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Polyclad fauna of Agatti Island, Lakshadweep, India: new records and description of two new species

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Abstract

The present paper deals with the first study of polyclad fauna from Agatti Island, Lakshadweep. Through this study, *Pseudobiceors apricus*, *Pseudobiceros hymanae* and *Pseudoceros bolool* are recorded for the first time from Lakshadweep waters while *Pseudoceros bicolor* is recorded for the first time from Indian waters. Description of two new species, *Pseudoceros agattiensis* **sp. nov.** and *Pseuodoceros stellans* **sp. nov.** is also provided with good quality photographs of external and internal details. *Pseudoceros agattiensis* **sp. nov.** is characterized by a brown to black background colour, with minute white spots, marginal band thick and black with minute white spots present at very edge of the margin, three dorsal longitudinal white bands, out of which, two are laterally branched. *Pseudoceros stellans* **sp. nov.** displays a brown background colour with a black marginal band and completely covered with lighter microdots and a unique pattern of white dorsal blotches. This study adds to the knowledge of Indian polyclads, which are still an understudied group from Indian waters.

Key words: Platyhelminthes, *Pseudoceros*, Marine flatworm, Taxonomy, novel species

Abbreviations

ce, Cerebral eyes
cg, Cement glands
cp, Cement pouch
ed, Ejaculatory duct
fa, Female atrium
fp, Female pore
in, Intestine
ma, Male atrium
mp, Male pore
pd, prostatic duct
ph, Pharynx
pm, Pharyngeal mouth
pp, Penis papilla
pv, Prostatic vesicle
pt, Stylet
su, Sucker
sv, Seminal vesicle
sa, Vagina
vd, Vas deferens

Introduction

Lakshadweep archipelago is a group of 10 inhabited islands, 17 uninhabited islands, and 5 submerged reefs situated in Arabian Sea near Southwest coast of India. This archipelago is one of the four major coral reef areas in India and the only coral atolls of the country. Agatti Island is one of the inhabited islands in the archipelago with an area of 3.2 sq km. This island has a large lagoon on western side which harbours many reef patches and variety of flora and fauna while eastern side is dominated by rocky shores which extend to greater depths.

There is no record of any study of polyclads from Agatti Island till date. However studies were carried out in the past on polyclads from this archipelago restricting only to Minicoy and Kavaratti Islands. The study conducted on

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Minicoy Island was in fact the first study on polyclads from India (Laidlaw 1902). At the same time, there is only one report on polyclads from Kavaratti Island (Apte and Pitale 2011).

From Indian waters, 55 species of polyclads are reported till date (Sreeraj and Raghunathan 2011, 2013, 2015; Apte and Pitale 2011; Dixit and Raghunathan 2013; Pitale *et al.* 2014; Sreeraj *et al.* 2015; Dixit *et al.* 2015, 2017 a, b, 2018 a, b, c; Pitale and Apte, 2017) out of which, 19 species are reported from Lakshadweep Islands (Table 1).

TABLE 1. List of species reported from Lakshadweep Islands including present study

S. No.	Species	Reference
1.	*Acanthozoon plehni* (Laidlaw, 1902)	Laidlaw, 1902
2.	*Euplanoida pardalis* (Laidlaw, 1902)	Laidlaw, 1902
3.	*Latocestus maldivensis* (Laidlaw, 1902)	Laidlaw, 1902
4.	*Maritigrella fuscopunctata* Newman & Cannon, 2000	Apte & Pitale, 2011
5.	*Paraplanocera langi* (Ladilaw, 1902)	Laidlaw, 1902
6.	*Pericelis byerleyana* Collingwood, 1876	Laidlaw, 1902
7.	*Pseudobiceros apricus* Newman & Cannon, 1994	Present study
8.	*Pseudobiceros flavomarginatus* (Laidlaw, 1902)	Laidlaw, 1902
9.	*Pseudobiceros gratus* (Kato, 1937)	Apte & Pitale, 2011
10.	*Pseudobiceros hymanae* Newman & Cannon, 1997	Present study
11.	*Pseudobiceros murinus* Newman & Cannon, 1997	Apte & Pitale, 2011
12.	*Pseudobiceros stellae* Newman & Cannon, 1994	Apte & Pitale, 2011
13.	*Pseudobiceros hancockanus* (Collingwood, 1876)	Apte & Pitale, 2011
14.	*Pseudoceros agattiensis* sp. nov.	Present study
15.	*Pseudoceros bicolor* Verrill, 1901	Present study
16.	*Pseudoceros bolool* Newman & Cannon, 1994	Present study
17.	*Pseudoceros buskii* (Collingwood, 1876)	Laidlaw, 1902
18.	*Pseudoceros gamblei* Laidlaw, 1902	Laidlaw, 1902
19.	*Pseudoceros goslineri* Newman & Cannon, 1994	Apte & Pitale, 2011
20.	*Pseudoceros indicus* Newman & cannon, 2002	Apte & Pitale, 2011
21.	*Pseudoceros paralaticlavus* Newman and Cannon, 1994	Apte & Pitale, 2011
22.	*Pseudoceros prudhoei* Newman & Cannon, 1994	Apte & Pitale, 2011
23.	*Pseudoceros cf susanae* Newman and Anderson, 1997	Apte & Pitale, 2011
24.	*Pseudoceros stellans* sp. nov.	Present study
25.	*Pseudoceros tigrinus* Laidlaw, 1902	Laidlaw, 1902

The genus *Pseudoceros* is the most populous genus under the family Pseudocerotidae with a total of 135 species worldwide (Jie *et al.* 2016; Cuadrado *et al.* 2017; Tyler *et al.* 2018, Dixit *et al.* 2018 a, b). Because of homogeneity in reproductive structures, numerous authors suggested that the specific identification relies on the colour and colour pattern of the *Pseudoceros* species (Prudhoe 1989; Newman and Cannon 1994, 1996, 1997, 1998). This criterion of identification was further validated by Litvaitis and Newman (2001), supported with nucleotide sequences.

