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New species and new records of *Melanommataceae* (*Pleosporales*) from Andaman Islands

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ABSTRACT

Andaman Islands are less investigated for fungal diversity and very meagre information is available on fungi. In our investigations on diversity of ascomycetous fungi from Andaman Islands we encountered one new species and three new records belonging to the family *Melanommataceae*. The new species, namely *Bertiella striatispora* sp. nov., is different from other species of the genus in having striations in the ascospores. The new records are three species belonging to the genus *Byssosphaeria* including *Byssosphaeria jamaicana, B. keithii* and, *B. schiedermayeriana.* These taxa are described and illustrated in this paper. A dichotomous key and a table are also provided to delineate the new species *B. striatispora* from other species of the genus.

KEY WORDS: Fungal diversity, *Pleosporales*, new ascomycetes, *Byssosphaeria* spp.

INTRODUCTION

Although Andaman and Nicobar Islands are rich in plant diversity, the fungal diversity has been poorly investigated. This is mainly due to the distance from the mainland of the Indian subcontinent. In a recent checklist of fungi from Andaman and Nicobar Islands Niranjan and Sarma (2018a) listed 446 fungi. Further, new species and new records are being added by our research team and other workers (Niranjan and Sarma, 2018 b, c, d, e, f; Rajamani *et al.,* 2018). *Pleosporales* is one of the largest orders in *Dothideomycetes* (Mugambi and Huhndorf, 2009; Tian *et al.,* 2015). The family *Melanommataceae* belonging to this order (Wijayawardene *et al.,* 2017; 2018) has members that are mostly saprobic and are distributed throughout the world by colonization of decaying twigs and woody litter in terrestrial, marine and freshwater environments (Tian *et al.,* 2015). The morphological characters of the *Melanommataceae* have been updated by different authors (Barr, 1990; Sivanesan, 1984; Zhang *et al.,* 2012; Hyde *et al.,* 2013; Tian *et al.,* 2015). The family *Melanommataceae* is mainly characterized by globose or depressed perithecial ascomata, trabeculate pseudoparaphyses, bitunicate and fissitunicate asci, pigmented and phragmosporous ascospores (Tian *et al.,* 2015). Many new species have been added to this family recently (Mugambi and Huhndorf, 2009; ChacónZapata and TapiaPadilla, 2013; Tian *et al.,* 2015; Li *et al.,* 2016; Almeida *et al.,* 2017), including several additions and exclusions of genera (Lumbsch and Huhndorf, 2007; Kirk *et al.,*2008; Wijayawardene *et al.,*2014; 2018 ; Tian *et al.,* 2015). Currently this family has 24 accepted genera (Wijayawardene *et al.,* 2018).

Bertiella (Sacc.) Sacc. (1899) is a genus belonging to *Melanommataceae* and has species that are mostly saprobic on lignicolous substrates and are predominantly known from the north temperate zone (Almeida *et al.,* 2017). This genus is morphologically characterised by superficial, subglobose ascomata and bitunicate, cylindroclavate or clavate, short stalked asci containing eight, fusiform, septate, hyaline to brown ascospores. Though only two species have been included by Wijayawardene *et al.* (2018), the current number has increased to 6 species including the present new taxon proposed in this paper.

Byssosphaeria Cooke (1879), another genus in *Melanommataceae*, has morphological differences from the existing genera in possessing the ostiole with reddish-orange or greenish tinge at pore. Currently, 25 species are accepted in this genus (Wijayawardene *et al.,* 2017). Most of them produce hyaline to brown fusiform ascospores with 3 septa or rarely 5 septate (Tennakoon *et al.,* 2018). *Byssosphaeria* was previously synonymized with *Herpotrichia*, but Barr (1984) felt that *Herpotrichia* was heterogeneous and restored *Byssosphaeria* in addition to other genera included in the synonymy.

