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MARINE FUNGI FROM INDIA-XIII. THE GENUS *COROLLOSPORA* WERDERMANN

Tuwar A. R.[1], Patil V. R.[2], Pawar N. B.[3], Borse K. N.[4] and Borse B. D.[5]

[1]M.E.S.'s Arts, Comm. and Sci. college, Sonai, Ahmednagar, M.S.

[2]Shri V. S. Nail Arts, Comm. and Sci. college, Raver, Jalgaon, M.S.

[3]L. B. Hire Arts, Comm. and Sci. college, Panchavati, Nashik, M.S.

[4]S.S.V.P. Sanstha's L.K. Dr. P.R. Ghogrey Sci. college, Dhule, M.S.

[5]N.S. Sanstha Dhule's U. P. Arts and Sci. college, Dahivel, Dhule, M.S.

ABSTRACT

An The present paper deals with fifteen species of the genus *Corollospora* Werdermann recorded from India. These species were encountered on drift wood buried in sand, intertidal woody debris and ascospores in foam samples from sandy beaches. Ascospores of *C. besarispora* and *C. fusca* encountered in foam samples are 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 Corollospora from India is provided. This data will be useful in the compilation of marine fungal biodiversity of India.

KEY WORDS: Ascomycetes, *Corollospora*, foam samples, intertidal and drift wood

INTRODUCTION:

The genus Corollospora (=*Peritrichospora* Linder, In: Bargoorn and Linder, 1944) (Halosphaeriaceae, Halospharials) was described by Werdermann in 1922 with C. maritima as the type species. It is one of the most specious genera in marine habitats and represented by 22 species (Jones et al., 2009, 2015). The genus is characterized as arenicolous marine fungi, inhabiting sandy beaches and saprophytically utilizing buried organic matter i. e. drift wood, sea weeds, sea

grasses and produce fruiting bodies on sand grains, shells of marine animals and other hard materials. Species of the genus are characterized by having globose or subglobose, superficial, erumpent, subiculate, ostiolate or lacking ostiole, papillate or epapillate, carbonaceous, pale brown to black ascomata; deliquescing catenophyses; fusiform or subclavate, apiculate, short pedunculate, unitunicate, thin-walled, lacking an apical apparatus, deliquescing asci; various fusiform, subellipsoidal, constricted at the septa, mostly didymosporous or 1-14-septate, muriform with longitudinal and trans-septa, hyaline to pale brown to dark brown, with two kinds of appendages, 1) polar spines or tubes (in some species this type of appendage is not developed), 2) equatorial and polar appendages developed by fragmentation of the exospore. According to Jones et al. (2009) *C. mesopotamica* may also have 2-septate ascospores that are brown. Similarly C. indica have ascospores that are brown at maturity (BDB personal observations). Only six species of the genus have brown ascospores: *C. cinnamomea, C. californica, C. fusca, C. indica, C. novofusca and C. mesopotamica.*

Materials and Methods

Sample of intertidal and drift wood were collected from various localities of marine habitats. Samples contaminated by sediments or fouling organisms were cleaned at the study sites and placed in polythene bags. Bags were tied with rubber bands to conserve a humid atmosphere. Then bags were transported to the laboratory. After two weeks, 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 boxes, to kill any insect in the wood samples. Distill water was added as if necessary to prevent the substratum form drying out. Plastic boxes were sealed with cellophane tape and placed in polythene bags to conserve a humid atmosphere. All samples were examined periodically and remoistened whenever necessary and there after examined for the presence of Ascocarps.

Samples of sea foam were collected during high tide from sandy beaches with the help of a ladle and placed in clean wide mouth plastic bottles and kept for 24 hours to enable the foam to dissolve. It was preserved by adding Formalin (45%) to yield 5% foam solution. Then samples were returned to the laboratory and scanned under a low or high power of a microscope for the presence of Ascospores of *Corollospora* species.

Samples of wood 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. Corollospora angusta Nakagiri & Tokura, 1987, *Trans. Mycol. Soc. Jpn*., 28: 417. [Fig. 1].

