



### AQUATIC ASCOMYCETES FROM INDIA: THE GENUS SAVORYELLA



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#### ABSTRACT

The present paper deals with ten species of the genus *Savoryella* E.B.G. Jones and R.A. Eaton recorded from India. These species were encountered on submerged woody debris in aquatic (Marine and Freshwater) habitats. Six species were found in freshwater habitats and four species were found in marine habitats. *S. lignicola* was found in both habitats. *S. melanospora* collected from marine habitats is being recorded for the first time from India. The data provides information on the distribution of these fungi in India, apart from description and illustrations. A key to the species of *Savoryella* from India is provided. This data will be useful in the compilation of aquatic fungal biodiversity of India.

**KEY WORDS:** Ascomycetes, Freshwater, Marine, Submerged wood

#### INTRODUCTION:

The genus *Savoryella* was introduced by Jones and Eaton (1969) with *S. lignicola* E.B.G. and R.A. Eaton as the type species. The species of the genus are characterized by having solitary to gregarious, immersed, partly immersed to superficial, ostiolate, periphysate, papillate, membranous and brown ascomata; peridium of *textura angularis* when viewed from the surface and in section composed of several layers of angular cells; paraphyses presents in young ascomata,

wide and septate; 2 to 8-spored, cylindrical to clavate, short pendunculate, unitunicate, persistent asci with a non-amyloid apical thickening containing a pore; ellipsoidal, 3-septate, central cells brown, end cells hyaline, with or without polar appendaged ascospores.

The taxonomic placement of the genus *Savoryella* has been widely debated and Jones et al. (2009) referred it to the Sordariales *incertae sedis*. Boonyuen et al. (2011), in a combined phylogenetic analysis of *Savoryella* species (LSU, SSU, 5.8S rRNA genes, rpb1, rpb2, tef1), showed that they formed a monophyletic group in the Sordariomycetes, but showed no affinities with accepted orders. The order Savoryellales was introduced to accommodate *Savoryella* species, along with the genera *Ascotaiwania*, *Ascothailandia* (and its asexual morph *Canalisporium*), as they formed a new lineage in the Sordariomycetes (Boonyuen et al., 2011). Boonyuen et al. (2011) introduced the order Savoryellales, and the family Savoryellaceae was subsequently introduced by Jaklisch and Råblovä (2015) to accommodate the genus *Savoryella* (Jones et al., 2015). The genus is represented by 11 species in aquatic habitats (Chang et al., 1998; Abdel-Wahab and Jones, 2000).

## Materials and Methods

Sample of submerged decaying woody debris were collected from various localities of marine and freshwater habitats. Samples contaminated by sediments or fouling organisms were cleaned at the collecting sites and placed in polythene bags. Bags tied with rubber bands to conserve a humid atmosphere. Then bags were transported to the laboratory. After one week, samples were observed for Ascocarps. After initial observations, samples were incubated in sterile plastic boxes containing layer of blotting paper or sterile sand moistened with sterile water. A few Naphthalene balls were placed in suitable container inside of plastic box, to kill any insect in the wood debris. Distill water was added as if necessary to prevent the substratum from drying out. Plastic boxes sealed with cellophane tape and placed in polythene bags to conserve a humid atmosphere within boxes. All samples were examined periodically and remoistened whenever necessary and after three weeks examined for the presence of Ascocarps.

Samples were observed initially under 30 X magnifying hand lens. Ascocarps then removed from the wood sample with fine pair of forceps or needle with a fine point. Semi-permanent mount of the fungi were made by replacing the Lacto phenol (with or without Cotton Blue) in place of water, by placing a drop of the mounting fluid to one side of the cover glass so that it sweeps under the cover glass. Excess mounting medium was cleaned through blotting paper. The cover glass was sealed with D.P.X. for temporary mounts. Permanent voucher slides of fungi were prepared according to the method 'double cover glasses' described by Volkmann-Kohlmeyer and Kohlmeyer (1996).

## Taxonomic Account:

**1. *Savoryella appendiculata*** K.D. Hyde & E.B.G. Jones. *Bot. Mar.*, 35: 84 (1992). [Fig. 1].

Ascospores: 26-35 x 11-16  $\mu\text{m}$ , uniseriate, ellipsoidal, 3-septate, constricted at the septa; central cells brown, apical cells smaller and hyaline, wall minutely verrucose, appendaged (appendages 30  $\mu\text{m}$  long).