MATERIAL METHODS

Dead and decomposing twig samples fallen on the forest floor in the Andaman Islands, India were collected in large polythene bags. They were rinsed with running tap water to remove the debris, dried overnight, and packed into new plastic bags for shipment to the laboratory for further processing. Before undertaking the microscopic examination, the twigs were placed individually into plastic bread boxes, lined with sterile tissue paper, rehydrated by sprinkling sterile distilled water and incubated for one week to 3 months. The samples were then examined under a Stereo Zoom microscope (Optika SZMLED, Italy) to locate the fungal fruit structures. Hand sections were taken wherever necessary. The fruit bodies were cut with a razor/blade and the sections were transferred to a microslide, mounted (in lactophenol or lactophenol cotton blue). Slides were then examined under the compound microscope (Olympus CH20i, Japan) for morphological characteristics. Nikon ECLIPSE TiU upright microscope with DIC objectives fitted with Nikon DSFi2 digital camera, Japan to fetch photomicrographs. Measurements were carried out with Nikon NIS Elements Imaging Software version 4.4 program. Photoplates were prepared with the help of Microsoft power point, and Adobe Photoshop version 7.0. Morphological identification was carried out by referring the recent literature (Tian *et al.,* 2015; Almeida *et al.,* 2017 and Wijayawardene *et al.,* 2018). The specimens and descriptions were deposited at the Ajrekar Mycological Herbarium (AMH), Pune and the Department of Biotechnology, Pondicherry University.

RESULTS AND DISCUSSION

Taxonomy:

Bertiella striatispora M. Niranjan & V.V. Sarma sp.nov.

Figs.1: a-q

Mycobank: MB 830985 ; "Facesoffungi: FOF 06134".

Diagnosis: *Bertiella striatispora* is distinct from existing species of the genus in having brown ascospores with longitudinal striations on the surface rather than hyaline and smooth surface.

Etymology: ***The species name has been based on the presence of striations on ascospores.***

Classification- *Melanommataceae*, *Pleosporales*, *Dothideomycetes*.

Saprobic on an unidentified twig. **Teleomorph:** *Ascomata* 185-233 (-434) × 225-276 (-345) µm, perithecial, globose to sub globose, soft, superficial, solitary to gregarious, surrounded by dark brown septate setae of 6-6.4 µm dia. Peridium 33-40 µm wide. *Hamathecium*: *Pseudoparaphyses* 2.2 µm wide, septate, branched, even, longer than asci. *Asci* 82.5-112.5 × 12.5-17.5 µm ($\bar{X}$= 94.2 × 14.6, n=25), bitunicate, 8-spored, clavate, apex rounded with an apical chamber when immature, at maturity it disappears, narrow towards base, short pedicellate. *Ascospores* 26.2-37.5 × 7.5-10 µm ($\bar{X}$= 30 × 8.2, n=25), biseriate, fusiform, 1 septate, often constricted at the septum and hyaline when young, pale brown or gray, collapsing, oblong with linear striations at maturity. **Anamorph:** Undetermined.

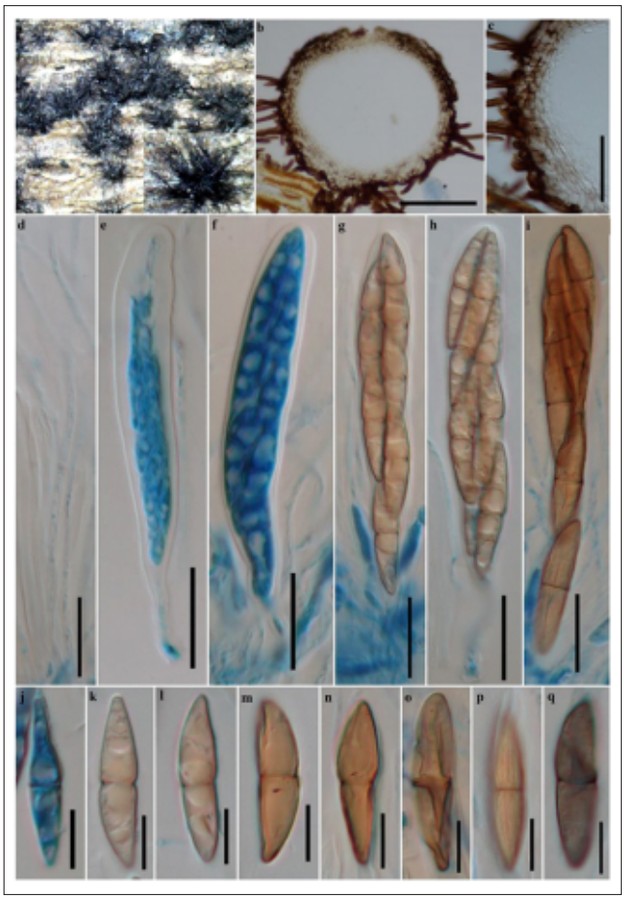
Distribution: India.

