

A first list of lichenicolous fungi from India

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Abstract. Thirty six species of lichenicolous fungi are reported from India, all but one being new to the country. *Endococcus incrassatus* and *Monodictys epilepraria* are new to Asia. *Endocarpon* and *Melanelixia* are new host genera for *Endococcus incrassatus* and *Lichenonium xanthoriae* respectively. *Cladosporium licheniphilum* is for the first time reported on *Xanthoria candelaria*, as is *Corticifraga peltigerae* on *Peltigera elisabethae* and *P. ponojensis*, and *Nectriopsis lecanodes* on *Peltigera elisabethae* and *P. scabrosa*. Two possibly undescribed species of lichenicolous fungi, viz. *Cercidospora* sp. on *Lecanora* sp. and *Lichenostigma* subgen. *Lichenogramma* sp. on *Seirophora contortuplicata*, are briefly described and discussed. Host lichens *Peltigera ponojensis*, *P. scabrosa* and *Seirophora contortuplicata* are new to India.

Key words: Asia, biogeography, India, lichen-inhabiting fungi, lichens, taxonomy

Introduction

Knowledge of Asian lichenicolous fungi is still very scant, most reports being from Siberia (Russia) and south-western Asia (mostly Turkey). No special survey of these fungi has been performed in India, wherefrom just seven species were formerly known: *Abrothallus peyritschii* (Stein) Kotte growing on *Vulpicida pinastri* from Himachal Pradesh (Alstrup & Ahti 2007), *Endococcus rugulosus* Nyl. on *Rhizocarpon disporum* from Kashmir (Triebel 1989), *Homostegia piggotii* (Berk. & Broome) P. Karst. on *Parmelia* sp. from Uttaranchal (Alstrup & Ahti 2007), *Lichenopeltella swaminathaniana* Harih., Mibey & D. Hawksw. on *Porina* sp. from Tamil Nadu (Hariharan et al. 1996), *Opegrapha foreaui* (Moreau) Hafellner & R. Sant. on *Heterodermia leucomela* from Madras (Coppins & Kondratyuk 1998), *Phyllosticta galligena* Moreau on *Parmotrema perforatum* from Shembaganur (Moreau 1951) and *Skyttea fusispora* Sherwood, D. Hawksw. & Coppins on *Ochrolechia trochophora* from Assam (Sherwood et al. 1981).

In April and May 2013 I gathered a small collection of lichenicolous fungi in Jammu and Kashmir State of India. Its identification yielded a list of 36 species, presented below, all but one being new to India and two new to Asia. Examined material also includes two possibly yet undescribed species of *Cercidospora* and *Lichenostigma* subgen. *Lichenogramma*. Some species revealed broader variation of the ascomatal characters compared with the descriptions mainly based on the European and/or on the aged herbarium collections. Pertinent notes on such observations are also provided.

Materials and methods

The study is based on 49 specimens, which were examined using Zeiss microscopes Stemi 2000-CS and Axio Imager A1 equipped with Nomarski differential interference contrast optics (DIC). Microscopical examination was done in water, 10% KOH (K), Lugol's iodine, directly (I) or after KOH pre-treatment (K/I), or Brilliant Cresyl blue (BCr). Measurements were taken from water mounts, unless otherwise indicated, and refer to recently collected material (cf. vital taxonomy: Baral 1992). The length and breadth of the asci, ascospores, conidia and cells of vegetative hyphae, as well as the length/breadth ratio (l/b) of the ascospores and conidia, are given (where $n > 10$) as: (min.-){X - SD}-{X + SD}(-max.), where min and max are the extreme values, X the arithmetic mean and SD the corresponding standard deviation. Studied specimens are housed in the mycological herbarium of the V. L. Komarov Botanical Institute in St.-Petersburg (LE-Fungi).

Collecting localities in Jammu and Kashmir State of India

- 1: Tawi River, 33°11.784'N, 74°15.263'E, alt. 600 m, rocks by the river, 24 Apr 2013.
- 2: Bhaderwah, 33°06.252'N, 75°20.595'E, alt. 1530 m, garden, 25 Apr 2013.
- 3: Pahalgam, 34°00.567'N, 75°18.659'E, alt. 2200 m, coniferous forest, 27 Apr 2013.
- 4: vicinities of Tangmarg, 34°04.200'N, 74°49.488'E, alt. 2160 m, rocks in coniferous forest near a river, 29 Apr 2013.
- 5: Gulmarg, 34°03.028'N, 74°23.969'E, alt. 2680 m, coniferous forest, 30 Apr 2013.
- 6: vicinities of Tangmarg, 34°04.200'N, 74°49.488'E, alt. 2180 m, coniferous forest near a river, 30 Apr 2013.
- 7: vicinities of Wullar Lake, 34°22.223'N, 74°31.299'E, alt. 1830 m, mixed forest, 1 May 2013.
- 8: Sonmarg, 34°22.224'N, 74°31.291'E, alt. 2405 m, open Ca-rocks among coniferous forest, 3 May 2013.
- 9: Lamayuru, 34°16.950'N, 76°46.337'E, alt. 3390 m, rocks in mountain desert, 5 May 2013.
- 10: near Khardung-La pass, 34°19.890'N, 77°38.810'E, alt. 4650 m, boulders in mountain desert, 9 May 2013.
- 11: vicinities of Leh, 34°14.908'N, 77°37.185'E, alt. 4560 m, boulders in mountain desert, 10 May 2013.
- 12: vicinities of Leh, 34°11'25.3"N, 77°34'49.1"E, alt. 3880 m, rocks in mountain desert, 12 May 2013.

