



CRYPTOFAUNAL PSEUDOCERATID POLYCLADS OF GULF OF MANNAR

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ABSTRACT

Polyclads are carnivorous unsegmented marine flatworms usually with striking colour patterns. Although they are easily recognisable their cryptic nature delicate body and lack of taxonomic expertise explains its meagre diversity in a mega diversified country such as India. The present paper reports four polyclads for the first time from the reefs of Gulf of Mannar, Tamil Nadu, India and also has provided a recent annotated checklist of polyclads from India.

KEY WORDS: Polyclads, cryptic nature, reports, Gulf of Mannar, annotated checklist.

INTRODUCTION

The Platyhelminthes or flatworms are bilaterally symmetrical, dorsoventrally flattened vermiform animals without coelom, definitive anus (Hyman, 1951). The order polycladia belonging to the class Turbellaria under this phylum are broad flattened forms usually smooth, free-living, exclusively marine and usually bottom dwellers (sometimes swimming). They are generally found gliding along the substratum using body undulation formed by their ciliary action (Hyman, 1951). This carnivorous unsegmented flatworm lacks skeletal system which makes them soft and flexible thus giving them accessibility to almost all cracks and crevices in the reef. Most of the polyclads occurring in coral reefs are usually with striking colour patterns when compared to their other counter parts making them easily recognizable in reef but their cryptic nature accounts to their poor understanding and meagre diversity in any area. There are 1500 species of polyclads circumscribed globally (Newman and Cannon, 2003) of which only 55 species of polyclads so far been recorded from India (Table 1). Most of these discoveries are mainly concentrated on the coral reefs of Andaman and Nicobar Islands (Ragunathan *et al.*, 2016; Sreeraj and Raghunathan, 2011; 2013; 2015; Sreeraj *et al.*, 2015; Sudhanshu and Raghunathan, 2013; Sudhanshu *et al.*, 2015; 2017a; 2017b), Lakshadweep Islands (Laidlaw, 1902; Aptae and Pitale, 2011) and Scattered reports from West coast (Pitale *et al.*, 2014; Bhadja, 2010). The polyclad studies on mainland reefs are often neglected due to their cryptic nature and lack of taxonomic expertise. Despite tedious faunal exploration studies over a century in Gulf of Mannar, there were no previous reports

regarding these colourful polyclads so far making them as one of the completely understudied group. The current surveys made during April 2013- 2015 for coral cryptofauna in the reefs of Gulf of Mannar Biosphere Reserve (GOMBR) have collected and identified four species belonging to three genera of one family. Although these species have been previously recorded from India the current observation makes them as new distributional records from GOMBR.

MATERIALS & METHODS

The surveys were made during April 2013-2015 on the reefs surrounding the Shingle Island, Manouliputti Island, Valimunai Island and Vaan Island in Gulf of Mannar Marine Biosphere Reserve (Fig. 1) by means of snorkelling and SCUBA diving. The reef polyclads were hand collected from coral skeletal framework of dead corals and was coaxed into sample containers with soft brushes. Particulars regarding the exact locality and nature of the substratum are given along with the description of the respective species.

Photographs were taken mostly in live condition by Nikon AW120. As they usually secrete mucus they were isolated from other samples to avoid stress. The separated polyclads were then preserved in 10% formalin buffered with seawater after relaxing them using 5% ethanol for morphological studies. Preserved specimens were then identified using Newman and Cannon (1996, 1998, 2003, 2005). Specimens thus identified were deposited and registered in National Zoological Collections at Zoological Survey of India, Marine Biology Regional Centre, Chennai.

