

## RESEARCH ARTICLE

## Three new black mildew fungi from Mahabaleshwar, Maharashtra, India

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Manuscript details:	ABSTRACT
<p>Received: 31 October, 2014            Revised : 05 December, 2014            Revised received: 10 December, 2014            Accepted: 15 December, 2014            Published : 30 December, 2014</p> <p><b>Editor: Dr. Arvind Chavhan</b></p> <p><b>Citation this article as:</b>            Bhise MR, Patil CR and Salunkhe CB (2014) Three new black mildew fungi from Mahabaleshwar, Maharashtra, India, <i>Int. J. of Life Sciences</i>, 2(4):304-310.</p>	<p>The present paper deals with three new black mildew fungi belonging to family Meliolaceae and Schiffnerulaceae, collected on the members of plant family Oleaceae from Mahabaleshwar region. Among these, <i>Asteridiella websteri</i> Hosag. var. <i>oleae</i> var. <i>nov.</i>, <i>Meliola dioicae</i> sp. <i>nov.</i> and <i>Sarcinella ligustri</i> sp. <i>nov.</i> are reported in the survey. The detail morphological description, line drawings, colour photographs and discussions are provided.</p> <p><b>Key words:</b> Meliolaceae, Schiffnerulaceae, taxonomy, Western Ghats</p>
<p><b>Acknowledgement:</b>            The authors are grateful to the authorities of Maharashtra State Biodiversity Board, Nagpur (M.S.) for granting permission for collection of plant material from study area. Thanks are due to Principal, D.K.A.S.C. College, Ichalkaranji and Principal, Krishna Mahavidyalaya, Shivnagar, Rethare (BK.), Dist. Satara, for providing the laboratory facilities.</p> <p><b>Copyright:</b> © 2014   Author(s), This is an open access article under the terms of the Creative Commons Attribution-Non-Commercial - No Derivs License, which permits use and distribution in any medium, provided the original work is properly cited, the use is non-commercial and no modifications or adaptations are made.</p>	<p><b>INTRODUCTION</b></p> <p>Northern Western Ghats of India, commonly known as 'Sahyadri' ranges are rich with biodiversity and a center for evolution of many species. Within these ranges, Mahabaleshwar is one of the largest hill station situated in Satara district of Maharashtra state. Mahabaleshwar and its surrounding area are blessed with abundant life forms and habitats, clad in subtropical evergreen and semi evergreen forest; hence, it provides suitable conditions for the growth of black mildew fungi. From this area, family Oleaceae is represented by 4 genera with 10 species and 1 variety of wild as well as cultivated plants (Deshpande <i>et al.</i>, 1995). Among these, <i>Jasminum malabaricum</i> Wight, <i>J. roxburghianum</i> Wall. ex C.B.Cl., <i>Ligustrum perrottetii</i> A. DC. and <i>Olea dioica</i> Roxb. are found to be infected with black mildew fungi</p> <p>Black colony forming fungi are known as 'Black or dark mildews'. These are obligate, ecto-parasites, superficial, host specific, belong to different taxonomic groups namely Meliolaceous, Schiffnerulaceous, Asterinaceous and some of Hyphomycetous fungi (Hansford, 1961; Hosagoudar, 1996). From India, 10 species and 5 varieties of <i>Meliola</i>; 1 species of <i>Amazonia</i>; 2 species of <i>Asteridiella</i> belongs to Meliolaceous</p>

fungi and 1 species *Sarcinella* is an anamorph of *Schiffnerula* belong to Schiffnerulaceous fungi are known on the members of family Oleaceae (Hosagoudar, 1996, 2008, 2011, 2013).

During the exploration of black mildew fungi in area under study, two species and one variety of black mildews are reported on the members of family Oleaceae. Among these, *Asteridiella websteri* Hosag. var. *oleae* var. nov. and *Meliola dioicae* sp. nov., belonging to family Meliolaceae and an anamorphic species, *Sarcinella ligustri* sp. nov. of family Schiffnerulaceae are taxonomically described here as new to science.

