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RESEARCH ARTICLE

TAXONOMIC ACCOUNT OF TWO BROWN SEAWEED GENERA *CHNOOSPORA* AND *PSEUDOCHNOOSPORA* (PHAEOPHYTA) IN INDIA

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Abstract: Seaweeds are the marine macro algae and represented globally with about 11,000 taxa, belonging to the division Chlorophyta, Phaeophyta and Rhodophyta. In India, seaweeds are represented with about 865 taxa. The two brown algal genera *Chnoospora* J. Agardh and *Pseudochnoospora* Santiañez, G.Y.Cho & Kogame belong to the family Scytosiphonaceae under the division Phaeophyta. The genus *Chnoospora* includes three taxa in the world and two taxa in India *i.e.,Chnoospora bicanaliculata* V. Krishnam. & P.C. Thomas and *Chnoospora minima* (K. Hering) Papenf. Whereas the newly established genus *Pseudochnoospora* is represented with only one species in the world as well as in India *i.e. Pseudochnoospora implexa* (J.Agardh) Santiañez, G.Y.Cho & Kogame. The species *C. bicanaliculata* is endemic to the Indian coast, whereas the species *C. minima* and *P. implexa* are economically very important and have therapeutic potentials. The present paper deals with the detailed taxonomic account of these three taxa in India including its economic potential.

Keywords: *Chnoospora*, Endemic, Phaeophyceae, *Pseudochnoospora*, Taxonomy

INTRODUCTION

The marine ecosystem is one of the most productive ecosystems of the world. Seaweeds are the marine macro algae and one of the most potential marine natural living resources. It constitutes an important component of the marine flora, along with other flora such as microalgae, seagrasses and mangroves and plays an important role in the sustainability of the marine ecosystems. Globally, about 45,000 taxa of algae have been reported (Guiry, 2012; https://www.seaweed.ie/) of which, seaweeds constitute about 11,000 taxa, comprising of *c*. 7,200 taxa of Rhodophyceae, *c*. 2,000 taxa of Phaeophyceae and *c*. 1,800 taxa of Chlorophyceae (https://www.seaweed.ie/). In India, algae are represented with about 9035 taxa (BSI, 2022), of which, seaweeds constitute about 865 taxa, comprising of *c*. 442 taxa of Rhodophyce ae, *c*. 212 taxa of Chlorophyceae and *c*. 211 taxa of Phaeophyceae (Rao and Gupta, 2015).

The taxonomy of the family Scytosiphonaceae under the division Phaeophyta is very complex and challenging, because of the many unresolved relationship of the taxa (Cho *et al*., 2006; Kogame *et al*., 1999; McDevit and Saunders, 2017; Santiañez *et al*., 2018), morphological variations and its limited distribution. These complexities in the genera have led many changes in the nomenclature and taxonomic circumscriptions. Therefore, the genus *Chnoospora* was subdivided by establishing a new genus *i.e. Pseudochnoospora* Santiañez, G.Y.Cho & Kogame on the basis of its morphological and phylogenetic study (Santiañez *et al*., 2018). Currently, the genus *Chnoospora* J. Agardh is represented by three taxa in the world (Guiry and Guiry, 2023) and two taxa in India *i.e., Chnoospora bicanaliculata* V. Krishnam. & P.C. Thomas and *Chnoospora minima* (K. Hering) Papenf. Whereas the genus recently established genus *Pseudochnoospora* Santiañez, G.Y.Cho & Kogame is represented by only one taxon in the world as well as in India *i.e. Pseudochnoospora implexa* (J.Agardh) Santiañez, G.Y.Cho & Kogame.

The coastline of India is about 7500 km in length and stretching along nine maritime states and four union territories. The diverse coastal habitats such as rocks, coralline beds, reefs, pebbles, shells, dead corals, mangroves etc. support excellent habitats for seaweeds diversity. Therefore, an attempt has been made here to present a detailed taxonomic account of these three taxa in India.

MATERIALS AND METHODS

The present study is based on the extensive botanical explorations to different coastal localities of India and thorough study of fresh collections of seaweeds

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and relevant literature. For survey and collection of seaweed resources of the various maritime states, the authors conducted several botanical explorations during 2011 to 2022 to different coastal localities of the Indian coast. During surveys, important field observations such as habit, habitats, nature of the coast, vegetation pattern, association with other plants, GPS position Garmin 12 channel XL) etc. were recorded and photographed using a digital camera (Nikon COOLPIX L120) and physic-chemical parameters of the water samples were analysed using Water Analysis Kit (Labtronics MODEL LT-59). Fresh collections of the seaweed samples were thoroughly preserved in the form of herbarium specimens (wet and dry forms) following the standard procedure (Srinivasan, 1969; Dhargalkar and Kavlekar, 2004) and studied microscopic characters under sophisticated compound microscopes (Nikon *SMZ1500* and Nikon *Eclipse 50i*). The samples were identified following the standard literature (Misra, 1966; Srinivasan, 1969, 1973; Silva *et al*., 1996; Krishnamurthy and Baluswami, 2010; Palanisamy *et al*., 2020). The preserved specimens were deposited into different herbaria of the Botanical Survey of India such as Madras Herbarium (MH), Coimbatore, Tamil Nadu and Central National Herbarium (CAL), Howrah. In addition, the specimens housed at BSIS were also referred. Besides, all the relevant global databases such as Algaebase (https://www.algaebase.org), WoRMS (https://www.marinespecies.org), Seaweeds (https://www. seaweed.ie) and Macroalgal Herbarium Portal (https://macroalgae.org) were referred for resolving nomenclatural ambiguities and provide the updated status of the taxa.