Polyclads of Gulf of Mannar

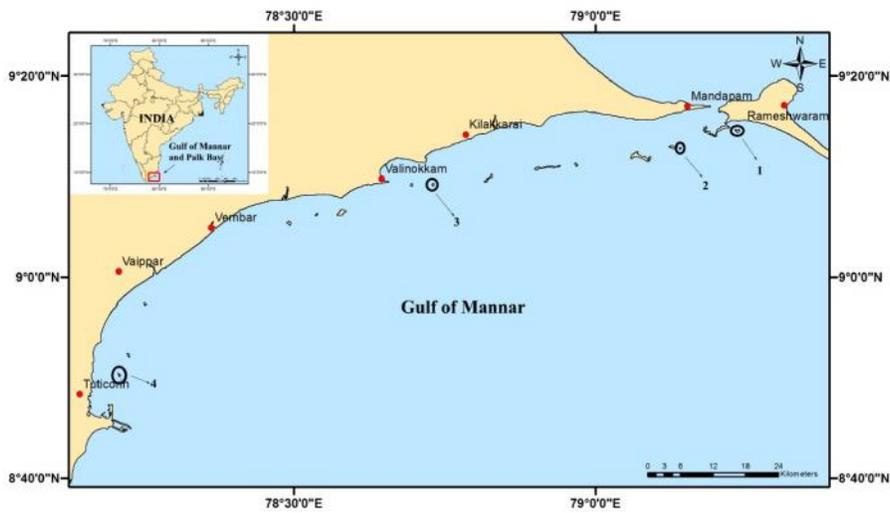


FIGURE 1: Gulf of Mannar with indication of sampled localities: 1. Shingle Island, 2. Manouliputti Island, 3. Valimunai Island, 4. Vaan Island

RESULTS

Systematics

Phylum: Platyhelminthes Minot, 1876

Class: Rhabditophora Ehlers, 1985

Order: Polycladida Lang, 1884

Family: **PSEUDOCEROTIDAE** Lang, 1884

Genus: *Pseudoceros* Lang, 1884

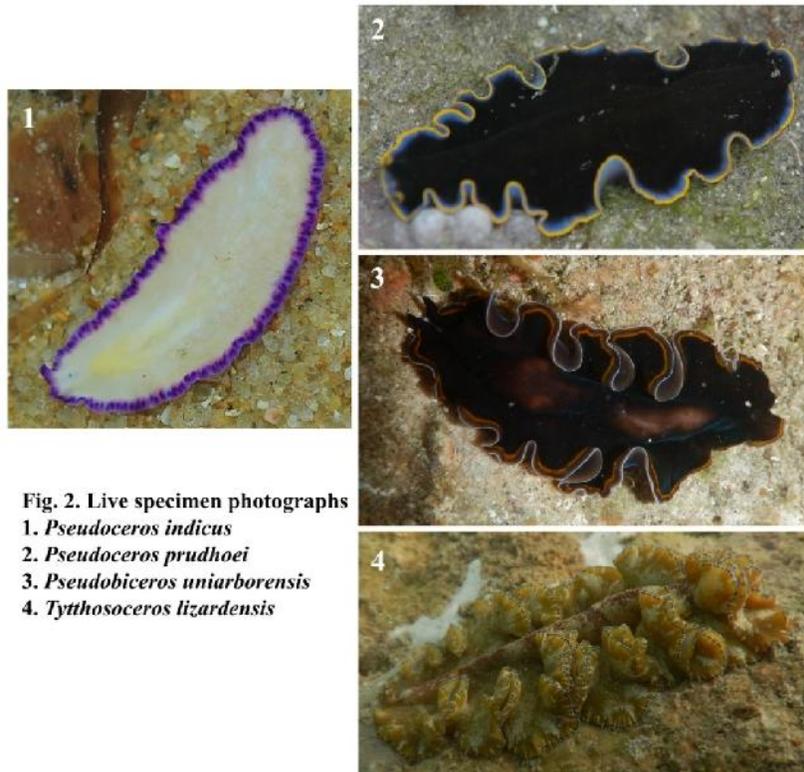


Fig. 2. Live specimen photographs

1. *Pseudoceros indicus*
2. *Pseudoceros prudhoei*
3. *Pseudobiceros uniaborensis*
4. *Tythosoceros lizardensis*

1. *Pseudoceros indicus* Newman and Schupp, 2002 (Fig. 2.1)
2002. *Pseudoceros indicus*, Newman and Schupp, *Micro.*, 34 (2): 178.
2011. *Pseudoceros indicus*, Apte and Pitale, *J. Bombay Nat. His. Soc.*, 108 (2): 110.
2013. *Pseudoceros indicus*, Sreeraj and Raghunathan, *Proc. Inter. Acad. Eco. Environ. Sci.*, 3 (1): 39.
2013. *Pseudoceros indicus*, Sudhanshu and Raghunathan, *J. Andaman Sci. Assoc.*, 18 (2): 166.