Ascospores: 35-57 x 3-8 µm (excluding polar appendages), fusiform, slender, 3(-5)-septate, hyaline. *Appendages:* of two kinds: (i) a single terminal appendage at each end of the spore, 3-8 mm long, spine- or thorn-like, attenuate; (ii) fibrous and peritrichous appendages at the terminal

appendages (6-13 μm long) and around the central septum (18-25 μm long), developed by fragmentation and peeling off of the exosporium.

Distribution in India:-

West Coast:- Goa, Karnataka, Pondicherry (Mahe), Kerala; East Coast:- Tamil Nadu, Pondicherry, Orissa (see Borse et al., 2012, 2013).

2. Corollospora besarispora Sundari, 1996, *Mycol. Res*. 100: 1259, 1996. [Fig. 2].

Ascospores: 108x 164 x 24-38 μm, fusiform, 7-8 septate, hyaline markedly constricted at the septa. *Appendages*: of two kinds: i) primary polar, spine-like appendage at each end of the spore, 11-34 μm long; ii) fibrous, peritrichous secondary appendages at the tip of polar spine, 12-26 μm long and around the central septum, 14-18 μm long. Secondary appendages formed by fragmentation of an exosporial sheath.

Material examined: Ascospores in foam samples, Galgibaga, Goa state, 7/6/2005, Leg. A. R. Tuwar.

Remarks: The present species is described by Sundari (In Sundari et al., 1996). The descriptions of the ascospores agree well with the description of ascospores of C. baserispora Sundari. Hence, it is assigned to that species. It is being reported for the first time from India.

3. Corollospora cinnamomea Jorg. Koch, 1986. *Nordic J. Bot*., 6: 498.[Fig. 3].

Ascospores: 18-25 x 6-9 μm (without polar spines), fusiform, 1-septate, not or slightly constricted at septum, asymmetric, brown, appendaged. *Appendages:* of two kinds a) polar spines 12-16 μm long, slender , 1 μm thick, slightly curved , hyaline, b) sheet like, soft, polar appendages up to 12 μm long from apical part of polar spine and equatorial appendages forming a double frill of thread-like spines 7-12 μm long.

Distribution in India:-

West Coast:- Gujarat, Maharashtra, Goa, Karnataka, Pondicherry (Mahe); East Coast:- Orissa (see Borse et al., 2012, 2013).

4. Corollospora colossa Nakagiri & Tokura, 1987. *Trans. Mycol. Soc. Jpn*., 28: 418. [Fig. 4].

Ascospores: 60-108 x 13-26 μm, fusiform to ellipsoidal, (6-) 7 (-8)-septate, hyaline. *Appendages:* fibrous, peritrichous at both ends of the spore (20-27 mm long) and around the central septum (20-28 μm long), developed by fragmentation and peeling off of the exosporium.

Distribution in India:-

West Coast:- Maharashtra, Gujarat, Goa, Karnataka, Pondicherry (Mahe), Kerala; East Coast:- Tamil Nadu, Pondicherry, Orissa, West Bengal (see Borse et al, 2012, 2013).

5. Corollospora filiformis Nakagiri, 1987. *Trans. Mycol. Soc. Jpn*., 28: 422. [Fig. 5].

Ascospores: 87-120 x 5-8 μm, filiform, (9-) 13 (-17)-septate, hyaline. Appendages: fibrous, peritrichous, at both ends of the spore (18-25 μm long) and around the central septum (13-22 μm long), developed by fragmentation and peeling off of the exsoporium.

Distribution in India:-

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

6. Corollospora fusca Nakagiri and Tokura, 1987, *Trans. Mycol. Soc. Jpn.,* 28: 424 [Fig. 6].

Ascospore: 78-168 x 22-34 µm (excluding polar appendages), fusiform, muriform with transversally septate, dark brown, longitudinally finely striated on the surface. Ridges of striation run in parallel and sometimes dichotumize. *Appendages:* of two kinds: i) a single terminal appendage at each end of the spore, 26-66 µm long thorn like, hyaline; ii) fibrous, peritrichous appendages (26-56 µm long) and around the central septum (24-72 µm long) developed by fragmentation and peeling of the exospore.

Material examined: Ascospores in foam samples, Galgibaga estuary, Goa, 7/6/2005, Leg. A. R. Tuwar.

