, 90–150 µm long, 1.2–2.5 µm wide; central cavity filled with gelatinized tissue and the remains of discharged asci; hymenial gel hemiamyloid, I+ orange, K/I+ blue.

Asci fissitunicate, subcylindrical to elongate clavate, tholus 0.5–2 µm, internal apical beak often distinct, short, sometimes refractive, foot distinct, 6(–8) spored, 75–100 × 10–15 µm (n = 50), K/I–. – Ascospores monostichously or distichously arranged and partly overlapping in the asci, ellipsoid to slightly fusiform, obtuse, with rounded ends, 1-septate, often with a bigger upper cell, rarely hyaline (specimen 80-396) to dark brown, (17.5)20–22.5(25) × (7)7.5–10(11) µm (n = 50), slightly constricted at septum, pigment somewhat concentrated at the slightly thickened apices and septum; wall 0.5–1.0 µm thick, dark; septum in mature spores dark, 0.5–1.0 µm thick, though sometimes thinner; perispore evident, gelatinous, without ornamentation, 0.5 µm thick. – Conidiomata not observed.

Hosts. – It grows on thalli of epiphytic *Ochrolechia* (*O. androgyna*), *Pertusaria* (*P. acuta*, *P. amarkantakana*, *P. coccodes*, *P. coronata*, *P. granulata*, *P. himalayensis*, *P. neilgherrensis*, *P. pertusa*, *P. quasiasiae*, *P. rigida*, *P. splendens*, *P. subdepressa*, *P. subochracea*, *P. tuberculifera*) and *Varicellaria* (*V. velata*) species. Since areoles of lichens infected by *Polycoccum ochvarianum* are scarcely affected and no deformation or discoloration was noticed, this fungus may be regarded as a commensalist.

Distribution. – So far, the species was found in Bihar, Himachal Pradesh, Kerala, Madhya Pradesh, Orissa, Tamil Nadu, Uttarakhand and Uttar Pradesh regions of India, with an elevation range from 297 to 2743 m. Some specimens (04-002206, 05-005577, 80-396, 80-396 Duplicate, 80-433, 05-005587) were also infected by *Arthonia pantherina*, *Buellia minimula*, *Lichenodiplis lecanorae* and *Sphinctrina tubiformis*.