RESULTS AND DISCUSSION

The present study revealed that the tropical seaweed genus *Chnoospora* J. Agardh has now been undergone many nomenclatural changes and divided into two genera based on the morphological and molecular analyses. Santiañez *et al*. (2018) established a new genus of *Pseudochnoospora* and accommodated the species of *Chnoospora implexa* J. Agardh. Though these genera are reported from many maritime localities of the world such as Taiwan, Japan, Sri Lanka, Indonesia, Malaysia, Myanmar, Philippines, Thailand, Viet Nam, China, Ghana, Liberia, Mozambique, Gulf of California, Hawaiian Islands, Brazil, Chile, Colombia, Venezuela; Central America: Panama, Caribbean Islands (Caribbean, Cuba, Lesser Antilles, Martinique, Netherlands Antilles, Puerto Rico, Trinidad & Tobago); Atlantic Islands: Cape Verde Islands. Australia, New Zealand etc. However, In India, these taxa have very limited distribution and also sporadically reported. The perusal of literature reveals that the species *Chnoospora bicanaliculata* is endemic to the Indian coast (Oza and Zaidi, 2001). Further, it is also revealed that In India, the genus *Chnoospora* was earlier represented with 3 taxa (Rao and Gupta, 2015; Palanisamy *et al*., 2020). However, with the new molecular studies and nomenclatural changes and establishment of a new genus *Pseudochnoospora* by Santiañez *et al*. (2018), the taxonomic status of both the genera in India has been changed. Therefore, an updated taxonomic circumscription of the two seaweed genera in India *Chnoospora* and *Pseudochnoospora* is provided below:

Key to the genera

1a. Thallus cylindrical - filiform, erect, solid to partially hollow, usually dichotomously branched, without any marginal proliferations; grooves on one or both sides, phaeophyceaen hairs develop in deep depression **1. *Chnoospora***

1b. Thallus terete to compressed, decumbent, solid, intricately branched, with dense marginal proliferations; grooves on one sids, phaeophyceaen hairs develop in deep pits **2. *Pseudochnoospora***

1. *CHNOOSPORA* J. Agardh

The genus is usually a tropical alga and characterised by its erect, cylindrical, solid to partially hollow thallus, with irregularly dichotomous branches, epilithic. Fronds cylindrical, terete to compressed, surface smooth or rough with slightly pitted microscopic hairs, grooves occur one or both sides. Gametangia plurilocular, associated with uniseriate hairs in deep depressions.

Currently 3 taxa in the world (Guiry and Guiry, 2023) and 2 in India.

