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Studies on foliicolous fungi-XXX: fungi of Shillong, Meghalaya

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Abstract: This paper gives an account of the fungi collected from Shillong. Of these, *Asteridiella phukanea, Asterina schimae, Meliola meghalayensis, M. shillongensis, Questieriella zanthoxyli, Sarcinella castanopsidis* and *S. lyoniae* are the new species. While, *Asterina indica*, *A. hakgalensis* and *Meliola rubiella* are reported for the first time from the state of Meghalaya. The study indicates that North-Eastern region of India is a treasure of foliicolous fungi and its systematic study may bring out several undescribed new species.

Keywords: Foliicolous fungi, Shillong, new species, new records

Introduction

As a part of "Diversity and distribution of Asterinaceous fungi in India", a tour was conducted to Shillong and preliminary survey of the fungi resulted in the discovery of seven new species and four new records to the state. This indicates the potentiality of the fungal wealth of the region.

Taxonomy

Asterina hakgalensis Hansf., Proc. Linn. Soc. London 158: 45, 1947; Hosag. & Shiburaj, Zoos' Print J. 18: 1193, 2003.

Materials examined: On leaves of *Rhododendron arboreum* Smith (Ericaceae), Jan. 21, 2007, Mawphlang, Shillong, Meghalaya, Jacob Thomas & P.J. Robin. HCIO 48038, TBGT 2821.

Asterina indica Sydow in Sydow & Butler, Ann. Mycol. 9:390, 1911

Materials examined: On leaves of *Symplocos theacifolia* Ham. (Theaceae), Mawphlang, Shillong, Meghalaya, Jan. 21, 2007, Jacob Thomas & P.J. Robin HCIO 48053, TBGT 2836.

***Asterina schimae* sp. nov.** (Fig. 1)

Coloniae epiphyllae, densae, dispersae, ad 2 mm diam., confluentes. Hyphae rectae vel undulatae, opposite vel alternatim acuteque vel laxe ramosae, laxe vel arte reticulatae et formans tages mycelialis, cellulae 12-29 x 5-7 µm. Appressoria opposita (70%), alternate, unicellularis, crassa posita, sessilis, ovata, globosa, mammiformes, integra, 7-11 x 7-10 µm. Thyriothecia dense dispersa, orbicularis vel raro ovata, 130-220 x 90-160 µm, stellatim dehiscentes ad centre, crenata vel fringiora ad margine; asci numerosi, ovati vel globosi, octospori, ad 58 µm diam.; ascosporae conglobatae, brunneae, uniseptatae, constrictae ad septatae, late rotundatae ad ambi apicem, 31-36 x 14-17 µm, parietus glabrus. Pycnothyria thyriotheciis similis, breviter; pycnothyriosporae pyriformes, brunneae, 10-24 x 5-10 µm.

Colonies epiphyllous, dense, scattered, up to 2 mm in diameter, confluent. Hyphae straight to undulate, branching opposite to alternate at acute to wide angles, closely reticulate and form a mycelial mat, cells 12-29 x 5-7 µm. Appressoria opposite (70%), alternate, unicellular, broad based, sessile, ovate, globose, mammiform, entire, 7-11 x 7-10 µm. Thyriothecia closely scattered, orbicular to rarely ovate, 130-220 x 90-160 µm, dehiscing stellately at the centre, crenate to fimbriate at the margin; asci many, ovate to globose, octosporous, up to 58 µm in diameter; ascospores conglobate, brown, 1-septate, constricted at the septum, broadly rounded at both