### Distribution in India:-

**West Coast:-** Kerala; **East Coast:-** Tamil Nadu, Andhra Pradesh, West Bengal, Orissa (see Borse et al, 2012, 2013).

**2. *Savoryella aquatica*** K.D. Hyde, *Aust. Syst. Bot.*, 6: 162 (1993). [Fig. 2].

*Ascospores*: 29-38 x 13.5-17 µm, ellipsoidal, biseriate, hyaline to olive-green when immature, central cells dark brown when mature, end cells hyaline, constricted weakly at the septa, central septa appearing as a band and highly guttulate.

**Distribution in India**:- Maharashtra, Gujarat ( see Borse et al., 2014; Patil and Borse, 2015).

**3. *Savoryella fusiformis*** W.H. Ho, K.D. Hyde & Hodgkiss, *Mycol. Res.*, 101: 804 (1997). [Fig. 3].

*Ascospores*: 25-35 x 6-9.6 µm, fusiform, biseriate, 3-septate, slightly constricted at the septa, smooth, thin-walled; central cells brown, apical cells 4-4.8 µm long, 4-4.8 µm wide, hyaline.

**Distribution in India**:- Maharashtra, Gujarat ( see Borse et al., 2014; Patil and Borse, 2015).

**4. *Savoryella grandispora*** K.D. Hyde, *Mycoscience*, 35: 59-61 (1994b). [Fig. 4].

*Ascospores*: 46-58 x 14-16 µm, ellipsoidal, biseriate, light brown, central cells dark brown when mature, end cells hyaline, constricted weakly at the septa.

**Distribution in India**:- Maharashtra, Gujarat (see Borse et al., 2014; Patil and Borse, 2015).

**5. *Savoryella lignicola*** E.B.G. Jones & R.A. Eaton, *Trans. Br. Mycol. Soc.*, 52: 162 (1969). [Fig. 5].

*Ascospores*: 24.5-33.5(43.0) x 8.5-12.5 µm, uni or biseriate, ellipsoidal, 3-septate, not markedly constricted at the septa; central cells brown (10.6-16.0 µm), apical cells smaller and hyaline (2.6-6.0 µm).

**Distribution in India**:-

**Marine Habitats**:- West Coast:- Daman, Gujarat, Goa, Karnataka, Pondecherry (Mahe), Kerala, Lakshadweep Islands; East Coast:-Tamil Nadu, Pondecherry, Andhara Pradesh, West Bengal, Andaman & Nicobar Islands (see Borse et al., 2012; 2013).

**Freshwater Habitats**: Tamil Nadu, Karnataka, Maharashtra, Gujarat (see Borse et al., 2014; Patil and Borse, 2015).

**6. *Savoryella limnetica*** H.S. Chang & S.Y. Hsieh, In: Chang et al, *Mycol. Res.*, 102: 715 (1998). [Fig. 6]

*Ascospores*: 20-25.5 x 7-9 µm, ellipsoidal, 3-septate, not constricted, smooth, thin-walled, central cells brown, end cells smaller and hyaline to sub-hyaline.

**Distribution in India**:- Maharashtra, Gujarat (see Borse et al., 2014; Patil and Borse, 2015).

**7. *Savoryella longispora*** E.B.G. Jones & K.D. Hyde, *Bot. Mar.*, 35: 83 (1992). [Fig. 7].

*Ascospores*: 33.5-46.5 x 7.5-12 µm (The length breadth ratio 4.1: 1.0), uni or biseriate, ellipsoidal, 3-septate, not markedly constricted at the septa; central cells brown, apical cells smaller and hyaline.

**Distribution in India**:-

**West Coast**:- Karanataka, Kerala; East Coast:- Orissa (see Borse et al., 2012, 2013).

**8. *Savoryella melanosopra*** Abdel-Wahab and E.B.G. Jones, *Mycoscience*, 41: 379 (2000). [Fig. 8].

*Ascomata*: 158-290 µm high, 180-218 µm in diameter, globose, subglobose, oblique to horizontal, solitary or gregarious, partly immersed or superficial, ostiolate, papillate, membranous and dark brown to black. *Necks*: 84-270 µm long and 72-150 µm indiameter, brown with periphyses. *Peridium*: brown, a textura angularis when viewed from the surface, while in section composed of two layers of thick – walled angular cells. Paraphyses present but sparse. Asci: 168-

205 x 16-24 µm, 8-spored, cylindrical, short stalked, unitunicate, persistent, with an apical truncate non-amyloid apical thickening containing a pore. Ascospores: 34-42 x 14-18 µm, uniseriate, ellipsoidal, tri-septate, constricted at the septa, central cells black, apical cells smaller and hyaline to subhyaline.