Discussion

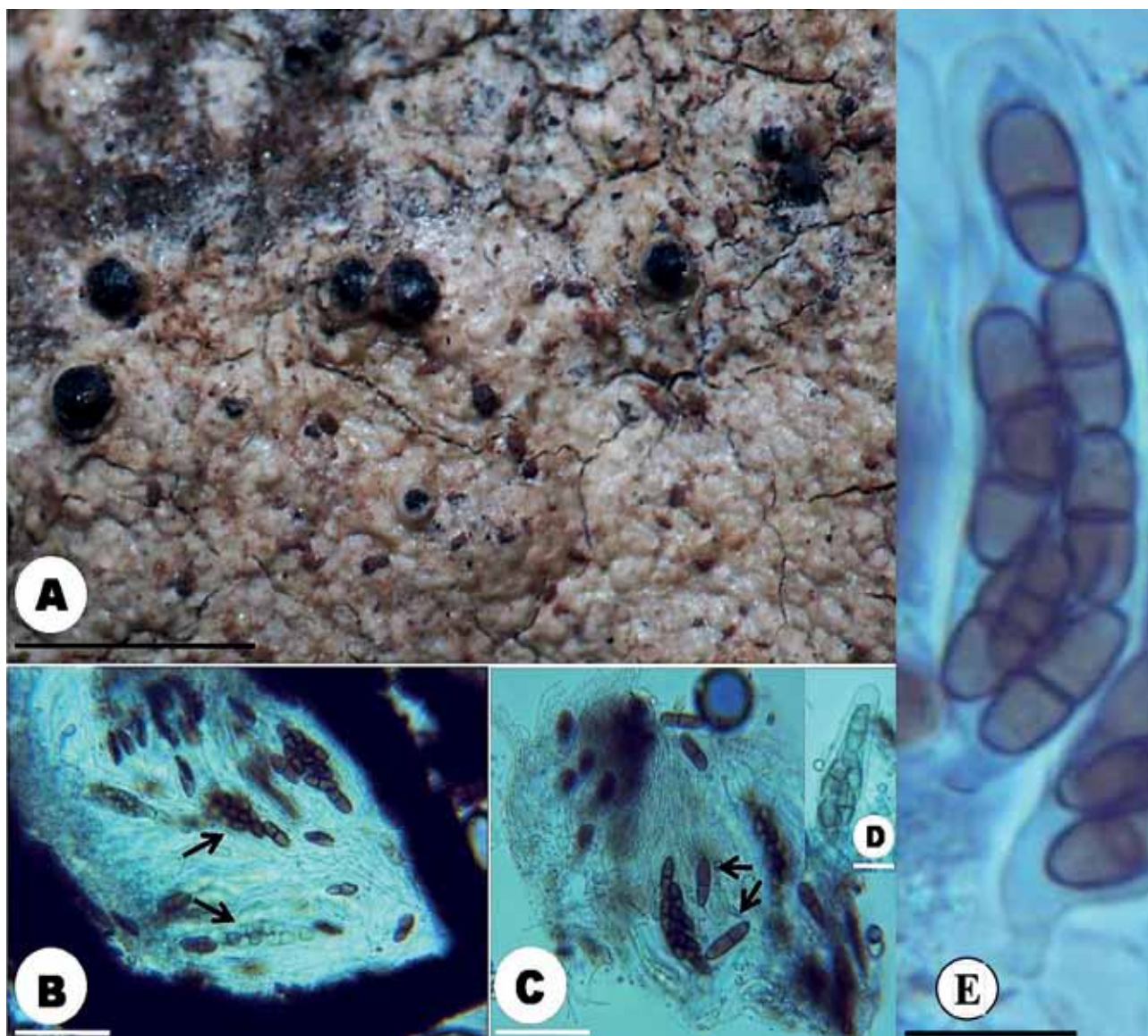
Currently no species of *Polycoccum* was recognized as occurring on *Ochrolechia* and *Varicellaria*, hence, our new species is the first lichenicolous *Polycoccum* reported from species of *Ochrolechia* (viz. *O. androgyna* (Hoffm.) Arnold) and *Varicellaria* (viz. *V. velata* (Turner) I. Schmitt & Lumbsch). Besides these two genera, the new taxon is also reported from several species of *Pertusaria* (viz. *P. acuta* Müll. Arg., *P. amarkantakana* Preeti Srivast. & D.D. Awasthi, *P. coccodes* (Ach.) Nyl., *P. coronata* (Ach.) Th. Fr., *P. granulata* (Eschw.) Müll. Arg., *P. himalayensis* D.D. Awasthi & Preeti Srivast., *P. neilgherrensis* (Müll. Arg.) D.D. Awasthi & Preeti Srivast., *P. pertusa* (L.) Tuck., *P. quasiasiae* (Fée) Nyl., *P. rigida* Müll. Arg., *P. splendens* D.D. Awasthi & Preeti Srivast., *P. subdepressa* Müll. Arg., *P. subochracea* Stirt. and *P. tuberculifera* Nyl.).

Polycoccum squamarioides, also reported from the thallus of *Pertusaria*, *Phlyctis* and *Lecanora*, resembles the new species in having narrower and shorter lower cell of the ascospore and a common host (*Pertusaria*), but differs in having perithecia arising in groups, showing no coloration in Iodine, small asci (80 × 14–16 µm) and ascospores (9–25 × 5–9 µm). In contrast, the new species is characterized by solitary perithecia showing I+ orange coloration and bigger asci (75–100 × 10–15 µm) and ascospores [(17.5)20–22.5(25) × (7)7.5–10(11) µm].