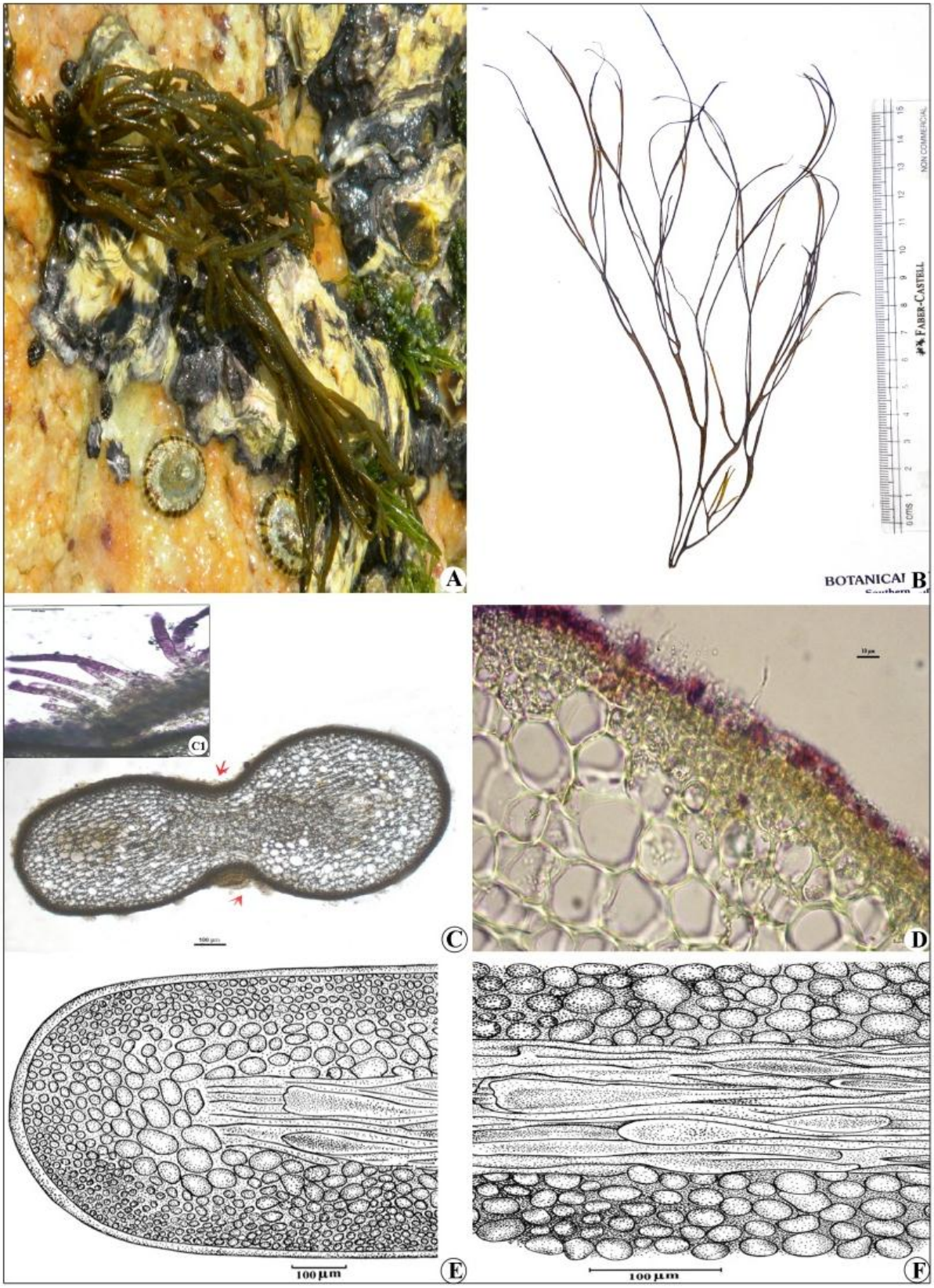
Key to the species

1a. Thallus large, 8-20 cm long, subdichotomously branched; grooves on both sides of thallus; apical dichotomy large, sometimes curved **1. C. bicanaliculata**

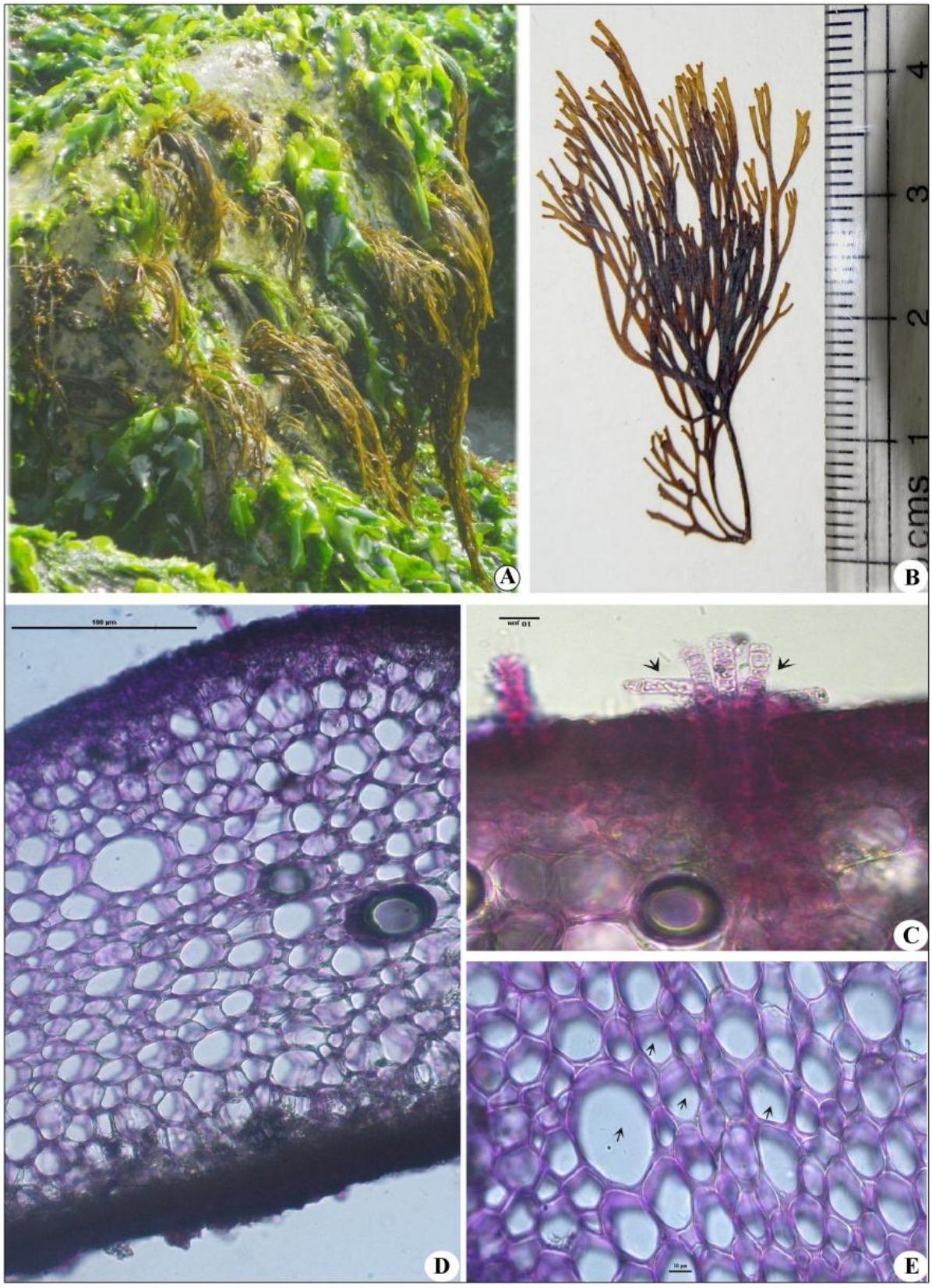
1b. Thallus small, 4-10cm long, densely dichotomously branched; apical dichotomy small, always straight **2. C. minima**