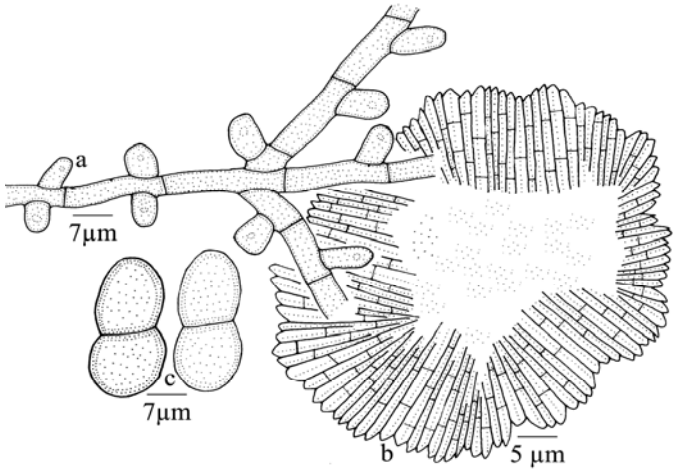

Fig.1. *Asterina schimae* sp.nov
a. Appressorium, b. Thyriothecium, c.Ascspores

apices, brown, 31-36 x 14-17 µm, wall smooth. Pycnothyria similar to thyriothecia, smaller; pycnothyriospores pyriform, brown, 10-24 x 5-10 µm.

Material examined: On the leaves of *Schima wallachi* (DC.) Korthals var. *khasiana* (Dyer) Bloem. (Theaceae), Lumshillong, Shillong, Meghalaya, Jan. 18, 2007, Jacob Thomas & P.J. Robin HCIO 48018 (type), TBGT 2801 (isotype).

Yamamoto (1957) proposed *Asterina theae* Yamam. on *Thea sinensis* from Taiwan and Katumoto (1975) synonymised it to *Asterina camelliae* Syd. & Butler and narrated the total history of *Schiffnerula camelliae* (Sydow, Sydow & Butler) Hughes. Subsequently, Hosagoudar *et al.* (2005) proposed *Asterina cannonii* Hosag. *et al*. However, the former two species have alternate appressoria and the latter has 5% alternate appressoria. *A. schimae* is similar to *Asterina cannonii* Hosag. *et al*. in having alternate appressoria but differs from it in having 70% opposite appressoria.

Key to the species of the Genus *Asterina* on Theaceae

1. Appressoria alternate 2
1. Appressoria alternate and opposite 3
2. Appressoria oblong, ovate, clavate, cylindrical, entire, 19-24 x 8-10 µm .... *A. cannonii*
2. Appressoria ovate, globose, clavate, cylindrical, entire to rarely furcate, 8-13 x 6-7 µm .... *A. euryae*
3. Appressoria 5% opposite ... *A. theacearum*

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3. Appressoria 70% opposite .... *A. schimae*

Asterina zanthoxyli Yamamoto, Sci. Rep. Hyogo Univ. Agric. Biol. Ser.3: 28, 1957. **Materials examined:** On leaves of *Zanthoxylum khasianum* Hook. f. (Rutaceae), Lumshillong, Shillong, Meghalaya, Jan. 18, 2007, Jacob Thomas & P.J. Robin HCIO 48070, TBGT 2853.

Asteridiella phukanea **sp. nov.** (Fig. 2)

Coloniae amphigenae, plerumque epiphyllae, ad 2 mm diam., confluentes. Hyphae subrectae vel leniter undulatae, alternate vel opposite acuteque vel laxe ramosae, arte reticulatae, cellulae 21-28 x 7-10 µm. Appressoria alternata, antrorsa vel subantrorsa, 24-31 µm longa; cellulae basilares cylindraceae vel cuneatae, 5-12 µm longae; cellulae apicales ovatae, globosae, integrae, angularis vel leniter lobatae, 14-22 x 10-19 µm. Phialides appressoriis intermixtae, oppositae vel alternatae, ampulliformes, 17-22 x 7-10 µm. Perithecia dispersa, ad 120 µm daim.; ascosporae obovoideae vel cylindraceae, 3-septatae, constrictae ad septatae, 36-43 x 16-18 µm.

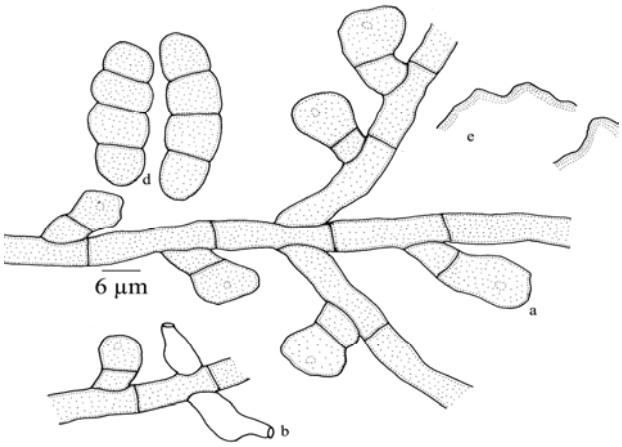

Fig. 2.*Asteridiella phukanea* sp.nov
a. Appressorium, b. Phialide, c. Perithecial cell wall, d.Ascspores

