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Two new *Pseudoceros* (Platyhelminthes: Polycladida: Pseudocerotidae) from Agatti Island, India and a species checklist from Indian waters

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Original Article

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Abstract

The Lakshadweep archipelago constitutes a major coral region of India but still lacks sufficient biodiversity data owing to its remoteness and a low number of faunal studies in the past. The present paper describes two new Pseudoceros species collected from Agatti Island, Lakshadweep, India. *Pseudoceros bipurpurea* sp. nov. and *Pseudoceros galaxea* sp. nov. are described based on external and internal characters, supported with histological studies and photographs. *Pseudoceros bipurpurea* sp. nov. is characterized by a cream background colour and an orange median line surrounded by dense patches of purple spots, which tend to disperse and broaden towards the posterior end. *Pseudoceros galaxea* sp. nov. displays a brown background colour with numerous white to cream dots covering almost the entire dorsal surface and a thin black margin. This study adds two new species to the polyclad fauna in Indian waters, raising the count to 68 species. An updated checklist of polyclads from Indian coast is also provided.

Introduction

The Lakshadweep archipelago consists of 36 islands, 10 of them inhabited, and five submerged reefs, the only coral atolls in India (Ghosh, 1991). The islands are scattered over a large stretch of the Arabian Sea, off the south-west coast of India (Figure 1). They are all characterized by the presence of a large lagoon with numerous reef patches on the western side, and steep slopes and rich coral reefs on the eastern side.

Polyclads of the suborder Cotylea, Lang, 1884 are characterized by the presence of a ventral sucker-like organ called a cotyl which is posterior to the female gonopore (Lang, 1884). Velasquez *et al.* (2018) indicated the presence of around 380 cotylean species worldwide, with highest diversity in the Caribbean and the Indo–Pacific regions. The genus *Pseudoceros* is the most populous genus under the suborder Cotylea with a total of 138 species worldwide (1 species, Jie *et al.*, 2016; 1 species, Cuadrado *et al.*, 2017; 135 species, Tyler *et al.*, 2006–2020; 1 species, Ramos-Sánchez *et al.*, 2020). Because of homogeneity in reproductive structures, some authors suggested that the specific identification relies on the colour and colouration pattern of the *Pseudoceros* species (Prudhoe, 1989; Newman & Cannon, 1994, 1996, 1997, 1998). This criterion of identification based on colours was further supported by Goggin & Newman (1996) and Litvaitis & Newman (2001) based on ribosomal nucleotide sequences. However, when species share relatively homogeneous external features such as colour or colouration patterns, internal characters such as orientation of seminal vesicle, morphology of the prostatic vesicle, depth of the male atrium, shape and size of the stylet, distance between sucker and female gonopore (Bolaños *et al.*, 2007; Marquina *et al.*, 2015) and musculature of the penile sheath (Ramos-Sánchez *et al.*, 2020) can be considered.

The first survey in Lakshadweep archipelago dated from the beginning of the 20th century (Ladilaw, 1902) and was carried out in Minicoy Island. The only available additional information about the polyclad fauna of these islands are reports from Kavaratti Island and Agatti Island (Apte & Pitale, 2011; Dixit *et al.*, 2019, 2021). This paper is a result of a continuous survey being undertaken at Agatti Island by CMLRE to assess the biodiversity of polyclads and describe two pseudocerotid flatworms. With this study, the number of polyclads reported from this archipelago will increase to 29 species. The present contribution not only adds new information to the biodiversity of polyclads in these unique ecosystems but also provides an updated checklist of polyclads inhabiting Indian waters (Table 1).

Materials and methods

Specimens were collected during scuba diving in subtidal and by hand picking in intertidal areas of Agatti Island (Figure 1) and photographed using an Olympus TG-5 camera with underwater housing. Animals were fixed on frozen 10% formalin buffered with seawater (modified methodology of Newman & Cannon, 2003). Key external morphological characters such as cerebral eyes, tentacular eyes, marginal eyes, pseudotentacles, dorsal and ventral surface were photographed with a stereo microscope (Leica, M80) and measurements such as total

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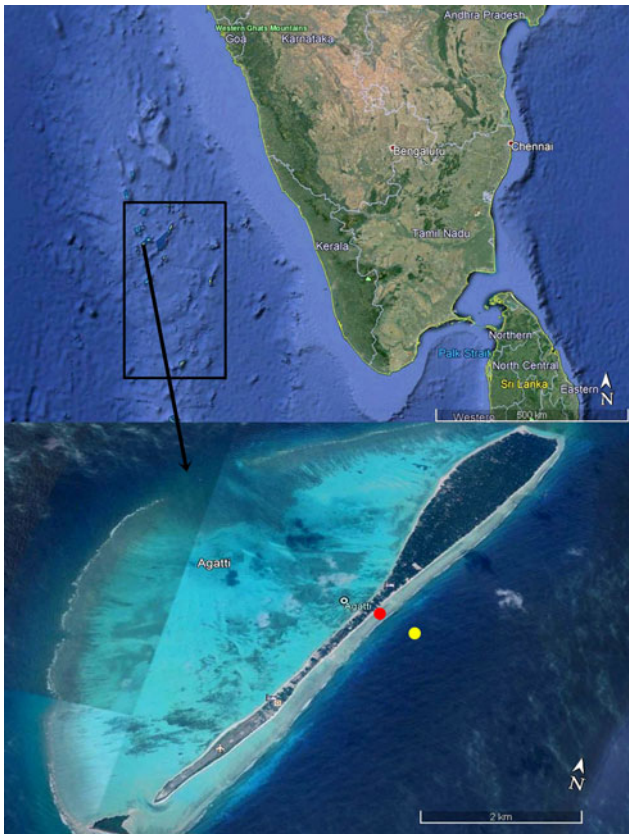

Fig. 1. Lakshadweep Islands (black rectangle) near the west coast of southern India (top) and magnified image of Agatti Island (below) with collection sites of new species – *Pseudoceros galaxea* sp. nov. (red dot); *Pseudoceros bipurpurea* sp. nov. (yellow dot). Source: Google Earth.

length and width of the specimen, distance between mouth, gonopores and sucker were made. The portions with reproductive structures were dissected out, serially sectioned (7–8 µm), stained with haematoxylin and eosin and photographed with a LEICA DMi8 inverted microscope. The holotypes and paratype of the newly described species are deposited at the Referral Centre at Centre for Marine Living Resources and Ecology (CMLRE), Kochi, India.