1. Chnoospora bicanaliculata V. Krishnam. & P.C. Thomas in Seaweed Res. Utiln. 2:44.1977; P.C. Silva & al., Cat. Benth. Mar. Alg. Ind. Ocean: 625. 1996; Oza & Zaidi, Rev. Checkl. Ind. Mar. Alg.: 119. 2001; Nettar & Panikkar in J. Econ. Taxon. Bot. 28 (2): 383. 2004; V. Krishnam. & Baluswami, Phaeophyceae India Neighb. 1: 128. 2010; Yadav & al. in Rajendran & Aravindhan (eds.), Biodiv. Cons.-Asp. Prosp.: 57. 2015; P.S.N. Rao &R.K. Gupta, Algae India 3: 25. 2015; Palanisamy & al., Seaweeds Kerala, India 90, pl 47. 2020. **(Fig. 1)**

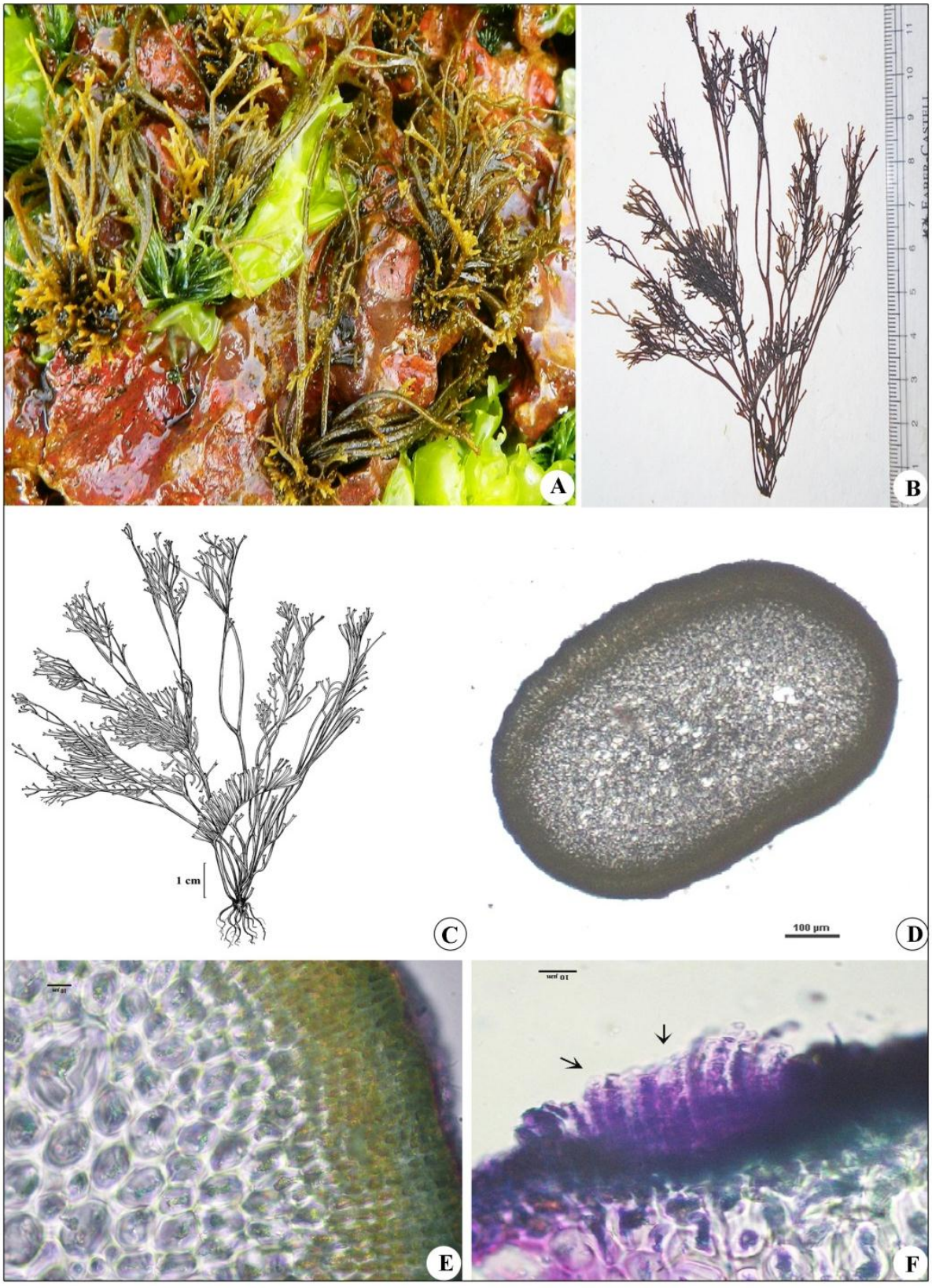
Type locality: Mandapam coast, Tamil Nadu, India.