Colonies amphigenous, mostly epiphyllous, up to 2 mm in diameter, confluent. Hyphae substraight to slightly undulate, branching alternate to opposite at acute to wide angles, closely reticulate, cells 21-28 x 7-10 µm. Appressoria alternate, antrorse to sub antrorse, 24-31 µm long; stalk cells cylindrical to cuneate, 5-12 µm long; head cells ovate, globose, entire, angular to slightly lobate, 14-22 x 10-19 µm. Phialides mixed with appressoria, opposite to alternate, ampulliform, 17-22 x 7-10 µm. Perithecia scattered, up to 120 µm in diameter; ascospores obovoidal to cylindrical, 3-septate, constricted at the septum, 36-43 x 16-18 µm.

Material examined: On leaves of *Castanopsis armata* Spach. (Fagaceae), Mawphlang, Shillong, Meghalaya, Jan. 18, 2007, Jacob Thomas & P.J. Robin HCIO 48066 (type), TBGT 2849 (isotype).

This new species is distinct from all the known species of the genus *Asteridiella* known on the members of the family Fagaceae in having three septate ascospores (Hansford, 1961; Hosagoudar, 1996; Hu *et al.* 1996, 1999) and is named in honour of Dr. (Mrs.) S.J. Phukan, Joint Director, Botanical Survey of India, Eastern Circle, Shillong for her dedicated help during the period of exploration.

Meliola meghalayensis sp.nov. (Fig. 3)

Coloniae epiphyllae, tenues, ad 2 mm diam. Hyphae rectae vel subrectae, opposite laxe ramosae, arte reticulatae et rete mycelialis formans, cellulae 21-31 x 7-10 µm. Appressoria alternate et 2% unilateralis, recta vel curvula, antrorsa vel subantrorsa, 24-29 µm longa; cellulae basilares cylindraceae vel cuneatae, 10-12 µm longae; cellulae apicales subglobosae vel ellipsoideae, integrae vel leniter angularis, 14-19 x 12-19 µm. Phialides appressoriis intermixtae, oppositae vel alternatae, ampulliformes, 17-26 x 9-12 µm. Setae mycelliales circa perithecia aggregatae, simplices, rectae, ad apicem acutae, obtusae vel dentatae, ad 820 µm longae. Perithecia dispersa, globosa, verrucosa, ad 180 µm daim.; ascosporae cylindraceae vel ellipsoideae, 4-septatae, constrictae ad septatae, 41-43 x 14-19 µm.

Colonies epiphyllous, thin, up to 2 mm in diameter. Hyphae straight to substraight, branching opposite at wide angles, closely reticulate and form a mycelial net, cells 21-31 x 7-10 µm. Appressoria alternate and about 2% unilateral, straight to curved, antrorse to subantrorse, 24-29 µm long; stalk cells cylindrical to cuneate, 10-12 µm long; head cells subglobose to ellipsoidal, entire to slightly angular, 14-19 x 12-19 µm. Phialides mixed with appressoria, opposite to unilateral, ampulliform, 17-26 x 9-12 µm. Mycelial setae grouped around perithecia, simple, straight, acute, obtuse to dentate at the tip, up to 820 µm long. Perithecia scattered, globose, verrucose, up to 180 µm. in diam.; ascospores cylindrical to ellipsoidal, 4-septate, constricted at the septa, 41-43 x 14-19 µm.