List of species

Arthonia molendoi (Frauenf.) R. Sant.

Causes slight discoloration of host tissues. Formerly known in Asia from Israel (Navrotskaya et al. 1996), Iran (Seaward et al. 2008), Turkey (Hafellner & John 2006), Tajikistan (Kondratyuk & Kudratov 2002) and Russia (Zhurbenko & Hafellner 1999).

Specimen examined. 10: on *Xanthoria elegans* (apothecia, thallus), 9 May 2013, M. Zhurbenko 1381 (LE 260 547).

Cercidospora macrospora (Uloth) Hafellner & Nav.-Ros.

Ascomata 125–200 µm diam., protruding only in ostiolar area to semi-immersed. Exciple in the upper half dark olive-brown outside, blue-green inside, ca 40 µm thick, in the lower half pale olive-brown to almost colorless, ca 20 µm thick. Asci cylindrical, 83–102 × 11–13 µm, (2–)4(–6)-spored. Ascospores narrowly ellipsoid to narrowly obovoid or rarely almost fusiform, (18–)20.5–25.5(–31.5) × (5.5–)6.5–7.5(–8) µm, l/b = (2.5–)3.0–3.8(–4.8) (n = 70), (0–)1-septate, not or slightly constricted at the septum, cells equal in shape and size or the upper one slightly wider, often with several conspicuous guttules, smooth-walled, non-halonate. Distinct pathogenicity not observed. Description of the species by Calatayud et al. (2013) prescribes just 1-septate and somewhat narrower ascospores 4–6(–7) µm wide, with cells equal in shape and size. However, their taxonomy was based only on herbarium specimens (P. Navarro-Rosinés, pers. comm.) and my measurements refer to the ‘living’ material, which usually has somewhat larger ascomatal structures (Baral 1992). *Cercidospora macrospora* is known from numerous collections from all over the northern hemisphere, including specimens from the Himalayas within Nepal and Pakistan (Calatayud et al. 2013).

Specimen examined. 11: on pale buff-yellow *Lecanora* species with small marginal lobes, growing on siliceous rock (equally frequent on thallus and discs and margins of apothecia), 10 May 2013, M. Zhurbenko 1334 (LE 261 098).

Cercidospora melanophthalmae Nav.-Ros., Calat. & Hafellner

Ascomata 150–250 µm diam., mostly semi-immersed. Exciple blue-green and partly olive or brown above, pale brown to colorless below, K–. Asci (4–)8-spored. Ascospores narrowly obovate to occasionally ellipsoid, sometimes attenuated at one or both ends, (14.5–)19.5–25.5(–31) × (4.5–)6–7.5(–8.5) µm, l/b = (2.7–)3.0–3.8(–4.5) (n = 80, in water or K), (0–)1-septate, not or rarely slightly constricted at the septum, with wider and usually slightly shorter upper cell, often with a few large guttules, smooth-walled, non-halonate. In the species protologue its ascospores are given somewhat smaller, viz. (16–)18–22(–24) × (4–)5–6.5(–7) (Calatayud et al. 2013), which can reflect differences between fresh and aged material (see pertinent note under *Cercidospora macrospora*). Formerly known in Asia from Syria, Armenia, Afghanistan and Pakistan (Calatayud et al. 2013).

Specimen examined. 10: on *Rhizoplaca melanophthalma* (discs and margins of apothecia, thallus), 9 May 2013, M. Zhurbenko 1359 (LE 260 918).

Cercidospora xanthoriae (Wedd.) R. Sant.

Formerly known in Asia from Turkey (Hafellner & John 2006) and Russia (Zhurbenko 2009b).

Specimen examined. 11: on *Xanthoria elegans* (thallus), 10 May 2013, M. Zhurbenko 1383 (LE 261 116).

Cercidospora sp.