Locality: Specimen were collected from Shingle Island (9°14'29.27"N, 79°13'55.50"E) at the depth of 1.0 m from branching colonies of dead coral on 07th Dec. 2012. NZC no.: ZSI/MBRC/Mi-44.

Characters: Body is soft, elongate oval and leaf-like with few marginal ruffles. Pseudotentacles are well developed, simple and erected. Dorsal surface is opaque, mottled cream with well defined irregular purple spots found along the margin and also extending over the pseudo tentacles.

Distribution: India - New record to Gulf of Mannar that was already reported from Andaman and Nicobar Islands, Gujarat and Lakshadweep Islands. Elsewhere - Indian Ocean region from South Africa, Maldives to Indonesia and Australia.

2. *Pseudoceros prudhoei* Newman and Cannon, 1994

(Fig. 2.2)

1994. *Pseudoceros prudhoei*, Newman and Cannon, *Mem. Queensland Mus.*, 37: 235.

1996. *Pseudoceros prudhoei*, Gosliner *et al.*, *Coral Reef Animals of the Indo-Pacific*, p. 107.

1998. *Pseudoceros prudhoei*, Newman and Cannon, *Raff. Bull. Zoo.*, 46: 312.

2011. *Pseudoceros prudhoei*, Apte and Pitale, *J. Bombay Nat. His. Soc.*, 108 (2): 110.

2013. *Pseudoceros prudhoei*, Sudhanshu and Raghunathan, *J. Andaman Sci. Assoc.*, 18 (2): 167.

Locality: Specimen were collected from Manouliputti Island (9°12'27.96"N, 79° 8'38.12"E) at the depth of 5.0 m from foliose colonies of dead coral on 17th March 2013. NZC no.: ZSI/MBRC/Mi-51.

Characters: Body is soft and elongated with a very ruffled margin. Pseudo tentacles are simple and formed the folds of the anterior margin. Background colour of the dorsal surface is black with two marginal bands; the wide inner band is bluish whereas, the narrow outer margin is yellow.

Distribution: India - New record to Gulf of Mannar and already reported from Andaman and Nicobar Islands and Lakshadweep Islands. Elsewhere-Indo-west Pacific region from Australia; Papua New Guinea, Micronesia and Kenya.

Genus: *Pseudobiceros* Faubel, 1984

3. *Pseudobiceros uniarborensis* Newman and Cannon, 1994 (Fig.2.3)

1994. *Pseudobiceros uniarborensis*, Newman and Cannon, *Mem. Queensland Mus.*, 37:252.

1996. *Pseudobiceros sp.*, Gosliner *et al.*, *Coral Reef Animals of the Indo-Pacific*, p. 103.

1997. *Pseudobiceros uniarborensis*, Newman and Cannon, *Raff. Bull. Zoo.*, 45 (2): 360.

2011. *Pseudobiceros uniarborensis*, Apte and Pitale, *J. Bombay Nat. His. Soc.*, 108 (2):110.

2015. *Pseudobiceros uniarborensis*, Sreeraj and Raghunathan, *Proc. Inter. Acad. Eco. Environ. Sci.*,5(2): 87.

Locality: Specimen were collected from Valimunai Island (9° 9'11.97"N, 78°43'34.69"E) at the depth of 1.5 m from branching colonies of dead coral on 08th Feb. 2014. NZC no.: ZSI/MBRC/Mi-312.

Characters: Body is delicate and elongated. Pseudo tentacles are black with pointed white tips and have grey-white triangle between them. Dorsal surface is dark brown with margins having three distinct bands; inner bright orange band, middle wide grey band and outer by a white rim.

Distribution: India - New record to Gulf of Mannar and already reported from Lakshadweep Islands. Elsewhere-Indo-west Pacific region from Australia, Papua New Guinea, Philippines, Indonesia, Red sea and Hawaii.