The present work deals with the first study on polyclad fauna from Agatti Island which includes some new records for the island and country along with description of two new species belonging to the genus *Pseudoceros*.

Material and methods

Specimens were collected using SCUBA diving and by hand picking method in intertidal areas of the Agatti Island (Fig. 1) and photographed by Sony RX 100V with underwater housing. Animals were fixed on frozen 10% formalin buffered with seawater (modified methodology of Newman and Cannon 2003). Key external morphological

characters like cerebral eyes, tentacular eyes, marginal eyes, pseudotentacles, dorsal and ventral surface were photographed under a stereo microscope (Leica, M80) and measurements (length mm × width mm) of fixed specimens (total length and width, distance between mouth, gonopores and sucker) were made. The portions with reproductive structures were dissected out, sectioned serially (7–8 μm), stained with Haematoxylin and Eosin and photographed under LEICA DMi8 inverted microscope. All identified materials are deposited in the Centre for Marine Living Resources and Ecology (CMLRE), Kochi, India.

Results

Classification

Order: Polycladida Lang, 1884

Family: Pseudocerotidae Lang, 1884

Genus: *Pseudobiceros* Faubel, 1984

Pseudobiceros apricus Newman & Cannon, 1994
(Fig. 2a)

Material examined: One specimen (15 x 8 mm) preserved in 10% formalin; collected on 12.05.2018 near eastern jetty (10°52′72″N 72°12′12″E), Agatti Island, Lakshadweep (Regn. No. IO/IT/POY/00001).

Description : Background colour light brown to black and translucent on the edges. Dorsum is speckled with numerous white dots and with clusters of white dots. Median area elevated and darker. Margins slightly ruffled, pseudotentacles square like with white tips. Eye cluster horseshoe shaped present in clear area (devoid of pigment) between pseudotentacles.

Remarks : *Pseudobiceros apricus* can be confused with congeners *Pseudobiceors stellae* Newman & Cannon, 1994 and *Pseudobiceros bajae* (Hyman, 1953). All three species possess nearly same black background colour with white dots but differs in patterns and arrangements of dots. In *Pseudobiceros stellae,* dots are arranged in flower like pattern while in *Pseudobiceros bajae*, white dots do not form clusters. However, in the original description of *Pseudobiceros apricus*, the background colour was stated as light orange but morphotypes collected by same authors (Newman and Cannon 2003) and specimens collected from Red Sea (Velasquez *et al.* 2018) possess black background. This is new record for Lakshadweep archipelago.

Distribution: Lakshadweep Islands (present study), Andaman and Nicobar Islands (Sreeraj *et al.* 2015) India; Heron Island and Queensland, Australia (Newman and Cannon 1994, 2003); Eilat, Red Sea (Valasquez *et al.* 2018).

Pseudobiceros hymanae Newman & Cannon, 1997
(Fig. 2b)

Material examined: One specimen (9 x 5 mm) preserved in 10% formalin; collected on 03.05.2018 from west coast outside lagoon at 20 m depth (10°52.290’ N 72°10.227’ E), Agatti Island, Lakshadweep. (Regn. No. IO/DV/POY/00002)

Description : Background colour black with velvety appearance and opaque. Black rim with orange submarginal band. Pseudotentacles square like, black with the same marginal bands. Ventrally black with same marginal bands. Unrecognizable cerebral eye-clusters due to the dark dorsal background colour.

Distribution: Lakshadweep Islands (present study), Andaman and Nicobar Islands, India (Sreeraj *et al.* 2015); Australia; Indonesia; Maldives; Papua New Guinea; Solomon Islands and South Africa (Newman and Cannon 2003, 2005)

Remarks: This is a new record for Lakshadweep archipelago.