Ascomata 125–150(–175) μm diam., immersed to slightly protruding in ostiolar area. Exciple dark olive throughout except blue-green inner rim above, 35–40 μm thick near ostiole, 15–20 μm thick below, K–. Asci cylindrical, (63–)70–82(–90) \times (8–)9–11(–12) μm (n = 21, in water, K or K/I), 4(–8)-spored. Ascospores narrowly ellipsoid to fusiform, with rather acute ends, (16.5–)24–32.5(–36.5) \times (5.5–)5.5–6.5(–7.5) μm , l/b = (2.8–)4.0–5.4(–6.4) (n = 38, in water or K/I), (0–)1-septate, not or slightly constricted at the septum, cells mostly equal in shape and size, sometimes slightly heteropolar, usually with several conspicuous lipid drops, smooth-walled, distinct halo not observed. Causes production of convex cecidia and slight bleaching of host thallus. Compared to the *Cercidospora* species growing on lichens of the genera *Aspicilia*, *Lecanora*, *Lobothallia*, *Rhizoplaca* and *Squamarina* (Navarro-Rosinés et al. 2004, 2009; Calatayud et al. 2013) examined material is most close to *C. macrospora* (growing on *Lecanora saxicola* group) and also resembles *C. crozalsiana* (H. Olivier) Nav.-Ros., Cl. Roux & Casares (growing on *Squamarina*). Descriptions of the former species differ in presenting the exciple colorless or slightly green-blue in its lower half and the ascospores somewhat smaller, (19–)20–25(–30) \times 4–6(–7) μm , and just 1-septate. *Cercidospora crozalsiana* differs in having larger ascomata, (160–)200–280 μm , often colorless at the base exciple, (2–)4-spored and longer asci, 85–120 \times 10–14 μm , and mostly halonate ascospores.

Specimen examined. 10: on pale olive-yellow *Lecanora* species with small marginal lobes growing on siliceous rock (thallus), 9 May 2013, M. Zhurbenko 1336 (LE 261 077).

Cladosporium licheniphilum Heuchert & U. Braun

Xanthoria candelaria is a new host species. Formerly known in Asia from Russia on *Pertusaria alpina* (Heuchert & Braun 2006).

Specimen examined. 7: on *Xanthoria candelaria* (soralia, thallus), 1 May 2013, M. Zhurbenko 1369 (LE 260 998).

Corticifraga peltigerae (Fuckel) D. Hawksw. & R. Sant.

Causes strong discoloration of host tissues. Despite many previous records on various hosts, *Peltigera elisabethae* and *P. ponojensis* are likely to be new host species. It is noteworthy that *Peltigera ponojensis*, a lichen with circumpolar temperate to arctic distribution (Vitikainen 1994), is absent in the recent compendium of the macrolichens of India (Awasthi 2007). Formerly known in Asia from Russia (Zhurbenko 2009b).

Specimens examined. 6: on *Peltigera elisabethae* (thallus), 30 Apr 2013, M. Zhurbenko 1353 (LE 260 537). – 7: on *P. ponojensis* (thallus), 1 May 2013, M. Zhurbenko 1348 (LE 260 997).

Endococcus incrassatus Etayo & Breuss

Ascomata semi-immersed, about 200 µm diam. Ascospores ellipsoid, occasionally obovoid or oblong, ends usually rounded or sometimes rather acute, rarely with small papilla at one end, hyaline then medium brown, (11–)12.5–15(–17) × (6–)6.5–8(–9.5) µm, l/b = (1.4–)1.6–2.2(–2.9) (n = 40, in water or I), simple or 1-septate with median septum and usually equal cells, not or rarely slightly constricted at the septum, usually with numerous small lipid drops, sometimes finely verruculose (DIC !), non-halonate. Pathogenicity not observed. Examined material supports suggestion that the species is conspecific with *Endococcus karlstadtensis* Kocourková & Brackel (Zhurbenko et al. 2012a), described from *Endocarpon pusillum*. *Endococcus incrassatus* was formerly reported only from *Placidopsis cinerascens* and from a sterile squamulose terricolous lichen. New to Asia.

Specimen examined. 1: on *Endocarpon pusillum* (thallus), 24 Apr 2013, M. Zhurbenko 1319 (LE 260 407).

Endococcus rugulosus Nyl. s. lat.

Ascomata 100–200 µm diam. Ascospores ellipsoid or occasionally slightly obovoid, mostly with rounded ends, olive then brown, (11.5–)12–14.5(–16) × 7.5–9.5(–13) µm, l/b = (1.2–)1.4–1.8(–2.0) (n = 25), 0–1-septate, not or rarely slightly constricted at the septum, usually with numerous small lipid drops, smooth-walled. Formerly known in Asia from Iran (Seaward et al. 2008), Turkey (Halici et al. 2007b) and Russia (Zhurbenko 2009a).

Specimen examined. 6: on *Aspicilia* sp. growing on siliceous rock (thallus), 30 Apr 2013, M. Zhurbenko 1362 (LE 261 218).

Intralichen christiansenii (D. Hawksw.) D. Hawksw. & M.S. Cole

Formerly known in Asia from Israel (Temina et al. 2005), Iran (Seaward et al. 2008), Turkey (Hafellner & John 2006), Russia (Zhurbenko & Hafellner 1999) and China (Hawksworth & Cole 2003).