Genus: *Tytthosoceros* Newman and Cannon, 1996

4. *Tytthosoceros lizardensis* Newman and Cannon, 1996 (Fig. 2.4)

1996. *Tytthosoceros lizardensis*, Newman and Cannon, *Raff. Bull. Zoo.*, 44: 485.

2009. *Tytthosoceros lizardensis*, Khalili *et al.*, *ZooKeys*, 31: 39.

2015. *Tytthosoceros lizardensis*, Sudhanshu *et al.*, *Mar. Bio. Rec.*, 8 (e29): 3.

Locality: Specimen were collected from Vaan Island (8°50'14.34"N, 78°13'0.13"E) at the depth of 0.5 m from branching colonies of dead coral on 02nd April, 2015. NZC no.: ZSI/MBRC/Mi-313.

Characters: Body is soft, elongated and oval, with posterior slightly tapering and raised medially. Pseudotentacles are small with white tips and cream mottling in between. Dorsal surface is mottled chocolate brown with cream dots forming loose transverse streaks medially and laterally. Median is dark with a tinge of red laterally near its margin. A very narrow black then grey marginal band is interrupted with short white transverse streaks of microdots at the edge.

Distribution: India - New record to Gulf of Mannar and already reported from Andaman and Nicobar Islands. Elsewhere - Indo west Pacific region from Australia, South Africa and Philippines.

DISCUSSION

Difficulties including the loss of colour and identification characters in preserved specimens due to their soft bodied nature along with their cryptic behaviour have made them one of least explored groups in Indian context. The development of taxonomic expertise in these gap areas may facilitate to group-specific faunal explorations leading to the better understanding of their diversity, role in reef trophodynamics and also might lead to discovery of new bioactive compounds from their mucus which is used in their protection against predators and also sometimes for subduing their prey.