Polycoccum epizoharyi Calatayud & V. Atienza resembles the new species in showing the same Lugol's reaction, but differs in having smaller ascospores (14)15–17(18) × (7)8–9(10) µm and a different host (*Buellia zoharyi* Galun) (Calatayud & Atienza 2000).

Didymocyrtis bryonothae (Arnold) Hafellner differs from the new taxon in having perithecia arising in dense groups on the apothecia of *Pertusaria*, narrow asci (60–80 × 7–10 µm), monostichously arranged smaller ascospores (10)11.5–14(16) × 4–5 µm and numerous pycnidia immersed in the hymenium of host apothecia with hyaline, biguttulate conidia (6)7–8 × 3–4 µm. In the new species the perithecia arise solitary on the thallus, asci are broader with monostichously or distichously arranged bigger ascospores, and pycnidia are lacking.

The genus is so far represented by four species in India, viz. *Polycoccum clauzadei* Nav.-Ros. & Cl. Roux, *P. microsticticum* (Leight.) Arnold, *P. peltigerae* (Fuckel) Vězda and *P. pulvinatum* (Eitner) R. Sant., of which *P. clauzadei* and *P. pulvinatum* were previously reported from Jammu & Kashmir region of India (Zhurbenko 2013), while *P. microsticticum*



Figs. 1. *Polycoccum ochvarianum* (holotype): **A.** Colonies of *Polycoccum ochvarianum* on thallus of *Pertusaria*. **B.** V.S. through perithecium, arrows indicating mature and immature spores. **C.** Arrows indicating variation in spore shape and size. **D.** Ascus bearing immature ascospores in 40x. **E.** Ascus bearing mature ascospores in 60x. Scale bars A–D = 25 µm, E = 20 µm.

and *P. peltigerae* along with *P. clauzadei* were recently reported by Joshi et al. (2016a) from Himachal Pradesh and Uttarakhand regions of India. These all differ from the new taxon in having different host preference. *Xanthoria elegans* (Link) Th. Fr., *Acarospora fuscata* (Nyl.) Th. Fr., *Peltigera canina* (L.) Willd. and *Physcia dubia* (Hoffm.) Lettau are the respective hosts of *P. clauzadei*, *P. microsticticum*, *P. peltigerae* and *P. pulvinatum*, while the new taxon is specific to species of *Ochrolechia*, *Pertusaria* and *Varicellaria*.

Material examined. – INDIA. Bihar, Paschim Champaran district, Don hills, Gadhi south, on thallus of *Pertusaria coccodes*, 19 February 1995, leg. D.K. Upreti & J.

Tandon 213236/C (LWG 14242). Himachal Pradesh, Sirmour district, Poanta Sahib, Khara Reserve Forest, alt. 350 m, on thallus of *P. himalayensis*, 25 June 2000, leg. S. Chatterjee, Dubey & Nayaka 20-65457/B (LWG 19650). Kerala, Calicut district, University of Calicut, University Campus, on thallus of *P. granulata*, 6 May 1979, leg. D.D. Awasthi, D.K. Upreti & U.C. Misra 79-853 (LWG-LWU). Madhya Pradesh, Anoopur district, Amarkantak, on thallus of *Varicellaria velata*, 3 March 2010, leg. Arvind Prajapati 10-017074 (LWG 26666); Kapildhara area, alt. 615 m, on thallus of *P. subdepressa*, 23 March 2004, leg. D.K. Upreti, S. Nayaka & Satya 04-002464, 04-002818, 04-002826 & 04-002833 (LWG 009934, 009922, 19565 & 19587); alt. 615 m, on thallus of *P. coronata*, 23 March 2004, leg. D.K. Upreti, S. Nayaka & Satya 04-002833 (LWG 19587); 5 km before Chaparwa from Amarkantak, alt. 475 m, on thallus of *P. subdepressa*, 19 March 2004, leg. D.K. Upreti, S. Nayaka & Satya 04-002221 (LWG 009910); Dindori district,