Specimen examined. 10: on *Candelariella aurella* (disc of apothecia), 9 May 2013, M. Zhurbenko 1320 (LE 260 467).

Lichenocodium usneae (Anzi) D. Hawksw.

Infected host parts are discolored. Formerly known in Asia from Iran (Sohrabi & Alstrup 2007), Turkey (Hafellner & John 2006) and Russia (Zhurbenko 2009a).

Specimen examined. 3: on *Flavoparmelia caperata* (thallus), 27 Apr 2013, M. Zhurbenko 1344 (LE 260 928).

Lichenocodium xanthorhiae M.S. Christ.

Infected host parts are discolored. *Melanelixia* is a new host genus. New to Asia.

Specimen examined. 6: on *Melanelixia subargentifera* (thallus), 30 Apr 2013, M. Zhurbenko 1343 (LE 261 228).

Lichenodiplis lecanorae (Vouaux) Dyko & D. Hawksw.

Formerly known in Asia from Turkey (Hafellner & John 2006) and Russia (Zhurbenko et al. 2012b).

Specimens examined. 3: on *Caloplaca cerina* (discs of apothecia), 27 Apr 2013, M. Zhurbenko 1318 (LE 261 008); on *Xanthoria candelaria* (thallus), 27 Apr 2013, M. Zhurbenko 1371 (LE 261 087).

Lichenostigma alpinum (R. Sant., Alstrup & D. Hawksw.) Ertz & Diederich

Formerly known in Asia from Iran (Sohrabi & Alstrup 2007), Turkey (Halici et al. 2007d), Russia (Zhurbenko 2009a) and China (Hawksworth & Cole 2003).

Specimen examined. 6: on *Pertusaria albescens* (soralia, thallus), 30 Apr 2013, M. Zhurbenko 1339 (LE 261 328).

Lichenostigma cosmopolites Hafellner & Calat.

The species strongly recalls a species of *Sphaerellothecium*. Formerly known in Asia from Turkey, Iran, Georgia, Nepal, China and Japan (Hafellner & Calatayud 1999; Aptroot & Sipman 2001; Hawksworth & Cole 2003; Sohrabi & Alstrup 2007).

Specimen examined. 7: on *Xanthoparmelia stenophylla* (thallus), 1 May 2013, M. Zhurbenko 1341 (LE 261 198).

Lichenostigma cf. *elongatum* Nav.-Ros. & Hafellner

Vegetative hyphae forming black, superficial, not or scarcely ramified strands, 50–150(–300) × (10–)20–30(–50) µm, consisting of up to 8 rows of cells and grouped in black patches on the host surface. Ascomata irregularly globose to elongated, 150–250 µm lengthways. Ascospores hyaline then medium olive-brown and finally dark brown, obovoid, 1(–2)-septate, not or slightly constricted at the equatorial septum, verruculose, sometimes with halo up to 2.5 µm wide, (11–)13–15(–16) × (6.5–)7–8(–9.5) µm, l/b = (1.5–)1.8–2.0(–2.3) (n = 38) [somewhat swollen in K: (10–)13.5–17(–19.5) × (6.5–)8–10(–11.5) µm, l/b = 1.5–1.9(–2.1) (n = 42)]. Occasionally causes slight discoloration of host tissues. According to Calatayud et al. (2002) ascospores of the species are just 1-septate and somewhat shorter, (9–)10–13 × 6–8.5 µm, but later Calatayud et al. (2004) mentioned that its ascospores are occasionally 2-septate as well. Examined material is also similar to *Lichenostigma rouxii* Nav.-Ros., Calat. & Hafellner growing on *Squamarina* species, which has 1(–3)-septate ascospores, (10–)10.5–13.5(–15.5) × (5.5–)6–7(–8) µm (Calatayud et al. 2004). However, vegetative hyphae of that species are scattered, never grouped in dense clusters, 400–1000 × 8–13 µm, formed of (1–)2–3 rows of cells, and ascomata are till 120 µm lengthways. *Lichenostigma elongatum* was formerly known in Asia from Iran (Valadbeigi & Sipman 2010), Syria (John et al. 2004), Turkey (Hafellner & John 2006) and Russia (Zhurbenko 2009b).

Specimens examined. 11: on pale grey *Lecanora* sp. with marginal lobes, growing on siliceous rock (thallus), 10 May 2013, M. Zhurbenko 1333 (LE 261 126). – 12: on *Lobothallia praeradiosa* (discs and margins of apothecia, thallus), 12 May 2013, M. Zhurbenko 1331 (LE 261 078).

Lichenostigma subgen. *Lichenogramma* sp.