TABLE 1. Annotated checklist of Indian Polyclads

S.No	Species	Reference
	Order: Polycladida Lang, 1844	
	Family: Pseudocerotidae Lang, 1844	
1	<i>Phirkoceros fritillus</i> Newman and Cannon, 1996	Sreeraj <i>et al.</i> , 2015
2	<i>Phirkoceros katoi</i> Newman and Cannon, 1996	Sreeraj <i>et al.</i> , 2015
3	<i>Phirkoceros mopsus</i> (Marcus, 1952)	Sreeraj <i>et al.</i> , 2015; Sreeraj and Raghunathan, 2015
4	<i>Pseudobiceros apricus</i> Newman and Cannon, 1994	Sreeraj <i>et al.</i> , 2015
5	<i>Pseudobiceros bedfordi</i> (Laidlaw, 1903)	Sreeraj <i>et al.</i> , 2015; Sreeraj and Raghunathan, 2013; Sudhanshu and Raghunathan, 2013
6	<i>Pseudobiceros damawan</i> Newman and Cannon, 1994	Sreeraj <i>et al.</i> , 2015; Sreeraj and Raghunathan, 2011; Sudhanshu and Raghunathan, 2013
7	<i>Pseudobiceros flavocanthus</i> Newman and Cannon, 1994	Sreeraj <i>et al.</i> , 2015; Sreeraj and Raghunathan, 2011; Sudhanshu and Raghunathan, 2013
8	<i>Pseudobiceros flavomarginatus</i> (Laidlaw, 1902)	Laidlaw, 1902
9	<i>Pseudobiceros fulgor</i> Newman and Cannon, 1994	Sreeraj <i>et al.</i> , 2015
10	<i>Pseudobiceros gardinieri</i> (Laidlaw, 1902)	Laidlaw, 1902
11	<i>Pseudobiceros gratus</i> (Kato, 1937)	Sreeraj <i>et al.</i> , 2015; Aptae and Pitale, 2011
12	<i>Pseudobiceros hymanae</i> Newman and Cannon, 1997	Sreeraj <i>et al.</i> , 2015; Sreeraj and Raghunathan, 2015; Sreeraj and Raghunathan, 2013; Sudhanshu and Raghunathan, 2013
13	<i>Pseudobiceros murinus</i> Newman and Cannon, 1997	Aptae and Pitale, 2011
14	<i>Pseudobiceros stellae</i> Newman and Cannon, 1994;	Sreeraj <i>et al.</i> , 2015; Sreeraj and Raghunathan, 2015; Aptae and Pitale, 2011; Bhadja, 2010
15	<i>Pseudobiceros uniarborensis</i> Newman and Cannon, 1994	Sreeraj <i>et al.</i> , 2015; Sreeraj and Raghunathan, 2015; Aptae and Pitale, 2011
16	<i>Pseudoceros auranticrinis</i> Sudhansu, Raghunathan and Chandra, 2017	Sudhansu <i>et al.</i> , 2017b
17	<i>Pseudoceros bifurcus</i> Prudhoe, 1989	Sreeraj <i>et al.</i> , 2015; Sreeraj and Raghunathan, 2011; Sudhanshu and Raghunathan, 2013
18	<i>Pseudoceros bolool</i> Newman & Cannon, 1994	Sreeraj <i>et al.</i> , 2015
19	<i>Pseudoceros buskii</i> (Collingwood, 1876)	Laidlaw, 1902
20	<i>Pseudoceros cf susanae</i> Newman and Anderson, 1997	Aptae and Pitale, 2011; Bhadja, 2010
21	<i>Pseudoceros concinnus</i> (Collingwood, 1876)	Sreeraj <i>et al.</i> , 2015; Sreeraj and Raghunathan, 2011; Sudhanshu and Raghunathan, 2013
22	<i>Pseudoceros confuscus</i> Newman and Cannon, 1995	Sreeraj <i>et al.</i> , 2015; Sreeraj and Raghunathan, 2013; Sudhanshu and Raghunathan, 2013
23	<i>Pseudoceros cruentus</i> Newman and Cannon, 1998	Sreeraj <i>et al.</i> , 2015; Sudhanshu <i>et al.</i> , 2015
24	<i>Pseudoceros galatheensis</i> Sudhansu Raghunathan and Chandra, 2017	Sudhanshu <i>et al.</i> , 2017 a
25	<i>Pseudoceros gamblei</i> Laidlaw, 1902	Laidlaw, 1902; Sreeraj <i>et al.</i> , 2015; Sreeraj and Raghunathan, 2011; Sudhanshu and Raghunathan, 2013
26	<i>Pseudoceros goslineri</i> Newman and Cannon, 1994	Sreeraj <i>et al.</i> , 2015; Sreeraj and Raghunathan, 2015; Aptae and Pitale, 2011; Sreeraj and Raghunathan, 2011; Sudhanshu and Raghunathan, 2013
27	<i>Pseudoceros imitatus</i> Newman, Cannon and Brunckhorst, 1994	Sreeraj <i>et al.</i> , 2015; Sudhanshu and Raghunathan, 2013
28	<i>Pseudoceros indicus</i> Newman and cannon, 2002	Sreeraj <i>et al.</i> , 2015; Aptae and Pitale, 2011; Sreeraj and Raghunathan, 2013; Sudhanshu and Raghunathan, 2013; Bhadja, 2010
29	<i>Pseudoceros intermittus</i> Newman and cannon, 1995	Sreeraj <i>et al.</i> , 2015
30	<i>Pseudoceros irretitus</i> Newman and Cannon, 1998	Sreeraj <i>et al.</i> , 2015; Sudhanshu <i>et al.</i> , 2015
31	<i>Pseudoceros leptostichus</i> Bock, 1913	Sreeraj <i>et al.</i> , 2015
32	<i>Pseudoceros nigropunctatus</i> Sudhansu Raghunathan and Chandra, 2017	Sudhanshu <i>et al.</i> , 2017 a
33	<i>Pseudoceros paralaticlavus</i> Newman and cannon, 1994	Aptae and Pitale, 2011
34	<i>Pseudoceros prudhoei</i> Newman and Cannon, 1994	Aptae and Pitale, 2011; Sudhanshu and Raghunathan, 2013
35	<i>Pseudoceros rubronanus</i> Newman and cannon, 1998	Sreeraj <i>et al.</i> , 2015; Sreeraj and Raghunathan, 2013; Sudhanshu and Raghunathan, 2013
36	<i>Pseudoceros scintillatus</i> Newman and Cannon, 1994	Sreeraj <i>et al.</i> , 2015
37	<i>Pseudoceros stimpsoni</i> Newman & Cannon, 1998	Sreeraj <i>et al.</i> , 2015
38	<i>Pseudoceros tigrinus</i> Laidaw, 1902	Laidlaw, 1902
39	<i>Pseudoceros tristratus</i> Hayman, 1959	Sreeraj <i>et al.</i> , 2015; Sreeraj and Raghunathan, 2013; Sudhanshu and Raghunathan, 2013
40	<i>Pseudoceros vishnui</i> Sudhansu, Raghunathan and Chandra, 2017	Sudhansu <i>et al.</i> , 2017b
41	<i>Acanthozoon plehni</i> (Laidlaw, 1902)	Laidlaw, 1902
42	<i>Tytthosoceros lizardensis</i> Newman and Cannon, 1998	Sreeraj <i>et al.</i> , 2015; Sudhanshu <i>et al.</i> , 2015
43	<i>Thysanozoon nisropapillosum</i> (Hayman, 1959)	Sreeraj <i>et al.</i> , 2015; Sreeraj and Raghunathan, 2013; Sudhanshu and Raghunathan, 2013