## MATERIALS AND METHODS

The plant leaves and twigs of members of family Oleaceae, infected with black mildews were collected from study area, during winter season (2012–2014). The infected host twigs were collected separately in sterilized polythene bags, tagged with field number, brought in the laboratory and pressed neatly to dry in between blotting papers. The well dried specimens were enclosed in butter paper and preserved in standard size herbarium packets. The host plants were identified by referring the regional flora (Deshpande *et al.*, 1995). Both macro and micro-morphological characters are used for taxonomical study of collected fungi. The fungal micro-morphological structures were mounted in lactophenol, stained with cotton blue and observed under compound light microscope. To observe mycelial branching and position of appressoria, a drop of peeling solution (Xylene–Thermocol solution) was applied on selected areas of the colonies, and after drying a film was mounted directly again in the same peeling solution. Biometric data were based on at least 20 measurements of structures; illustrations were prepared with Camera Lucida and photographed under Leica DM2000 fluorescence microscope equipped with digital camera. The fungal specimens were identified by using respective standard literature (Hansford, 1961; Hosagoudar, 1996, 2008, 2011, 2013; Far and Rossman, 2014). Type specimens were deposited in Herbarium Cryptogamae Indiae Orientalis (HCIO), IARI, New Delhi (India) for their accession. The detail taxonomic description, beeli formula for meliolaceous fungi, line drawings, colour photographs, comparative account and description of each new taxon are discussed in present paper.

## RESULTS AND DISCUSSION

### Taxonomy

**1. *Asteridiella websteri* Hosag. var. *oleae*** Bhise and Patil var. nov. (Fig. 1)

MycoBank MB810261

Beeli formula: 3101.2220

**Type:** India, Maharashtra: Mahabaleshwar, Par, on living leaves of *Olea dioica* Roxb. (Oleaceae), 17°55'22.30"N, 73°36'00.20"E, elev. 762m, 17.10.2013, Bhise M.R., HCIO 51649 (holotype).

**Etymology:** The specific epithet is based on name of the host genus.

Colonies amphigenous, dark black, circular to spreading, subdense, confluent, up to 7 mm in diameter. Hyphae dark brown, undulate to flexuous, branching opposite to alternate, mostly opposite at acute to wide angles, closely reticulate, cells 14–36 × 6 µm. Appressoria alternate, closely arranged, antrorse, bicelled, straight to curved, 12–23 × 7–10 µm; stalk cells cylindrical to cuneate, 4–9 × 6 µm; head cells obovate, oblong to subglobose, straight to slightly curved, entire, 9–14 × 7–10 µm. Phialides born on a separate mycelial branch, opposite, alternate to unilateral, closely arranged, ampulliform, 14–18 × 5–7 µm. Perithecia globose, scattered to grouped, verrucose to crenate at margin, up to 160 µm in diameter. Perithecial wall cells conoid to mammiform, up to 14 µm. Ascospores cylindrical to oblong, olivaceous brown, 4-septate, constricted at the septa, rounded at end, 26–30 × 11–14 µm, smoothed margin.