Fig. 1

The examined material possibly represents an undescribed species of *Lichenostigma* subgen. *Lichenogramma* Nav.-Ros. & Hafellner (see key: Fernandez-Brime et al. 2010). Ascomata about 50 μm lengthways, subglobose, associated with superficial, black, richly ramified, ornamented hyphal strands, 20–60(–100) \times 7–15(–20) μm , consisting of 1–3 rows of cells. Ascospores hyaline then medium olive-brown and finally dark brown, broadly obovoid, (9–)10–12 \times 6–7.5(–8.5) μm , l/b = (1.4–)1.5–1.7(–1.8) (n = 25), 1-septate, markedly constricted at the septum, smooth-walled, when immature with halo 1–2 μm thick. Distinct pathogenicity not observed. Most *Lichenostigma* species are specific to a particular host genus, and none of them has so far been reported on *Seiophora*. The only *Lichenostigma* species known on lichens of the same host family *Teloschistaceae* is *L. bolacinae* Nav.-Ros., Calat. & Hafellner (Calatayud et al. 2004). It grows on *Caloplaca bolacina* and can be distinguished by its ascospores, which are smaller, 8–9.5 \times 5–6 μm , slightly constricted at the septum, ornamented and non-halonate. It is noteworthy that the host lichen *Seiophora contortuplicata*, though widely distributed in the mountain regions of the northern hemisphere (Frödén et al. 2004), is absent in the recent compendium of the macrolichens of India (Awasthi 2007).

Specimen examined. 12: on *Seiophora contortuplicata* (apothecia, thallus), 12 May 2013, M. Zhurbenko 1366 (LE 261 117).

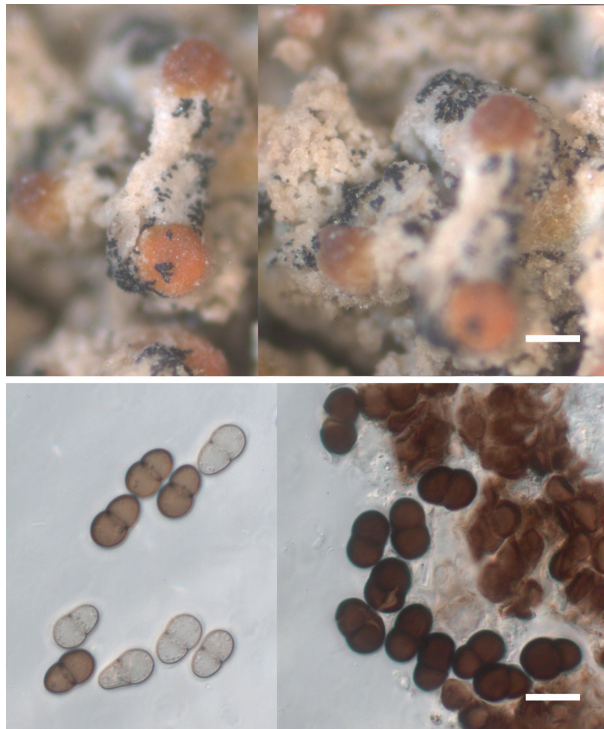


Fig. 1. *Lichenostigma* subgen. *Lichenogramma* sp. on *Seiophora contortuplicata* (LE 261117). Habitus (above, bar = 200 μm) and ascospores in water (below, bar = 10 μm)

Marchandiomyces corallinus (Roberge) Diederich & D. Hawksw.

Formerly known in Asia from Russia (Zhurbenko 2008) and China (Hawksworth & Cole 2003).

Specimen examined. 7: on thalli of neighbouring *Physcia aipolia* and *Xanthoria candelaria*, 1 May 2013, M. Zhurbenko 1370 (LE 260 417).

Monodictys epilepraria Kukwa & Diederich

New to Asia.

Specimen examined. 6: on *Lepraria* sp. growing on mosses (thallus), 30 Apr 2013, M. Zhurbenko 1314 (LE 261 288).

Muellerella erratica (A. Massal.) Hafellner & V. John

Ascomata 150–250 µm diam. Ascospores (5.5–)6–8(–9.5) × (3–)3.5–4(–5.5) µm, l/b = (1.2–)1.6–2.2(–3.1) (n = 77). Formerly known in Asia from Iran (Seaward et al. 2008), Turkey (Hafellner & John 2006), Russia (Zhurbenko 2009b), Pakistan (Poelt & Grube 1993), China (Poelt & Grube 1993) and Nepal (Triebel 1989).

Specimens examined. 10: on *Lecidea lapicida* (thallus), 9 May 2013, M. Zhurbenko 1315 (LE 260 958). – 11: on pale buff-yellow *Lecanora* sp. with tiny marginal lobes, growing on siliceous rock (thallus), 10 May 2013, M. Zhurbenko 1325 (LE 261 108).

Muellerella pygmaea (Körb.) D. Hawksw.

Ascomata 150–250 µm diam. Ascospores (6.5–)7.5–10(–13.5) × (4–)5–6(–7.5) µm, l/b = (1.3–)1.4–2.0(–3.4) (n = 93). Infected host parts are sometimes slightly discolored. The species was formerly known in Asia from Iran (Seaward et al. 2008), Turkey (Hafellner & John 2006), Tajikistan (Kondratyuk & Kudratov 2002), Russia (Triebel 1989, Zhurbenko 2009b) and China (Hawksworth & Cole 2003).