around Jagatpur Forest Rest House, alt. 1300 m, on thallus of *P. amarkantakana*, 5 July 2005, leg. D.K. Upreti, S. Nayaka & Satya 05-005585, 05-005577 & 05-005628/A (LWG 009892, 009895 & 009891); on thallus of *P. rigida*, 5 July 2005, leg. D.K. Upreti, S. Nayaka & Satya 05-005587 (LWG 009847); Chauradader, alt. 1500 m, on thallus of *P. rigida*, 5 July 2005, leg. D.K. Upreti, S. Nayaka & Satya 05-005644/A (LWG 009877); Tarwartola, near to Chauradader, alt. 1480 m, on thallus of *P. rigida*, 6 July 2005, leg. D.K. Upreti, S. Nayaka & Satya 05-005649, 05-005661 & 05-005687/A (LWG 19545, 009850 & 009856); on thallus of *P. amarkantakana*, 6 July 2005, leg. D.K. Upreti, S. Nayaka & Satya 05-005669 (LWG 009845); on thallus of *P. subochracea*, 6 July 2005, leg. D.K. Upreti, S. Nayaka & Satya 05-005656/A (LWG 19546); Karanjiya, on thallus of *P. quassiae*, 8 May 2010, leg. Arvind Prajapati 10-017117 (LWG 26732); Khurkhuridader, alt. 1500 m, on thallus of *P. acuta*, 7 July 2005, leg. D.K. Upreti, S. Nayaka & Satya 05-005761 (LWG 009840); on thallus of *P. rigida*, 7 July 2005, leg. D.K. Upreti, S. Nayaka & Satya 05-005755 (LWG 009878); on thallus of *P. splendens*, 7 July 2005, leg. D.K. Upreti, S. Nayaka & Satya 05-005762 (LWG 13652); Hoshangabad district, Pachmarhi, near Aprabihari falls, alt. ca. 1080 m, on thallus of *Ochrolechia androgyna*, 18 January 1980, leg. D.K. Upreti & U.C. Misra 80-128 (LWG-LWU); Shahdol district, Amarkantak, Jwaleshwar, 12 km from Amarkantak town, alt. ca. 1200 m, on thallus of *O. androgyna*, 30 January 1980, leg. D.K. Upreti & U.C. Misra 80-555 (LWG-LWU); near Jwaleshwar temple, on thallus of *P. amarkantakana*, 29 September 1987, leg. D.K. Upreti 201773 (LWG 19458); Batay Krishna, 1 km away from Amarkantak town, alt. ca. 1060 m, on thallus of *P. pertusa*, 28 January 1980, leg. D.K. Upreti & U.C. Misra 80-396 (LWG-LWU); on thallus of *P. amarkantakana*, 28 January 1980, leg. D.K. Upreti & U.C. Misra 80-396 Duplicate, 80-396A, 80-430A (LWG-LWU); Sonemuda, 2 km away from Amarkantak town, alt. ca. 1060 m, on thallus of *O. androgyna*, 28 Jan. 1980, leg. D.K. Upreti & U.C. Misra 80-433 (LWG-LWU); near Boxite mines, 8 km from Amarkantak town, alt. ca. 1100 m, on thallus of *P. amarkantakana*, 29 January 1980, leg. D.K. Upreti & U.C. Misra 80-466A (LWG-LWU); Valko-Khurkhuridader, 8 km from Amarkantak town, alt. ca. 1100 m, on thallus of *P. pertusa*, 29 January 1980, leg. D.K. Upreti & U.C. Misra 80-479 (LWG-LWU); 10 km from Amarkantak town, alt. ca. 1160 m, on thallus of *O. androgyna*, 29 January 1980, leg. D.K. Upreti & U.C. Misra 80-472 (LWG-LWU); Hindalco, 2 km from Amarkantak town, alt. ca. 1060 m, on thallus of *P. neilgherrensis*, 31 January 1980, leg. D.K. Upreti & U.C. Misra 80-584 (LWG-LWU). Orissa: Jharsuguda district, Bel Pahar forest, north-western region, dominated coal mines, on thallus of *P. quassiae*, 19 December 1993, leg. D.K. Upreti 212762 (LWG 14759); near Kharu Baba Ashram, on thallus of *P. quassiae*, 24 December 1993, leg. D.K. Upreti s.n. (LWG). Tamil Nadu, Madurai district, Kodaikanal, alt. 2133 m, on thallus of *P. tuberculifera*, 20 December 1959, leg. D.D. Awasthi 4416 (LWG-AWAS). Uttarakhand, Chamoli district, Mandal, alt. 1100 m, on thallus of *P. coccodes*, 16 June 2007, leg. S. Rawat 07-008719 (LWG 19315); Dehra Dun district, Chakrata division, Deoban, alt. 2743 m, on thallus of *P. pertusa*, 3 July 1951, leg. D.D. Awasthi 952 (LWG-AWAS 13844); Nainital district, Jim Corbett Tiger Reserve, Shandikhal, alt. 1000–1100 m, on thallus of *P. coccodes*, 2 December 1999, leg. D.K. Upreti & Jyoti Tandon 217435 (LWG 19591). Uttar Pradesh, Sonbhadra district, 9 km before Anpara, alt. 297 m, 24°12.479'N 82°59.734'E, on thallus of *P. quassiae*, 6 September 2011, leg. D.K. Upreti, S. Nayaka, P.K. Divakar & R. Bajpai 11-016504 (LWG 26954).