Chnoospora bicanaliculata V. Krishnam. & P.C. Thomas: **A.** Habit; **B.** Herbarium specimen; **C - C1.** Cross section of frond showing grooves and reproductive bodies on both sides; **D.** Cross section of frond showing cortex and medulla cells; **E - F.** Illustrations showing cross section of frond (middle part).



Chnoospora minima (Hering) Papenf.: **A.** Habit; **B.** Herbarium specimen; **C.** Cross section of frond (apical part) showing grooves and reproductive bodies; **D-E.** Cross section of frond showing cortex and medulla cells.



Pseudochnoospora implexa (J.Agardh) Santiañez, G.Y.Cho & Kogame: **A.** Habit; **B - C.** Herbarium specimen and illustration of habit; **D.** Cross section of frond (apical part); **E.** Cross section showing cortex and medulla cells; **F.** Cross section showing groove and reproductive bodies.

Thallus dark brown in colour, 7-20 cm long, cylindrical - filiform, tufted, irregular to sub-dichotomously branched, epilithic. Holdfast discoid, hard, 0.3-3 mm across, attached firmly on rocky

substrata. Stipe stalked, up to 10 cm long and 0.5-2 mm wide. Fronds sub-cylindrical - slightly flattened, 5-10 cm long and 0.5-2 mm wide, irregularly sub-dichotomous; median dichotomy with two distinct grooves on both edges; apical dichotomy 1-5 × 0.3-1 mm, slightly curved in mature stage; margins entire; apex acute - obtuse. *Microscopic characters*: Cells in surface view elongate-rectangular, 4.1-6.5 × 2.3-4.7 µm; in cross section thallus multi layered; cortex 4-7-layered, 40-72 µm thick, cells spherical, 28-35 µm across, thick walled; medulla 6-8-layered, 450-675 µm thick, cells elongate to polygonal, 24.5-160× 19-32 µm, thick walled, compressed. Reproductive bodies develop near grooves on frond surface, microscopic hairs present; sporangia plurilocular, growing in uni- to biseriate sori.
Occurrence: Throughout the year.

Distribution: **India**: Andhra Pradesh (Srikakulam and Visakhapatnam), Kerala (Alappuzha, Kollam and Thiruvananthapuram), Lakshadweep Islands and Tamil Nadu (Mandapam). **Global distribution status:** Not reported from any other parts of the world.

Specimens examined: INDIA**: Andhra Pradesh**-Srikakulam Distr.: Yerramukkam, 18.03.2019, *M.Palanisamy & Aron Santhosh Kumar* 137976(MH); Dokulupadu, 21.08.2019, *M.Palanisamy & Aron Santhosh Kumar* 140387(MH); Visakhapatnam Distr.: Bheemunipatnam,23.08.2019, *M.Palanisamy & Aron Santhosh Kumar* 140422(MH); **Kerala** - Alappuzha Distr.: Thottappalli, 14.09.2011, *M. Palanisamy & S.K. Yadav* 127137 (MH); Kollam Distr.: Thangassery Fishery Harbour, 11.09.2011, *M. Palanisamy & S.K. Yadav* 127066 (MH); 16.06.2013, *M. Palanisamy & S.K. Yadav* 128821 (MH); Thirumullavaram, 12.09.2011, *M. Palanisamy & S.K. Yadav* 127091 (MH); 16.06.2013, *M. Palanisamy & S.K. Yadav* 128833 (MH); Neendakara, 16.06.2013, *M. Palanisamy & S.K. Yadav* 128857 (MH); Thiruvananthapuram Distr.: Poovar, 08.09.2011, *M. Palanisamy & S.K. Yadav* 127002 (MH); Somatheeram (Chowara), 08.09.2011, *M. Palanisamy & S.K. Yadav*127013 (MH); 01.10.2013, *M. Palanisamy & S.K. Yadav*128997 (MH); Vizhinjam Fishery Harbour, 03.07.2012, *M. Palanisamy & S.K. Yadav*127657 (MH); 13.06.2013, *M. Palanisamy & S.K. Yadav*128542 (MH); 01.10.2013, *M. Palanisamy & S.K. Yadav* 129355, 129358 (MH); Kovalam, 09.09.2011, *M. Palanisamy & S.K. Yadav* 127032 (MH); 01.10.2013, *M. Palanisamy& S.K. Yadav* 129378 (MH); Valliathura, 01.10.2013, *M. Palanisamy & S.K. Yadav* 129399 (MH); Varkala, 02.10.2013, *M. Palanisamy & S.K. Yadav* 129408 (MH); Edava, 04.07.2012, *M. Palanisamy & S.K. Yadav* 127667 (MH).