Specimens examined. 9: on *Xanthoria elegans* (thallus), 5 May 2013, M. Zhurbenko 1376 (LE 260 487). – 11: on *X. elegans* (thallus, occasionally apothecia), 10 May 2013, M. Zhurbenko 1372 (LE 260 517); M. Zhurbenko 1373 (LE 260 447); M. Zhurbenko 1374 (LE 260427). – 12: on brown *Acarospora* sp. growing on siliceous rock (thallus), 12 May 2013, M. Zhurbenko 1317 (LE 261 177).

Nectriopsis lecanodes (Ces.) Diederich & Schroers

Peltigera elisabethae and *P. scabrosa* are new host species. It is noteworthy that *Peltigera scabrosa*, a lichen with circumpolar boreal to arctic distribution (Vitikainen 1994), is absent in the recent compendium of the macrolichens of India (Awasthi 2007). Formerly known in Asia from Russia (Zhurbenko & Davydov 2000).

Specimens examined (all on moribund parts of *Peltigera* spp. thalli). 6: on *P. elisabethae*, 30 Apr 2013, M. Zhurbenko 1351 (LE 261 209); on *P. scabrosa*, 30 Apr 2013, M. Zhurbenko 1349 (LE 261 348). – 7: on *P. cf. scabrosa*, 1 May 2013, M. Zhurbenko 1347 (LE 261 057).

Phoma sp.

Conidia (4.5-)5.5-6.5(-8) × 3.5-4(-4.5) μm, l/b = (1.1-)1.2-1.8(-2.1) (n = 21). Infected host tissues become darker.

Specimen examined. 5: on *Xanthoria elegans* (apothecia), 30 Apr 2013, M. Zhurbenko 1378 (LE 261 037).

Polycoccum clauzadei Nav.-Ros. & Cl. Roux

Ascospores (14.5-)16.5-19.5(-22) × (6.5-)7-8(-8.5) μm, l/b = (2.1-)2.2-2.6(-2.9) (n = 29). Formerly known in Asia from an uncertain report from Russia (Urbanavichene & Urbanavichus 2007).

Specimen examined. 11: on *Xanthoria elegans* (apothecia, thallus), 10 May 2013, M. Zhurbenko 1380 (LE 261 007).

Polycoccum pulvinatum (Eitner) R. Sant.

Ascospores olive then brown, more or less ellipsoid, 1-septate, not or slightly constricted at the septum, verrucose, sometimes with halo up to 3 μm thick, diagonally uniseriate in an ascus, slightly shorter than reported by Hawksworth (1975), viz. (13.5-)14.5-16.5(-17) × 7.5-8.5(-9.5) μm, l/b = (1.5-)1.7-2.1(-2.2) (n = 26) vs. 14-18(-21) × 7-9 μm. Formerly known in Asia from Iran (Sohrabi & Alstrup 2007) and Russia (Zhurbenko 2009b).

Specimen examined. 6: on *Physcia dubia* (thallus), 30 Apr 2013, M. Zhurbenko 1356 (LE 261 298).

Pronectria subimperspicua (Speg.) Lowen

Ascospores are slightly longer than reported for the species type by Rossman et al. (1999), namely (5.5-)7-9(-10.5) × (4-)4.5-5.5(-6) μm, l/b = (1.1-)1.3-1.9(-2.2) (n = 35) vs. 6.5-8 × 5-6 μm. Associated with discolored areas on the host thallus. Formerly known in Asia from China (Santesson 1998).

Specimen examined. 2: on *Punctelia borreeri* (thallus), 25 Apr 2013, M. Zhurbenko 1346 (LE 261 168).

Pyrenidium actinellum Nyl. s. lat.

Ascomata associated with necrotic patches or dark swellings on the host thallus. Formerly known in Asia from Turkey (Halici et al. 2007c), Russia (Zhurbenko 2009b) and China (Hafellner & Obermayer 1995).

Specimens examined. 6: on *Peltigera elisabethae* (thallus), 30 Apr 2013, M. Zhurbenko 1350 (LE 261 208); on *P. praetextata* (thallus), 30 Apr 2013, M. Zhurbenko 1352 (LE 261 458).

Rosellinula frustulosae (Vouaux) R. Sant.

Pathogenicity not observed. Formerly known in Asia from Iran (Sohrabi & Alstrup 2007), Turkey (Halici et al. 2007a), Kyrgyzstan (Nadyeina & Halici 2011) and Mongolia (Hafellner 1985).

Specimen examined. 12: on *Lecanora argopholis* (thallus), 12 May 2013, M. Zhurbenko 1328 (LE 261 017).

