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Some new additions to black mildew fungi of North Western Himalayas, India

Gautam AK[1*] and Avasthi S[2]

[1] Faculty of Agriculture, Abhilashi University, Mandi-175028, India
[2] Department of Botany, Abhilashi Institute of Life Sciences, Mandi- 175008, India

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Abstract

Three black mildew fungi, namely *Schiffnerula celastri*, *Sarcinella oreophila* and *Schiffnerula cryptostegiae* were reported on *Celastrus paniculatus*, *Carissa* sp. and *Cryptolepis buchanani* respectively and are described and illustrated in detail in the present study. Although, these black mildews have previously been reported from various parts of India, there is no report from Himachal Pradesh and surrounding areas. Therefore, the present study contributes new records to the black mildew fungi, not only in the state, but also in the north western Himalaya.

Key words – Black mildews – Himachal Pradesh – India – *Schiffnerula* – *Sarcinella* – taxonomy

Introduction

Black mildews are fungi that produce black colonies on the host surface. These fungi are ectotrophic, obligate parasites that inhabit moist humid environments in tropical and sub-tropical regions. They occur on higher plants and infect mostly soft stems, petioles and leaves. The fungi are believed to be host-specific and produce beautiful web-like structures, appressoria, setae, thyrotecia, pycnothyria, asci, ascospores, pycnothyriospores, perithecial appendages and brown septate ascospores on infected hosts. These fungi can be categorized in several taxonomic groups, viz. meliolaceous fungi, schiffnerulaceous fungi, asterinaceous fungi, hyphomycetous fungi (Hansford 1961, Hosagoudar 2008, Hosagoudar & Agarwal 2008).

During explorations of foliicolous fungi in the Himachal Pradesh, India, some black mildew fungi infecting host plants were collected from various localities of Mandi and Bilaspur districts of the state. The variable climatic and topographical conditions of the state provide best favorable conditions for the luxuriant growth and development of foliicolous fungi. This northern Himalayan state is known for its rich biodiversity and has been explored to a large extent for mycorrhizal fungi, rusts, powdery mildews and to some extent hyphomycetes. However there is little information available on Black mildews. Hence, we have taken an interest in the systematic study of black mildews in the state.

Materials & Methods

Infected plant parts were observed in the field, field notes were made regarding their pathogenicity, nature of colonies, nature of infection, locality, and altitude. In the field, infected plants were collected separately in polythene bags. These infected plant parts were pressed neatly and dried in between blotting papers. After ensuring their dryness, they were kept in the manifold or butter paper

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Corresponding Author: Ajay K Gautam – e-mail – a2gautam2006@gmail.com

folders. The type specimens have been deposited in Faculty of Agriculture, Abhilashi Univertsity (AUMH), Himachal Pradesh, India.

For microscopic study, scrapes were taken directly from the infected host and mounted in 10% KOH solution. After 30 minutes, KOH was replaced by lactophenol for clear visibility of septa. Nail polish technique was used to study the colonies in the natural conditions. A drop of clear, transparent high quality natural nail polish was applied to the selected colonies as thin layer with a fine brush and kept in dust free chamber for 30 minutes. The thin film or flip formed after dryness was lifted off with a slight pressure on the opposite side of the leaves or with the help of a razor or scalpel. The thin film or flip was mounted in a drop of DPX (A mixture of Distyrene, a plasticizer and xylene) on a clean glass slide and used for observation and retained (Hosagoudar & Kapoor 1984). The microscopic observations were made under oil immersion by standard light microscopy to note down characters of appressorial mycelium, conidiophores, conidia, thyriothecia, ascus and ascospores used to identify species. Camera lucida drawings were also prepared to support the final confirmation of fungi.

Results

Three black mildew fungi were collected on aerial parts of infected plants during the course of mycological survey. Description and illustrations of these fungi along with a discussion on their taxonomy are presented as here.

Taxonomy

Schiffnerula celastri Hosag., Riju & Sabeena, Indian J. Sci. Techn. 2(6):8, 2009. (Figs. 1–2)

= *Stigmella palawanensis* Sydow, Philippine J. Sci. 9: 189, 1914; Sahni, Mycopath. Mycol. Appl. 23: 332, 1964.