Materials examined: On leaves of *Castanopsis armata*

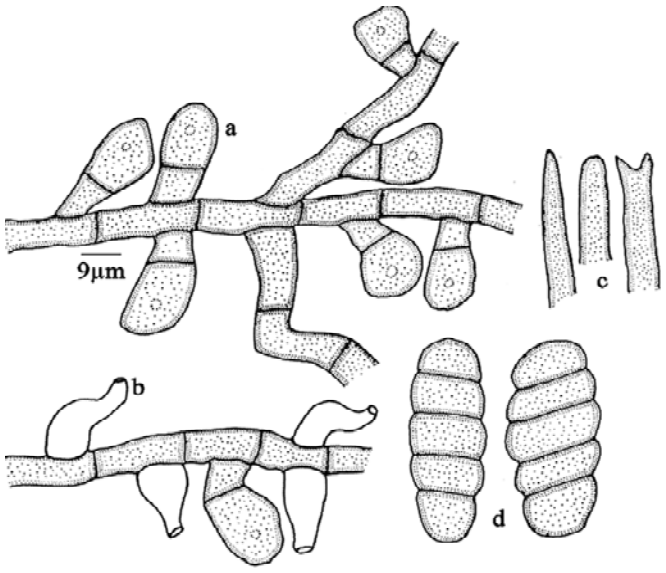

Fig.3. *Meliola meghalayensis* sp.nov.
a. Appressorium, b. Phialide, c. Apical portion of the mycelial setae, d. Ascspores

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Spach. (Fagaceae), Lumshillong, Shillong, Meghalaya, Jan. 18, 2007, Jacob Thomas & P.J. Robin HCIO 48069 (type), TBGT 2852 (isotype).

This species differs from *Meliola taiwaniona* Yamam. and *M. melanochaeta* Sydow in having simple to dentate mycelial setae. However, it differs from both in having entire head cells of appressoria and smaller ascospores (Hansford, 1961). It also differs from *M. bosei* Hosag. in having longer appressoria, mycelial setae and larger ascospores (Hosagoudar, 1996).

Meliola rubiella Hansf., Sydow Beih. 1: 115, 1957; Sydowia Beih. 2: 240, 1961; Kapoor, Indian Phytopathol. 20: 158, 1967; Hosag., Meliolales of India, p. 303, 1996.

Materials examined: On the leaves of *Rubus* sp. (Rosaceae), Shillong peak, Shillong, Meghalaya, Jan. 20, 2007, Jacob Thomas & P.J. Robin HCIO 48054, TBGT 2837.

***Meliola shillongensis* sp. nov.** (Fig. 4)

Coloniae epiphyllae, densae, velutinae, ad 3 mm diam. Hyphae subrectae vel undulatae, alternate vel opposite acuteque vel laxe ramosae, arte reticulatae et formans rete mycelialis ad centro, cellulae 19-25 x 7-9 µm. Appressoria alternata, antrorsa vel retrorsa, recta vel curvula, dense posita, 22-34 µm longa; cellulae basilares cylindraceae vel cuneatae, 7-12 µm longae; cellulae apicales ovatae, globosae vel subglobosae, integrae, 14-22 x 9-12 µm. Phialides paucae in numero, appressoriis intermixtae, opposite, ampulliformes, 21-29 x 7-10 µm. Setae myceliales numerosae, circa peritheciis aggregatae, simplices, rectae, leniter curvulae, ad apicem acutae vel obtusae, ad 620 µm longae. Perithecia dispersa, globosa, verrucosa, ad 170 µm diam.; ascosporae oblongae vel obovoideae, cylindraceae, 4-septatae, constrictae ad septatae, 19-31 x 10-12 µm.

Colonies epiphyllous, dense, velvety, up to 3 mm in diameter. Hyphae substraight to undulate, branching alternate to opposite at acute to wide angles, closely reticulate and form a mycelial mat at the centre, cells 19-25 x 7-9 µm. Appressoria alternate, antrorse to retrorse, straight to curved, closely placed, 22-34 µm long; stalk cells cylindrical to cuneate, 7-12 µm long; head cells ovate, globose to subglobose, entire, 14-22 x 9-12 µm. Phialides few in number, mixed with appressoria, opposite, ampulliform, 21-29 x 7-10 µm. Mycelial setae numerous, grouped around perithecia, simple, straight, slightly curved, acute to obtuse at the tip, up to 620 µm long. Perithecia scattered, globose, verrucose, up to 170 µm in diam.; ascospores oblong to obovoidal, cylindrical, 4-septate, constricted at the septa, 19-31 x 10-12 µm.

Materials examined: On the leaves of *Vaccinium griffithianum* Wight (Vacciniaceae), Mawphlang, Shillong, Meghalaya, Jan. 21, 2007, Jacob Thomas & P.J. Robin HCIO 48065 (type), TBGT 2848 (isotype).