Sarcogyne sphaerospora J. Steiner

Ascospores ellipsoid to globose, (3–)4–5(–6) × (3–)3.5–4(–4.5) μm, l/b = 1.0–1.4(–2.0) (n = 63). Lichenization was not observed, which matches with observations of K. Knudsen (pers. comm.). This rarely reported species seems to be so far known in Asia only from the type locality in eastern Turkey (Steiner 1899) and from Tajikistan (Kudratov & Mayrhofer 2002).

Specimens examined (both on thalli of *Candelariella* species or occasionally on siliceous rock nearby them). 10: 9 May 2013, M. Zhurbenko 1322 (LE 261 106). – 11: 10 May 2013, M. Zhurbenko 1323 (LE 260 996).

Sphaeropezia cf. *lecanorae* (Diederich & Marson) Baloch & Wedin

Ascomata 350–500 μm diam., pore 30–150 μm diam., margin radially fissured. Ascospores ellipsoid to narrowly ellipsoid, 3-septate, (10.5–)12–14.5(–16) × (4.5–)5–6.5(–7.5) μm, l/b = (1.8–)2.1–2.7(–2.8) (n = 22, in water or K/I), wall K/I+ pale blue. *Sphaeropezia lecanorae* is the only species of the genus known from saxicolous placidioid *Lecanora* species of the *L. muralis* group. However, in the species protologue its ascospores were reported as being smaller, viz. (9–)10–11.5(–13) × (3.5–)4–5(–6.5) μm (Diederich et al. 2002). Examined material also fits description of “*Odontotrema* sp. 3”, characterized by ascospores of similar size, (12–)13–15.5(–17) × (4.5–)5–6 μm, but growing on corticolous and lignicolous, non-placidioid *Lecanora symmicta* and *L. pulicaris* (Diederich et al. 2002). Both species are as yet known only from a few collections and the variability of their ascomatal characters is insufficiently known. *Sphaeropezia lecanorae* has hitherto not been reported from Asia.

Specimen examined. 6: on *Lecanora muralis* s. lat. (thallus), 30 Apr 2013, M. Zhurbenko 1332 (LE 261 418).

Stigmidium gyrophorarum (Arnold) D. Hawksw.

Causes local darkening of the host thallus. Formerly known in Asia from Turkey (Halici et al. 2007e), Tajikistan (Kondratyuk & Kudratov 2002) and Russia (Zhurbenko & Santesson 1996).

Specimen examined. 4: on *Umbilicaria vellea* (thallus), 29 Apr 2013, M. Zhurbenko 1365 (LE 261 338).

Stigmidium pumilum (Lettau) Matzer & Hafellner

Ascomata 30–70 μm diam., mostly semi-immersed, associated with poorly visible dark hyphae. Asci (26–)26.5–34(–39) × (11–)11.5–15.5(–16.5) (n = 11), wall BCr–. Ascospores narrowly obovoid with wider upper cell, hyaline, smooth-walled, 1-septate, when over-mature occasionally pale brown, verruculose and/or 2-septate, markedly constricted at the septum, (11–)12.5–14.5(–15.5) × 4–4.5 μm, l/b = (2.8–)2.9–3.5(–3.7) (n = 37), usually with 1–2 large lipid drops in each cell, non-halonate, wall BCr–.

Infection associated with darkened areas on the host lobes. Formerly known in Asia from Iran (Sohrabi & Alstrup 2007), Turkey (Hafellner & John 2006) and Russia (Zhurbenko 2009b).

Specimen examined. 6: on *Phaeophyscia ciliata* (thallus), 30 Apr 2013, M. Zhurbenko 1342 (LE 261 258).

Stigmidium tabacinae (Arnold) Triebel

Ascomata 50–70 µm diam., semi-immersed, associated with immersed brown hyphae. Ascospores hyaline, narrowly obovoid, (7.5–)8–10(–11) × (3–)3.5–4 µm, l/b = (2.1–)2.2–2.6(–2.8) (n = 19, in water or BCr), 1-septate, slightly constricted at the septum, smooth-walled, usually with several conspicuous lipid drops (sometimes pseudotetrablastic), non-halonate. Walls of asci and ascospores BCr–. Triebel (1989) reported for the species somewhat longer ascospores, (10–)11.5–12.5(–14) × (3–)3.5–4 µm. Formerly known in Asia from Iran (Sohrabi & Alstrup 2007), Turkey (Hafellner & John 2006) and Russia (Zhurbenko 2009a).

Specimen examined. 8: on *Toninia tristis* (thallus), 3 May 2013, M. Zhurbenko 1363 (LE 260 988).

Vouauxiella lichenicola (Linds.) Petr. & Syd.

Distinct pathogenicity not observed. Formerly known in Asia from Turkey (Etayo & Breuss 1998).

Specimens examined [both on *Lecanora* spp. from *L. subfusca* group (discs of apothecia)]. 3: 27 Apr 2013, M. Zhurbenko 1327 (LE 261 107). – 5: 30 Apr 2013, M. Zhurbenko 1329 (LE 261 027).

Zwackhiomyces coepulonus (Norman) Grube & R. Sant.

