

## RESEARCH ARTICLE

# Ascomycetes from Mangrove ecosystem of Wandoor- Andaman (India)

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**ABSTRACT**

The present study deals with marine fungi from Wandoor -Andaman. The dead, decaying, intertidal and submerged mangrove wood samples were collected from Wandoor. These samples examined for colonization of marine fungi. Total 10 species of marine Ascomycetes fungi were encountered. These includes *Aigialus mangrovei*, *Astrosphaeriella striatopora*, *Eutypa bathurstensis*, *Halorosellinia oceanica*, *Rimora mangrovei*, *Savoryella lignicola*, *Torpedospora radiata*, *Trematosphaeria mangrovei*, *Verruculina enalia* and *Zopfiella marina*. Out of these fungi *Halorosellinia oceanica* is very common fungus reported from most of the wood samples in Wandoor Island.

**Keywords:** Mangrove, Marine, Fungi, Ascomycetes, Wandoor and Andaman.

**INTRODUCTION**

Mangrove forests are the 'hot spots' of biodiversity and also for marine fungi. Number of species of marine fungi from mangroves have been reported in recent years [Borse and Borse (2005), Kohlmeyer and Kohlmeyer (1979), Kohlmeyer (1984), Kohlmeyer (1985), Kohlmeyer and Volkmann- Kohlmeyer (1987), Hyde, (1988), Hyde and Mouzouras (1988), Hyde and Jones (1989), Kohlmeyer and Volkmann- Kohlmeyer (1990), Scott (1988), Hyde and Lee (1995), Sridhar and Prasannaraj (2001), Borse and Borse (2005) and Borse et. al (2012)]. To some extent Chinnaraj (1993) reported some marine Fungi from different coastal area of Andaman and Nicobar Islands. Ten species of Ascomycetes marine fungi from Wandoor - Andaman were isolated and illustrated in this paper.

Wandoor is in the Andaman and it enjoys Tropical wet and dry climate. Marine ecosystem is one of the richest and most productive areas of organic detritus and form the base of the food chain. Marine fungi play an important role in nutrient generation cycles as decomposers of dead and decaying organic matter. Although mangroves are the dominant features of Indian coastline and provide niches and habitats for many marine organisms.

## MATERIAL AND METHODS

The samples of dead and decaying mangrove (*Avicennia alba*, *Avicennia marina*, *Avicennia officinalis*, *Rhizophora apiculata*, *Rhizophora mucronata* and *Sonneratia alba*) substrates were collected from Wandoor -Andaman coast- India. All the collected samples were observed directly for the fungal fructification under microscope and incubated in plastic boxes. Incubated material was periodically examined for the occurrence of fungi. The permanent slides were prepared as per suggested by (Volkman-Kohlmeyer and Kohlmeyer, 1996; Kohlmeyer and Kohlmeyer 1972). The measurements of various parts of fungi were taken with the help of ocular micrometer and stage micrometer. The photomicrographs were taken. The identification of the fungi were made with the help of Kohlmeyer and Kohlmeyer, 1979; Kohlmeyer and Volkman-Kohlmeyer, 1991; Hyde and Sarma 2000; Hyde et al., 2000 and other relevant literature.

## RESULTS AND DISCUSSION

During the present work Total 10 species of Ascomycetes marine fungi were encountered from Wandoor -Andaman, These includes *Aigialus mangrovei*, *Astrosphaeriella striatopora*, *Eutypa bathurstensis*, *Halorosellinia oceanica*, *Rimora mangrovei*, *Savoryella lignicola*, *Torpedospora radiata*, *Trematosphaeria mangrovei*, *Verruculina enalia* and *Zopfiella marina*. Out of these fungi *Halorosellinia oceanica* is very common fungi reported from most of the wood samples in Wandoor of Andaman. Chinnaraj (1993) isolated 63 marine fungi from mangroves of Andaman and Nicobar Islands.