Results

SYSTEMATICS

Order POLYCLADIDA Lang, 1881
Suborder COTYLEA Lang, 1884
Family PSEUDOCEROTIDAE Lang, 1884
Genus *Pseudoceros* Lang, 1884
Pseudoceros bipurpurea sp. nov. Dixit
(Figures 2–4)

Type material

Holotype: One specimen, 16 × 9 mm, serial sectioned and mounted on 43 slides. Solar Point, Agatti Island, Lakshadweep, India (10°50′28″N 72°11′30″E); sandy substratum; water depth: 32 m; (CMLRE IO/DV/POY/00028); Coll. S. Dixit, 6 May 2019.

Etymology

The specific name *bipurpurea* is a compound Latin noun meaning 'two purple' refers to the characteristic dorsal colour pattern, two (*bi*) purple (*purpura* in Latin) regions of dense purple spots surrounding the orange median line.

Diagnosis

Background body colour cream with an orange median band surrounded by dense patches of purple spots without touching the margin (Figure 2A). These dense purple spots tend to disperse and broaden toward posterior end. Marginal rim blue.

Description

Live: Body oval and margin without ruffles. Background body colour cream with an orange median band. The median band is surrounded by dense purple spots (Figure 2A). These purple spots tend to disperse and broaden toward posterior end encircling the orange median band. The median band and purple spots start at the same point below cerebral eyes cluster and end without touching the posterior end. Marginal rim blue (Figure 2A). Pseudotentacles are simple folding of the anterior margin with same colour pattern as margin. Cerebral eyes dense and more or less forming a circular cluster (Figure 2A, B), tentacular eyes hard to locate due to the blue colour of the pseudotentacles and only visible in the preserved specimen (Figure 2B). The ventral surface is of cream colour.

Preserved: Specimen whitish and colour lost after fixation (Figure 2B, D). Orange median band discoloured and purple spots turned light brown showing the spotted pattern more clearly. Male and female gonopores are 1 mm apart, while female gonopore and sucker are 1.3 mm apart (Figure 2C). Pharynx ruffled with eight folds and male gonopore is situated very near to last pair of pharyngeal folds (Figure 2C). Pharynx is 3.2 mm long and distance between mouth and male gonopore is 2.3 mm. Cerebral eye cluster with about 60–70 eyes. Tentacular eyes arranged in two scattered lines (Figure 2B).

Reproductive system: The male copulatory apparatus consists of seminal vesicle, free prostatic vesicle, penis papilla armed with a stylet housed in male atrium which opens to the outside via male gonopore. An elongated seminal vesicle (670 µm long and 280 µm high) is present (Figures 3A & 4). An oval and thick-walled prostatic vesicle (192 long × 89 µm high) is present anterior to seminal vesicle (Figures 3C & 4). Prostatic vesicle has smooth glandular lining, 12–15 µm high (Figure 3C). Prostatic and ejaculatory duct enter separately in penis papilla and join before stylet (Figures 3D & 4). Male atrium conical (Figure 3C) housing conical penis papilla (130 µm) armed with an elongated stylet (241 µm) (Figure 3C, E) opening to the exterior via male gonopore (Figure 3C).

Female copulatory apparatus consists of oviduct, vagina, cement pouch, cement glands, female atrium and female gonopore (Figures 3B & 4). The common oviduct enters in vagina which then leads to a short female atrium via cement pouch. Numerous cement glands are scattered in parenchyma tissue from oviduct to seminal vesicle surrounding the vagina. Female atrium opens to exterior via female gonopore (Figures 3B & 4).

Taxonomic remarks

Presence of smooth dorsal surface, ruffled pharynx, cerebral and tentacular eyes, marginal tentacles formed by upfolding of anterior margin, centrally located sucker behind female gonopore, male copulatory apparatus single and just behind pharyngeal cavity, free prostatic vesicle and penis papilla armed with stylet place this new species within the family Pseudocerotidae and in the genus *Pseudoceros*.

Pseudoceros bipurpurea sp. nov. differs from all other *Pseudoceros* species by its colour pattern on dorsal surface. In terms of background colour and marginal rim (cream background and blue rim) the newly described species here matches with *Pseudoceros indicus* Newman & Schupp, 2002, *P. gamblei* Laidlaw, 1902, *P. rubrotentaculatus* Kaburaki, 1923 and *P. concinnus* (Collingwood, 1876) but differs in terms of colour pattern on dorsum. Several species of *Pseudoceros* display median

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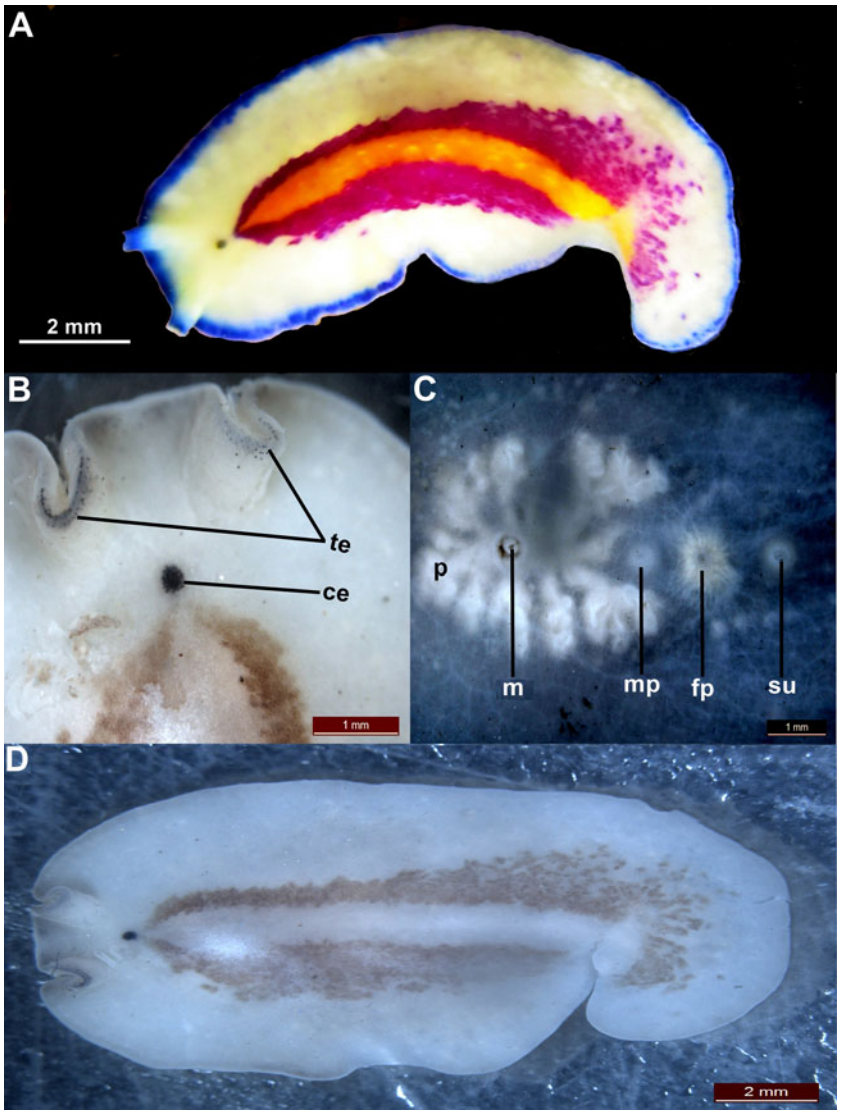