Ascospores (18–)20–25.5(–27) × (5.5–)6–7 µm, l/b = (2.7–)3.1–3.9(–4.0) (n = 17), which corresponds to the measurements of Zhurbenko (2009b) [(15–)18.5–23(–25) × (5.5–)6–7(–8) µm, l/b = (2.1–)2.6–3.6(–4.4)], but differs from those of Grube & Hafellner (1990) [(15–)16–20(–21) × 5.5–8.5(–9) µm, l/b = 2.6]. Sometimes associated with slightly discolored portions of the host lobes. Formerly known in Asia from Israel (Navrotskaya et al. 1996), Turkey (Hafellner & John 2006), Russia (Zhurbenko 2009b) and Mongolia (Huneck et al. 1992).

Specimen examined. 11: on *Xanthoria elegans* (apothecia, thallus), 10 May 2013, M. Zhurbenko 1375 (LE 260 437).

Zwackhiomyces cf. *kiszkianus* D. Hawksw. & Miądl.

Fig. 2

Ascomata black, more or less pyriform, 150–250 µm diam., protruding only in ostiolar area to semi-immersed, scattered. Exciple about 30–40 µm thick, brown throughout, K+ olive. Ostiolar filaments 30–35 × 2.5–3.5 µm. Interascal filaments abundant, hyaline, branched, anastomosed, 2–3.5 µm diam. Asci subcylindrical to narrowly clavate, usually with distinct foot and with ocular chamber ca 2 µm tall, (89–)93–113(–120) × (14–)15–19(–20) µm (n = 16, in water or K/I), originally 8-spored, but sometimes with 2–4 mature spores.

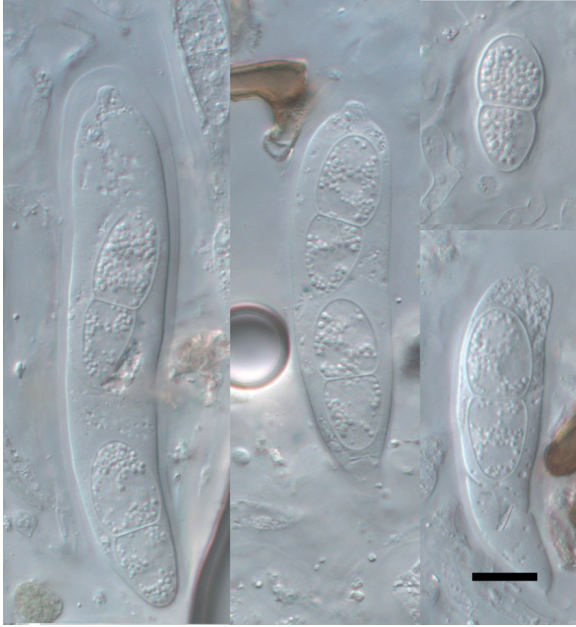


Fig. 2. *Zwackhiomyces* cf. *kiskianus* on *Peltigera elisabethae* (LE 260507). Asci and ascospores in water. Bar = 10 μ

Ascospores narrowly obovoid, 1-septate, usually markedly constricted at the septum, with wider and often somewhat longer upper cell, (19–)23.5–29(–33) \times (7–)8.5–11(–12.5) μ m, l/b = (1.8–)2.4–3.0(–3.2) (n = 60, in water or K), with numerous small lipid drops, smooth-walled, non-halonate, refractive spots not observed. Sometimes causes local discoloration of the host tissues. There are some differences between the examined material and the species protologue (Hawksworth & Miądlikowska 1997), where its ascomata were said to be immersed and not associated with any necrotic patches, interascal filaments 1–2 μ m diam., asci 90–105 \times 14–15.5 μ m, ascospores shorter (19.5–25.5 \times 8.5–13 μ m), with a refractive spot at the junction of wall and septum, surrounded by a perispore with a granular internal ornamentation. However, the species was previously known only from the type collection in Germany (on *Peltigera canina*), and it is possible that its ascomatal characters have a wider range of variation.

Specimen examined. 4: on *Peltigera elisabethae* (upper, occasionally lower sides of lobes), 29 Apr 2013, M. Zhurbenko 1354 (LE 260 507).

Discussion

The list includes 36 species of lichenicolous fungi, all of which except *Endococcus rugulosus* are new to India, thus increasing the number of these fungi species known from the country to 42. Taking into consideration that: 1) Awasthi (2007) enumerated 874 species

of macrolichens from India, Nepal and Sri Lanka, which should be less than half of the total lichen species number of the area; 2) in the well-studied regions of the Holarctic ratio of the number of lichen species to the number of lichenicolous fungi species is roughly equal to 5:1 (Zhurbenko 2007); 3) the British Isles, with far fewer potential host lichens and a much smaller geographical area, has at least 460 species of lichenicolous fungi (B.J. Coppins, pers. comm.), it is likely that the true richness of lichenicolous fungi in India is far in excess of 400 species.

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