Based on the morphology and measurements, *M. shillongensis* is closer to *M. vaccinii* Stev. known on *Vaccinium reticulatum* from Hawaii (Hansford, 1961; Hosagoudar *et al.*, 1997). However, differs from it in having only alternate and shorter appressoria and smaller ascospores.

***Questieriella zanthoxyli* sp. nov.** (Fig. 5)

Coloniae epiphyllae, minutae, ad 2 mm diam., confluentes. Hyphae rectae vel subrectae, leniter flexuosae, opposite vel alternatim acuteque ramosae, laxe reticulatae, cellulae 19-29 x 4-7 µm. Appressoria dispersa, mammiformes, integra vel angularis, 7-12 x 5-7 µm. Conidia numerosa, producentes cellulae hyphales, pallid brunnea, recta vel curvula, 3-septata, raro constricta ad septata, 24-34 x 7-10 µm.

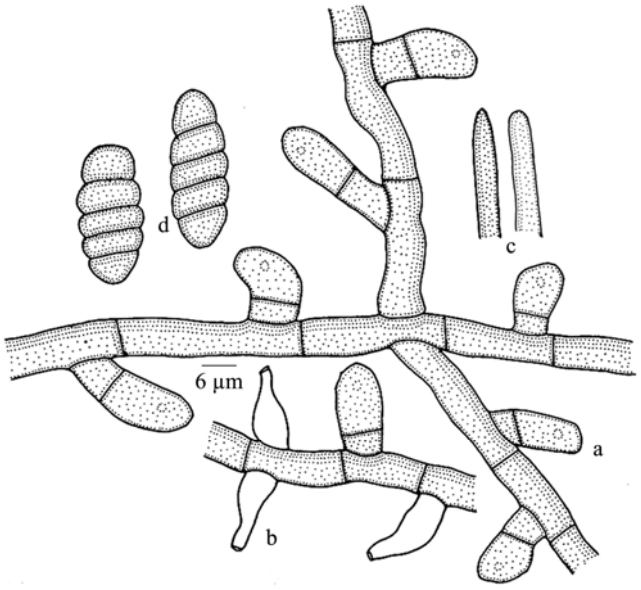

Fig.4. *Meliola shillongensis* sp.nov.
a. Appressorium, b. Phialide, c. Apical portion of the mycelial setae, d. Ascspores

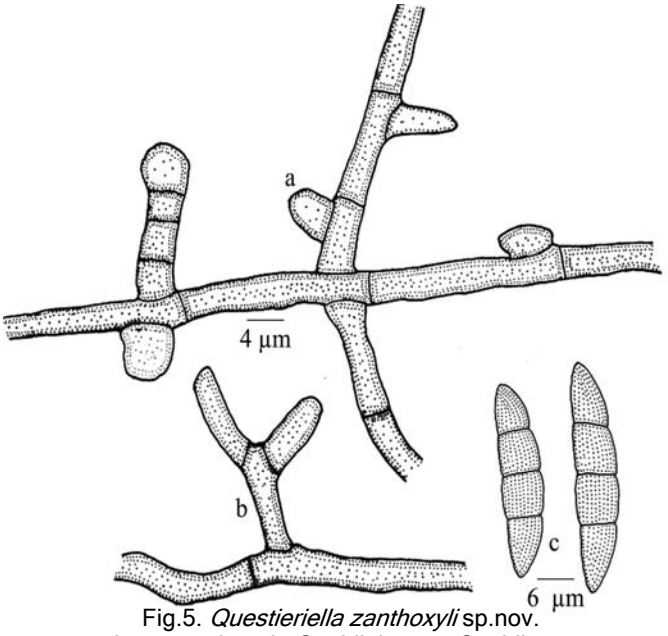

Fig.5. *Questieriella zanthoxyli* sp.nov.
a. Appressorium, b. Conidiphore, c.Conidiospore

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Colonies epiphyllous, minute, up to 2 mm in diameter, confluent. Hyphae straight to substraight, slightly flexuous, branching opposite to alternate at acute angles, loosely reticulate, cells 19-29 x 4-7 µm. Appressoria scattered, mammiform, entire to angular, 7-12 x 5-7 µm. Conidia numerous, borne directly from the hyphal cells, pale brown, straight to curved, 3-septate, rarely constricted at the septa, 24-34 x 7-10 µm.