Remark: The present fungus is described by Nakagiri and Tokura (1987) from Japan. The morphology and description of the ascospores observed in foam samples is completely agree with that of the ascospores of C. fusca given by Nakagiri and Tokura (1987). Therefore, it is assigned to that species. It is being reported for the first time from India.

7. Corollospora gracilis Nakagiri & Tokura, 1987. *Trans. Mycol. Soc. Jpn*., 28: 426. [Fig. 7].

Ascospores: 26-45 x 3-6 µm (excluding polar appendages), fusiform, slender, one-septate, hyaline. *Appendages:* of two kinds : (i) a single terminal appendage at each end of the spore, 6-12 mm long, spine- or thorn-like, attenuate; (ii) fibrous and peritrichous appendages at the terminal appendages (4-8 µm long) and around the central septum (12-20 µm long), developed by fragmentation and peeling off of the exosporium.

Distribution in India:-

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

8. Corollospora indica Prasannarai, Ananda & K.R. Sridhar, 2000. *J. Envirn. Biol.,* 21: 335. [Fig. 8].

Ascospores: 45-103 x 7-18 µm, fusiform, (3) 7-9 (-12)- septate, hyaline, at maturity become brown, cells bulged, septations often unequal, appendaged. Appendages: primarary, terminal, spine like appendages at each end of the spore, 5-15 µm long; fibrous, peritrichous, secondary appendages at each tip of the polar spine, 12-25 µm long and around the central septum,18-27 mm long.

Distribution in India:

West Coast:- Gujarat, Karnataka; East Coast:- Tamil Nadu, Pondecherry (Karaikkal), Pondicherry, Andhra Pradesh, Orissa (see Borse et al., 2012, 2013).

9. Corollospora intermedia I. Schmidt, 1969. *Nat. Naturschutz Meeklenburg*, 7: 6. [Fig. 9].

Ascospores: 25-34 x 7-12 µm (excluding appendages), fusiform, straight or slightly curved, 3-septate, constricted at the septa, hyaline, appendaged. Appendages: at both ends with a single, terminal appendage, 10-14 x 1-2 µm, thorn-like, slender, attenuate, rigid, straight or some what curved, at the tip with a refractive body and bearing a small cap or fibers that develop by peeling off of the exospore, peritrichous around the central septum with 10-18 flexible setae, 10-16 mm long, which develop fragmentation of exosporium; setae attached to a narrow equatorial, belt-like thickening of the wall.

Distribution in India:-

West Coast:- Gujarat, Goa, Karnataka, Pondicherry (Mahe), Kerala; East Coast:- Tamil Nadu (see Borse et al., 2012, 2013).

10. Corollospora lacera (Linder) Kohlm., 1962. *Ber. Dtsch. Bot. Ges.,* 75: 126.
= *Peritrichospora* lacera Linder, In: Barghoorn & Linder, *Farlowia,* 1: 415 (1944).

Ascospores: 39-60 x10-16 µm (excluding terminal appendage and fibres), fusiform, straight or curved, 5-septate, constricted at the septa, hyaline, appendaged. Appendages: at both ends with a single, terminal appendage, 9.5-24 µm long, 2.2-4.5 µm in diam, thorn-like, attenuate, rigid, straight or some what curved, at the tip with a refractive body and bearing a tube or fibers that develop by peeling off of the exospore, 19-33 x 2-6 µm; peritrichous around the central septum with flexible setae, 12-17 µm long, which develop by fragmentation of exosporium.

Distribution in India:-

West Coast:- Maharashtra, Karnataka (see Borse et al., 2012, 2013).

11. Corollospora luteola Nakagiri & Tubaki, 1982. *Trans. Mycol. Soc. Japan*, 23: 102.

Ascospores: 50-85 x 5-8 µm (excluding the appendages), fusiform, slightly curved, 5 (4 to 6)-septate, hyaline. *Appendages:* the appendages developing by exospore fragmentation, seta-like, flexible, attached in a tuft at each apex and around the central septum.

Distribution in India:-

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

12. Corollospora maritima Werderm., 1922. *Notizbl. Bot. Gart.Mus. Berlin-Dahlem*, 8: 248. [Fig. 10].
= *Arenariomyces cinctus Hohnk, Ver. Inst. Meeres. Bremerhaven*, 3: 28 (1954).
= *Peritrichospora integra Linder, Farlowia*, 1: 414 (1944).