= *Sarcinella palawanensis* (Sydow & Sydow) Sahni, Mycopath. Mycol. Appl. 29: 241, 1966.

= *Sarcinella paniculatae* Verma, Tripathi & R. K. Choudhary, Indian Phytopath. 52: 379, 1999.

= *Clypeolella inversa* Hohn *sensu* Thite & Kulkarni, Indian Phytopath. 26: 76, 1973.Figs 1–2

Colonies amphigenous, black, dense, coalesced up to 4 mm in diameter; hyphae substraight to crooked, branching irregular at acute angles, opposite to alternate, loosely to closely reticulate, 3.1– 4.0 µm wide, cells 13.2–46.5 × 3–4.5 µm. *Appressoria* opposite, unicellular, sessile, globose, entire 6.6–11 × 6–9 µm. **Sexual morph**:*Thyriothecia* scattered, orbicular, ovate, initially radiating, later central portion dissolved by exposing asci, up to 156 µm in diameter, marginal cells radiating. *Asci* 5–8 per thyriothecia, globose, 8-spored, bitunicate, 15–28 µm in diameter. *Ascospores* 16.94–26 × 6–13 µm, oblong, conglobate, uni-septate, constricted at the septum, remaining hyaline for some time, but turning brown at maturity. **Asexual morph**: *Conidia* of *Questieriella* 31.5–53 × 6–9.5 µm, scattered, free, not attached, curved, 3-septate, slightly constricted at the septa, tapering towards both ends, 31.5–53 × 6–9.5 µm. *Sarcinella* conidiophores produced lateral to the hyphae, single, straight to flexuous, macronematous, mononematous, 0–2- septate, 11–31 × 4–6 µm. *Conidiogenous cells* monoblastic, integrated, mostly terminal, cylindrical. *Sarcinella* conidia 16.5–24.2 (20.24±2.78) µm in diameter, blastic, terminal, mostly sessile, solitary, dry, ovate to globose, sarciniform, cruciately septate, 2–8-celled, constricted at the septa, wall smooth.

Material examined – India, Himachal Pradesh, Berthin (Distt. Bilaspur) 673 meters (2,208 ft), Tanda (Distt. Mandi) 760 meters (2,495 ft), and Chail Chowk (Distt. Mandi) 1400 metres (4,592 ft), on leaves of *Celastrus paniculatus* L. (Celastraceae), collected by A. K. Gautam, 26.10.2015 (AUMH 1034).

Notes – The fungus collected on *Celastrus paniculatus* was identified as *Schiffnerula celastri* and produced both asexual (*Quistieriella* and *Sarcinella*) and sexual morphs. The species has also reported previously from various localities of Kerala, Maharashtra, Karnataka and Uttar Pradesh. The *Sarcinella* morph of this fungus is also known from Uttar Pradesh. It is reported for the first time from Himachal Pradesh.

Fig. 1 – Black mildew infection on leaves of *Celastrus paniculatus*.