Fig. 2. *Pseudoceros bipurpurea* sp. nov. (A) Holotype (live); (B) cerebral and tentacular eyes (preserved specimen); (C) ventral surface (preserved specimen); (D) dorsal surface (preserved specimen). ce, cerebral eyes; fp, female gonopore; m, mouth; mp, male gonopore; p, pharynx; su, sucker; te, tentacular eyes.

stripes (either one or more than one). A species which possesses a single median stripe of matching colour (orange) on dorsum is *Pseudoceros galatheensis* Dixit, Raghunathan & Chandra, 2017 (thin orange median stripe) but it has light blue background colour which grows darker towards margins which differentiates it with newly described species here. However, there are a few species with median stripe bordered or surrounded by other stripes of different colour which include *Pseudoceros bifurcus* Prudhoe, 1989 (white median stripe outlined with dark burgundy), *Pseudoceros monostichos* Newman & Cannon, 1994 (black brown median line bordered by white and light brown), *Pseudoceros susanae* Newman & Anderson, 1997 (white median stripe surrounded by two orange stripes) and *Pseudoceros tristriatus* (three orange stripes on dorsum). *Pseudoceros bipurpurea* sp. nov. differs from all above-mentioned species by presence of an orange median stripe surrounded by dense purple spots. As no other valid species under the genus *Pseudoceros* is comparable with the newly described species in terms of colouration and pattern, we establish *Pseudoceros bipurpurea* sp. nov. as a new species to science.

Pseudoceros galaxea sp. nov. Dixit (Figures 5–7).

Type material

Holotype: One specimen, 28 × 20 mm, serial sectioned and mounted on 22 slides. Intertidal area near CMLRE field research station, Agatti Island, Lakshadweep, India (10°50′38″N 72° 11′17″E) (CMLRE IO/IT/POY/00029); Coll. S. Dixit, 7 May 2019.

Paratype: One specimen, 16 × 12 mm. Location and collection details same as holotype (CMLRE IO/IT/POY/00030).

Etymology

The specific name *galaxea* is the Latin genitive form of galaxiās (galaxy), which means 'belong to the galaxy' and refers to the colour pattern resembling the stars in a galaxy.

Diagnosis

Background body colour chocolate brown with numerous small white to cream dots on the entire dorsal surface (Figure 5A). These minute dots are very densely distributed giving a spray-like appearance. Some white dots are too close forming clusters appearing like bigger dots. A black marginal band studded with white microdots runs around the whole body including pseudotentacles.

Description

Live: Body large, oval and margin slightly ruffled. Background body colour chocolate brown with numerous small white to cream dots on entire dorsal surface (Figure 5A). Median area slightly darker in colour and raised. White dots are densely distributed giving a spray-like appearance. Some white dots are

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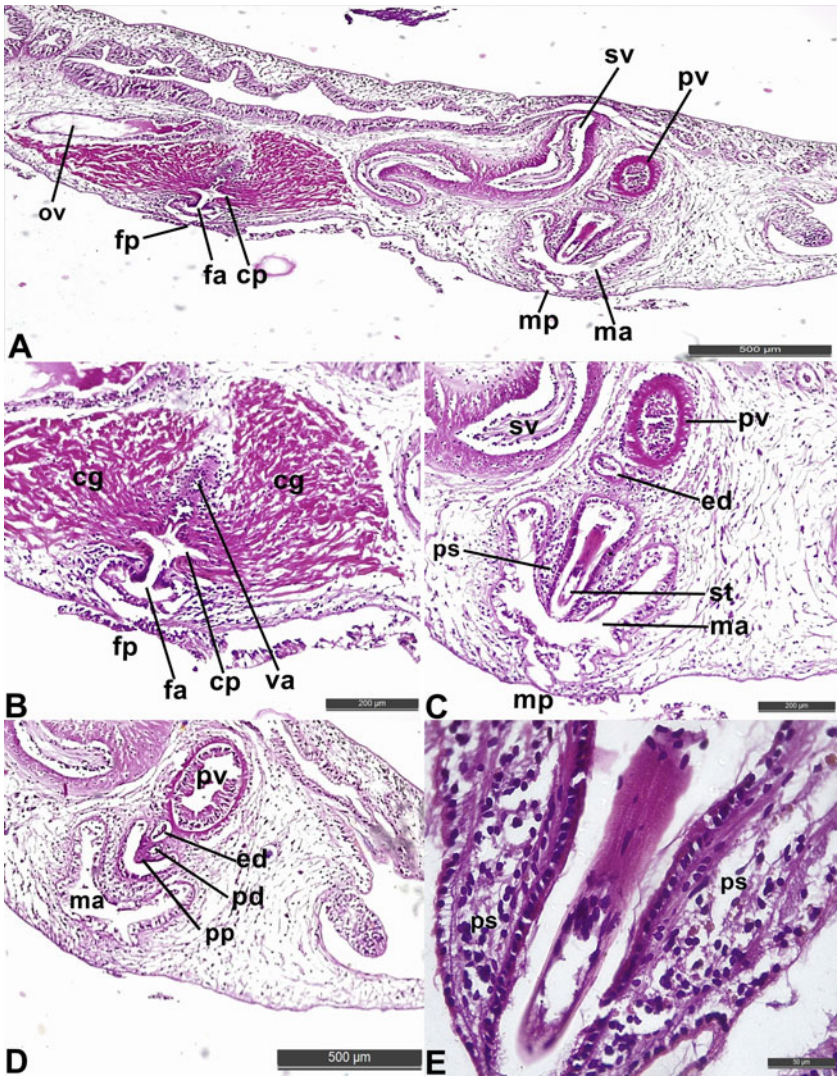

Fig. 3. *Pseudoceros bipurpurea* sp. nov. Sagittal sections (A) showing arrangement of reproductive structures; (B) female reproductive system; (C) and (D) male reproductive system; (E) stylet (magnified). cg, cement glands; cp, cement pouch; ed, ejaculatory duct; fa, female atrium; fp, female gonopore; ma, male atrium; mp, male gonopore; ov, oviduct; pd, prostatic duct; pp, penis papilla; ps, penis sheath; pv, prostatic vesicle; st, stylet; sv, seminal vesicle; va, vagina.