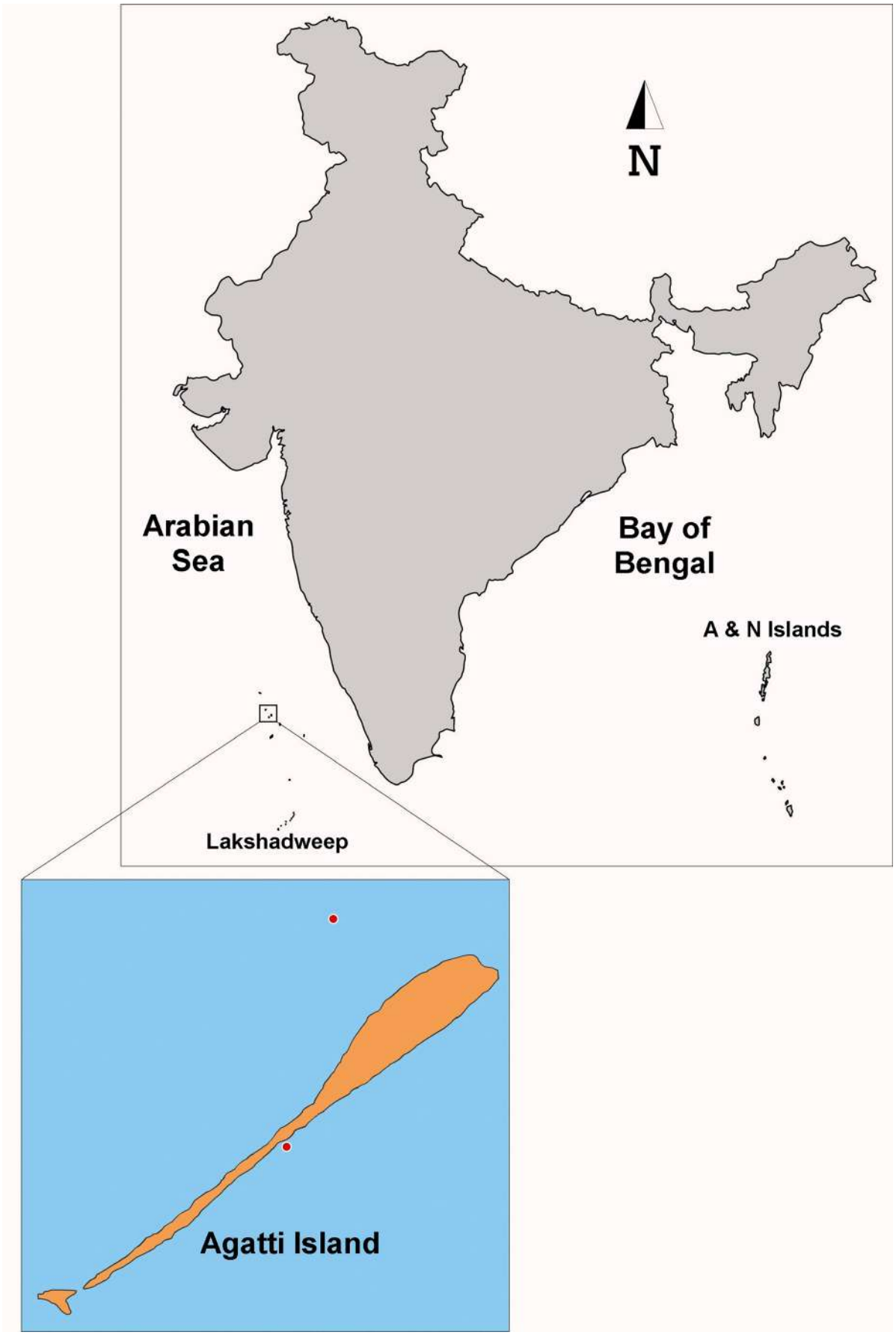

FIGURE 1. Map of India showing position of Lakshadweep and magnified image of Agatti Island (down) with collection sites of new species (red dots)

Genus: *Pseudoceros* Lang, 1884

***Pseudoceros bolool* Newman & Cannon, 1994**
(Fig. 2c)

Material examined: One specimen (60 x 40 mm) preserved in 10% formalin; collected on 12.05.2018 near eastern jetty (10°52′72″N 72°12′12″E), Agatti Island, Lakshadweep. (Regn. No. IO/IT/POY/00003)

Description: Background colour velvety black with no markings or patterns. Ventrally lighter black to grey. Pseudotentacles small and black; cerebral eyespot difficult to spot due to black body colour.

Distribution: Lakshadweep Islands (Present study), Andaman and Nicobar Islands (Sreeraj *et al.* 2015), India; Australia; Indonesia; Papua New Guinea; Philippines (Newman and Cannon, 2003; 2005).

Remarks : In the original description, cerebral eyes are said to be in clear area. This species is new record to Lakshadweep waters.