Material examined: INDIA, Andaman and Nicobar Islands, Middle Andaman, Bharatpur (12˚29'58"N 92˚52'53"E). Recorded on unidentified twig, February 3, 2016. M. Niranjan and V.V.Sarma (PUFNI 330).

Remarks: The family *Melanommataceae* has been revised and a key has been provided for both sexual and asexual morphs by Tian *et al.*(2015). *Bertiella* is similar to *Byssosphaeria* in having the superficial ascomata with long setae around the ascomata, but is distinct in having ostioles without a coloured tint unlike *Byssosphaeria* that has reddish-orange or greenish tint at pores. The genus *Bertiella* consists of five species (Almeida *et al.,*2017). Among the different species of *Bertiella*, the new taxon resembles *B. ellipsoidea* in having the long setae around the ascomata. The ascomata and ascospores of *B.striatispora* are larger, while asci are smaller in length and width when compared to *B. ellipsoidea*. Further, *Bertiella striatispora* also differs in possessing dense setae around the ascomata, fusiform ascospores with longitudinal striations that are brown at maturity. Hence a new species *B. striatispora* is introduced in the genus *Bertiella* based on the above mentioned morphological characteristics and differences (**Table1**).

Byssosphaeria jamaicana (Sivan.) M.E. Barr, *Mycotaxon* **20** (1): 30 (1984)**.** **Fig: 2. a-m**

Classification **-** *Melanommataceae*, *Pleosporales*, *Dothideomycetes*.



Figs: 1. ***Bertiella striatispora*** (PUFNI 330 Holotype)- **a.** Ascomata, **b.**Vertical section, **c.** Peridium, **d.** Pseudoparaphyses, **e-i.** Asci, **j-q.** Ascospores. Scale bars: **b**=100µm,**c=**50 µm, **d-i**= 20 µm, **j-q**= 10 µm.

Saprobic on unknown twig. **Teleomorph:** *Ascomata* 542-564 × 570-598 µm, perithecial, clusters on surface, superficial, sub globose, brown, coriaceous, ostiolated canal surrounded by a rinse of orange tissue, setae 5.1 µm, covered lateral side of ascomata. *Peridium* 80 µm wide, comprising thin brown textura prismatica cell layers, middle thick yellow and inner thin hyaline textura subglobosa and textura angularis cells, respectively. Hamathecium: *Pseudoparaphyses* filamentous, septate, unbranched, guttulated. *Asci* 100-110 × 8.2-9.0 µm, bitunicate, 8 spored, overlapping uniseriate at below, clavate, smooth, persistent, short pedicel. *Ascospores* 20.8-26.7 ×4.2-5.9 µm, ($\bar{X}$= 24.2 × 50, n=25), biseriate, with 1 median septum having a strong constriction, pale brown, apical cell wider than the basal cell, smooth-walled, straight to slightly curved with obtuse ends. **Anamorph:** Undetermined.