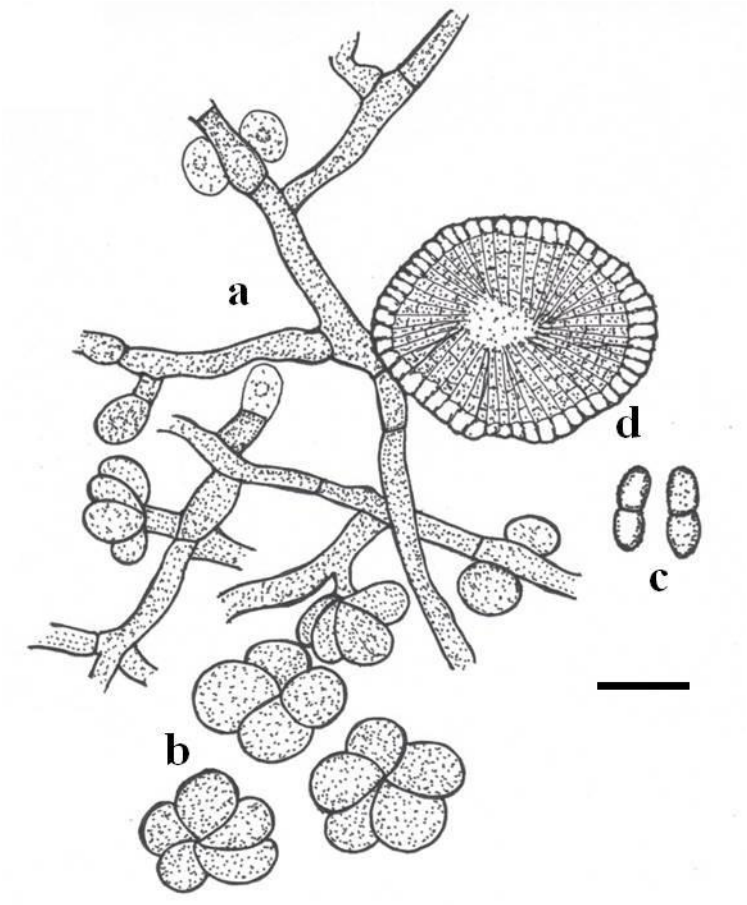

Fig. 2 – *Schiffnerula celastri*. a. Branched mycelium, b. Sarciniform conidia, c. Ascospores. d. Thyriothecia. (Scale bar: 20µm)

Sarcinella oreophila H. Sydow, Ann. Mycol. 35: 242, 1927. (Figs. 3–4)

Colonies amphigenous, subdense, up to 5 mm in diameter, confluent. Hyphae pale brown, straight, branching irregular, at acute angles, loosely reticulate, cells 19–31 × 3–4.5 µm. *Appressoria* alternate to unilateral, unicellular, globose, margin entire, 4–7.5 × 5–6.5 µm. **Sexual morph**: Undetermined. **Asexual morph**: *Conidiophores* macronematous, micronematous, simple, straight, short, light brown, arise laterally from the hyphae, smooth, 3–5 × 4–5 µm. *Conidiogenous cells* integrated, terminal, monoblastic, cylindrical. Conidia 14.3 –23.1 µm, simple, dry, solitary, acrogenous, globose, smooth, dark brown, constricted at the septa, cells 3–8, sarcinately arranged.

Material examined – India, Himachal Pradesh, Berthin (Distt. Bilaspur), 673 meters (2,208 ft) and Mandi 760 meters (2,495 ft), on leaves of *Carissa* sp. (Apocynaceae), collected by A.K. Gautam, 14.11.2015 (AUMH 1035).

Note – This fungus collected on *Carissa* sp. was identified as *Sarcinella oreophila*. Two asexual morphs (*Quistieriella* and *Sarcinella*) were observed. The species has previously been reported only from Kerala. No reports are available from other part of the country. Therefore, present collection constitutes new record for north western Himalaya and second for India.

Fig. 3 – Black mildew infection on leaves of *Carissa* sp.