## TAXONOMIC ACCOUNT

### 1. *Aigialus mangrovei* Borse (Fig. 1 A)

*Trans. Br. Mycol. Soc.*, **88**: 424, 1987c.

Ascomata: 600-850  $\mu\text{m}$  high, 600-800  $\mu\text{m}$  wide, 150-200  $\mu\text{m}$  thick. Ostioles: 40-50  $\mu\text{m}$  diam. Pseudoparaphyses: 1.5-2  $\mu\text{m}$  diam. Asci: 300-425 x 20-30  $\mu\text{m}$ . Ascospores: 35-55 $\mu\text{m}$  long, 10-16  $\mu\text{m}$  broad, muriform, with 6-7 transverse septa and 1-2 longitudinal septa in all but the end cells, slightly constricted at the septa, yellow-brown except for the hyaline or light brown apical cells, with a gelatinous cap, around the apical and sub-apical cells may present.

**Material examined:** On intertidal stem of *Rhizophora mucronata*.

Distribution in India: East coast: -Tamilnadu (Ravikumar and Vittal, 1996); Andhra Pradesh (Sarma and Vittal, 1998-99, 2000, 2001); West Bengal (Pawar et al., 2005). West coast: Maharashtra (Borse, 1987b and 1988); Kerala (Raveendran and Manimohan, 2007 and Nambiar et al., 2008) and Andaman and Nicobar Islands Chinnaraj (1993).

Remark: - The present fungus is rare in occurrence from Andaman (0.45%).

### 2. *Astrosphaeriella striatopora* (K. D. Hyde) K. D.

Hyde (Fig. 1B) *Bot. J. Linn. Soc.*, **110**: 97

*Trematosphaeria striatopora* K. D. Hyde *Bot. J. Linn. Soc.*, **98**: 142, 1988

Fruiting bodies: black, slightly raised spots, with a central neck; in section lenticular, clypeus; clypeus 390-520  $\mu\text{m}$  in diameter, black, composed of host epidermal cells, encrusted with melanin practical, 85-170  $\mu\text{m}$  in thick, ascomata; 352-528  $\mu\text{m}$  in diameter, 176-355  $\mu\text{m}$  in high, subglobose broadly conical, ostiolate, papillate, solitary or gregarious. Peridium: indistinguishable from clypeus, the side and lower layer, 42-57  $\mu\text{m}$  in thick, Necks: 193-484  $\mu\text{m}$  long, 53-82  $\mu\text{m}$  in diameter, black, periphysate. Pseudoparaphyses: 0.8-2.1  $\mu\text{m}$  in diameter, filiform, trabeculate. Asci: 100-173  $\mu\text{m}$  long, 11-23  $\mu\text{m}$  in diameter, 8 spored, cylindrical, pedunculated, bitunicate, thick-walled and with ocular chamber.