	Family: Planoceridae Lang, 1844	
44	<i>Planocera armata</i> Laidlaw, 1902	Laidlaw, 1902
45	<i>Paraplanocera langi</i> (Laidlaw, 1902)	Laidlaw, 1902
46	<i>Paraplanocera oligoglana</i> Schmarda, 1859	Sreeraj <i>et al.</i> , 2015
	Family: Euryleptidae Lang, 1884	
47	<i>Cycloporus venetus</i> Newman and Cannon 2002	Sreeraj <i>et al.</i> , 2015; Sreeraj and Raghunathan, 2015;
48	<i>Mantigrella fuscipunctata</i> Newman and Cannon, 2000	Aptae and Pitale, 2011
49	<i>Prostheceraeus fuscolineatus</i> Sudhansu, Raghunathan and Chandra, 2017	Sudhansu <i>et al.</i> , 2017b
	Family: Prosthlostomidae Lang, 1884	
50	<i>Prosthlostomum cooperi</i> Laidlaw, 1902	Laidlaw, 1902
51	<i>Prosthlostomum elegans</i> Laidlaw, 1902	Laidlaw, 1902
52	<i>Prosthlostomum trilineatum</i> Yeri and Kaburaki, 1920	Sreeraj <i>et al.</i> , 2015; Pitale <i>et al.</i> , 2014
	Family: Euplanidae Marcus & Marcus, 1966	
53	<i>Euplanoida pardalis</i> (Laidlaw, 1902)	Laidlaw, 1902
	Family: Pericelidae Laidlaw, 1902	
54	<i>Pericelis beyerleyana</i> Collingwood, 1876	Laidlaw, 1902
	Family: Latocestidae Laidaw, 1903	
55	<i>Latocestus maldivensis</i> (Laidlaw, 1902)	Laidlaw, 1902