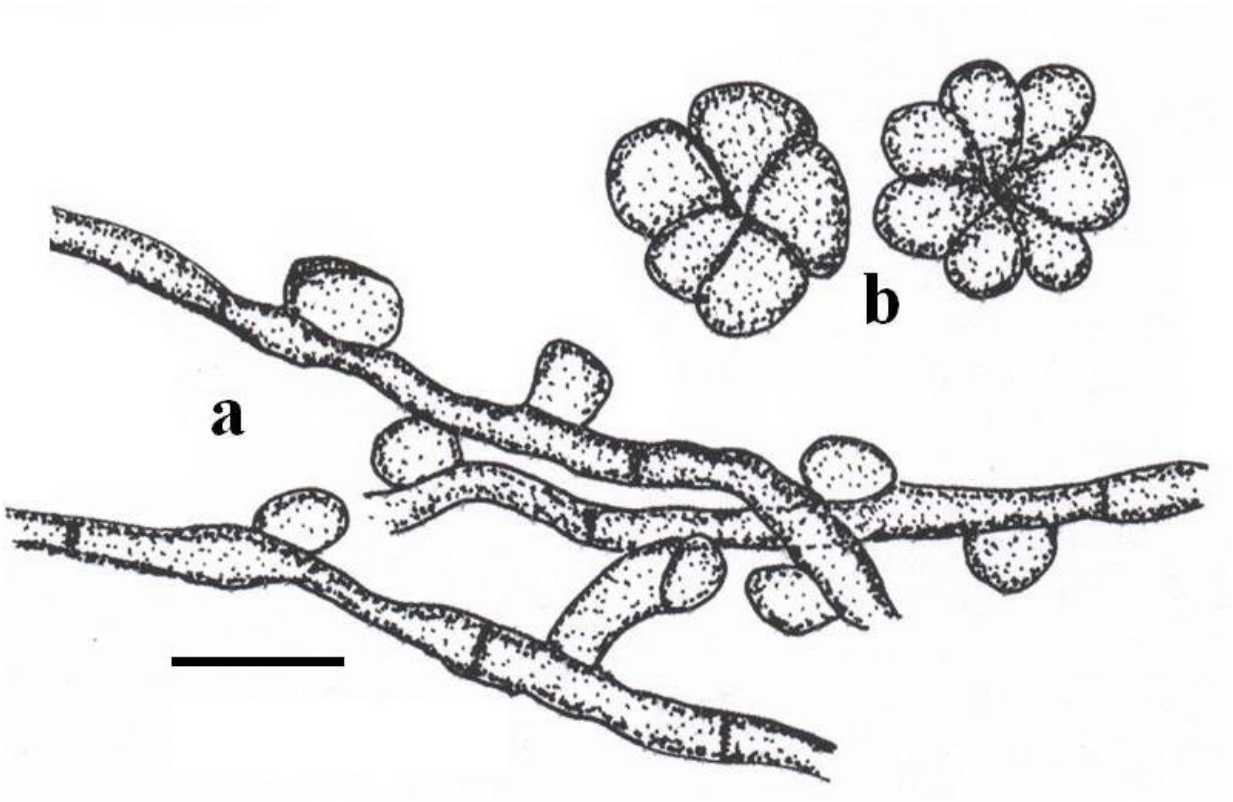

Fig. 4 – *Sarcinella oreophila*. a. Branched mycelium, b. Sarciniform conidia. (Scale bar: 20µm)

Schiffnerula cryptostegiae Hosag. & Jacob-Thomas, Pl. Pathol. Quarantine 1(2), 131–204, 2011 (Figs. 5-6)

Colonies amphigenous, black, subdense, 2-5.5 mm in diameter, confluent. *Hyphae* pale brown, straight, branching irregular, at acute angles, loosely reticulate, cells 4.7 – 5.5 × 2.2 – 4.5 µm. *Appressoria* alternate to unilateral, unicellular, globose, margin entire, 5– 11.5 × 5.5–9 µm. **Sexual morph**: *Thyriothecia* scattered, orbicular, ovate, initially radiating, later central portion dissolved by exposing asci, up to 60 µm in diameter, marginal cells radiating. **Asexual morph**: *Conidiophores* macronematous, micronematous, simple, straight, short, light brown, arise laterally from the hyphae, smooth, 3–5 × 4–5 µm. *Conidiogenouscells* integrated, terminal, monoblastic, cylindrical. *Conidia* 22 – 33 µm, simple, dry, solitary, acrogenous, globose, smooth, dark brown, constricted at the septa, cells 3–8, sarcinately arranged. *Questeriella* state present, slightly curved, 3-septate, constricted at the septa, end cells acute, 30–35 × 10.5–12 µm.

Material examined – India, Himachal Pradesh, Berthin (Distt. Bilaspur), 673 meters (2,208 ft) and Mandi 760 meters (2,495 ft), on leaves of *Cryptolepis buchanani* Roem & Schult (Apocynaceae), collected by A. K. Gautam, 13.12.2015 (AUMH 1036).

Note – *Schiffnerula cryptostegiae* was collected on *C. buchanani*from Vazhachal Forests, Thrissur, Kerala. The *Sarcinella*state of this fungus is known from Uttar Pradesh. It is reported here for first time from Himachal Pradesh.