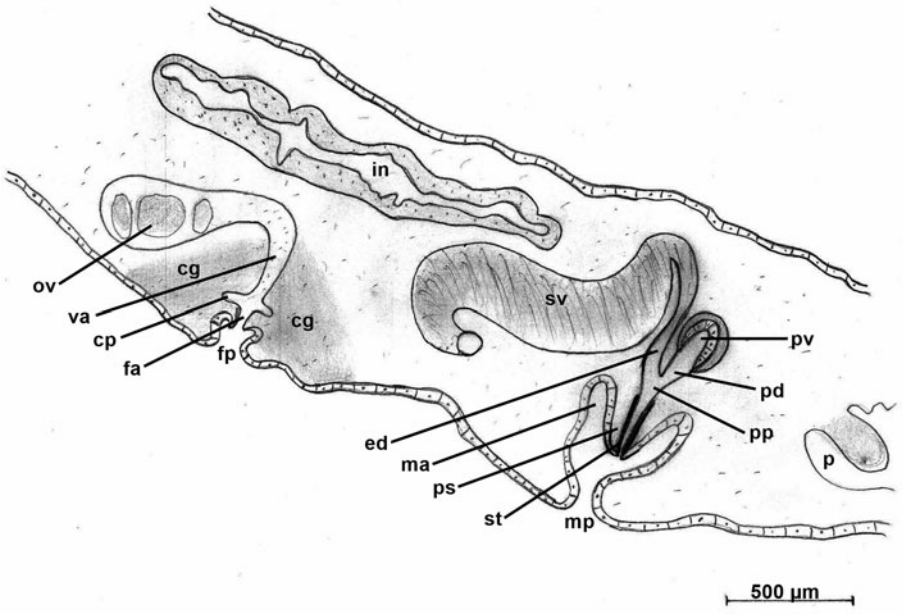

Fig. 4. *Pseudoceros bipurpurea* sp. nov. Diagrammatic reconstruction of male and female reproductive system. cg, cement glands; cp, cement pouch; ed, ejaculatory duct; fa, female atrium; fp, female gonopore; in, intestine; ma, male atrium; mp, male gonopore; ov, oviduct; p, pharynx; pd, prostatic duct; pp, penis papilla; ps, penis sheath; pv, prostatic vesicle; st, stylet; sv, seminal vesicle; va, vagina.

very close forming small white clusters delimiting bigger dots. Marginal rim black (Figure 5A, C) with white dots which are smaller than dots on dorsum. Pseudotentacles are simple folding of the anterior margin, black and spotted. Intensity of spots decreases towards margin (Figure 5B). Cerebral eyes cluster horse-shoe shaped, tentacular eyes hard to recognize due to black colour of pseudotentacles however some eyes can be seen on ventral side of pseudotentacles. Ventral surface light brownish.

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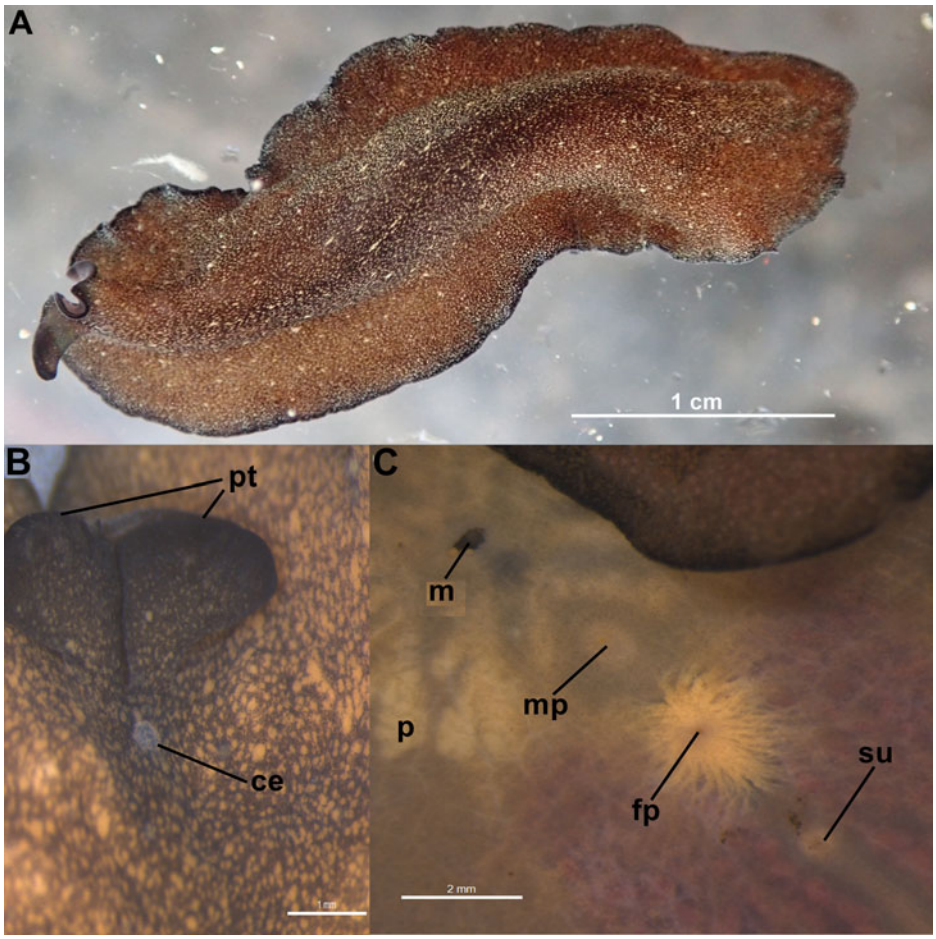

Fig. 5. *Pseudoceros galaxea* sp. nov. (A) Holotype (live); (B) pseudotentacles and cerebral eyes (preserved specimen); (C) ventral surface (preserved specimen). ce, cerebral eyes; fp, female gonopore; m, mouth; mp, male gonopore; p, pharynx; pt, pseudotentacles; su, sucker.

Preserved: Measurements based on holotype. Specimen brown in colour even after fixation but spots turned pale. Mouth and male gonopore are 2.9 mm, male and female gonopore are 2.2 mm while female gonopore and sucker are 2.8 mm apart (Figure 5C). Pharynx ruffled with nine folds (eight in paratype) and male gonopore is situated immediately behind pharynx. Cerebral eyes cluster with about 35–40 eyes (Figure 5B).