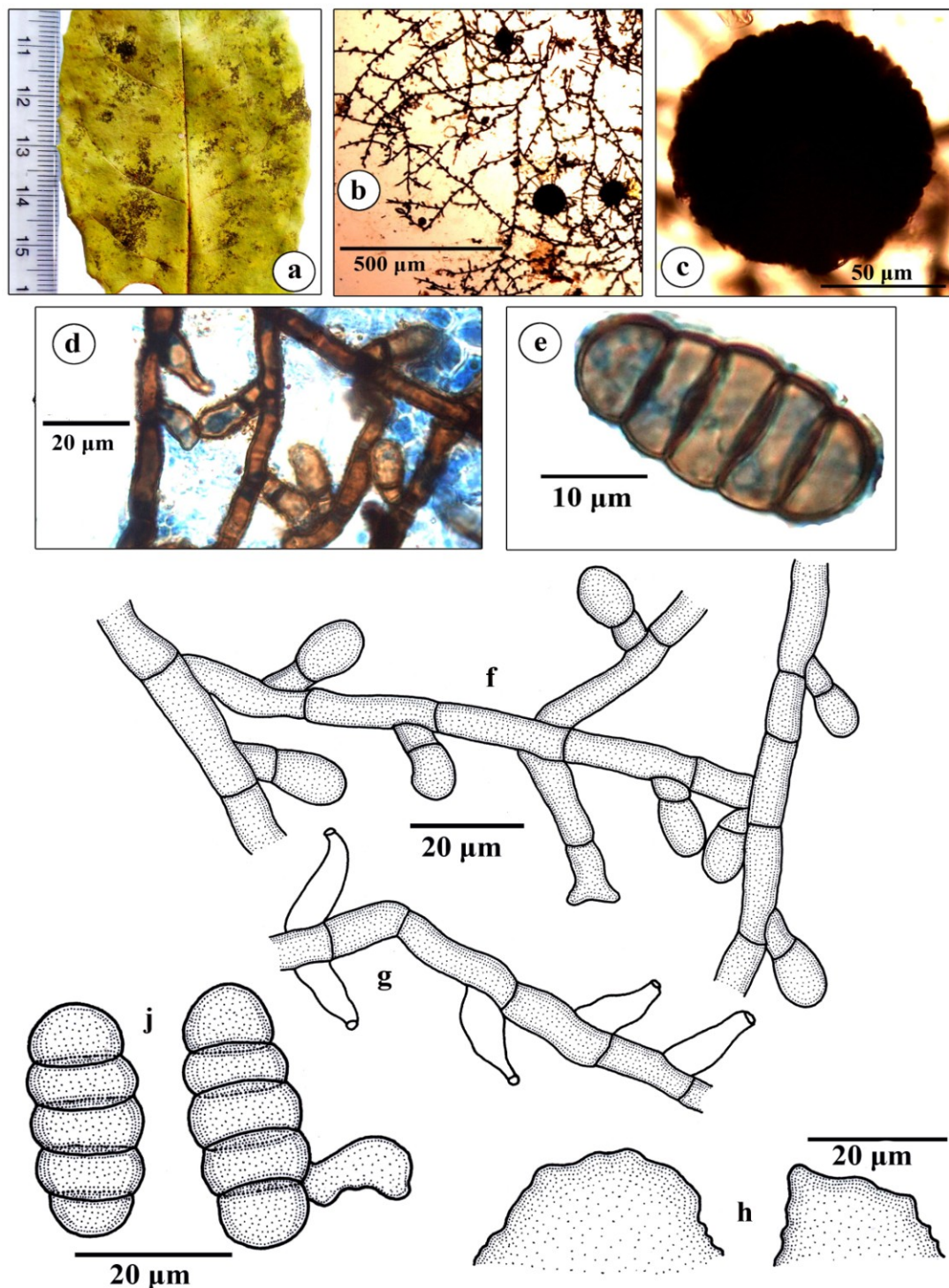
**Habitat and Distribution:** Inhabiting living leaves of *Olea dioica*, along the streams from Par, Gonoshi, Mahabaleshwar, Maharashtra, India.

**Other specimens examined:** Other specimens examined – On living leaves of *Olea dioica* Roxb. (Oleaceae), Mahabaleshwar, 17°57'50.44"N, 73°39'12.47"E, elev. 1339m, 2.1.2012, Bhise M.R., HCIO 51648; Gonoshi, 17°55'22.30"N, 73°36'00.20"E, elev. 762m, 4.2.2014, Bhise M.R., HCIO 51650.

**Notes:** So far *Asteridiella americana* Hansf., *A. hispaniolensis* (Cif.) Hansf., *A. linocieriae* (Sydow) Hansf. and *A. websteri* Hosag. are reported on the members of family Oleaceae from Florida, San Domingo, Philippines and India respectively (Hansford, 1961; Hosagoudar, 1996). However, the

present taxon is similar to *Asteridiella websteri* Hosag. known on *Olea dioica* Roxb. from Coimbatore, Tamil Nadu, India, due to the presence of phialides born on a separate mycelial branch (Hosagoudar, 1991, 1996).

But, the present variety differs from the var. *websteri* in having amphigenous colonies; larger phialides and perithecia, and smaller size of ascospores (Table 1). Hence, reported here as a new variety.



**Fig. 1:** *Asteridiella websteri* Hosag. var. *oleae*. a. Infected leaf; b. Mycelial colony; c. Perithecium; d, f. Appressoriolate mycelium; e, j. Ascospores; g. Phialides; h. Perithecial wall cells.