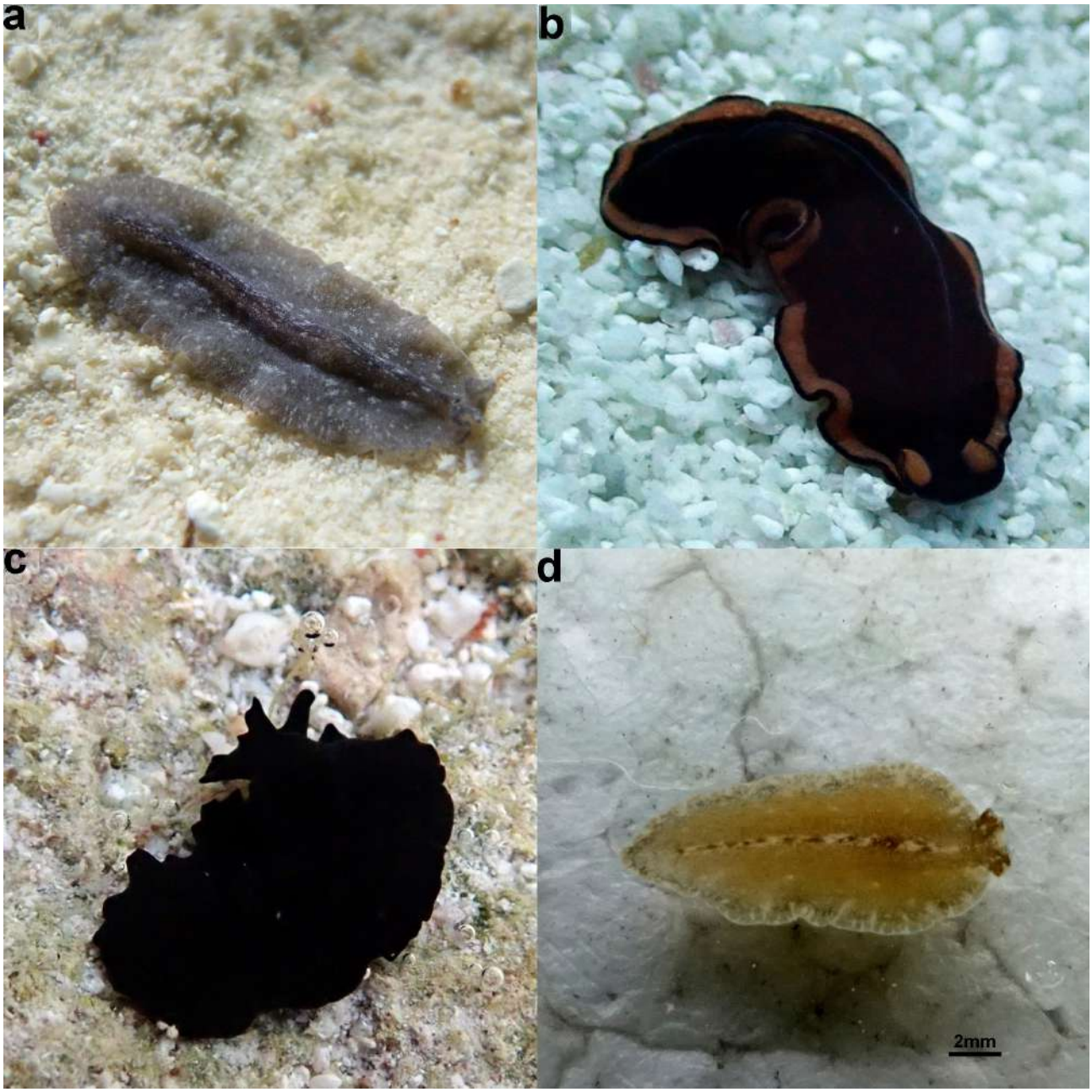

FIGURE 2. a—*Pseudobiceros apricus*; b—*Pseudobiceros hymanae*; c—*Pseudoceros bolool*; d—*Pseudoceros bicolor* (*ex-situ*).

***Pseudoceros bicolor* Verrill, 1901**
(Fig. 2d)

Material examined: One specimen (11 x 9 mm) preserved in 10% formalin; collected on 05.05.2018 from eastern jetty, 15m depth (10°52′46″N 72°12′21″E), Agatti Island, Lakshadweep. (Regn. No. IO/DV/POY/00004)

Description : Background colour yellow to light brown, numerous minute white spots present all over body except margins; marginal band white with greyish transversal stripes; dorsal longitudinal band speckled with interrupted brown and white blotches; pseudotentacles developed and square like, shaded with white and brown.

Distribution: Lakshadweep, India (present study); Bermuda (Verrill 1901); Colombia (Quiroga *et al.* 2004); Jamaica; Belize; Hounduras; Panama (Rawlinson 2008); Brazil (Bahia *et al.* 2014)

Remarks: This species is very similar to *Pseudoceros rawlinsonae* in terms of colours and can only be differentiated on the basis of presence or absence of the marginal band or the colour of the marginal band. In *P. bicolor* the marginal may be absent, or is yellow to greenish when present while in *P. rawlinsonae* is golden yellow to orange. Our specimen shows no golden yellow to orange marginal band, which agrees with one of the morphological variations of *P. bicolor.* This is a new record to Indian waters.

***Pseudoceros agattiensis* sp. nov. Dixit**
(Figs. 3, 4 & 5)

Material examined: Holotype: One specimen (20 × 18 mm) as serial sections (10 Slides), remainder of animal in 70% ethanol. Collected on 12.5.2018, underneath rubble in intertidal area, Agatti Island (10°52′72″N 72°12′12″E), Lakshadweep, India. (Regn. No. IO/IT/POY/00005)

Type locality: Agatti Island, Lakshadweep, India.

Etymology: The specific name refers to Agatti Island in Lakshadweep, where type specimen was collected.

Diagnosis: Background body colour is brown in centre and fading to black towards the margin, covered with numerous white spots, densely arranged in the centre and sparse towards the margin. (Fig. 3a). Three longitudinal stripes runs throughout the dorsal surface. Median stripe is thin without any branches while lateral stripes are branches towards the margin. These stripes are white in centre and light brown at most extremities with bulging ends. Pseudotentacles are simple folding of the anterior margin and black in colour. Cerebral eye cluster horseshoe shaped (Fig. 3b).

Description : ***Live.*** Body small, oval and margin without ruffles. Background body colour brown to black. Numerous small white spots present all over dorsal surface except on the three stripes. Marginal band thick and black with minute white spots present at very edge of the margin (Fig. 3a). These small white dots are very close which gives a very thin white rim like appearance. Dorsal surface patterned with three longitudinal stripes and its branches. Median stripe thin and without any branches, lateral stripes branched radiating towards margins. Lateral stripes are white in centre and light brown at most extremities with bulging ends. Some small bulged and incomplete stripes starting from margins towards median area ends abruptly before touching any stripe of either side. Pseudotentacles small and black. Cerebral eye cluster horseshoe shaped (Fig. 3b), tentacular eyes hard to locate due to black colour of pseudotentacles. Ventral surface brown in colour.

Preserved. Specimen brown in colour after fixation. Ventrally dull brown in colour. Male and female pore are 0.8 mm apart, while female pore and sucker are 1.7 mm apart (Fig. 3c). Pharynx ruffled with seven folds and male pore is situated very near to last pair of pharyngeal folds (Fig. 3c). Pharynx is 2.9 mm long (measured externally) and distance between mouth and male pore is 1.4 mm. Cerebral eye cluster with about 50 -55 eyes.

Reproductive system: Male copulatory apparatus consists of seminal vesicle, free prostatic vesicle, penis papilla, penis stylet housed in male atrium which open outside via male pore. A large, elongated and thick walled seminal vesicle (574 x 315 µm) is present (Fig. 4b, c). Its rounded part oriented towards prostatic vesicles while tapered part is oriented towards cement glands. An oblong and thick walled prostatic vesicle (187 x 91 µm) is present anterior of seminal vesicle (Fig. 4b). Thickness of prostatic vesicle's wall varies from 10 to 15 µm. Male atrium conical (Fig. 4d) housing conical penis papilla (170 µm) with a short stylet (87 µm). The ejaculatory duct and the prostatic duct joins before entering the penis papilla (Fig. 4b). Male atrium opens to exterior via male gonopore. Female copulatory apparatus consists of oviducts, vagina, cement pouch surrounded by numerous cement glands and female atrium. The vagina opens to a short female atrium via cement pouch which receives secretion from cement glands .