Reproductive system: The male copulatory apparatus consists of a seminal vesicle (Figure 6A), a free prostatic vesicle and an armed penis papilla (Figures 6 A, B & 7) housed in male atrium which opens outside via male gonopore. An oval seminal vesicle, 517 × 257 µm, its rounded part oriented towards prostatic vesicle while tapered part oriented towards cement glands (Figure 6A). A free, small and circular prostatic vesicle (75 × 48 µm) present anterior to the seminal vesicle (Figure 6B). Thickness of prostatic vesicle's muscular wall varies from 10–14 µm. The male atrium is wide housing a reduced penis papilla armed with a stylet (197 µm) (Figure 6B). Female copulatory apparatus consists of oviduct, vagina, cement pouch surrounded by dense cement glands and female atrium (Figure 6C, D). The vagina is oriented towards posterior region of body connecting to oviducts. The vagina opens to a very short female atrium. Cement pouch wide which receives secretion from numerous cement glands distributed in parenchyma tissue. The female atrium opens to exterior via female gonopore (Figures 6C & 7).

Taxonomic remarks

The presence of characters such as ruffled pharynx, male copulatory apparatus right behind pharyngeal cavity, free prostatic vesicle, marginal tentacles formed by upfolding of anterior margin and centrally located sucker behind female gonopore (Faubel, 1984) matches with the characters of the family Pseudocerotidae. The presence of characters such as smooth dorsal surface, single male copulatory apparatus with seminal vesicle and armed penis papilla, pseudotentacles as simple folds of anterior margin, female gonopore equidistant from male gonopore and sucker (Faubel, 1984; Newman & Cannon, 1998) matches the diagnosis of the genus *Pseudoceros*. The newly described species differs from all other congeners on the basis of spotted pattern and marginal rim. However, species such as *Pseudoceros astrorum* Bulnes & Torres, 2014, *Pseudoceros bicolor* Verrill, 1901, *Pseudoceros canadiensis* Hyman, 1953, *Pseudoceros josei* Newman & Cannon, 1994, *Pseudoceros kylie* Newman & Cannon, 1998 and *Pseudoceros stellans* Dixit, 2019 exhibit similar background colour, dorsally with blotches or spots of different sizes and marginal band. These species are compared with the newly described species below.

Pseudoceros astrorum, described from Brazil, is characterized by dark brown ground colour, net-like pattern of small black granules, white spots of different sizes uniformly distributed, a thin black submarginal band with white rim and anterior margin and cerebral region devoid of pigment. *Pseudoceros galaxea* sp. nov. differs from *P. astrorum* because of absence of the white rim, net-like pattern of black granules and pigment devoid area in cerebral region.

Pseudoceros bicolor, described from Bermuda, its dorsal colouration varies from yellow to dark brown with white spots on dorsum, white marginal band with greyish black transverse stripes. The marginal band in *P. galaxea* sp. nov. is black with no transverse stripes which differentiates it from the former species.

Pseudoceros canadiensis, described from Canada, is apparently brown or flecked with brown as per its original description. This species differs from *P. galaxea* sp. nov. which possesses white to cream dots on dorsum and black rim.

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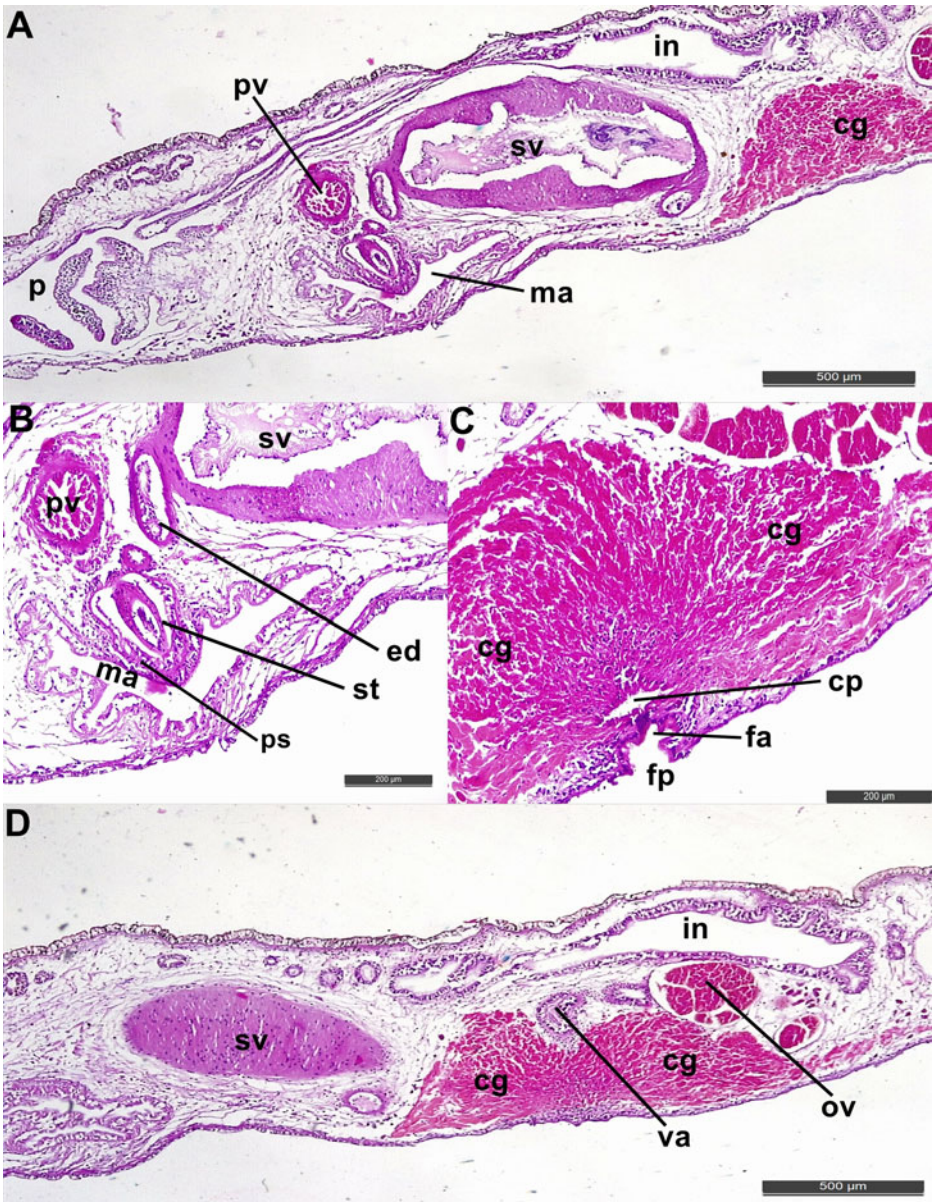

Fig. 6. *Pseudoceros galaxea* sp. nov. Sagittal sections (A) male reproductive structures, cement glands and pharynx; (B) male reproductive system (magnified); (C) female reproductive system showing cement glands, cement pouch and female atrium; (D) female reproductive structures showing vagina and oviduct. cg, cement glands; cp, cement pouch; ed, ejaculatory duct; fa, female atrium; fp, female gonopore; in, intestine; ma, male atrium; ov, oviduct; p, pharynx; ps, penis sheath; pv, prostatic vesicle; st, stylet; sv, seminal vesicle.