**Table 1: Comparative account of *Asteridiella websteri* Hosag. var. *websteri* and *A. websteri* Hosag. var. *oleae* var. *nov.***

Sr. No.	Morphotaxonomic characters	<i>Asteridiella websteri</i> Hosag. var. <i>websteri</i>	<i>Asteridiella websteri</i> Hosag. var. <i>oleae</i> var. <i>nov.</i>
1.	Host Plant	<i>Olea dioica</i>	<i>Olea dioica</i>
2.	Colonies	Strictly epiphyllous, crustose, up to 4 mm diam.	Amphigenous, subdense, up to 7 mm diam.
3.	Hyphae	Branching opposite to irregular, cells 27–31 × 4.5–6.5 µm	Branching mostly opposite, cells 14–36 × 6 µm
4.	Phialides	12–15 × 9–12µm	14–18 × 5–7µm
5.	Perithecia	up to 115 µm diam.	upto 160 µm diam.
6.	Perithecial wall cells	Conoid, up to 10 µm	Conoid to mammiform, up to 14 µm
7.	Ascospores	Slightly constricted at septum, 37–40.5 × 15–18.5 µm	Constricted at septum, 26–30 × 11–14 µm

**2. *Meliola dioicae* Bhise and Patil sp. nov.** (Fig. 2)

Mycobank MB810262

Beeli formula: 3111.4233

**Type:** India, Maharashtra: Mahabaleshwar, Par-Wada, on living leaves of *Olea dioica* Roxb. (Oleaceae), 17°55'22.30"N, 73°36'00.20"E, elev. 762m, 22.12.2012, Bhise M.R., HClO 51678 (holotype).

**Etymology:** The specific epithet is based on name of the host species.

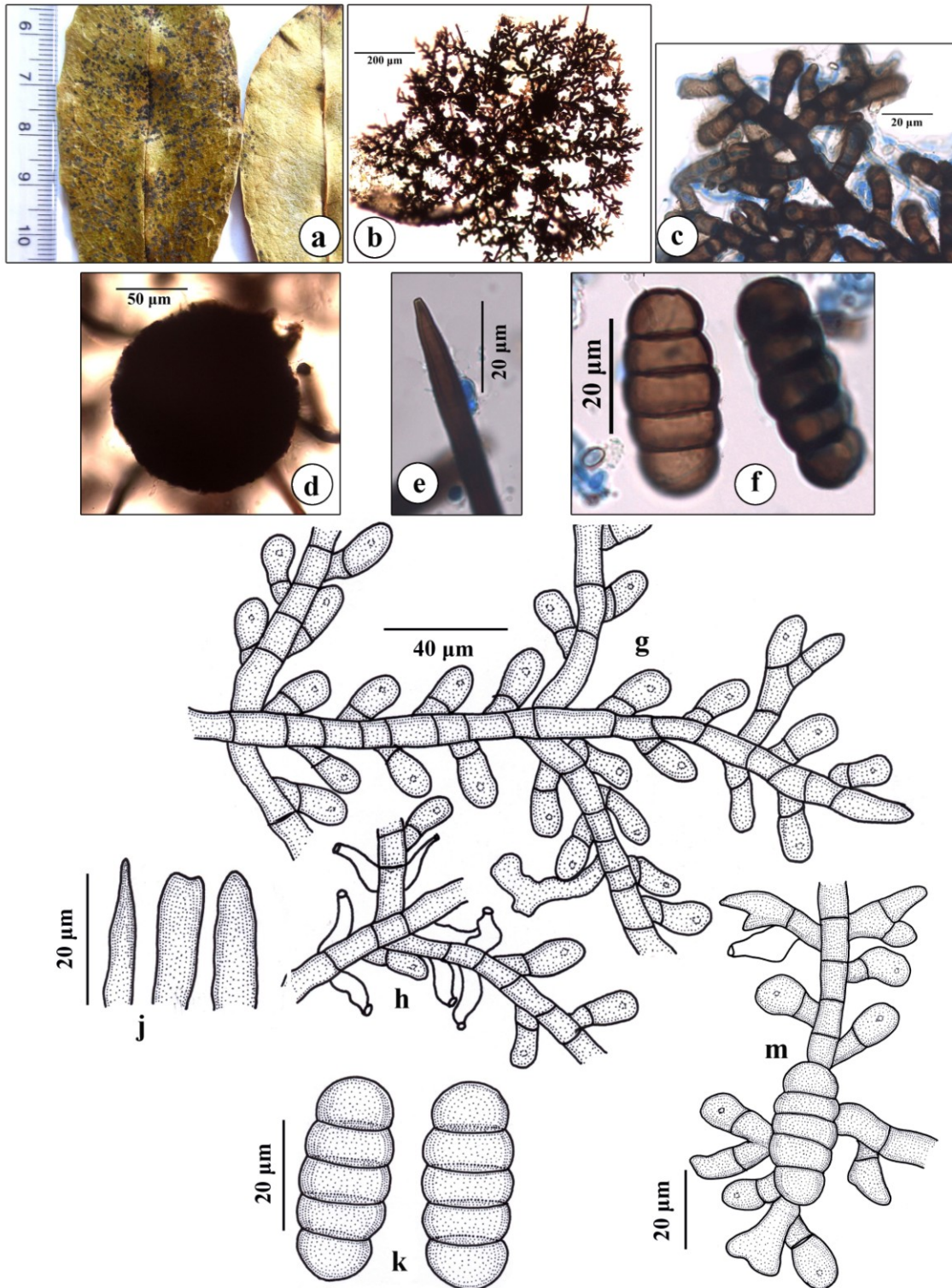
Colonies amphigenous, mostly epiphyllous, dark black, circular to spreading, dense, confluent, effused, up to 3mm in diameter, easily pilled off. Hyphae dark brown, substraight to flexuous, branching opposite to alternate, mostly opposite at acute to wide angles, closely reticulate, cells 13–16 × 9 µm. Appressoria