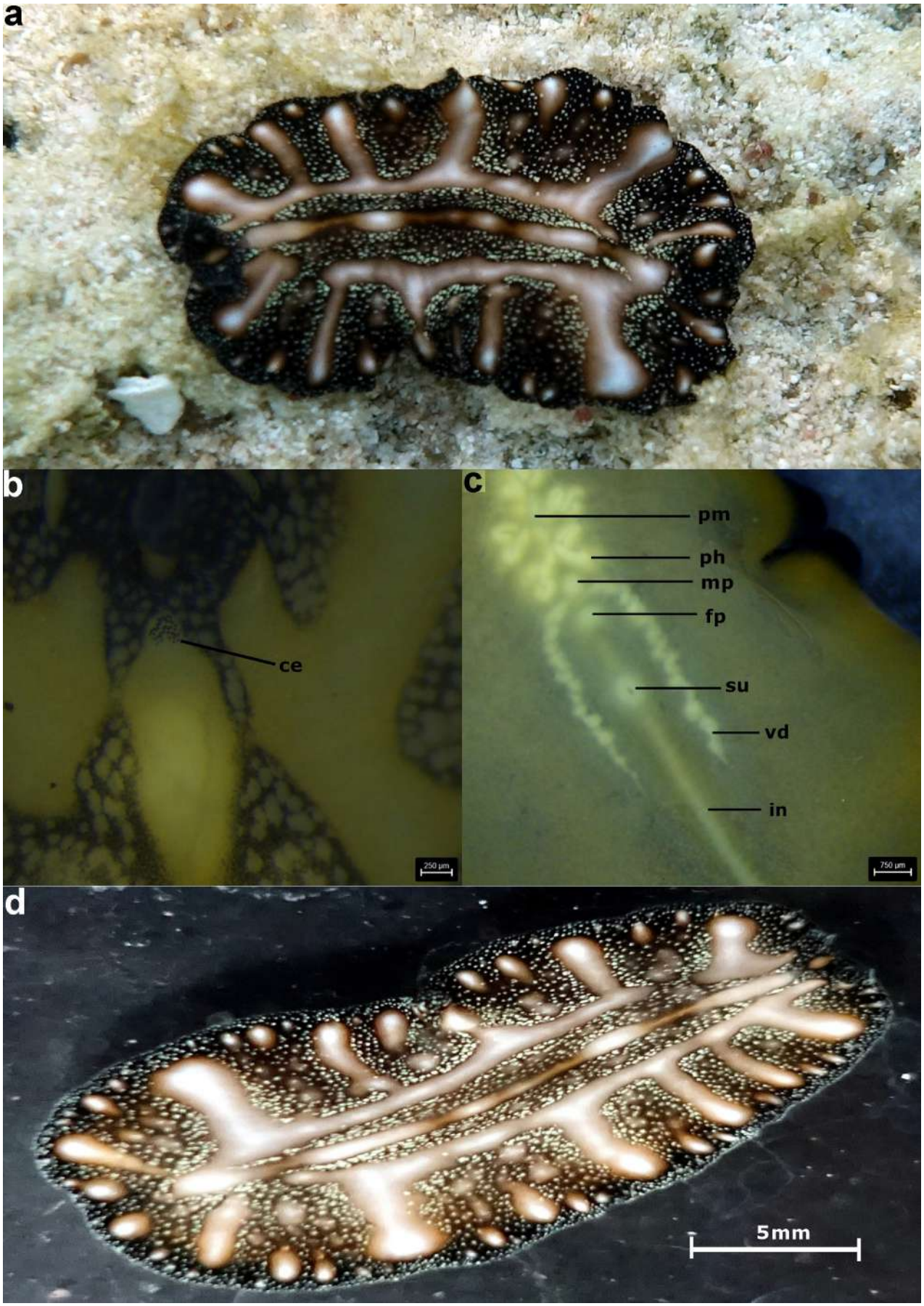

FIGURE 3. a—*Pseudoceros agattiensis* **sp.nov.** (*in-situ)* from Agatti Island (Holotype: IO/IT/POY/00005); b—cerebral eyes (preserved specimen); c—ventral surface (preserved specimen); d—live specimen (*ex-situ)*. Scales—b: 250 µm; c: 750 µm.