Pseudoceros josei, described from Papua New Guinea, is transparent black with numerous small and densely packed yellow spots which turn smaller and white towards the margin while in *P. galaxea* sp. nov., the spots are white to cream and a black marginal band is present.

Pseudoceros kylie, described from Australia, is dark brown in background with cream microdots but has a bright orange broken band just before the rim while the marginal band is black and continuous in *P. galaxea* sp. nov.

Pseudoceros stellans, described from India, has a thick black marginal band with white to yellow spots and yellow blotches; median area marbled with irregular white shading while *P. galaxea* sp. nov. has a thin black marginal rim and dorsum is without any yellow blotches or shading.

As no other species was found comparable in the genus, in light of the above-mentioned characters and comparisons, *P. galaxea* sp. nov. is described as a new species to science.

Discussion

All the studies on the polyclads living in Indian waters have been conducted in the last nine years, except one study conducted a century ago by Laidlaw (1902). A total of nine species were reported from Laidlaw's work which marked the beginning of polyclad research in India. A few species such as *Acanthozoon plenhi*, *Latocestus maldivensis*, *Planocera langi*, *Pseudoceros buskii* and *Pseudoceros tigrinus* described by Laidlaw from Lakshadweep have never been recorded since. These species are in need of redescription based on fresh samples and coloured photographs of internal and external details. From the year 1902 until 2011, not even a single study was conducted on these worms from Indian waters, including in the Lakshadweep Islands which are one of the major coral reef areas of India and nurture rich reef-associated biodiversity. However, many works were published on polyclads during this period from nearby geographic areas in Arabian Sea such as Sri Lanka (Kelaart, 1858; Laidlaw, 1904), Maldives (Laidlaw, 1902, 1903), Djibouti (Mexiner, 1907*a*, 1907*b*) and the Red Sea (Meyer, 1922; Prudhoe, 1952). Since 2011, efforts from a handful of researchers raised the number of species from nine to 68 from Indian waters (Apte & Pitale, 2011; Sreeraj & Raghunathan, 2011, 2013, 2015; Dixit & Raghunathan, 2013; Pitale *et al.*, 2014; Sreeraj *et al.*, 2015; Dixit *et al.*, 2015, 2017*a*, 2017*b*, 2018*a*, 2018*b*, 2018*c*, 2019, 2021; Pitale & Apte, 2017, 2019; Dixit, 2018; present study). All species of polyclads reported from Indian waters are compiled in a checklist (Table 1) based on published reports. The maximum number

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Table 1. Checklist of polyclads reported from Indian coasts

	Species name	Region	References
	Order: Polycladida Lang, 1881		
	Suborder Cotylea Lang, 1884		
	Family: Pseudocerotidae Lang, 1884		
	Genus: *Acanthozoon* Collingwood, 1876		
1	*Acanthozoon alderi* (Collingwood, 1876)	AN	Dixit *et al.* (2018*c*)
2	*Acanthozoon fuscobulbosum* Dixit, Sivaperuman & Raghunathan, 2018	AN	Dixit *et al.* (2018*a*)
3	*Acanthozoon plehni* (Laidlaw, 1902)	LK	Laidlaw (1902)
	Genus: *Bulaceros* Newman & Cannon, 1996		
4	*Bulaceros newcannorum* Dixit, 2021	LK	Dixit *et al.* (2021)
5	*Bulaceros porcellanus* Newman & Cannon, 1996	LK	Dixit *et al.* (2021)
	Genus: *Phrikoceros* Newman & Cannon, 1996		
6	*Phrikoceros fritillus* Newman & Cannon, 1996	AN	Sreeraj *et al.* (2015)
7	*Phrikoceros katoi* Newman & Cannon, 1996	AN	Sreeraj *et al.* (2015)
8	*Phrikoceros mopsus* (Marcus, 1952)	AN	Sreeraj & Raghunathan (2015)
9	*Phrikoceros lizardensis* (Newman & Cannon, 1996)	AN, GOM	Dixit *et al.* (2015); Dixit (2018); Shrinivaasu *et al.* (2018)
	Genus: *Pseudobiceros* Faubel, 1984		
10	*Pseudobiceros apricus* Newman & Cannon, 1994	AN, LK	Sreeraj *et al.* (2015); Dixit *et al.* (2019)
11	*Pseudobiceros bedfordi* (Laidlaw, 1903)	AN	Sreeraj & Raghunathan (2013); Dixit (2018)
12	*Pseudobiceros damawan* Newman & Cannon, 1994	AN	Sreeraj & Raghunathan (2011); Dixit (2018)
13	*Pseudobiceros flavocanthus* Newman & Cannon, 1994	LK	Sreeraj & Raghunathan (2011)
14	*Pseudobiceros fulgor* Newman & Cannon, 1994	AN	Sreeraj *et al.* (2015); Dixit (2018)
15	*Pseudobiceros gratus* (Kato, 1937)	LK, AN	Apte & Pitale (2011); Dixit (2018)
16	*Pseudobiceros hancockanus* (Collingwood, 1876)	LK, AN, GOM	Apte & Pitale (2011); Dixit (2018); Shrinivaasu *et al.* (2018)
17	*Pseudobiceros kryptos* Newman & Cannon, 1997	AN	Dixit (2018)
18	*Pseudobiceros murinus* Newman & Cannon, 1997	LK, AN	Apte & Pitale (2011); Dixit (2018)
19	*Pseudobiceros splendidus* (Lang, 1884)	AN, LK	Sreeraj & Raghunathan (2013); Dixit (2018); Dixit *et al.* (2019)
20	*Pseudobiceros stellae* Newman & Cannon, 1994	LK, AN	Apte & Pitale (2011); Sreeraj & Raghunathan (2015)
	Genus: *Pseudoceros* Lang, 1884		
21	*Pseudoceros agattiensis* Dixit, 2019	LK	Dixit *et al.* (2019)
22	*Pseudoceros auranticrinis* Dixit, Raghunathan & Chandra, 2017	AN	Dixit *et al.* (2017*b*); Dixit (2018)
23	*Pseudoceros bicolor* Verill, 1901	LK	Dixit *et al.* (2019)
24	*Pseudoceros bifurcus* Prudhoe, 1989	AN	Sreeraj & Raghunathan (2011); Dixit (2018)
25	*Pseudoceros bipurpurea* sp. nov.	LK	Present study
26	*Pseudoceros bolool* Newman & Cannon, 1994	AN, LK	Sreeraj *et al.* (2015); Dixit (2018); Dixit *et al.* (2019)
27	*Pseudoceros buskii* (Collingwood, 1876)	LK	Laidlaw (1902)
28	*Pseudoceros concinnus* (Collingwood, 1876)	AN	Sreeraj & Raghunathan (2011); Dixit (2018)
29	*Pseudoceros cruentus* Newman & Cannon, 1998	AN	Dixit *et al.* (2015); Dixit (2018)
30	*Pseudoceros duplicinctus* Prudhoe, 1989	LK, AN, GOM	Apte & Pitale (2011); Dixit (2018); Shrinivaasu *et al.* (2018)
31	*Pseudoceros flavomarginatus* Laidlaw, 1902	LK	Laidlaw (1902)
32	*Pseudoceros galatheensis* Dixit, Raghunathan & Chandra, 2017	AN	Dixit *et al.* (2017*a*); Dixit (2018)
33	*Pseudoceros galaxea* sp. nov.	LK	Present study
34	*Pseudoceros gamblei* Laidlaw, 1902	AN	Sreeraj & Raghunathan (2011); Dixit (2018)
35	*Pseudoceros goslineri* Newman & Cannon, 1994	LK, AN	Apte & Pitale (2011); Sreeraj & Raghunathan (2011); Dixit (2018)