*Notes***:** This species was first discovered by Krishnamurthy and Thomas (1977) from the Mandapam coast of India. Now, it has been reported from various coastal localities of Andhra Pradesh, Kerala, Tamil Nadu and Laccadive Islands. However, it has not been reported from any other country hitherto. Therefore, this species is recognised as endemic to the Indian coast (Oza and Zaidi, 2001). Further, in habitats this species is found growing luxuriantly on rocky substrata in highly surf exposed areas in association with the species of *Chaetomorpha*, *Gracilaria*, *Grateloupia*, *Hypnea* and *Ulva* during the monsoon and post-monsoon seasons.

2. Chnoospora minima (K. Hering) Papenf. in J. S. African Bot. 22: 69. 1956; J.N. Misra, Phaeophyceae India: 123. 1966; Untawale & al., List Mar. Alg. India: 20. 1983; Chennubhotla & al. in Bull. Centr. Mar. Fish. Res. Inst. 41: 10, fig. 10. 1987; Oza & Zaidi, Rev. Checkl. Ind. Mar. Alg.: 119. 2001; Nettar & Panikkar in J. Econ. Taxon. Bot. 28 (2): 383. 2004.V. Krishnam. & Baluswami, Phaeophyceae India Neighb. 1: 129. 2010; P.S.N. Rao & R.K. Gupta, Algae India 3: 25. 2015; Palanisamy & al., Seaweeds Kerala, India 91, pl 49. 2020. *Fucus minimus* K. Hering in Ann. Mag. Nat. Hist. 8: 92. 1841.*Chnoospora pacifica* J.Agardh Vetenskaps-Adademiens Förhandlingar 7. 1847.*Chnoospora fastigiata* J.Agardh, *nom. illeg*. Species genera: 171-172. 1848. **(Fig. 2)**

Type locality: Port Natal, Durban, South Africa (Hering, 1841).

Thallus dark - light brown in colour, cylindrical - filiform, 4-8 cm long, rigid, bushy, densely clumped, epilithic. Holdfast discoid, hard, 0.2-2 mm across, attached tightly on rocks in low intertidal regions. Stipe stalked, 0.5-2 cm long and up to 1 mm wide, simple, cylindrical towards base and flattened towards apex. Fronds sub cylindrical - filiform or wiry, slightly flattened, 2-6 cm long and 0.5-2 mm across, regularly dichotomously branched, compressed with sunken points at dichotomy, grooves only on one side; margins entire; apical dichotomy up to 4 mm long and 0.8 mm wide, usually unequal, straight with acute to rounded apex. *Microscopic characters*: Cells in surface view rectangular or elongated, meristematic, 7-12 × 4-8 µm; in cross section, thallus multilayered; cortex 5-9-layered, 70-100 µm thick, cells spherical to polygonal, 12-30 µm across, thick walled; medulla 6-8-layered, 245-450 µm thick, cells elongate, spherical towards cortex, 21-85 × 17-28 µm, compact. Reproductive bodies develop on frond surface, sporangia plurilocular, develop in sori in the grooves, multicellular, uni- to biseriate.
Occurrence: Throughout the year. Common.
Distribution: **India**: Andhra Pradesh (Srikakulam and Visakhapatnam), Goa, Gujarat, Kerala

(Alappuzha, Kollam, Thiruvananthapuram and Thrissur) and Tamil Nadu. **Global distribution status: Asia:** India, Taiwan, Japan, Sri Lanka, Indonesia, Malaysia, Myanmar, Philippines, Thailand, Viet Nam, China, Christmas Island, Mauritius, Réunion, Seychelles, Red Sea; **Africa:** Pagalu, Benin, Côte d'Ivoire (Ivory Coast), Equatorial, Ghana, Liberia, Mozambique, Nigeria, São Tomé & Príncipe Sierra Leone, South Africa, Togo; **North America**: Baja California, Gulf of California, Easter Island, Hawaiian Islands; **South America:** Brazil, Chile, Colombia, Venezuela; **Central America:** Panama, Caribbean Islands (Caribbean, Cuba, Lesser Antilles, Martinique, Netherlands Antilles, Puerto Rico, Trinidad & Tobago); **Atlantic Islands:** Cape Verde Islands. Australia, New Zealand.