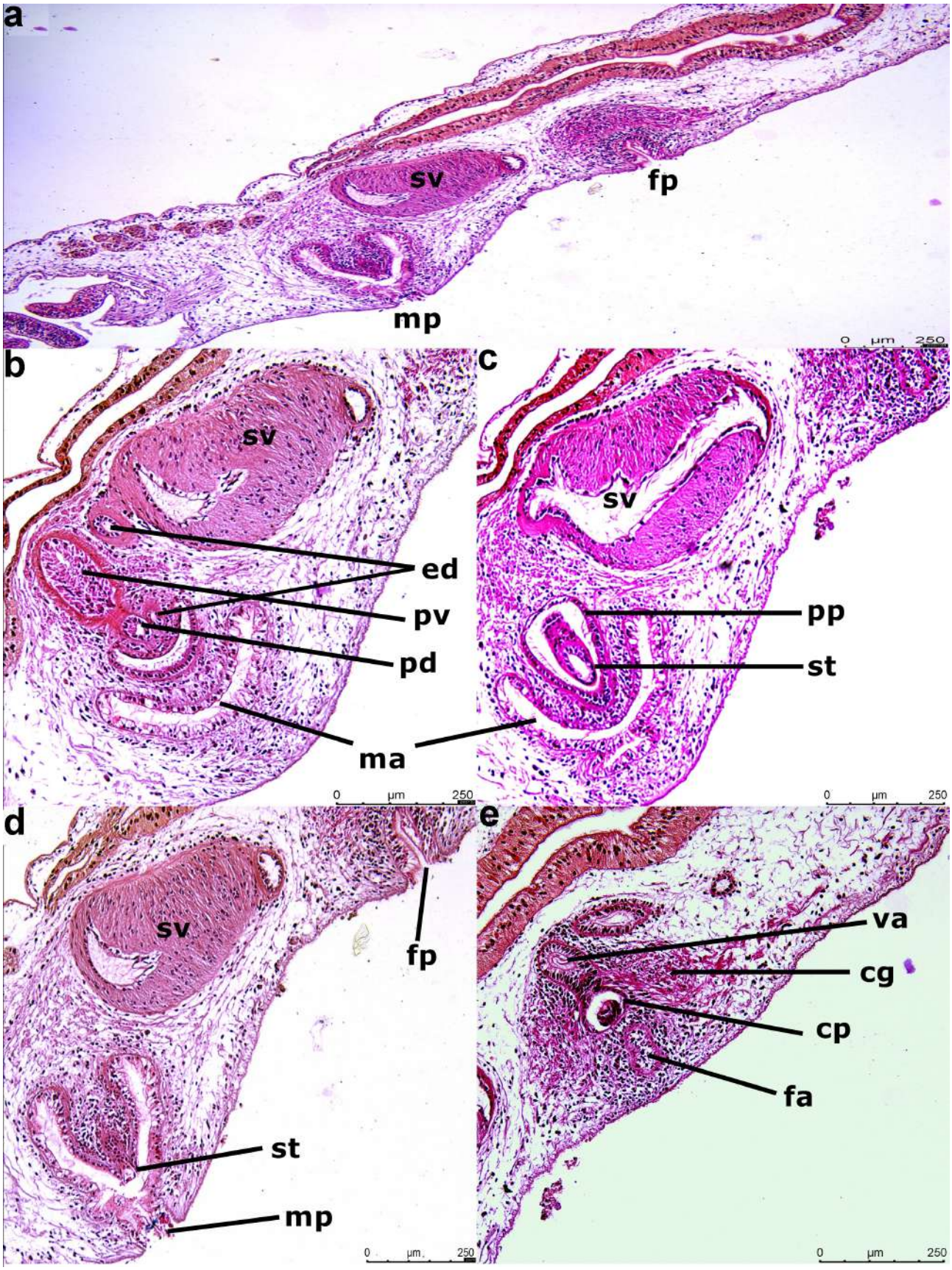

FIGURE 4. *Pseudoceros agattiensis* **sp. nov.** (Holotype: IO/IT/POY/00005); a —sagittal section; b, c, d—male reproductive system; e—female reproductive system.

