RESEARCH ARTICLE

Mitosporic fungi from mangrove ecosystem of Wandoor - Andaman (India)

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Manuscript details:

Received: 31.08.2017
Accepted: 1.12.2017
Published : 05.12.2017

Editor:
Dr. Arvind Chavhan

Cite this article as:
Cholake JB and Aher RK (2017) Mitosporic fungi from mangrove ecosystem of Wandoor - Andaman (India); *International J. of Life Sciences*, 5 (4): 606-612.

Acknowledgment
Authors are thankful to Savitribai Phule Pune University, Principal of New Arts, Commerce and Science College, Parner and Ahmednagar for encouragement and for providing research facilities during the present work.

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 Mitosporic marine fungi (*Alternaria* sp., *Bactrodesmium linderii, Camarosporium roumeguerii, Clavatospora bulbosa, Halenospora varia, Hydea pygmea, Periconia prolifica, Trichocladium achrasporum, Trichocladium alopallonellum* and *Trichocladium lignicola*) were encountered. Out of these fungi *Alternaria* sp. is very common fungi reported from most of the wood samples in Wandoor Island.

Keywords: Mangrove, Marine Fungi, Mitosporic fungi, Wandoor and Andaman.

INTRODUCTION

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.

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 Mitosporic marine fungi from Wandoor -Andaman were isolated and illustrated in this paper.

MATERIAL AND METHODS

The samples of dead and decaying mangrove 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 (Volkmann- 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 Volkmann-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 Mitosporic marine fungi were encountered, these include *Alternaria* sp*., Bactrodesmium linderii, Camarosporium roumeguerii, Clavatospora bulbosa, Halenospora varia, Hydea pygmea, Periconia prolifica, Trichocladium achrasporum, Trichocladium alopallonellum* and *Trichocladium lignicola.* Out of these fungi *Alternaria* sp. is very common fungi reported from most of the wood samples in Wandoor-Andaman. Chinnaraj (1993) isolated 63 marine fungi from mangroves of Andaman and Nicobar Islands.

Taxonomic Account

1.*Alternaria* sp. (Fig.1)
Conidiophores: cylindrical, septate, simple or irregularly branched, straight or curved, basal cell occasionally swollen, smooth, yellowish to brown, singly. Conidia: enteroblastic- tretic, ovoid, obclavate, obpyriform or ellipsoidal, with a basal pore, tapering or not into an apical beak, muriform, constricted at the septa, smooth or rough, olivaceous to brown.

Material examined: - on intertidal stem of *Acanthus ilicifolius*, *Aegiceras corniculatum*, *Avicennia marina*, *Bruguiera gymnorhiza*, *Rhizophora apiculata,* Intertidal mangrove wood and Foam sample from Andaman.
Distribution in India: - East coast: Orissa (Borse and Borse, 2005); West Bengal (Pawar and Borse, 2005b). West coast: Karnataka (Prasannarai and Sridhar, 2001, 2000-2001; Maria and Sridhar, 2002a, 2003a, 2004, Anand and Sridhar, 2003, 2004). Kerala (Maria and Sridhar, 2002a).
Remark: -This fungus is very common from Andaman (14.49%).

2.*Bactrodesmium linderii* (Crane and Shearer) Palm and Stewart (Fig. 2) *Mycotaxon,* **15:** 319-325, 1982.
Trichocladium linderii Crane and Shearer *Mycologia,* **70:** 866, 1978.
Mycelium: composed of branched, septate, at first hyaline, latter sub hyaline to light brown hyphae, Conidiophores: macronematous, mononematous, smooth, thin-walled and hyaline or thick-walled and brown. Conidiogenous cells: holoblastic, integrated, terminal or intercalary, smooth, cylindrical, determinate. Conidia: solitary, subglobose to obpyriform, 1-2 septate, without constriction, 18-27 µm x 8-18 µm, becoming 3-6 µm wide at base, apical cell larger, dark brown to black, 11-16 µm high, basal and sub-basal cells smaller, light brown.