**Material examined:** on intertidal wood of *Rhizophora apiculata*, *Sonneratia alba* and *Avicennia marina*.

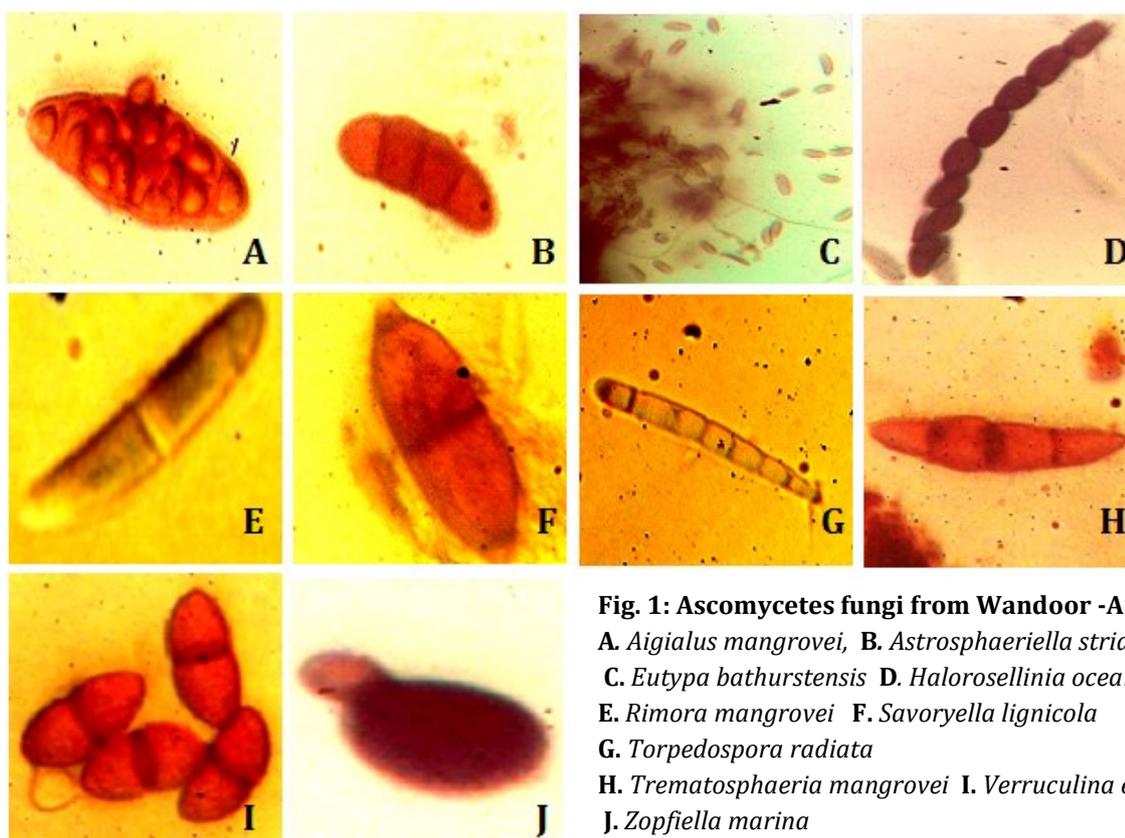
Distribution in India: - East coast: Tamil Nadu (Prasannaraj and Sridhar, 2001); West Bengal (Pawar et al., 2005). Andaman and Nicobar Islands (Chinnaraj and Untawale, 1992 and Chinnaraj 1993). West coast: Maharashtra (Borse, 2000 and Borse et al., 2005); Karnataka (Prasannaraj and Sridhar, 2000-2001, 2001).

Remark: - The present fungus is rare in occurrence from Andaman (0.67%).

### 3. *Eutypa bathurstensis* K. D. Hyde and Rappaz

(Fig. 1C) *Mycol. Res.* 97: 861, 1993.

Fruiting area effuse up to 4.5-5 mm. long, blackening the wood surface. Entostroma prosenchymatous poorly developed, dorsally limited by a black zone binding the fruiting areas. Ascomata: spherical to flattened, 0.2-0.6 mm high, up to 0.8 mm wide. Necks:



**Fig. 1: Ascomycetes fungi from Wandoor -Andaman;**  
**A.** *Aigialus mangrovei*, **B.** *Astrosphaeriella striatopora*  
**C.** *Eutypa bathurstensis* **D.** *Halorosellinia oceanica*  
**E.** *Rimora mangrovei* **F.** *Savoryella lignicola*  
**G.** *Torpedospora radiata*  
**H.** *Trematosphaeria mangrovei* **I.** *Verruculina enalia*  
**J.** *Zopfiella marina*

up to 0.3 mm long. Peridium: enclosing fragments of crystals in the external layer, 30-43  $\mu\text{m}$  wide or wider near the ostiolar canal. Ostioles: poorly developed or conical, up to 280  $\mu\text{m}$  high, 129-177  $\mu\text{m}$  diam., not sulcate. Hymenium: lining the whole cavity. Paraphyses: numerous, persistent. Asci: clavate, 26-42  $\mu\text{m}$  x 7.5-9.5  $\mu\text{m}$ , eight-spored. Ascospores: olive-brown, containing oil droplets and limited by a thin episporium, 7 x 2-3  $\mu\text{m}$ .