REFERENCES

- Apte, D. and Pitale, R.D. (2011) New records of polyclad flatworms (Platyhelminthes: Turbellaria) from coral reef of Lakshadweep Island, India. *J. Bombay Natl. His. Soc.*, 108, 109–113.
- Bhadja P. (2010) Marine wealth of Saurashtra coast: spatial and temporal variation in the seawater quality and its role in intertidal assemblages and macrofaunal diversity around anthropogenically influenced shores. PhD thesis. Saurashtra University, India.
- Hyman, L.H. (1951) The Invertebrates, IV. *Platyhelminthes and Rhynchocoela*. The acoelomate Bilateria. Vol. II. McGraw-Hill Inc., New York, 550pp.
- Laidlaw, F.F. (1902) The Marine Turbellaria with an account of the anatomy of some species. *Fauna and Geology of the Maldive and Laccadive Archipelagoes*, 1, 282–312.
- Newman L.J. and Cannon L.R.G. (1996) *Bulaceros*, new genus and *Tythisoceros*, new genus (Platyhelminthes, Polycladida, Pseudocerotidae) from the Great Barrier Reef, Australia and eastern Papua New Guinea. *Raff. Bull. Zool.*, 44, 479–492.
- Newman L.J. and Cannon L.R.G. (1998) *Pseudoceros* (Platyhelminthes, Polycladida) from the Indo-Pacific with twelve new species from Australia and Papua New Guinea. *Raff. Bull. Zool.*, 46, 293–323.
- Newman L.J. & Cannon L.R.G. (2003) *Marine flatworms: the world of polyclads*. Melbourne, Victoria: CSIRO Publishing, 112 pp.
- Newman L.J. and Cannon L.R.G. (2005) *Fabulous flatworms: a guide to marine polyclads. Version 1*. Canberra and Melbourne, Australia: ABRS and CSIRO Publishing, CD-ROM.
- Pitale, R., Vishal B. and Apte, D. (2014) First record of family Prosthlostomidae and *Prosthlostomum trilineatum* (Platyhelminthes: Polycladida) from the west coast of India. *Mar. Biodiv. Rec.*, 7 (e37), 1-6.
- Ragunathan, C. and Venkataraman, K. (2015) An account of Lesser Known Marine Faunal communities in Indian Sea. In: Venkataraman K., Raghunathan, C., Tamal Mondal and Raghuraman, R. (eds.), *lesser known marine animals of India*; 1-550 (Published by the Director, Zoological Survey of India, Kolkata), 48-78.
- Ragunathan, C., Tamal Mondal, Smithanjali, C. and Chandra, K. (2016) Lesser known marine animals of India- is a Dearth totaxonomists ?. In Chandra, K., Raghunathan, C., Tamal Mondal and Dash, S. (eds.), *Current status of Marine faunal diversity in India: 1-525* (Published by the Director, Zoological Survey of India, Kolkata), 50-82.
- Sreeraj, C.R. and Raghunathan, C. (2011) New records of pseudocerotid polyclads from Andaman and Nicobar Islands, India. *Mar. Biodiv. Rec.*, 4 (e73), 1-5.
- Sreeraj, C.R. and Raghunathan, C. (2013) Pseudocerotid polyclads (Platyhelminthes, Turbellaria, Polycladida) from Andaman and Nicobar Islands, India. *Proc. Inter. Acad. Eco. Environ. Sci.*, 3 (1), 36-41.
- Sreeraj, C.R. and Raghunathan, C. (2015) A report on the coral reef dwelling polyclads of Nicobar Islands, India. *Proc. Inter. Acad. Eco. Environ. Sci.*, 5 (2), 83-88.
- Sreeraj, C.R., Raghunathan, C., Raghuraman, R., Sudhanshu Dixit and Venkataraman, K. (2015) Polyclads of Andaman and Nicobar Islands. Zoological Survey of India, 2015, 1–100
- Sudhanshu, D. and Raghunathan, C. (2013) Polyclads of Andaman and Nicobar Islands. *J. Andaman Sci. Assoc.*, 18 (2), 165-169.
- Sudhanshu, D., Sivaperuman, C. and Raghunathan, C. (2015) Three new records of polyclad flatworms from India. *Mar. Biodiv. Rec.*, 8 (e29), 1-4.
- Sudhansu, D., Raghunathan, C. & Chandra, K. (2017a) Twonew marine flatworms (Polycladida: Pseudocerotidae) from Andaman & Nicobar Islands, India. *Zootaxa*, 4221 (1), 111–122. <https://doi.org/10.11646/zootaxa.4221.1.5>
- Sudhansu, D., Raghunathan, C. & Chandra, K. (2017b) Two new Pseudoceros (Polycladida: Pseudocerotidae) and a Prostheceraeus (Polycladida: Euryleptidae) from Andaman and Nicobar Islands, India. *Zootaxa*, 4269 (4): 495–512. <https://biotaxa.org/Zootaxa/article/view/zootaxa.4269.4.5>