Material examined: on drift wood of *Avicennia officinalis*, *Rhizophora apiculata, Rhizophora mucronata*, Intertidal mangrove wood and Foam sample from Andaman.
Distribution in India: East coast: Andhra Pradesh (Sarma and Vittal, 1998-99, 2000, 2001). West coast: Maharashtra (Borse 1984, Patil and Borse, 1986, Borse, 1988 and Ramesh and Borse, 1989).
Remark: In present study this fungus is rare in occurrence from Andaman.

3. *Camarosporium roumeguerii* Sacc**.**
(Fig.3) *Michelia* **2:** 112, 1880.
Camarosporium obiones Jaap, Verh. *Bot. Ver. Prov. Branenburg*, **47:**97.1905.
Pycnidia: 90-210 µm x 85-260 µm, globose to ellipsoidal or lenticular, immersed, ostiolate, short papillate, coriaceous, yellow brown to olivacious, dark at the ostiole, solitary or gregarious, venter filled with a mucilage. Peridium: 7-12 µm thick at base, 12-20 µm at ostiole. Paraphyses: simple filiform, hyaline, non Septate, Conidiogenous cells: phialidic, flask shaped, simple, hyaline. Conidia: 10-20 µm x 7-13 µm, enteroblastic, monophialidic, initially one celled, hyaline mature conidia subglobose, ovoid, ellipsoidal or irregular, muriform, with (1)-3 transverse and 1 or 2 longitudinal or oblique septa, slightly constricted at the septa, composed of 2 to 8 cells, smooth, gold.

Material examined: - on intertidal stem of *Acanthus ilicifolius*, *Aegiceras corniculatum*, *Avicennia marina*, *Avicennia officinalis*, *Rhizophora apiculata, Rhizophora mucronata*, and Intertidal mangrove wood from Andaman.

Distribution in India:- East coast: Tamilnadu (Ravikumar, 1991); Andhra Pradesh (Sarma and Vittal, 98-99, 2000, 2001, 2004 and Vittal and Sarma, 2005); West Bengal (Pawar and Borse, 2005b and Shini et al 2009-10). West coast: Gujarat (Patil and Borse, 2001); Maharashtra (Borse, 1988, Patil and Borse, 1986, Borse, et al 1988, 2005a and Shrivastava, 1994).

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

4. *Clavatospora bulbosa* (Anast.) Nakagiri and Tubaki (Fig.4)*Bot. Mar*., **28:** 489, 1985.

Clavariopsis bulbosa Anastasiou, *Mycologia,* **53:** 11, 1961.

Hyphae: 2.5-4 µm in diameter, septate, ramose, and fuscous. Conidiophores: 18-78 µm x 2-4.5 µm, cylindrical, septate, simple or branched, hyaline. Conidia: tetra radiate, septate, slightly constricted at the septa, hyaline to light brown, basal arm one–septate, proximal cell 8-16 µm x 4-9 µm ellipsoidal or ovoid, truncate at the base, light brown, distal cell 7-12 µm x 6-14 µm , cylindrical or shortly three branched, fuscous, three divergent arms arising simultaneously from the inflated distal cell of basal arm, 20-60 µm x 4-6 µm, cylindrical, one-to-five septate and light brown. One armed conidia: Conidia consisted of only single arm also observed, these are grey brown, 5-10 celled, 54-60 µm x 6.5-9 µm, constricted around septa, basal and apical cells lighter color.

Material examined: - on intertidal wood of *Aegiceras corniculatum*, *Avicennia marina*, *Avicennia officinalis*, *Rhizophora apiculata, Sonneratia alba,* and Foam sample from Andaman.