**Material examined:** on intertidal stem of Mangrove wood, on intertidal stem of *Avicennia alba*.

Distribution in India: - East coast: Andhra Pradesh (Sarma and Vittal, 2000). West coast: Maharashtra (Borse, 2000b) and Gujrat (Borse *et al.*, 2000a).

Remark: - The present fungus is occasional in occurrence from Andaman (1.12%).

**4. Halorosellinia oceanica** (Schatz) Whalley, Jones, Hyde and Laessle. (Fig. 1D) *Mycol. Res.*, **104**: 368, 2000.

*Hypoxyton oceanicum* Schatz, *Mycotaxon*, **33**: 413, 1988.

Pseudostromata: occasionally embedded at the base, pulvinate to hemispherical, 0.4-0.8 mm diam., single or

in clusters, linear to suborbicular, black. Ascomata: 614-785  $\mu\text{m}$  x 724-980  $\mu\text{m}$ , immersed in pseudostroma, subglobose to hemispherical, soft to leathery, black, ostioles papillate. Peridium: 25-32  $\mu\text{m}$  wide. Paraphyses: 2-3  $\mu\text{m}$  wide at the base, abundant, persistent, remotely septate. Asci: eight-spored, 168-214  $\mu\text{m}$  long, spore-bearing part 132-140  $\mu\text{m}$  long, stipe 36-78  $\mu\text{m}$  long, cylindrical, unitunicate. Ascospores: uniseriate or partially biseriate, dark grey-olive to opaque brown, ellipsoid, upper end broadly rounded, lower end slightly pointed, one-celled, 16-18  $\mu\text{m}$  x 6-8  $\mu\text{m}$ , biguttulate, wall smooth and thick, without appendages.

**Material examined:** - on intertidal stem of *Avicennia marina*.

Distribution along Indian coast: -East coast: Andhra Pradesh (Sarma and Vittal, 2000); Tamilnadu (Prasannarai and Sridhar, 2001, Nambiar *et al.*, 2008). West coast: Karnataka and Goa (Chinnaraj and Untawale, 1992); Gujrat (Borse *et al.*, 2000a and Patil and Borse, 2001); Maharashtra (Borse, 2000b); Kerala (Prasannarai and Sridhar, 2001; Raveendran and Manimohan, 2007; Nambiar and Raveendran 2007, 2008a, b, c, 2009b and Nambiar *et al.*, 2006) and Andaman and Nicobar Islands (Chinnaraj and

Untawale 1992)

Remark: - The present fungus is common in occurrence from Andaman (13.48%).

**5. *Rimora mangrovei*** (Kohlm. and Vittal) Kohlm.

Volk- Kohlm. Suetrong, Sakayaroj and E. B. G. Jones, *Studies in mycology*, **64**:167, 2009. (Fig. 1E)

*Lophiostoma mangrovei* Kohlm. and Vittal. *Mycologia*, **78**:487, 1986.

*Astrosphaeriella mangrovei* (Kohlm. and Vittal) Aptroot and Hyde, *Fungi in Marine Environments, Fungal Diversity Press*, **7**:106, 2002.

Ascomata: 260-400  $\mu\text{m}$  high, 775-950  $\mu\text{m}$  wide, 450-535  $\mu\text{m}$  thick, broadly oblong with flat top in frontal view, conidial to truncate in sagittal section, elongated, laterally compressed. Peridium: 69-150  $\mu\text{m}$  thick at the side, 5-18  $\mu\text{m}$  at the base, encrusted with melanin particles, thick walled. Ostioles: 10-60 mm wide, ostiolar canal filled with hyaline periphyses, 1.8-2.2 mm thick. Pseudoparaphyses 2mm in diam., branched, merging with the periphyses. Asci: 155-218 x 13-19 mm, 8 spored, cylindrical, short pedunculate, and thick walled, fissitunicate. Ascospore: 37-55 x 7-11 mm, biseriate, fusiform, 1- septate, upon germination 3 septate, constricted at the central primary septum, hyaline.