Materials examined: On leaves of *Zanthoxylum khasianum* Hk. f. (Rutaceae), Lumshillong, Shillong, Meghalaya, Jan. 18, 2007, Jacob Thomas & P.J. Robin HCIO 48070 (type), TBGT 2853 (isotype).

This is the synanamorph of the genus *Schiffnerulla. Schiffnerulla toddaliae* Hansf. on *Toddalia asiatica* from Uganda, *Sarcinella glycosmidis* Kamal & Singh on *Glycosmis pentaphylla* and *Sarcinella fumosa* Sahni on *Eagle marmelos* from India are known. The present collection persists in its *Questieriella* form on a hitherto unrecorded host genus and it warrants its placement in a new species.

***Sarcinella castanopsidis* sp. nov.** (Fig. 6)

Coloniae epiphyllae, tenues, patentiae, ad 2 mm diam. Hyphae pallid brunneae, rectae vel subrectae, alternate vel opposite acuteque vel laxe ramosae, laxe vel arte reticulatae, formans rete, cellulae 22-31 x 5-7 µm. Appressoria alternata vel unilateralis, recta, ovata, globosa, unicellularis, crassa posita, margine integra, sessilis, 7-10 x 12-14 µm. Conidiophora producentes hyphis lateralis, formans erectes, unicellularis, gibbous ad basim, micronemata, mononemata, simplices, recta, 4-10 x 5-7 µm; cellulae conidiogena integrata, monoblastica, cylindracea; conidia simplices, solitaria, acrogena, globosa vel subglobosa, cellulae 8-15, sarciniformes, leniter vel fortiter constrictae ad septatae, nigra, 31-46 µm diam., parietus glabrus.

Colonies epiphyllous, thin, spreading, up to 2 mm in diameter. Hyphae pale brown, straight to substraight, branching alternate to opposite at acute to wide angles, loosely to closely reticulate and form a net, cells 22-31 x 5-7 µm. Appressoria alternate to unilateral, straight, ovate, globose, unicellular, broad based, margin entire, sessile, 7-10 x 12-14 µm. Conidiophores borne lateral to the hyphae, become erect, unicellular, gibbous at the base, micronematous, mononematous, simple, straight, 4-10 x 5-7 µm; conidiogenous cells terminal, integrated, monoblastic, cylindrical; conidia simple, solitary, acrogenous, spherical to subspherical, 8-15 celled, sarciniform, slightly to deeply constricted at the septa, charcoal black, 31-46 µm in diameter, wall smooth.

Materials examined: On the leaves of *Castanopsis armata* Spach. (Fagaceae), Lumshillong, Shillong, Meghalaya, Jan. 18, 2007, Jacob Thomas & P.J. Robin TBGT 2899 (type).

Questieriella quercina Hughes on *Quercus* sp. from Costa Rica and *Sarcinella quercina* Verma & Kamal on *Quercus dilatata* from India are known (Hosagoudar, 2003). Based on the host specificity, the present fungus has been accommodated in a new species.

***Sarcinella lyoniae* sp.nov.** (Fig. 7)

Coloniae epiphyllae, tenues, patentiae, ad 2 mm diam., confluentes. Hyphae pallid brunneae, subrectae vel undulatae, alternate vel opposite acuteque vel laxe ramosae, laxe reticulatae, cellulae 9-29 x 2-5 µm. Appressoria dispersa, alternata vel unilateralis, recta, ovata, globosa, unicellularis, crassa posita, margine integra, sessilis, 7-10 x 12-14 µm. Conidiophora *Sarcinella* micronemata, mononemata, simplices, recta, plerumque unicellularis, 9-12 x 4-5 µm; cellulae conidiogenae integratae, monoblasticae, determinatae, cylindraceae; conidia simplices, solitaria, sicca, acrogena, subglobosa vel globosa, cellulae 4-12 numero, sarciniformes, constrictae ad septatae, nigrae, 24-31 µm diam., parietus glabrus. Conidia *Questieriella* in coloniis dispersa, germinatio et producentes myceliis et appressoria, conidia pallid brunnea, 3-septata, leniter constrictae ad septata, leniter curvula, falcata, 33-41 x 7-10 µm, cellulae terminalis attenuatae ad apicem.