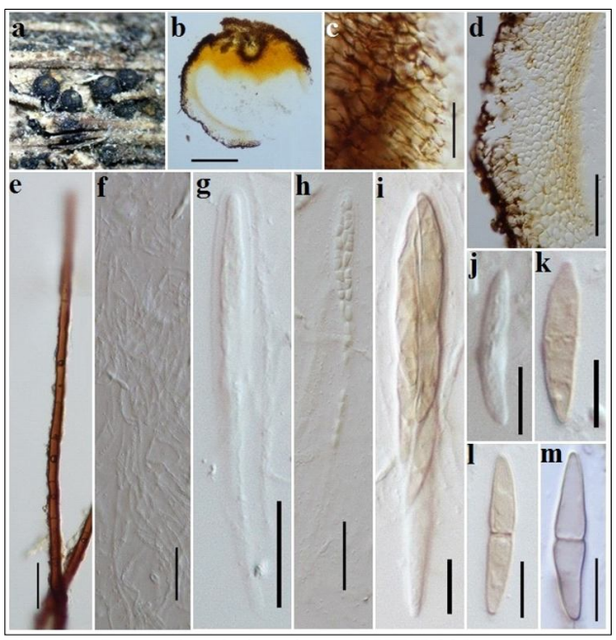
Distribution: Costa Rica. India, Panama and USA.

Material examined: INDIA, Andaman and Nicobar Islands, Middle Andaman, Nimbudera (12˚43'40"N 92˚53'1.9"E). Recorded on unidentified twig, February 3, 2016, M. Niranjan and V.V. Sarma **(**PUFNI 295).

Remarks: *Byssosphaeria* is a genus established by Cooke

Table: 1. Morphological characters of *Bertiella* species*.

	Ascomata		Asci		Ascospores				
Species	**Shape**	**Size** (µm)	**Shape**	**Size** (µm)	**Shape and colour**	**Septa**	**Sheath**	**Size** (µm)	**Reference**
B.striatispora	Subglobose	185–233 (–434) × 225–276 (345.3)	Clavate	82.5–112.5 × 12.5–17.5 µm	Ellipsoid, Brown	1	Absent	26.2–37.5 × 7.5–10	Present study
B. botryosa Morgan	Subglobose	200	Cylindric–clavate	100–110 × 11–14	Fusiform, Hyaline	1–3	Absent	20–30 × 5–6	Morgan (1904)
B. ellipsoidea Ekanayaka, Zhao & K.D. Hyde	Subglobose	200–250	Cylindric–clavate	112–160 × 10–12	Ellipsoid,Hyaline	1	Absent	14–18× 7-9.6	Hyde *et al.* (2016)
B. gelatinosa D.A.C. Almeida, Gusmão & A.N. Mill	Discoid to sub globose	200–550	Clavate	124–188 × 14–22	Fusiform, Hyaline	1	Present	42–55 × 6.5–9	Tian *et al.*(2015)
B. macrospora (Sacc.) Sacc . & Traverso	Subglobose	———	Cylindric–clavate	130–150 × 22	Fusiform, Hyaline	1	Absent	22–43 × 5–9	Eriksson and Yue (1986); Mugambi and Huhndorf (2009)
B. rhodospila (Berk. & M.A. Curtis) M.E. Barr.	Pyriform	190–440	Clavate	50–85 × 5 – 11	Fusiform, Hyaline	3	Absent	16–25 × 3–5	Barr*et al.* (1986)
* This table is modified from Tian *et al.*(2015) to include the present new taxon									



Figs: 2. ***Byssosphaeria jamaicana*** (PUFNI 295)**- a.** Ascomata on decaying host, **b.** Vertical section of ascomata, **c.**Textura prismatica, **d.**Textura subglobosa, **e.** Setae, **f.** Pseudoparaphyses, **g.-i.** Asci, **j.-m.** Ascospores. Scale bar: **b**= 200 µm, **d**= 50 µm, **e-h**=20 µm, **i-m**=10 µm.