**Material examined:** - On intertidal stem of *Avicennia officinalis*.

Distribution in India: -East coast: Tamilnadu (Ravikumar and Vittal, 1996); Andhra Pradesh (Sarma and Vittal, 1998-99, 2000, 2001, 2002 and 2004 and Vittal and Sarma, 2005)) and Andaman and Nicobar Islands (Chinnaraj 1993). West coast: Gujrat (Patil and Borse, 2001); Maharashtra (Borse, 1988, Kohlmeyer and Vittal, 1986, Shrivastava, 1995, Borse *et al.*, 2005); Goa (Maria and Sridhar, 2002a); Karnataka (Prasannarai and Sridhar, 1997, 2001, 2000-2001 and Maria and Sridhar, 2002, 2003 and 2004); Kerala (Maria and Sridhar, 2002) and Lakshadweep Islands (Chinnaraj 1992).

Remark: - The present fungus is rare in occurrence from Andaman (0.45%).

**6. *Savoryella lignicola*** Jones and Eaton (Fig. 1F)

*Trans. Br. Mycol. Soc.*, **52**: 161, 1969.

Ascomata: 212-292  $\mu\text{m}$  high, 120-264  $\mu\text{m}$  in diameter, globose, sub globose or ellipsoidal, immersed, partly immersed or superficial, ostiolate, papillate, membranous and pale to dark brown. Necks: 72-148  $\mu\text{m}$  long and upto 70  $\mu\text{m}$  in diameter, brown with

periphyses. Peridium: brown. Paraphyses present but sparse. Asci: 106-178  $\mu\text{m}$  x 16-26  $\mu\text{m}$ , 8- spored, cylindrical or clavate, short stalked, unitunicate, persistent. Ascospores: 26-36  $\mu\text{m}$  x 9-22  $\mu\text{m}$ , uni or triseriate, ellipsoidal, tri-septate, constricted at the septa, central cells brown, apical cells smaller and hyaline.

**Material examined:** - on intertidal wood of *Avicennia marina*.

Distribution in India: - East coast: Tamilnadu (Raghukumar, 1973 and Nambiar *et al.*, 2008); Orissa and West Bengal (Borse, 2000 a); Andhra Pradesh (Sarma and Vittal, 1998-99, 2000). West coast: Maharashtra (Borse, 1987 a, 1988; Borse and Shrivastava, 1988 and Shrivastava, 1995); Goa (Borse *et al.*, 1999a); Karnataka (Prasannarai *et al.*, 1999); Kerala (Raveendran and Manimohan, 2007); Daman (Borse *et al.*, 2000b); Gujrat (Patil and Borse, 2001); Kerala (Prasannarai and Sridhar, 2001; Nambiar and Raveendran; 2006, 2007, 2008a, b, c, 2009a,b and Nambiar *et al.*, 2008); Pondicherry and Mahe (Nambiar and Raveendran, 2008d); Lakshadweep Islands (Chinnaraj 1992) and Andaman and Nicobar Islands (Chinnaraj 1993).

Remark: - The present fungus is occasional in occurrence from Andaman (1.24%).

**7. *Torpedospora radiata*** Meyers (Fig. 1G)

*Mycologia*, **49**: 496, 1957.