**Material examined:** On intertidal mangrove wood, Colva, 16/05/2006, Leg, A. R. Tuwar

**Distribution in India:-** Goa (present work)

**Remark:** The present species is described by Abdel-Wahab and Jones (2000) from coastal sand dunes in Australia. The descriptions and morphology of Ascomata, Asci, and Ascospores are agreed well with the description of *S. melanospora*. Hence, it is assigned to that species. The present fungus is rare in occurrence. It is being recorded for the first time from India.

**9. *Savoryella paucispora*** (Cribb & J.W. Cribb) Jorg. Koch, *Nordic. J. Bot.*, 2: 169 (1982). [Fig. 9].  
= *Leptosphaeria paucispora* Cribb & J.W. Cribb, *Pap. Dept. Bot., Uni. Qd.*, 4: 41, (1960)

**Ascospores:** (36)-44-50(60) x 12-16.5 µm, fusoid-ellipsoidal, 3-septate, slightly constricted at the septa, central cells brown, apical cells hyaline, without appendages.

**Distribution in India:-**

**West Coast:-** Maharashtra, Goa, Karnataka, Pondecherry (Mahe), Lakshadweep Islands; East Coast:- Tamil Nadu, Pondecherry (Karaikkal), West Bengal, Andaman & Nicobar Islands (see Borse et al., 2012, 2015).

**10. *Savoryella verrucosa*** Minoura & T. Muroi, *Trans. Mycol. Soc. Japan*, 19: 132 (1978). [Fig. 10].

**Ascospores:** 29-40 x 12.5-18 µm, biseriate, ellipsoidal, hyaline when immature, 3-septate when mature, constricted at the septa; central cells brown, distinctly verrucose, polar cells 3.8-6.4 µm long, 4-5 µm wide, hyaline.

**Distribution in India:-** Karnataka, Maharashtra (see Borse et al., 2014; Borse and Patil, 2015).

**Key to *Savoryella* species from India:**

- 1. Occur in freshwater habitats ..... 2
- 1. Occur in marine habitats ..... 7
- 2. Ascospore wall verrucose, 29-40 x 12-18 µm ..... *S. verrucosa*
- 2. Ascospore wall smooth ..... 3
- 3. Ascospores 20-26 x 7-9 µm ..... *S. limnetica*
- 3. Ascospores 27 µm or longer ..... 4
- 4. Ascospores 46-58 x 14-16 µm ..... *S. grandispora*
- 4. Ascospores 45 mm or less ..... 5
- 5. Ascospore dark brown, 29-38 x 13-18 µm ..... *S. aquatica*
- 5. Ascospores pale brown ..... 6
- 6. Ascospore width 9 mm or less, 25-35 x 6-9 µm ..... *S. fusiformis*
- 6. Asospore width more than 9 µm, 24-37 x 8-14 µm ..... *S. lignicola*
- 7. Asci 2-spored, 36-60 x 12-16.5 µm ..... *S. paucispora*
- 7. Asci 8-spored ..... 8
- 8. Ascospores appendaged, 26-35 x 11-16 µm..... *S. appendiculata*
- 8. Ascospores not appendaged ..... 9

9. Ascospores wider than 15  $\mu\text{m}$ , 32-45 x 15-18  $\mu\text{m}$  .... *S. melanospora*  
 9. Ascospores narrower than 15  $\mu\text{m}$  ..... 10  
 10. Ascospores 24-36 x 8-12  $\mu\text{m}$  ..... *S. lignicola*  
 10. Ascospores 33.5-46.5 x 7.5-12  $\mu\text{m}$  ..... *S. longispora*

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**Figs. 1-9 Ascospore(s):** 1) *S. appendiculata*, 2) *S. aquatica*,  
3) *S. fusiformis*, 4) *S. grandispora*, 5) *S. lignicola*, 6) *S. limnetica*,  
7) *S. longispora*, 8) *S. melanospora*, 9) *S. paucispora*, and 10) *S. verrucosa*