Specimens examined: INDIA**: Andhra Pradesh**- Srikakulam Distr.: Bandaruvanipeta, 07.09.2018, *M.Palanisamy & Aron Santhosh Kumar* 137538(MH); Yerramukkam, 18.03.2019, *M.Palanisamy & Aron Santhosh Kumar* 137980(MH); Laxmipuram, 21.08.2019, *M.Palanisamy & Aron Santhosh Kumar* 140379(MH); Visakhapatnam Distr.: Bheemunipatnam, 09.09.2018, *M.Palanisamy & Aron Santhosh Kumar* 137831(MH); **Kerala** - Alappuzha Distr.: Arthunkal, 19.03.2012, *M. Palanisamy & S.K. Yadav* 127591 (MH); Kollam Distr.: Cheriazheekal, 13.09.2011, *M. Palanisamy& S.K. Yadav* 127118 (MH); 17.02.2013, *M. Palanisamy* 128458 (MH); Azheekal, 13.09.2011, *M. Palanisamy & S.K. Yadav* 127128 (MH); Thiruvananthapuram Distr.: Mulloor, 01.10.2013, *M. Palanisamy & S.K. Yadav* 129320, 129324 (MH); Somatheeram (Chowara), 01.10.2013, *M. Palanisamy & S.K. Yadav* 128998 (MH); Vizhinjam Fishery Harbour, 08.09.2011, *M. Palanisamy & S.K. Yadav* 127026 (MH); 01.10.2013, *M. Palanisamy & S.K. Yadav* 129344, 129354(MH); Kovalam, 01.10.2013, *M. Palanisamy & S.K. Yadav* 129376 (MH), 129381; Samudra beach, 19.02.2013, *M. Palanisamy* 128508 (MH); Valliathura, 01.10.2013, *M. Palanisamy & S.K. Yadav* 129404 (MH); Varkala, 02.10.2013, *M. Palanisamy & S.K. Yadav* 129407 (MH); Thrissur Distr.:Vadanappally, 17.02.2013, *M. Palanisamy* 128453 (MH); **Tamil Nadu**: Kanniyakumari Distr.: Cape Comorin, 08.07.1949, *K.S. Srinivasan* 1708 (BSIS); Kanniyakumari Distr.: Cape Comorin, 08.07.1949, *K.S. Srinivasan* 1707, 1708, 1709 (BSIS); Cape Comorin, 09.07.1949, *K.S. Srinivasan* 1710, 1711 (BSIS); Chengalpattu Distr.: Mahabalipuram, 1945, *K.S. Srinivasan* s.n. (BSIS).

*Notes***:** In habitats, this species is usually found growing in highly surf exposed areas in the intertidal regions of the coast. This species is economically very important and known to have therapeutical values. The methanol extract and its bioactive fraction (CF4) from this species has Anti-cancerous properties and highly potential Anti-angiogenesis and apoptogenic values (Parveen and Nadumane, 2020). Further, it is known to have Antioxidant activities (Van *et al*., 2013). Therefore, this species is highly economically important with several medicinal values and need more research on its conservation, cultivation, and sustainable utilisation of this promising marine natural resource.

2. *PSEUDOCHNOOSPORA* Santiañez, G.Y.Cho & Kogame

The genus is also a tropical one and characterised by its decumbent, terete to compressed, solid, intricately branched, epilithic thalli. Fronds terete to compressed, surface smooth or rough with linear rows of microscopic hairs, grooves found one side only. Gametangia plurilocular, clavate, uni- or biseriate associated with uniseriate hairs in pits.

Currently only one taxon in the world (Guiry and Guiry, 2023) as well as in India.

Pseudochnoospora implexa (J.Agardh) Santiañez, G.Y.Cho & Kogame in Botanica Marina 61(1): 59. 2018.*Chnoospora implexa*J. Agardh, Spec. Gen. Ord. Alg.: 78. 1848; Boergesen in J. Indian Bot. Soc. 16: 313. 1937; S.C. Dixit in J. Univ. Bombay 32(3&5): 3. 1966; J.N. Misra, Phaeophyceae India: 124. 1966; Oza & Zaidi, Rev. Checkl. Ind. Mar. Alg.: 119. 2001; V. Krishnam. & Baluswami, Phaeophyceae India Neighb. 1: 128. 2010; P.S.N. Rao & R.K. Gupta, Algae India 3: 25. 2015; Palanisamy & al., Seaweeds Kerala, India 90, pl 48. 2020. *Chnoospora pannosa* J. Agardh, Spec. Gen. Ord. Alg.: 172. 1848. **(Fig. 3)**

Type locality: Near Tor, Sinai Peninsula, Egypt (Agardh, 1848).