Ascomata: 248-326  $\mu\text{m}$  high, 188-374  $\mu\text{m}$  in diameter, subglobose to pyriform, immersed or superficial, ostiolate, papillate, subcoriaceous, fuscous or dark brown above, subhyaline grey or brownish below, gregarious. Peridium: two-layered, outer layer composed of subglobose, thick-walled cells with small lumina. Papillae or Necks: up to 206  $\mu\text{m}$  long, 18-26  $\mu\text{m}$  in diameter, cylindrical, fuscous. Paraphyses: 1-2  $\mu\text{m}$  in diameter, septate, ramose, growing irregularly through the venter of the ascomata. Asci: 52-154  $\mu\text{m}$  x 10-14  $\mu\text{m}$ , eight-spored, clavate or oblong-ellipsoidal, sessile or short pedunculated, unitunicate, thin-walled, aphysoclastic, without apical apparatuses. Ascospores: 32-44 x 4-7  $\mu\text{m}$ , cylindrical or clavate, broader at the apex, tri-septate, hyaline, appendaged, 18-38  $\mu\text{m}$  x 1.5-4  $\mu\text{m}$ , semi rigid, straight or slightly curved.

Material examined: - on *Avicennia marina* and Ascospores in foam sample.

Distribution in India: - East coast: Tamilnadu (Raghukumar, 1973). West coast: Maharashtra (Borse, 1987 a, 1988, 2000b, Ramesh and Borse, 1989 and

Shrivastava, 1995); Karnataka (Prasannarai and Sridhar, 1997, 2001 and Prasannarai *et al.*, 1999); Goa (Borse *et al.*, 1999a and Borse and Tuwar, 2006); Gujrat (Borse *et al.*, 2000a); Kerala (Prasannarai and Sridhar, 2001); Mahe Pondicherry (Borse and Pawar, 2005) and Lakshadweep Islands (Chinnaraj 1992). Remark: - The present fungus is rare in occurrence from Andaman (0.23%).

### 8. *Trematosphaeria mangrovei* Kohlm. (Fig.1H)

*Mycopathologia and Mycolgia Applicata*- **34**: 1-2, 1968.

Ascomata: 360-440  $\mu\text{m}$  high, 520-610  $\mu\text{m}$  in diameter, ovoid, partially immersed in substratum, solitary or gregarious, black carbonaceous, ostiolate and periphysate. Hamethecium: filamentous, numerous. Asci: 174-210  $\mu\text{m}$  long, 18-26  $\mu\text{m}$  in diameter eight-spored, cylindrical, pedunculated, bitunicate and thick-walled. Ascospores: 42-48  $\mu\text{m}$  x 9-12  $\mu\text{m}$  uniseriate to biseriate with overlapping end cells, dark brown, three-septate, slightly constricted at the septa.

Material examined: - On intertidal wood *Avicennia alba*.

Distribution in India: -West coast: Mangalore (Sridhar and Prasannarai 1993).

Remark: - The present fungus is rare in occurrence from Andaman (0.56%).

### 9. *Verruculina enalia* (Kohlm.) Kohlm. and Volkmann-Kohlm. (Fig. 1I) *Mycol. Res.* **94**: 689, 1990.

*Didymosphaeria enalia* Kohlm, *Ber. Destch, Bot. Ges.*, **79**: 28, 1966.

Ascomata: 286-494  $\mu\text{m}$  high (including papilla), 265-474  $\mu\text{m}$  in diameter, subglobose, ampliform or depressed, ellipsoidal, partly or completely immersed, ostiolate, papillate, clypeate, carbonaceous, black, solitary. Peridium: 8-14  $\mu\text{m}$  thick, composed of about six or more layers of irregular roundish or elongate, thick-walled cells, with usually small lumina, brown, hyphae or stromatic structures. Papillae: 72-144  $\mu\text{m}$  long, 135-310  $\mu\text{m}$  in diameter, conical, surrounded by blackish brown clypeus, ostiolar canal obturbinate, filled with long delicate, hyaline periphyses; the pore is closed by somewhat thicker, shorter, hyaline hyphae. Pseudoparaphyses: 1.5-2  $\mu\text{m}$  in diameter, septate, rarely branched, attached at both ends and reaching into the ostiolar canal. Asci: 118-134  $\mu\text{m}$  x 11-14  $\mu\text{m}$ , eight-spored, cylindrical, pedunculated, bitunicate, thick-walled, physoclastic, without apical apparatuses; developes at the base of the ascomata venter. Ascospores: 16-24  $\mu\text{m}$  x 6.5-10  $\mu\text{m}$ , obliquely

uniseriate, ellipsoidal, one-septate, constricted at the septum, dark brown, verrucose to verruculose.