Discussion

The black mildews namely *Schiffnerula celastri*, *Sarcinella oreophila* and *Schiffnerula cryptostegiae* were reported on *Celastrus paniculatus*, *Carissa* sp. and *Cryptolepis buchanani* respectively in the present study. These black mildew fungi have been reported previously from Kerela, Maharashtra, Karnataka and Uttar Pradesh (Srivastava et al. 1990; Verma et al. 1999; Hosagoudar 2011), but are unknown in Himachal Pradesh and surrounding areas. However, two black mildew fungi i.e. *Schiffnerula girijae* and *Prillieuxina aeglicola* (Gautam 2014; Gautam 2015) were reported on *A. marmelos* from the state. Therefore, present study contributes new additions to black mildew fungi, not only to the state, but also to North Western Himalaya.

Fig. 5 – Black mildew infection on leaves of *Cryptolepis buchanani*.

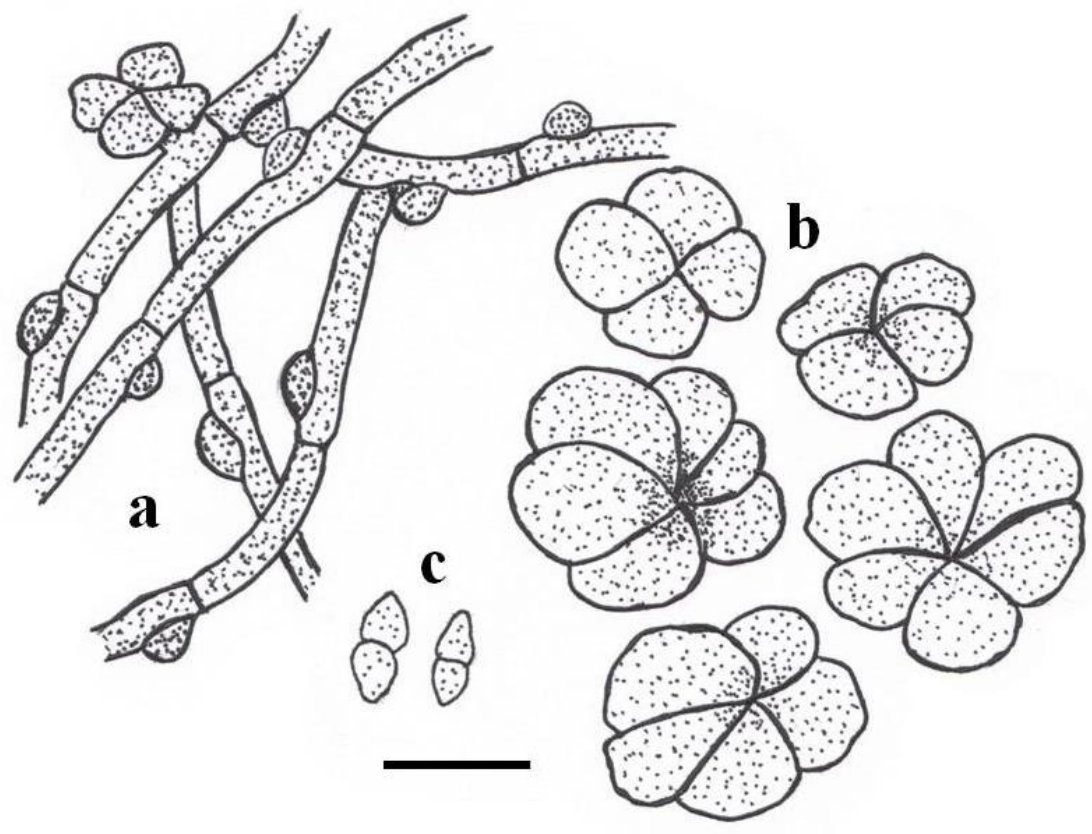

Fig. 6 – *Schiffnerula cryptostegiae*. a. Branched mycelium, b. Sarciniform conidi. C. Ascospores. (Scale bar: 20µm)

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