Distribution in India: -East Coast: Tamilnadu (Raghukumar, 1973 and Nambiar *et al*., 2008); Orissa (Borse *et al.,* 2001b); West Bengal (Borse *et al.,* 2001a). West Coast: Kerala (Kohlmeyer *et al.,* 1967); Maharashtra (Borse, 1984),;Karnataka (Sridhar and Kaveriappa, 1991); Kerala (Nambiar and Raveendran, 2007, 2008b, 2009a and Nambiar *et al.,* 2008); Goa (Nandan *et al.,* 1993 and Borse and Tuwar, 2006);

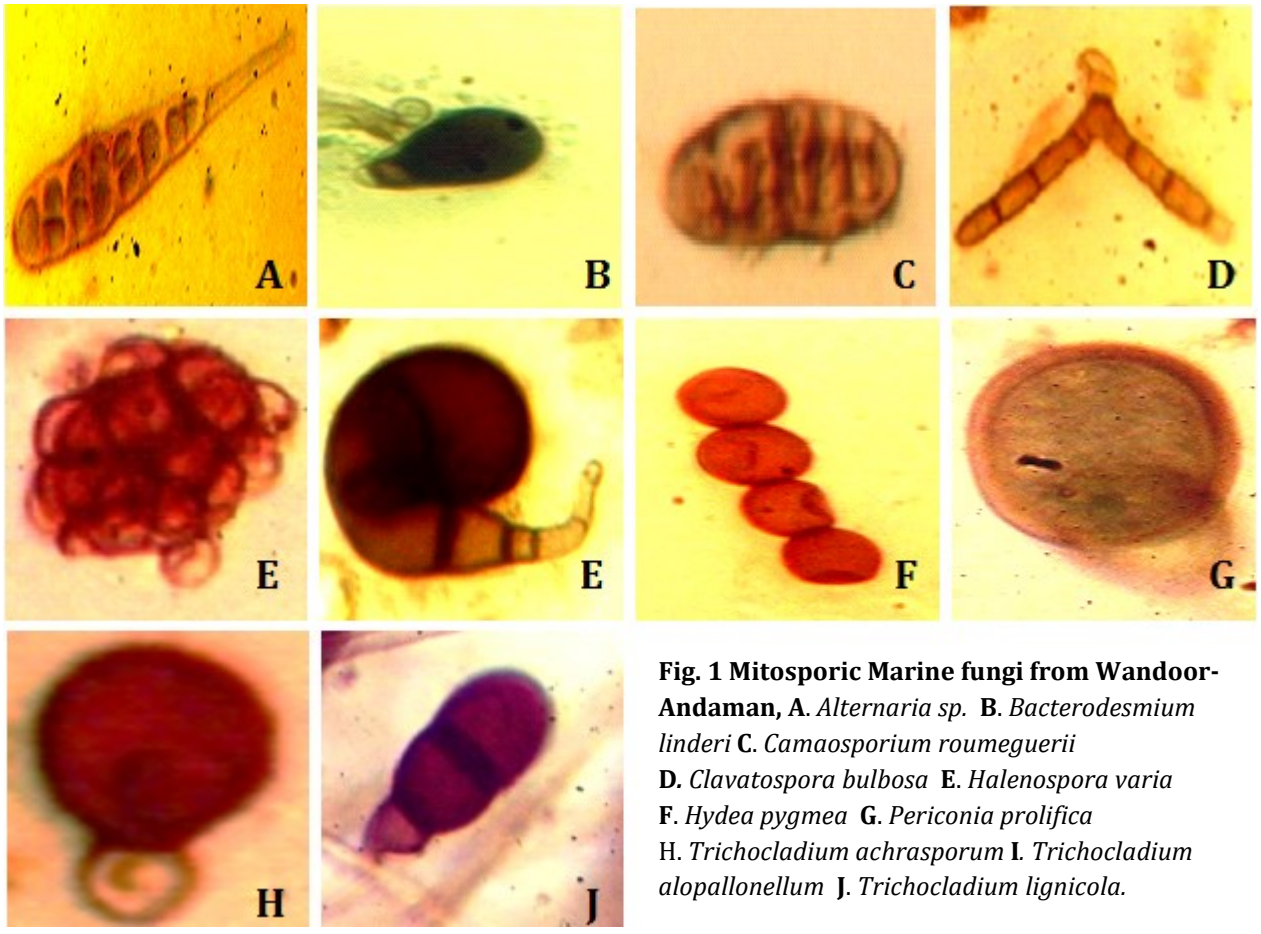

Fig. 1 Mitosporic Marine fungi from Wandoor-Andaman, A. *Alternaria sp.* **B**. *Bacterodesmium linderi* **C**. *Camaosporium roumeguerii* **D.** *Clavatospora bulbosa* **E**. *Halenospora varia* **F**. *Hydea pygmea* **G**. *Periconia prolifica* H. *Trichocladium achrasporum* **I**. *Trichocladium alopallonellum* **J**. *Trichocladium lignicola.*

Gujarat (Patil and Borse, 2001); Mahe Pondicherry (Borse and Pawar, 2005, Nambiar and Raveendran, 2008d) and Andaman and Nicobar Islands (Chinnaraj1993).
Remark: - The fungus is occasional in occurrence from Andaman (1.57%).

5. *Halenospora varia* (Anastasiou) E.B. G. Jones (Fig.5) *Fungal Diversity*, **35:**154, 2009.
Zalerion varium Anastasiou
Can. J. Bot., **41:** 1136, 1963 (as *Z. Varia*).
Hyphae: septate, branched, immersed, hyaline, Conidiophores: up to 30 µm long, 2-3 µm in diameter, micronematous, simple, cylindrical, septate, sometimes absent, superficial, hyaline to light olive colored. Conidia: 14-62 µm x 13-44 µm, solitary, irregularly helicoid or coiled in three planes, forming a knot or ball of about 10 to 28 cells. Conidial filament lateral, rarely branched or subtending an additional conidium, thick–walled, smooth, brown to dark brown, appearing black in mass. Cells 6-13 µm x 4-11µm.