Material examined: - on intertidal wood of *Avicennia marina*, *Avicennia officinalis* and *Sonneratia alba*.

Distribution in India: - East coast: Tamilnadu (Ravikumar and Vittal, 1996 and Nambiar *et al.*, 2008); Andhra Pradesh (Sarma and Vittal, 2000). West coast: Maharashtra (Patil and Borse, 1985, Borse, 2000b and Shindikar and Borse, 2002); Karnataka (Prasannarai and Sridhar, 1997); Kerala (Raveendran and Manimohan, 2007, Nambiar and Raveendran 2006, 2007, 2008a, b, 2009a, b and Nambiar *et al.*, 2006, 2008); Diu (Borse *et al.*, 1999b); Goa (Borse *et al.*, 1999a); Daman (Borse *et al.*, 2000b); Gujrat (Borse *et al.*, 2000a and Patil and Borse, 2001); Pondicherry and Mahe (Nambiar and Raveendran, 2008d); Lakshadweep Islands (Chinnaraj 1992) and Andaman and Nicobar Islands (Chinnaraj 1993).

Remark: - The present fungus is common in occurrence from Andaman (11.18%).

### 10. *Zopfiella marina* Furuya and Udagawa (Fig.1J) *J. Jpn. Bot.* 50-149, 1975.

Ascomata: 180-450  $\mu\text{m}$  in diam., globose to subglobose, superficial or immersed, nonostiolate, coriaceous, irregularly dehiscing, black, and almost glabrous or loosely covered by some curved, hyaline, septate, simple hyphae, 2-2.5  $\mu\text{m}$  in diam. at the base, solitary. Peridium: 15-28  $\mu\text{m}$  thick, semitransparent, composed of 4 layers of angular, thin walled cells of 5-14  $\mu\text{m}$  in diam., forming a textura angularis. Paraphyses: composed of vesicular cells, early deliquescing. Asci: 75-90  $\mu\text{m}$  x 14-20  $\mu\text{m}$ , 8 spored, clavate, broadest in the middle, short pedunculate, unitunicate, deliquescing, with an indistinct apical ring. Ascospores: biseriate, clavate, becoming 1-septate in the lower third; slightly constricted at the septum, larger upper cell (14) 15-20  $\mu\text{m}$  x 10-13 (14)  $\mu\text{m}$ , ellipsoidal, apex slightly abonate, base truncate, olivaceous to dark brown, thin walled, smooth, with a apical germ pore, 1 $\mu\text{m}$  in diam., smaller lower cell 4-10  $\mu\text{m}$  long, 3 -4  $\mu\text{m}$  in diam., elongate cylindrical, apex truncate, base rounded, straight or slightly curved, hyaline.

**Material examined**:-On intertidal stem of *Avicennia officinalis*.

Distribution in India: - East coast: Andhra Pradesh (Sarma and Vittal, 1998- 99, 2000, 2001 and 2004, Sarma *et al.*, 2001 and Vittal and Sarma, 2005).

Remark: - The present fungus is rare in occurrence from Andaman (0.56%).

## SUMMARY AND CONCLUSION

The results of our investigation Total 10 species of Ascomycetes marine fungi were encountered from Wandoor -Andaman, These includes *Aigialus mangrovei*, *Astrosphaeriella striatapura*, *Eutypa bathurstensis*, *Halorosellinia oceanica*, *Rimora mangrovei*, *Savoryella lignicola*, *Torpedospora radiata* *Trematosphaeria mangrovei*, *Verruculina enalia* and *Zopfiella marina*. Out of these fungi *Halorosellinia oceanica* is very common fungi reported from most of the wood samples in Wandoor of Andaman.

**Conflicts of interest:** The authors stated that no conflicts of interest.

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