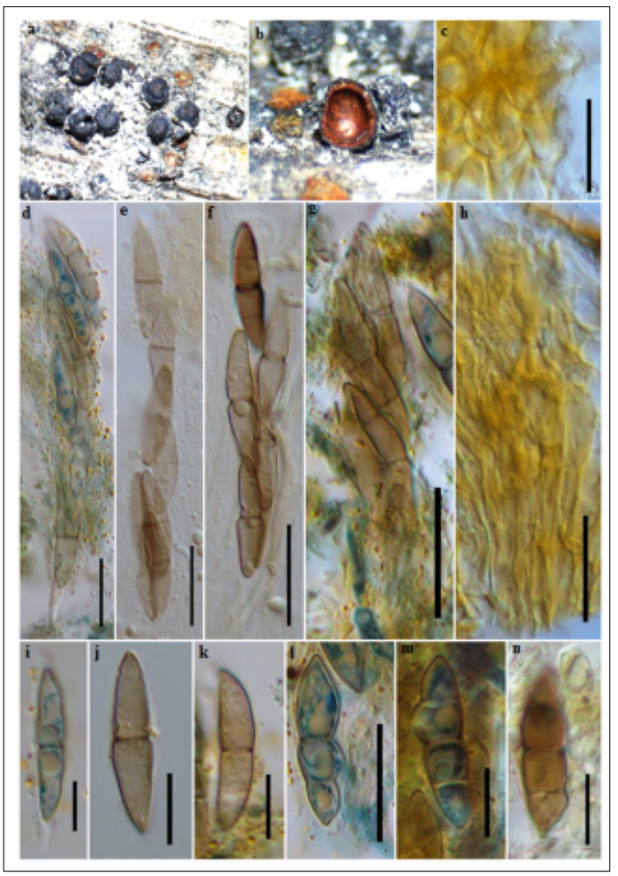
(1879). There are currently 25 species included in this genus (Wijayawardane *et al.,* 2017). This genus is characterized by superficial to semi-immersed, separate or gregarious ascomata, with rounded ostioles (Barr, 1990). The pore area may be pale to bright yellow, orange or red, and the surface may be irregular or slightly rough, with dependent hyphal appendages fusing with the subiculum below. The asci are cylindrical to claviform and the hamathecium is composed of trabeculate pseudoparaphyses. The ascospores are ellipsoidal to fusoid, symmetrical, hyaline to pale reddish or light brown, with one to several septa often with a mucilaginous sheath or appendages. The 'type' collection of *B. jamaicana* has larger asci and wider ascospores than our collection. This is the first report of this fungus from the Andaman Islands and India.

Byssosphaeria keithii (Berk. & Broome) Cooke, *Grevillea* (1879). **Figs: 3. a-l**

Classification *-Melanommataceae*, *Pleosporales*, *Dothideomycetes*.

Saprobic on unidentified twig. Teleomorph: *Ascomata* 448-517 × 418-535 µm ($\bar{X}$=484.3 x 473.8, n=5), perithecioid, superficial, mostly scattered, coriaceous, subiculated, subglobose to oblong or circular, brown, hyphal setae connected to lateral peridium of ascomata, flat at the base and apex, central ostiole collapsing. *Peridium* 77 µm wide, composed of outer black acellular coat, inner hyaline to pale yellow cells of textura subglobosa. Hamathecium: *Pseudoparaphyses* 1.8 µm wide, septate, unbranched. *Asci* 120-173.3 × 10.1-12.4 µm, ($\bar{X}$=143 × 10.9, n=25), bitunicate, 8-spored, clavate, having small rounded end with apical chamber, long pedicels, persistent. *Ascospores* 24.1-30.4 × 5.1-7.2 µm ($\bar{X}$=26.2 × 6.1, n=25), overlapping, triseriate, fusiform, initially hyaline becoming pale brown, 1septate with constriction, straight to

Figs: 3. ***Byssosphaeria keithii*** **(**PUFNI 17512**)- a.** Ascomata, **b.** Vertical section, **c.** Peridium, **d.** Pseudoparaphyses, **e.- f.** Asci, **h.** Hyphae and **g., i-l.** Ascospores. Scale bars: **b.=**100µm, **c-h.=**50µm, **d-f.** =20 µm and **g., I-l.=**10 µm.