alternate, closely arranged, antrorse, bicelled, straight to curved, 22–25 × 9–11 µm; stalk cells cylindrical to cuneate, 4–7 × 7–9 µm; head cells broadly oblong, cylindrical to rarely clavate, straight to slightly curved, entire, 18–19 × 9–11 µm. Phialides few, mixed with appressoria, opposite to alternate, ampulliform, 14–18 × 6–8 µm. Mycelial setae simple, straight, closely scattered, aggregated around perithecia, apex pointed to obtuse, up to 600 µm long. Perithecia globose, scattered to grouped, verrucose at margin, up to 207 µm in diameter. Ascospores cylindrical to oblong, olivaceous brown, 4-septate, constricted at the septa, rounded at end, 40–43 × 13–18 µm, smoothed margin.

**Habitat and Distribution:** Inhabiting living leaves of *Olea dioica*, along the streams from Par-Wada, Hatlote, Mahabaleshwar, Maharashtra, India.

**Table 2: Comparative account of *Meliola glanduliferae* Hosag. et al., *M. malabarensis* Hansf., *M. oleacearum* Hosag. and *M. dioicae* sp. nov.**

Sr. No.	Morpho-taxonomic characters	<i>Meliola glanduliferae</i>	<i>Meliola malabarensis</i>	<i>Meliola oleacearum</i>	<i>Meliola dioicae</i> sp. nov.
1.	Host Plant	<i>Olea glandulifera</i>	<i>Olea</i> sp.	<i>Olea dioica</i>	<i>Olea dioica</i>
2.	Colonies	Amphigenous, up to 2 mm diam.	Hypophyllous, up to 4 mm diam.	Hypophyllous, up to 10 mm diam.	Amphigenous, up to 3 mm diam.
3.	Hyphae	Branching mostly opposite, cells 12–18 × 5–7 µm	Branching opposite, cells 22–42 × 6–8 µm	Branching irregular, cells 20–26 × 4–6 µm	Branching mostly opposite, cells 13–16 × 9 µm
4.	Appressoria	19–22 µm long	16–24 µm long	14–24 µm long	22–25 × 9–11 µm
5.	Phialides	19–24 × 4–7µm	18–20 × 6–10µm	20–26 × 4–6µm	14–18 × 6–8µm
6.	Mycelia setae	Up to 200 µm	Up to 480 µm	Up to 400 µm	Up to 599 µm
7.	Perithecia	Up to 160 µm	Up to 144 µm diam.	Up to 120 µm	Up to 207 µm
8.	Ascospores	Obovoid to cylindrical, 35–40 × 14–16 µm	Obovoid, 32–38 × 10–16 µm	Obovoid, 35–40 × 14–16 µm	Obovoid to cylindrical, 40–43 × 13–18 µm



**Fig. 2:** *Meliola dioicae*. a. Infected leaves; b. Mycelial colony; c, g. Appressoriate mycelium; d. Perithecium; e, j. Mycelial setae; f, k. Ascospores; h. Phialides; m. Germinating ascospores.