Ascospores: 18-36 x 6–9 µm (excluding apical thorns and setae), fusiform or subellipsoidal, one-septate , constricted at the septum, hyaline. Appendages: at both ends with a single terminal appendage 8-15 x 1-2 µm, spine or thorn-like, slender, attenuate, rigid, straight or some what curved, at the tip with a refractive body and bearing a small cap or fibers, 7-9 µm long, peritrichous around the septum with 8 or more flexible ribbon-shaped setae, 6-16 x 1 µm.

Distribution in India:-

West Coast: Diu Island, Gujarat, Maharashtra, Goa, Karnataka, Pondicherry (Mahe), Kerala, Lakshadweep Islands; East Coast:- Tamil Nadu, Pondicherry, Andhra Pradesh, Orissa, West Bengal (see Borse et al., 2012, 2013).

13. Corollospora pseudopulchella Nakagiri & Tokura, 1987. *Trans. Mycol. Soc. Jpn.,* 28: 428. [Fig. 11].

Ascospores: 65-98 x 8-12 µm (excluding appendages), fusiform, slender, 7-11-septate, hyaline, appendaged. Appendages: fibrous, peritrichous, at both ends of the spore (8-13 µm long) and around the central septum (18-31 µm long), developed by fragmentation and peeling off of the exosporium.

Distribution in India:-

West Coast:- Kerala; East Coast:- Tamil Nadu (see Borse et al., 2012, 2013).

14. Corollospora pulchella Kohlm., I. Schmidt & N.B. *Nair, 1967. Ber. Dtsch*. Bot. Ges., 80: 98. [Fig. 12].

Ascospores: 24-36 x 8-11 µm (excluding appendages), fusiform, slightly curved, 7-septate (rarely 9-11-septate), constricted at the septa, hyaline. Appendages: setalike, flexible, attached in a tuft to a conical papilla at each apex and peritrichous around the central septum, about 7-apical appendages, 13-20x 1 µm, about 15 lateral appendages, 14-24 x 1 µm.

Distribution in India:-

West Coast:- Daman, Gujarat, Maharashtra, Goa, Karnataka, Pondicherry (Mahe), Kerala ; East Coast:- Tamil Nadu, Pondicherry (Karaikkal), Andhara Pradesh, Orissa, West Bengal (see Borse et al, 2012, 2013).

15. Corollospora quinqueseptata Nakagiri, 1987. *Trans. Mycol. Soc. Jpn.,* 28: 430. [Fig. 13].

Ascospores: 42-58 x 8-10 µm (excluding polar appendages), fusiform, (3-) 5 (-8)-septate, hyaline. Appendages: of two kinds: (i) a single terminal appendage at each end of the spore, 5-12 mm long, spine-or thorn-like, attenuate; (ii) fibrous and peritrichous appendages at the terminal appendages (8-12 µm long) and around the central septum (17-25 µm long), developed by fragmentation and peeling of the exosporium.

Distribution in India:-

West Coast:- Karnataka, Pondicherry (Mahe), Kerala; East Coast:- Orissa (see Borse et al., 2012, 2013).

Key to Corollospora species from India:

1. Ascospores light to dark brown 2
1. Ascospores hyaline 3
2. Ascospores 1-septate, no trans-septa ..... *C. cinnamomea*
2. Ascospores with long and trans-septa ..... *C. fusca*
3. Ascospores 1-septate 4
3. Ascospores with more than 1-septate 5
4. Ascospores wider than 8 µm, 22-23 x 8-10 µm ..... *C. maritima*
4. Ascospores narrower than 8 µm, 26-45 x 3-7 µm ..... *C. gracilis*
5. Ascospores with 3-septate 6
5. Ascospores with more than 3-septate 7
6. Ascospores narrower than 7 µm, 35-57 x 3-7 µm ..... *C. angusta*
6. Ascospores wider than 7 µm, 25-34 x 7-12 µm ..... *C. intermedia*
7. Ascospores with polar appendages 12
7. Ascospores without polar appendages 8
8. Ascospores 5-septate, 50-85 x 5-8 µm ..... *C. luteola*
8. Ascospores with more than 5-septate 9
9. Ascospores predominantly 7-septate 10
9. Ascospores with more than 7-septate 11
10. Ascospores 60-108 x 13-26 µm ..... *C. colossa*
10. Ascospores 52-112 x 7-16 µm ..... *C. pulchella*
11. Ascospores 7-11-septate, 65-98 x 8-12 µm ..... *C. pseudopulchella*
11. Ascospores 13-septate, 73-120 x 5-8 µm ..... *C. filiformis*
12. Ascospores 3-5-septate 13