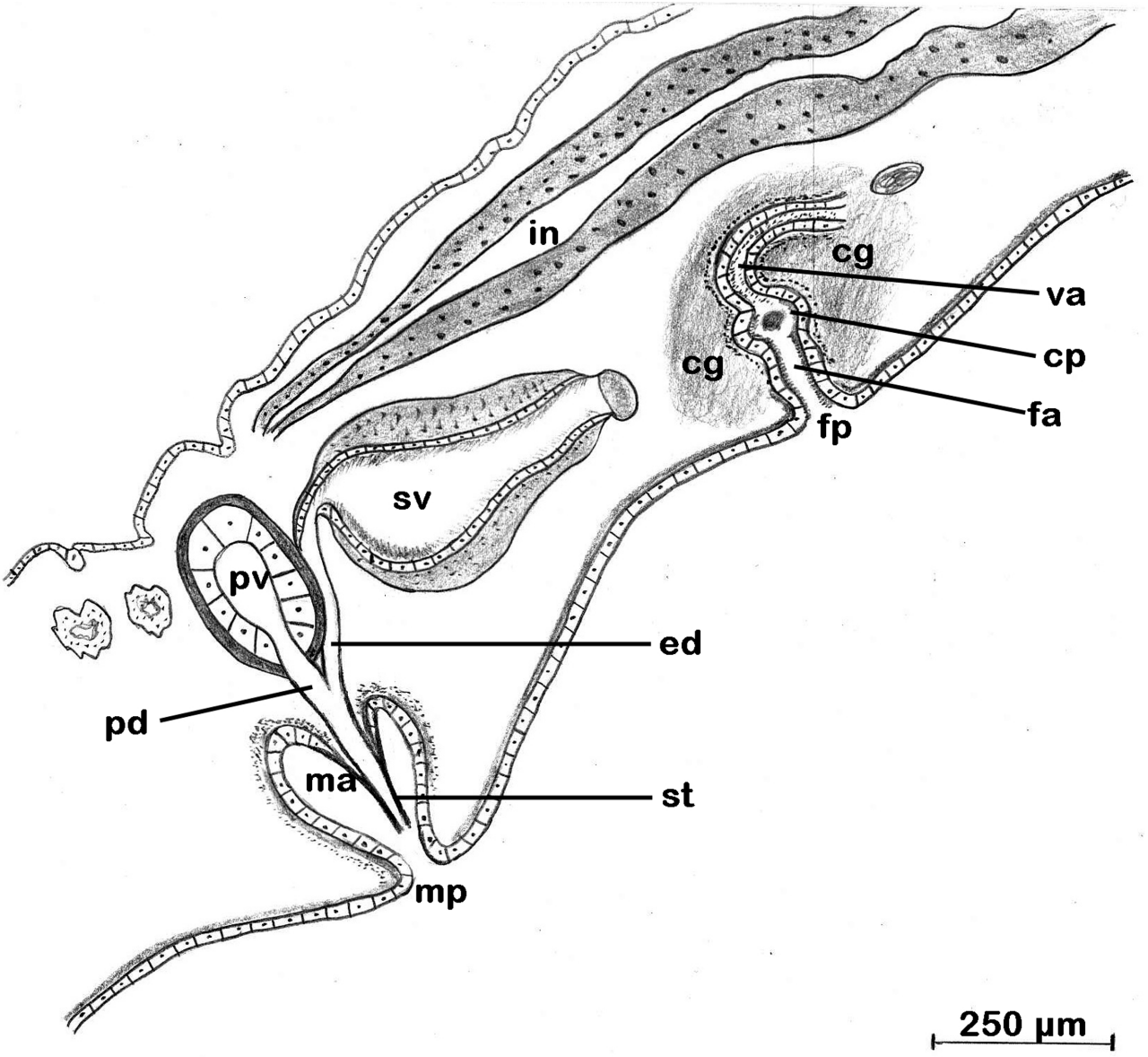

FIGURE 5 . *Pseudoceros agattiensis* **sp. nov.** (Holotype: IO/IT/POY/00005); Diagrammatic reconstruction of male and female reproductive system

Taxonomic remarks: Presence of ruffled pharynx, male copulatory apparatus just behind pharyngeal cavity, free prostatic vesicle, marginal tentacles formed by upfolding of anterior margin, centrally located sucker behind female pore (Faubel 1984) places *Pseudoceros agattiensis* **sp. nov.** in the family Pseudocerotidae while presence of characters such as smooth dorsal surface, single male copulatory apparatus with seminal vesicle (Fig. 4a) and armed penis papilla, pseudotenctacles as simple folds of anterior margin, female pore equidistant from male pore and sucker (Faubel 1984; Newman and Cannon 1998) place this newly described species in the genus *Pseudoceros*. There are only few species in genus *Pseudoceros* which displays transverse streaks on dorsum namely *Pseudoceros felis* Neman and Cannon, 1994*, Pseudoceros mororum* Cuadrado, Moro and Norena, 2017; *Pseudoceros zebra* (Leuckart, 1828); *Pseudoceros* sp. 14 (see Neman and Cannon 2003; pg 79); *Pseudoceros* sp. 24 (see Neman and Cannon 2005) and *Pseudoceros* sp. 42 (see Neman and Cannon 2005). *Pseudoceros felis* is grey brown in colour with white to cream transverse streaks and spots which clearly differentiate it from *Pseudoceros agattiensis* **sp. nov**. *Pseudoceros zebra* have white streaks with black markings and yellow marginal band which differentiates it with newly described species. *Pseudoceros* sp. 14 is the fairly closest example we could find from the genus *Pseudoceros* in terms of colour and streaks, however no information is known about ventral surface or number of pores, so

further comparison would be unclear and vague. *Pseudoceros agattiensis* **sp. nov.** can be readily distinguished from other congeners in terms of colour, arrangement and patterns of transverse streaks. The newly described species is a perfect example for importance of careful observation of colours and patterns especially among pseudocerotids. If not observed carefully, the newly described species can easily be confused with juvenile of *Pseudobiceors bedfordi*. A similar looking juvenile was photographed by Scott Johnson in Marshall Islands (Newman and Cannon 2005). Both species at first instance looks quite similar and can only be differentiated by careful examination of external characters (number of male pores) and colour patterns. Based on above mentioned characters and comparisons, we establish *Pseudoceros agattiensis* **sp. nov.** as new species to science.

***Pseudoceros stellans* sp. nov. Dixit**
(Figs. 6, 7 & 8)

Material examined: Holotype: One specimen (13 × 9 mm) as serial sections (16 Slides), remainder of animal in 70% ethanol. Collected on 21.5.2018, 15 m depth, Agatti Island (10°52′28″N 72°11′11″E), Lakshadweep, India (Regn. no. IO/IT/POY/00006)

Type locality: Agatti Island, Lakshadweep, India.

Etymology: From the Latin *stellans* (adjective) — starry or star studded; for stars like appearance on dorsum

Diagnosis : Background body colour brown with numerous small white to yellow microdots on dorsum. Different sized yellow blotches present on dorsum but most of the small white blotches are present on marginal area. Half of the median area is marbled with irregular white shading, thus appearing as depigmented area. A thick black marginal band run around whole body including pseudotentacles. This marginal band is studded with microdots and small yellow blotches. Pseudotentacles are simple folding of the anterior margin, black and spotted with white dots on dorsal side. Cerebral eye cluster horseshoe shaped.

Description : ***Live.*** Body small, oval and margin without ruffles. Background body colour brown (Fig. 6a). Numerous small white to yellow microdots present all over dorsum. White dots are numerous near median area and gradually turns yellow towards margins. Many yellow blotches of different sizes on dorsum near margins (Fig. 6a). Anterior half of median area is marbled with irregular white shading. Marginal band thick and black with minute yellow microdots and small yellow blotches. Pseudotentacles are simple foldings of the anterior margin, black and spotted with white dots on dorsal side. Cerebral eye cluster horseshoe shaped (Fig. 6b), tentacular eyes hard to recognize due to black colour of pseudotentacles. Ventral surface light brownish in colour.

Preserved. Specimen brown in colour after fixation (Fig. 6c). Ventrally dull whitish in colour. Male and female pore are 0.6 mm apart, while female pore and sucker are 2 mm apart (Fig. 6d). Mouth and male pore are 1.2 mm apart while mouth and sucker are 3.9 mm apart. Pharynx ruffled with eight to nine folds and male pore is situated between last pair of pharyngeal folds. Cerebral eye cluster with about 60 - 65 eyes.