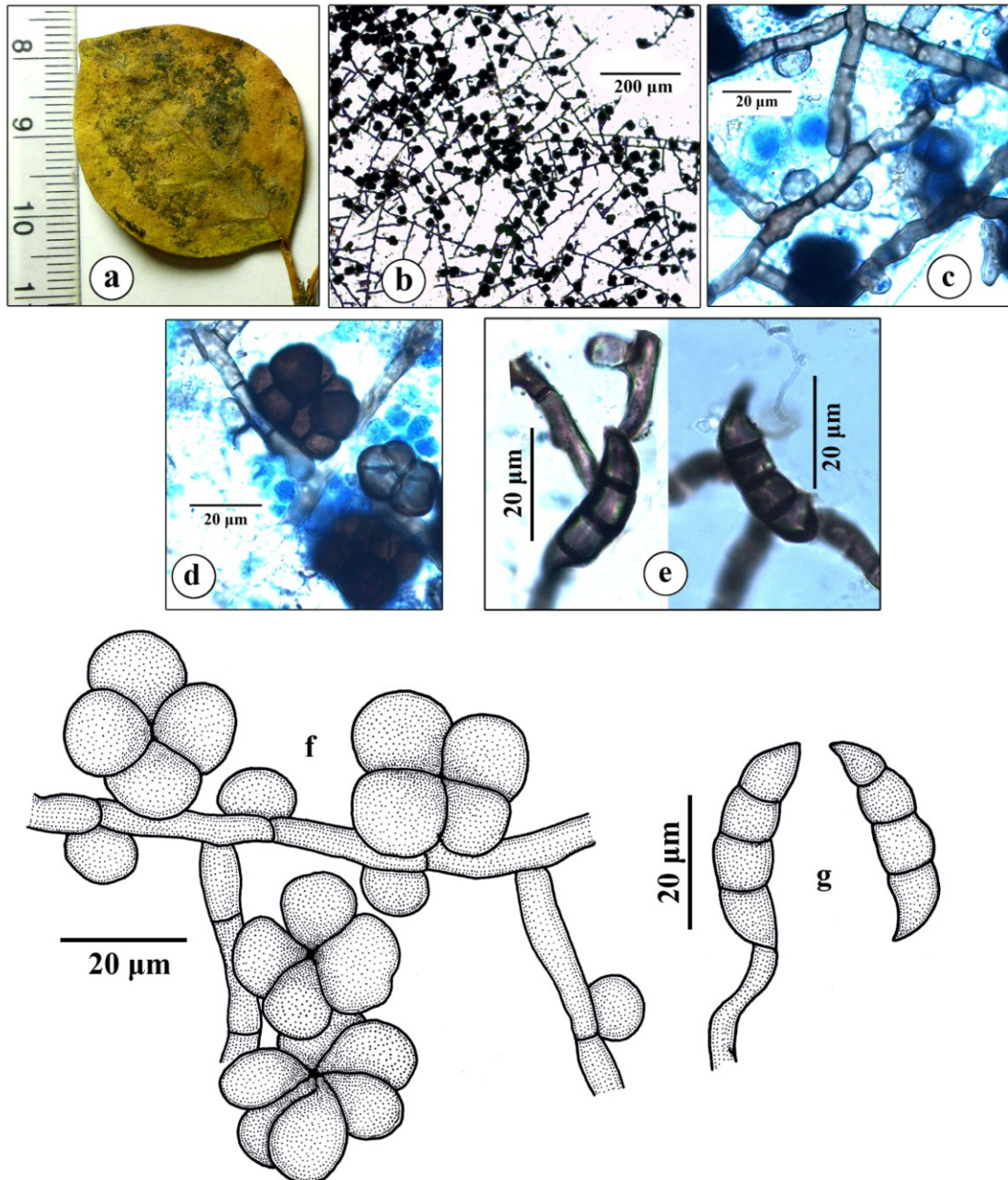
**Other specimen examined:** On living leaves of *Olea dioica* Roxb. (Oleaceae), Hatlote, (Mahabaleshwar), 17°51'43.60"N, 73°35'33.80"E, elev. 742m, 6.2.2014, Bhise M.R., HClO 51679.