12. Ascospores over 5-septate ……. 14

13. Ascospores 39-63 x 10-19 µm, polar appendages 10-14 mm..... *C. lacera*

13. Ascospores 38-59 x 8-10 µm, polar appendages 5-12 mm ..... ……. *C. quinqueseptata*

14. Ascospores 7-8-septate, 100-163 x 25-38 µm, polar appendages 10-38 mm ……. *C. besarispora*

14. Ascospores 3-12-septate, 45-103 x 7-18 µm, polar appendages 12-25 mm …… *C. indica*

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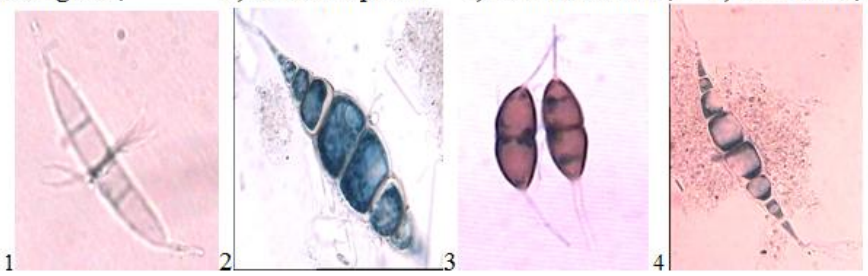
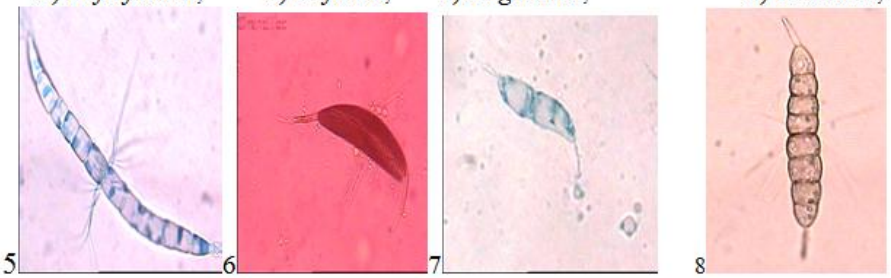
Photo Plate 1-14. Ascospore(s):

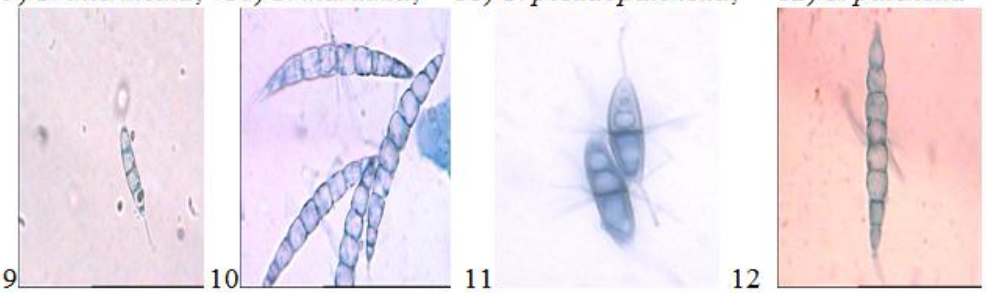
1) *C. angusta*, 2) *C. besarispora*, 3) *C. cinnamomea*, 4) *C. colossa*,



5) *C. filiformis*, 6) *C. fusca*, 7) *C. gracilis*, 8) *C. indica*,



9) *C. intermedia*, 10) *C. maritima*, 11) *C. pseudopulchella*, 12) *C. pulchella*



13) *C. quinqueseptata*