Material examined: on intertidal stem of *Acanthus ilicifolius*, *Avicennia marina*, *Rhizophora apiculata, Rhizophora mucronata*, Intertidal mangrove wood and foam sample from Andaman.
Distribution in India: - East coast: Tamilnadu (Raghukumar, 1973 and Nambiar *et al*., 2008); Andhra Pradesh (Sarma and Vittal, 2000); Orissa (Borse and Borse, 2005); West Bengal (Pawar and Borse, 2005b). West coast: Maharashtra (Borse, 1984; Shrivastava, 1994; Shindikar and Borse, 2002); Karnataka (Sridhar and Kaveriappa, 1991); Daman (Borse *et al.,* 2000b); Gujarat (Patil and Borse, 2001); Goa (Nandan *et al.,* 1993); Kerala (Prasannarai and Sridhar, 2001, Nambiar and Raveendran 2006, 2007, 2008a, b, c; 2009a, b and Nambiar *et al.,* 2006); Lakshadweep Islands (Chinnaraj 1992) and Andaman and Nicobar islands (Chinnaraj 1993).
Remark: - The present fungus is very common from Andaman (14.16%).

6. *Hydea pygmea* (Kohlmeyer) Pang and Jones (Fig.6)
Ber. Disch. Bot. Ges., **79:** 35, 1966.
Cirrenalia pygmea (Kohlmeyer) Pang and Jones
Hyphae: 2-4 µm in diameter, septate, ramose, fuscous. Conidiophores: obsolete. Conidia: acrogenous, solitary, helicoid, contorted ½ or 1 time, three or four septate, not or slightly constricted at the septa, fish-shaped or reniform, black or fuscous, fulgent, spirals 25-30 µm x 26-32 µm, terminal cell 14-20 µm in diameter, subglobose to reniform, basally flattened basal cells 3-5.5 µm in diameter and central cells irregularly conical or almost wedge-shaped.