(*Continued*)

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Table 1. (*Continued.*)

	Species name	Region	References
36	*Pseudoceros imitatus* Newman, Cannon & Brunckhorst, 1994	AN	Sreeraj *et al.* (2015); Dixit (2018)
37	*Pseudoceros indicus* Newman & Schupp, 2002	LK, AN, GOM	Apte & Pitale (2011); Sreeraj & Raghunathan (2013); Shrinivaasu *et al.* (2018)
38	*Pseudoceros intermittus* Newman & Cannon, 1995	AN	Sreeraj & Raghunathan (2013)
39	*Pseudoceros irretitus* Newman & Cannon, 1998	AN	Dixit *et al.* (2015); Dixit (2018)
40	*Pseudoceros jebborum* Newman & Cannon, 1994	AN	Dixit (2018)
41	*Pseudoceros leptostictus* Bock, 1913	AN	Sreeraj *et al.* (2015); Dixit (2018)
42	*Pseudoceros meenae* Dixit, Sivaperuman & Raghunathan, 2018	AN	Dixit *et al.* (2018*a*); Dixit (2018)
43	*Pseudoceros nigropunctatus* Dixit, Raghunathan & Chandra, 2017	AN	Dixit *et al.* (2017*a*); Dixit (2018)
44	*Pseudoceros paralaticlavus* Newman & Cannon, 1994	LK, AN	Apte & Pitale (2011); Dixit (2018)
45	*Pseudoceros rubronanus* Newman & Cannon, 1998	AN	Sreeraj & Raghunathan (2013)
46	*Pseudoceros scintillatus* Newman & Cannon, 1994	AN	Sreeraj *et al.* (2015); Dixit (2018)
47	*Pseudoceros* cf. *susanae* Newman & Anderson, 1997	LK	Apte & Pitale (2011)
48	*Pseudoceros stellans* Dixit, 2019	LK	Dixit *et al.* (2019)
49	*Pseudoceros stimpsoni* Newman & Cannon, 1998	AN	Sreeraj *et al.* (2015); Dixit (2018)
50	*Pseudoceros tigrinus* Laidlaw, 1902	LK	Laidlaw (1902)
51	*Pseudoceros tristratus* Hyman, 1959	AN	Sreeraj & Raghunathan (2013); Dixit (2018)
52	*Pseudoceros vishnui* Dixit, Raghunathan & Chandra, 2017	AN	Dixit *et al.* (2017*b*); Dixit (2018)
	Genus: *Thysanozoon* Collingwood, 1876		
53	*Thysanozoon brocchii* Risso, 1818	MH	Pitale & Apte (2017)
54	*Thysanozoon nigropapillosum* (Hyman, 1959)	AN	Sreeraj & Raghunathan (2013); Dixit (2018)
	Family: Euryleptidae Lang, 1884		
	Genus: *Cycloporus* Lang, 1884		
55	*Cycloporus australis* Prudhoe, 1982	MH	Pitale & Apte (2019)
56	*Cycloporus reticulatus* Newman & Cannon, 2002	MH	Pitale & Apte (2019)
57	*Cycloporus variegatus* Kato, 1934	MH	Pitale & Apte (2019)
58	*Cycloporus venetus* Newman & Cannon, 2002	AN	Sreeraj & Raghunathan (2015)
	Genus: *Eurylepta* Ehrenberg, 1831		
59	*Eurylepta aurantiaca* Heath & Mc Gregor, 1912–1913	MH	Pitale & Apte (2019)
	Genus: *Maritigrella* Newman & Cannon, 2000		
60	*Maritigrella fuscopunctata* Newman & Cannon, 2000	LK	Apte & Pitale (2011)
	Genus: *Prostheceraeus* Schmarda, 1959		
61	*Prostheceraeus fuscolineatus* Dixit, Raghunathan & Chandra, 2017	AN	Dixit *et al.* (2017*b*)
	Genus: *Stylostomum* Lang, 1884		
62	*Stylostomum mixtomaculatum* Pitale & Apte, 2019	MH	Pitale & Apte (2019)
	Suborder: Acotylea Lang, 1884		
	Family: Planoceridae Lang, 1844		
	Genus: *Paraplanocera* Ladilaw, 1903		
63	*Paraplanocera langi* (Ladilaw, 1902)	LK	Laidlaw (1902)
64	*Paraplanocera oligoglena* Schmarda, 1859	AN	Sreeraj *et al.* (2015)
	Family: Prosthiostomidae Lang, 1884		
	Genus: *Prosthiostomum* De Quaterfage, 1845		
65	*Prosthiostomum trilineatum* Yeri & Kaburaki, 1920	MH, AN	Pitale *et al.* (2014); Sreeraj *et al.* (2015)
	Family: Leptoplanidae Stimpson, 1857		

(*Continued*)

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Table 1. (*Continued.*)

	Species name	Region	References
	Genus: *Euplanoida* Faubel, 1983		
66	*Euplanoida pardalis* (Laidlaw, 1902)	LK	Laidlaw (1902)
	Family: Diposthidae Woodworth, 1898		
	Genus: *Pericelis* Laidlaw, 1902		
67	*Pericelis byerleyana* (Collingwood, 1876)	LK	Laidlaw (1902)
	Family: Latocestidae Laidlaw, 1903		
	Genus: *Latocestus* Plehn, 1896		
68	*Latocestus maldivensis* (Laidlaw, 1902)	LK	Laidlaw (1902)

AN, Andaman and Nicobar Islands; GOM, Gulf of Mannar; LK, Lakshadweep Islands; MH, Maharashtra.