Colonies epiphyllous, thin, spreading, up to 2 mm in diameter, confluent and cover the larger area of the

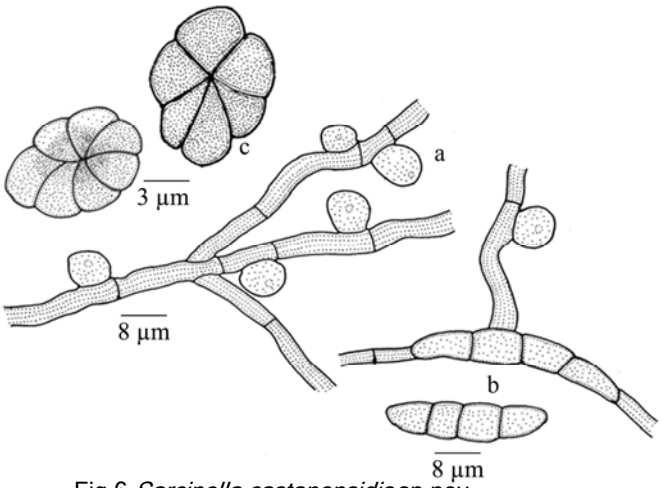

Fig.6. *Sarcinella castanopsidis* sp.nov.
a.Appressorium, b. *Questieriella* conidiospores,
c. *Sarcinella* conidiospores

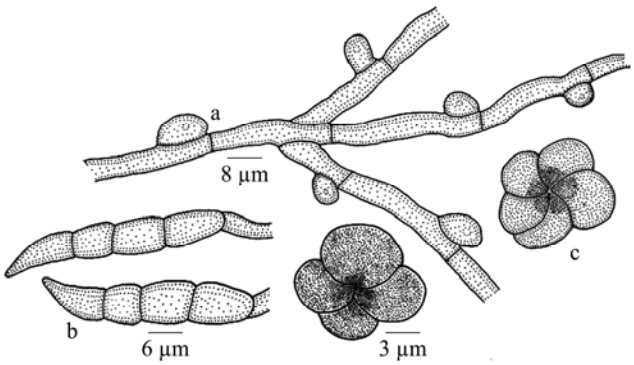

Fig.7. *Sarcinella lyoniae* sp.nov.
a.Appressorium, b. *Questieriella* conidiospores,
c. *Sarcinella* conidiospores

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upper surface of leaves. Hyphae pale brown, substraight to undulate, branching alternate to opposite at acute to wide angles, loosely reticulate, cells 9-29 x 2-5 µm. Appressoria scattered, alternate to unilateral, straight, ovate, globose, unicellular, broad based, margin entire, sessile, 7-10 x 12-14 µm. The conidiophores of *Sarcinella* form were micronematous, mononematous, simple, straight, mostly unicellular, 9-12 x 4-5 µm; conidiogenous cells terminal, integrated, monoblastic, determinate, cylindrical; conidia simple, solitary, dry, acrogenous, subglobose to globose, 4-12 celled, sarciniform, constricted at the septa, charcoal black, 24-31 µm in diameter, wall smooth. Several conidia of *Questieriella* form were scattered in the colony and were germinating by producing mycelium and appressoria; conidia pale brown, 3-septate, slightly constricted at the septa, slightly curved, falcate, 33-41 x 7-10 µm, end cells pale, attenuated at the tip.

Materials examined: On the leaves of *Lyonia ovalifolia* (Wall.) Drude (Ericaceae), Mawphlang, Shillong, Meghalaya, January 20, 2007, Jacob Thomas & P.J. Robin., HCIO 48067 (type), TBGT 2850 (isotype).

The genus *Schiffnerula* constitute five synanamorphs namely, *Sarcinella, Mitteriella, Questeriella, Digitosarcinella* and the teleomorph *Schiffnerula.* The present fungus reveals two anamorph states, namely, *Sarcinella* and *Questieriella.* Hughes (1987) has given a list of the genus *Schiffnerula* and Hosagoudar (2003) has updated it. There are no records of any Schiffnerulaceous fungi on the members of the host family Ericaceae and hence, the present fungus warrants its placement in a new species.

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