Figs: 4. ***Byssosphaeria schiedermayeriana*** (PUFNI 17477 Holotype) **-a.** Ascomata, **b.**Vertical section, **c.** Textura angularis, **d-g.** asci, **h.** Pseudoparaphyses, **i-n.** ascospores. Scale bars: **c-h.,l.**= 20 µm, **i-k.,m.,**

slightly curved, fusiform, becoming obtuse, brown, 3septate with slight constrictions at maturity, with mucilaginous sheaths and appendages 2.2 × 2.5 µm in length. **Anamorph:** Undetermined.

Distribution: India and Sweden.

Material examined: INDIA, Andaman and Nicobar Islands, South Andaman, Wright mayo, (11˚47'36.0"N 92˚42'35.1"E). Recorded on unidentified twig, March 28, 2017, M. Niranjan and V.V. Sarma (PUFNI 17512).

Remarks: *Byssosphaeria* species possess 3 or 5 septate ascospores. The ascospores of *B. keithii* are similar in length to *B. xestothele*, but are 3 septate rather than one septate found in the latter. When compared to the type of *B. Keithii,* our record of *B. keithii* has smaller ascomata, larger asci and slightly smaller ascospores. The present report of *B. keithii* is the first from Andaman and Nicobar Islands, India.

Byssosphaeria schiedermayeriana (Fuckel) M.E. Barr, *Mycotaxon* **20** (1): 34 (1984). **Figs. 4 a-n**

Classification **-***Melanommataceae*, *Pleosporales*, *Dothideomycetes*.

Saprobic on an unidentified twig. **Teleomorph:** *Ascomata* superficial, single, sub globose with wide, cap-like structure closing the ascomata, subiculated on wood, coriaceous, outer thin carbonaceous, middle thick orange and inner hyaline layer of textura angularis cells. *Hamathecium*: *Pseudoparaphyses* septate, smaller than asci, uneven in width broad to narrow towards the end, 2.5-4.2 µm. *Asci* 75-100 × 12.5-15 µm ($\bar{X}$=99.16 × 13.75, n=10), unitunicate, 8-spored, overlapping uniseriate, clavate to cylindrical, short pedicel, deliquescent, with obtuse apical ends. *Ascospores* 27.5-37.5× 7.5-10.5 µm ($\bar{X}$=30.8 × 8.6, n=25), hyaline to pale brown, fusiform, usually with 1central septum with a strong constriction and rarely 3-septate with slight constrictions, acute ends, straight to slightly curved, smooth walled. **Anamorph:** Undetermined.

Distribution: Kenya, India, New Zealand, Germany and USA.

Material examined: INDIA, Andaman and Nicobar Islands, North Andaman, Diglipur, Kalighat (13˚13'43"N 92˚56'35"E). Recorded on unidentified twig, January 6, 2017, M. Niranjan and V.V. Sarma (PUFNI 17477).

Remarks: *Byssosphaeria* is characterised with superficial subiculated ascomata that are turbinate with a rounded pore

and apical area that is usually light coloured (Barr, 1984).Currently this genus has 25 species (Wijayawardene *et al.,* 2017). Our taxon closely resembled *Byssosphaeria schiedermayeriana* in asci and ascospore measurements with a slight variation in ascospore colour,which become dark brown at maturity. Earlier reports on this fungus show that the matured ascospores are pale-brown, have acute ends and mucilaginous sheaths and appendages. Our collection of *B. schiedermayeriana* has smaller ascomata and ascospores compared to the type of *B. schiedermayeriana* (Chen and Hsieh, 2004).

KEY TO *BERTIELLA* SPECIES

1. Ascomata covered with outwardly projecting, long setae.....2
1' Ascomata without setae and presence of hyaline ascospores…….....3
2. Ascospores brown with longitudinal striations ….....……***B.striatispora***
2' Ascospores hyaline ….....*B. ellipsoidea*
3. Ascospores surrounded by a gelatinous sheath.....*B. gelatinosa*
3' Ascospores lacking a sheath 4
4. Ascomata wall cephalothecioid.....*B. macrospora*
4' Ascomata wall not cephalothecioid.....5
5. Ascomata red at the apex ..... *B. rhodospila*
5' Ascomata black at the apex.....*B. botryosa*

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