**Notes:** *Meliola oleicola* Doidge from South Africa; *M. glanduliferae* Hosag. et al., *M. malabarensis* Hansf. and *M. oleacearum* Hosag. from Kerala and Karnataka, India are known on genus *Olea* (Hansford, 1961;

Hosagoudar, 1996, 2008). However, the new species differs from the related species described on *Olea* (Table 2) in having smaller hyphal cells and phialides; larger size of appressoria, mycelial setae, perithecia and ascospores. Also, it differs from *M. oleicola* in having phialides born mixed with appressoria and smaller size of ascospores. Therefore, present species is treated as new to science.

**3. *Sarcinella ligustri* Bhis and Patil sp. nov.** (Fig. 3)  
Mycobank MB810263

**Type:** India, Maharashtra: Old Mahabaleshwar, on living leaves of *Ligustrum perrotetti* A. DC. (Oleaceae), 17°57'50.44"N, 73°39'12.47"E, elev. 1339m, 18.10.2013, Bhis M.R., HClO 51703 (holotype).



**Fig. 3:** *Sarcinella ligustri*. a. Infected leaves; b. Mycelial colony; c. Appressoriolate mycelium; d, f. *Sarcinella* conidia; e, g. *Questieriella* conidia.

**Table 3: Comparative account of *Sarcinella heterospora* Sacc. and *Sarcinella ligustri* sp. nov.**

Sr. No.	Morphotaxonomic characters	<i>Sarcinella heterospora</i>	<i>Sarcinella ligustri</i> sp. nov.
1.	Host Plant	<i>Ligustrum</i> sp.	<i>Ligustrum perrotetti</i>
2.	Colonies	Epiphyllous, velvety, up to 2 mm diam.	Amphigenous, scattered on entire leaf surface
3.	Hyphae	Straight to flexuous, cells 12–16 × 4–6 µm	Straight to substraight, cells 14–34 × 4–5 µm
4.	Appressoria	Globose, broad based	Globose to hemispherical.
5.	<i>Sarcinella</i> type conidia	2–5 celled, 19–32 µm diameter	4–6 celled, mostly 4–celled, 25–34 × 16–30 µm
6.	<i>Questieriella</i> type conidia	Absent	Scattered on hyphae, straight to slightly falcate, 30–38 × 9–10 µm

**Etymology:** The specific epithet is based on name of the host genus.

Colonies amphigenous, mostly epiphyllous, thin, scattered on almost entire leaf surface. Hyphae brown, straight to sub-straight, branching opposite to irregular at wide angles, loosely to closely reticulate, cells 14–34 × 4–5 µm. Appressoria alternate to unilateral, less pigmented than other cells, closely arranged, unicellular, globose to hemispherical, entire, 7–12 × 9–10 µm. Conidiophores micronematous, mononematous, simple, straight, light brown, arise laterally from the hyphae, 11–17 × 5–7 µm; conidia simple, solitary, globose to tetragonal, smooth, brown to carbonaceous black, sarciniform, constricted at the septa, 4–6 celled, mostly 4–celled, 25–34 × 16–30 µm. Conidia of *Questieriella* present, few, straight to falcate, pale brown, ends tapering and pointed, 3–septate, 30–38 × 9–10 µm, wall smooth.

**Habitat and Distribution :** Inhabiting living leaves of *Ligustrum perrotetti*, along the streams from Wilson Point, Mahabaleshwar, Maharashtra, India.

**Other specimen examined:** On living leaves of *Ligustrum perrotetti* A. DC. (Oleaceae), Wilson Point (Mahabaleshwar), 17°55'25.11"N, 73°40'26.27"E, elev. 1316m, 16.10.2013, Bhise M.R., HClO 51704.

**Notes:** *Sarcinella heterospora* Sacc. and *Questieriella pulchra* Huges are an anamorph of *Schiffnerula pulchra* (Sacc.) Petrak. known on *Ligustrum vulgare* and *Ligustrum* sp. from USA, Italy, Europe and India (Hosagoudar, 2003, 2011); *Schiffnerula pulchra* is reported from Kodagu, Karnataka, India by Hosagoudar (2011) with only its anamorph *Sarcinella heterospora* on *Ligustrum* sp., however, present

species differs from the earlier reported species in having closely scattered amphigenous colonies; larger size of hyphae cells and sarciniform conidia, also presence of its synanamorph *Questieriella* (Table 3). Therefore, present species is treated as new to science.

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