Material examined: on intertidal stem of *Acanthus ilicifolius*, *Aegiceras corniculatum*, *Rhizophora apiculata, Rhizophora mucronata*, Intertidal mangrove wood and Foam sample from Andaman.
Distribution in India: East coast: Andhra Pradesh (Sarma and Vittal, 98-99, 2000 and 2001); Tamilnadu (Ravikumar and Vittal, 1996 and Nambiar *et al*., 2008); Orissa (Borse and Borse, 2005); West Bengal (Pawar and Borse, 2005b). West coast: Gujarat (Patil and Borse, 2001); Pirotan Islands (Borse, *et al*., 2000a); Maharashtra (Borse, 1984, 1988; Patil and Borse, 1986; Ramesh and Borse, 1989); Kerala (Nambiar and Raveendran 2007, 2008a, b, 2009b; Nambiar *et al.,* 2006 and 2008); Goa (Nandan, *et al.*, 1993), Pondicherry and Mahe (Nambiar and Raveendran, 2008d); Lakshadweep Islands (Chinnaraj 1992) and Andaman and Nicobar Islands Chinnaraj (1993).
Remark: The present fungus is frequent in occurrence from Andaman (8.99%).

7. *Periconia prolifica* Anastasiou (Fig. 7)
Nova Headwigia, **6:** 260, 1963.
Conidiophores: 5-180 µm x 3 µm; cylindrical, septate, simple or branched, hyaline. Conidiogenous cell: ellipsoidal or ovoid, hyaline, produced acrogenously. Conidia: 6.5-8.5 µm in diameter, one-celled, subglobose or ovoid, smooth, thick-walled, light brown with a reddish or dark brown, developing basipetally, catenulate, cells finally separating.

Material examined: On intertidal stem *Aegiceras corniculatum*, *Avicennia marina*, *Avicennia officinalis*, *Bruguiera gymnorhiza, Rhizophora apiculata, Rhizophora mucronata*, *Sonneratia alba,* Intertidal mangrove wood and Foam sample from Andaman.
Distribution in India: -East coast: Tamilnadu (Raghukumar, 1973 and Nambiar *et al*., 2008); Andhra Pradesh (Sarma and Vittal, 2000); Orissa (Borse and Borse, 2005); West Bengal (Pawar and Borse, 2005b). West coast: Maharashtra (Borse, 1984; Srivastava, 1994; Shindikar and Borse, 2002); Goa (Nandan *et al.,* 1993); Karnataka (Prasannarai and Sridhar, 1997); Diu (Borse *et al.,* 1999b); Daman (Borse *et al.,* 2000b); Gujarat (Borse *et al.,* 2000a and Patil and Borse, 2001); Kerala (Prasannarai and Sridhar, 2001, Raveendran and Manimohan, 2007, Nambiar and Raveendran 2006,

2007, 2008a, b, c 2009 b and Nambiar *et al.,* 2006, 2008); Pondicherry and Mahe (Nambiar and Raveendran*,* 2008d); Lakshadweep Islands (Chinnaraj 1992) and Andaman and Nicobar Islands (Chinnaraj 1993).
Remark: - The present fungus is frequent in occurrence from Andaman (10.11%).

8. ***Trichocladium achrasporum*** (Meyers and Moore) Dixon in Shearer and Crane (Fig.8)
Mycologia, **63:** 344, 1971.
Culcitalna achraspora Meyers and Moore. *Am. J. Bot*., **47:** 349, 1960.
Trichocladium achraspora Dixon, *Trans. Br. Mycol. Soc*. **51:** 163, 1968.
Sporodochia: occasionally found, superficial, compact and fuscous to black. Conidiophores: absent or short, zero-to four-septate, simple, formed laterally on hyphae, hyaline to light brown or fuscous. Conidia: (blastoconidia) 22-32 µm x 14-20 µm, clavate, ovoid or obpyriform, two-to five-septate, constricted at the septa, straight or slightly curved, increasing in diameter from base to apex, formed singly on the conidiophores; apical cells subglobose, dark brown; basal cells conical or sub cylindrical, sub hyaline to light brown or fuscous.
Material examined: - On intertidal stem of *Aegiceras corniculatum*, *Avicennia marina*, *Avicennia officinalis*, *Rhizophora mucronata* and Intertidal mangrove wood from Andaman.