Thallus light-dark brown in colour, terete-compressed, 5-20 (-30) cm long, intricately branched, several small marginal proliferations develop towards apex, clumped, rigid, bushy, epilithic. Holdfast discoid or fibrous, rigid, up to 3 mm across, attached firmly on rocky substrata in intertidal zones. Stipe stalked, 0.5-4 cm long and 0.5-1 mm wide, simple, cylindrical - slightly flattened, microscopic hairs present towards base. Fronds terete to compressed, 4-15 cm long and 0.4-3 mm across, dichotomously branched towards base and densely - intricately branched towards apex, grooves found one side only; grooves associated with linear rows of hairs (paraphyses); margins entire towards base and densely proliferated towards apex; proliferations single or on both sides of the margins, 0.4-3.5 mm long and 300-800 µm wide, apex usually rounded or obtuse; apical dichotomy up to 3 mm long and 1 mm wide, straight with rounded - obtuse apex. *Microscopic characters*: Cells in surface view usually rectangular; in cross section, thallus

multilayered, up to 800 µm thick; cortex 5-8-layered, 50-95 µm thick, cells usually elongate, 5-9.5 × 3-4 µm across, thick walled; medulla multilayered, 280-560 µm thick, cells usually spherical, 21-85 × 17-28 µm, central cells large, gradually become smaller towards periphery, compact, thick walled, colourless. Reproductive bodies develop on frond surface in association with microscopic hairs, sori plurilocular, covered by a cuticle; plurangial gametangia clavate, uni- or biseriate, 20-30 × 5-7 µm.
Occurrence: Monsoon and post-monsoon seasons. Moderate.
Distribution: **India**: Kerala (Alappuzha and Kollam) and Tamil Nadu. **Global distribution status:** India, Bangladesh, Indonesia, Myanmar, Philippines, Singapore, Viet Nam, China Japan, Taiwan, Yonaguni Island, Mauritius, Réunion, Rodrigues Island, Seychelles and Jordan; **Africa:** Kenya, Tanzania, Egypt; **North America***:* Gulf of California, Mexico (Pacific), Hawaiian Islands; **S. America:** Colombia, Galápagos Islands. Australia and New Zealand.

Specimens examined: **Kerala**: Alappuzha Distr.:Thrikkunnapuzha, 13.09.2011, *M. Palanisamy & S.K. Yadav* 127133 (MH); Kollam Distr.: Paravur, 10.09.2012, *M. Palanisamy & S.K. Yadav* 127055 (MH); Thangassery Fishery Harbour, 11.09.2011, *M. Palanisamy & S.K. Yadav* 127065 (MH); 05.07.2012, *M. Palanisamy & S.K. Yadav* 127675 (MH); Thirumullavaram, 03.10.2013, *M. Palanisamy & S.K. Yadav* 129464 (MH); Neendakara, 12.09.2011, *M. Palanisamy & S.K. Yadav* 127108 (MH); Arathupuzha, 06.07.2012, *M. Palanisamy & S.K. Yadav*127711 (MH).

Notes: This species is mainly distributed in tropical seas. In India, this species was first reported from the Tuticorin coast in Tamil Nadu (Krishnamurthy and Baluswami, 2010). Later, it was reported from many other coastal localities of Alappuzha and Kollam districts in Kerala (Palanisamy *et al*., 2020). Fotos (1981) and Kogame (2001) studied the life history of this alga in the culture in Japan and confirmed its heteromorphic and diphasic life cycle, alternating between erect gametophytes and discoid sporophytes. Further, economically this species is also known to have Antioxidant activities (Van *et al*., 2013).

CONCLUSION

The marine ecosystem is one of the most productive ecosystems of the world and supports enormous number of the biodiversity. Most of the brown algae are exclusively marine in nature and show high diversity in morphological and anatomical characters. Both the brown genera *Chnoospora* J. Agardh and *Pseudochnoospora* Santiañez, G.Y.Cho & Kogame of the family Scytosiphonaceae are tropical in distribution and have been reported from many maritime localities of the world such as Taiwan, Japan, Sri Lanka, Indonesia, Malaysia, Myanmar, Philippines, Thailand, Viet Nam, China, Hawaiian Islands, Brazil, Chile, Colombia, Venezuela; Central America: Panama, Caribbean Islands; Australia, New Zealand etc. However, in India, the reveals that these taxa have very limited distribution and sporadically reported. Therefore, through extensive botanical explorations, a significant number of fresh collections of these seaweeds were made and preserved in the form of herbarium specimens. These seaweeds are environmentally tolerant and adapted to grow in very harsh marine climate thatled to develop many secondary metabolites, which are of high therapeutic and economic importance. The genus *Chnoospora bicanaliculata* is endemic to the Indian coast. The species *Chnoospora minima* has been significantly known to have Anti-cancerous and Antioxidant potential. Similarly, the species *Pseudochnoospora implexa* also has Antioxidant properties. Therefore, considering the importance of these seaweeds, more research on its conservation, cultivation, and sustainable utilisation of this promising marine natural resource.

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