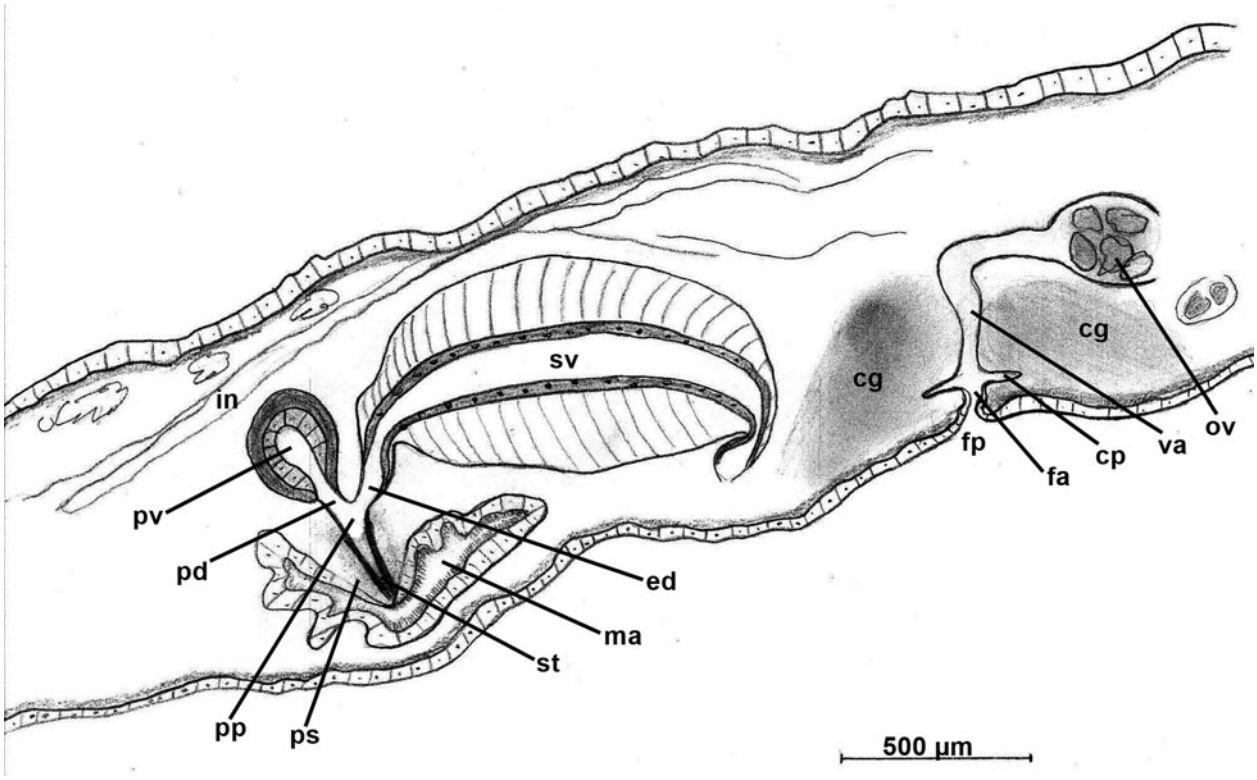

Fig. 7. *Pseudoceros galaxea* sp. nov. Diagrammatic reconstruction of male and female reproductive system. cg, cement glands; cp, cement pouch; ed, ejaculatory duct; fa, female atrium; fp, female gonopore; in, intestine; ma, male atrium; ov, oviduct; pd, prostatic duct; pp, penis papilla; ps, penis sheath; pv, prostatic vesicle; st, stylet; sv, seminal vesicle; va, vagina.

of species is reported from Andaman and Nicobar Islands (44 species) followed by Lakshadweep Islands (29 species). The genus *Pseudoceros* is dominating with 32 species in Indian waters out of which 14 species are from Lakshadweep waters. The genus *Pseudobiceros* follows next with 11 species from India while seven species are reported from Lakshadweep Islands alone. Other genera such as *Euplanoida* Faubel, 1983; *Eurylepta* Ehrenberg, 1831; *Latocestus* Plehn, 1896; *Maritigrella* Newman & Cannon, 2000; *Pericelis* Laidlaw, 1902; *Prostheceraeus* Schmarda, 1859; *Prosthiostomum* De Quaterfage, 1845; and *Stylostomum* Lang, 1884 are represented by only one species so far from Indian waters. Apte & Pitale (2011) reported *Pseudoceros* cf. *susanae* Newman & Anderson, 1997 from Lakshadweep Islands. This species though doubtful in its identification is retained in the checklist until new specimens of this species are collected for confirmation of its identification.

The discovery of five new species (two species from Dixit *et al*., 2019; one species from Dixit *et al*., 2021 and two from the present study) from this archipelago in recent times is a clear indication that more efforts are required for inventorization of polyclad fauna from these islands. Their extreme fragility has made these animals difficult to study (Newman & Cannon, 2003). During our field surveys, many polyclad specimens of different genera were collected, but some of them tended to curl, distort or dissolve during the course of fixation (personal observation). However, members of the genus *Pseudoceros* were less difficult to fix in comparison with species from other genera such as *Acanthozoon*, *Bulaceros*, *Thysanozoon* and *Pericelis* (personal observation). Thus, based on our observations, we speculate this as one of the reasons for a higher number of species being described under the genus *Pseudoceros* in comparison with other genera under suborder Cotylea. The flamboyant colouration

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of species in the genus *Pseudoceros* may also be the reason for more numerous descriptions but more studies are required to test these speculations. We hope that recent publications in polyclad taxonomy from Indian waters will attract the interest of young researchers towards these extraordinary worms. The main food source of polyclads are oysters, bivalves and ascidians (Newman & Cannon, 2003), which are present in both intertidal and subtidal zones making these islands an ideal habitats for polyclads. Only three islands of the Lakshadweep archipelago have been surveyed for polyclad fauna to date (Agatti, Kavaratti and Minicoy), leaving 33 islands unexplored.

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