New records

The following four species are new to Indian lichenicolous flora:

Arthonia pantherina Etayo

Material examined. – INDIA. Anoopur district, 5 km before Chaparwa from Amarkantak, alt. 470 m, on thallus of *Pertusaria subdepressa*, 19 March 2004, leg. D.K. Upreti, S. Nayaka & Satya 04-002206 (LWG 009909); Shahdol district, Amarkantak, Batay Krishna, 1 km away from Amarkantak town, alt. ca. 1060 m, on thallus of *P. pertusa*, 28 January 1980, leg. D.K. Upreti & U.C. Misra 80-396 (LWG-LWU); on thallus of *P. amarkantakana*, 28 January 1980, leg. D.K. Upreti & U.C. Misra 80-396 Duplicate (LWG-LWU).

Opegrapha anomea Nyl.

Material examined. – INDIA. Madhya Pradesh, Dindori district, Tarwartola, near to Chauradader, alt. 1480 m, on thallus of *Pertusaria amarkantakana*, 6 July 2005, leg. D.K. Upreti, S. Nayaka & Satya 05-005653 (LWG 009844). Uttarakhand, Bageshwar district, Khati to Dwali, in route to Pindari glacier, on thallus of *P. albescens*, 21 May 1950, leg. D.D. Awasthi & A.M. Awasthi 708 (LWG-AWAS 14715); Pithoragarh district, Munsiyari, Khaliya top, alt. 2700–3000 m, on thallus of *P. coronata*, 17 November 2006, leg. Y. Joshi & R. Bajpai 06-007029 (LWG 19588). West Bengal, Darjeeling, on thallus of *Pertusaria*, 1960, leg. M.N. Bose s.n. (LWG-LWU 13730).

Roselliniopsis tartaricola (Nyl. ex Leight.) Matzer

Material examined. – INDIA. Uttarakhand, Chamoli district, on way from Chopta to Tungnath peak, alt. 3657–4267 m, on *Pertusaria variolosa*, 24 September 1976, leg. K. Dange 76-599 (LWG-LWU); *ibid.*, alt. 3600–4200 m, on *P. variolosa*, 24 September 1976, leg. K. Dange 76-710 (LWG-LWU 08437).

Weddellomyces periphericus (Taylor) Alstrup & D. Hawksw.

Material examined. – INDIA. South India, Nilgiri hills, Kodanad shola, near forest rest house, alt. ca. 2051 m, on *Pertusaria amara*, 31 December 1970, leg. D.D. Awasthi & K.P. Singh 70-1399 (LWG-LWU).

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