Distribution in India: - East coast: Tamilnadu (Ravikumar and Vittal, 1996 and Nambiar *et al*., 2008); Andhra Pradesh (Sarma and Vittal, 2000); Orissa (Borse and Borse, 2005); West Bengal (Pawar and Borse, 2005b). West coast: Maharashtra (Borse, 1984, 2000b; Srivastava, 1994; Shindikar and Borse, 2002); Goa (Nandan *et al*., 1993); Karnataka (Prasannarai and Sridhar, 1997); Gujarat (Borse *et al.,* 2000a and Patil and Borse, 2001); Kerala (Prasannarai and Sridhar, 1997, Raveendran and Manimohan, 2007, Nambiar and Raveendran 2007, 2008c, 2009a, Nambiar *et al.,* 2008); Lakshadweep Islands (Chinnaraj 1992) and Andaman and Nicobar Islands (Chinnaraj 1993).
Remark: - The present fungus is rare in occurrence from Andaman (0.67%).

9. ***Trichocladium alopallonellum*** (Meyers and Moore) Kohlm. and Volk. – Kohlm. *Mycotaxon,* **53:** 349-353, 1995. (Fig. 9)
Humicola alopallonella Meyers and Moore, *Am. J. Bot*., **47:** 346, 1960.
Hyphae: septate, sub hyaline to light brown. Conidiophores: 4-8µm x 3-6 µm, macronematous, simple, one-to two–celled, smooth, hyaline to light brown, lateral, short. Conidia: 12-18 µm x 14-20 µm, obpyriform, ovoidal or subglobose , one-to two-celled, fuscous, when two-celled, apical cell larger (8–16 µm x 6-12 µm), fuscous, basal cell, smaller, obconical to cylindrical, light brown.

Material examined: On intertidal stem of *Avicennia marina* and *Rhizophora apiculata* from Andaman.
Distribution in India:- East coast: Orissa (Borse and Borse, 2005) West Bengal (Pawar and Borse, 2005b), Tamilnadu (Ravikumar and Vittal, 1996; Nambiar *et al*.,2008), Andhra Pradesh (Sarma and Vittal, 2000, 2004), West coast: Maharashtra (Jones, 1968; Borse, 2000b; Shindikar and Borse, 2002), Karnataka, (Prasannarai and Sridhar, 1997), Gujarat (Borse *et al*., 2000a, Patil and Borse, 2001), Goa (Nandan *et al.,* 1993).
Remark: - The present fungus is rare in occurrence from Andaman (0.79%).

10. ***Trichocladium lignicola*** Schmidt **(**Fig. 10)
Nat Naturschutz Mecklenburg, **12:**116, 1974.
Hyphae: septate, sub hyaline to light brown. Conidiophores: 4-6 µm x 3-6 µm, macronematous, simple, one-to two–celled, smooth, hyaline to light brown, lateral, short, indistinct. Conidia: middle brown, 3-6 celled, 24-30 µm x 13-15 µm, constricted around septa, single cell nearly globular.

Material examined: - On intertidal stem of *Avicennia officinalis* and Foam sample from Andaman.
Distribution in India: - East coast: Orissa (Borse and Borse, 2005); West Bengal (Pawar and Borse, 2005b). West coast: Kerala (Prasannarai and Sridhar, 2001).
Remark: - The present fungus is occasional in occurrence from Andaman (1.69%).

SUMMARY AND CONCLUSION

The results of our investigation Total 10 species of Mitosporic marine fungi were encountered from Wandoor-Andaman Out of these fungi *Alternaria* sp. is very common fungi reported from most of the wood samples in Wandoor-Andaman..

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

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