Reproductive system : Male copulatory apparatus consists of seminal vesicle, free prostatic vesicle (Fig. 7a), penis papilla, penis stylet housed in male atrium which open outside via male pore. An oval seminal vesicle (317 x 157 µm) is present (Fig. 7b). Its rounded part oriented towards prostatic vesicle while tapered part is oriented towards cement glands. A free, small, circular and thick walled prostatic vesicle (80 x 58 µm) is present anterior to seminal vesicle (Fig. 7 a, b). Thickness of prostatic vesicle's wall varies from 15 to 20 µm. Male atrium conical (283 µm x 187 µm) housing conical penis papilla (170 µm) with a stylet (Fig. 7c). Female copulatory apparatus consists of vagina, cement pouch surrounded by dense cement glands and female atrium. The vagina opens to a short female atrium via cement pouch which receives secretion from cement glands (Fig. 7c).

Taxonomic remarks : Presence of ruffled pharynx, male copulatory apparatus just behind pharyngeal cavity, free prostatic vesicle, marginal tentacles formed by upfolding of anterior margin, centrally located sucker behind female pore (Faubel 1984) places *Pseudoceros stellans* **sp. nov.** in the family Pseudocerotidae while presence of characters such as smooth dorsal surface, single male copulatory apparatus with seminal vesicle (Fig. 4a) and armed penis papilla, pseudotentacles as simple folds of anterior margin, female pore equidistant from male pore and sucker (Faubel 1984; Newman and Cannon 1998) place this newly described species in the genus *Pseudoceros*. All of the above mentioned characters can be recognised in the present species from Agatti Island. The newly described species differs from all other congeners on the basis of dorsal colour and spots. Although there are some species under the genus *Pseudoceros* with spots (*Pseudoceros astrorum* Bulnes and Torres, 2014 *Pseudoceros heroensis*

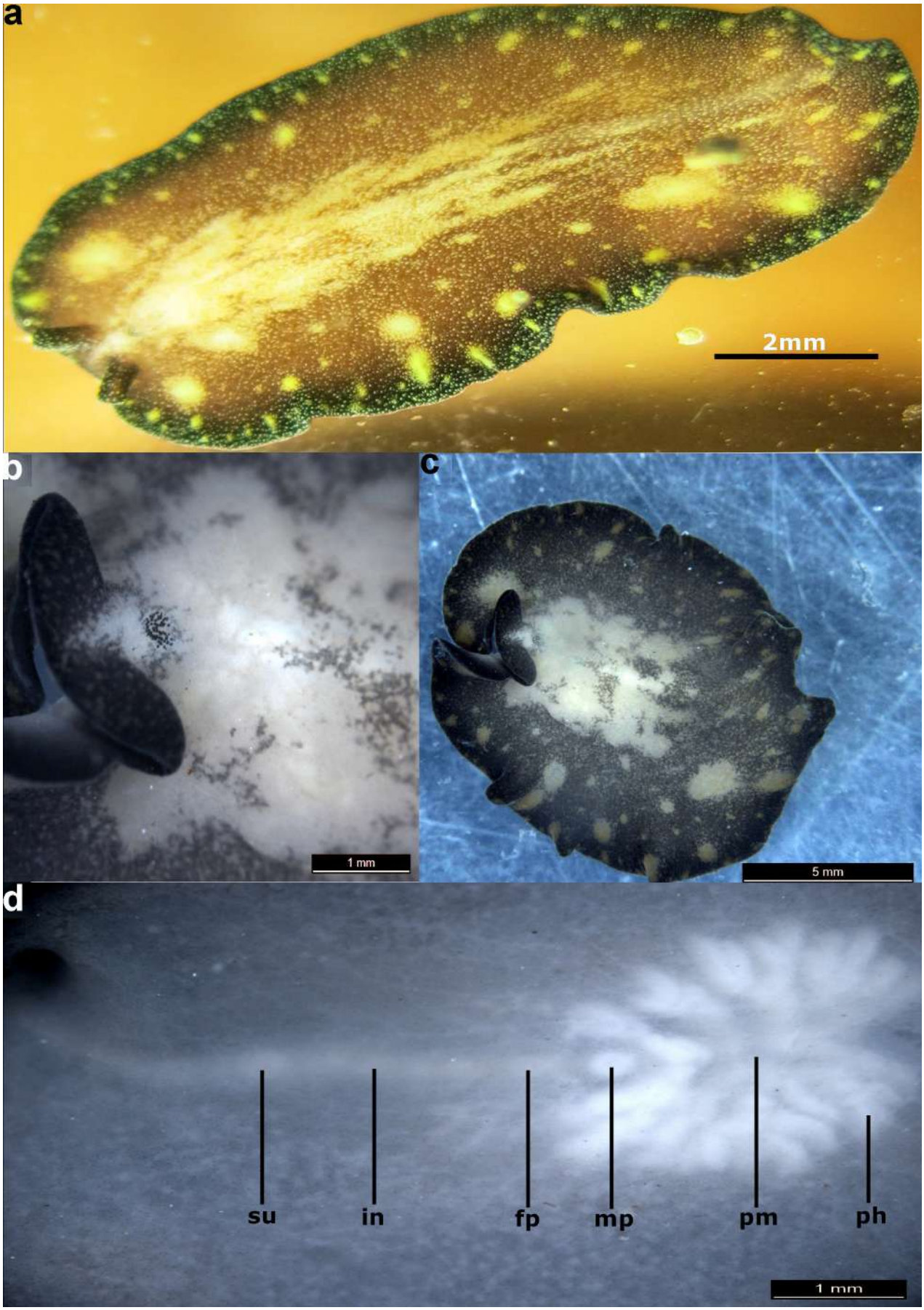

FIGURE 6. a—*Pseudoceros stellans* **sp. nov.** (*ex-situ)* from Agatti Island (Holotype: IO/IT/POY/00006); b—pseuotentacles and cerebral eyes (preserved specimen); c—dorsal surface of preserved specimen; d—ventral surface (preserved specimen).

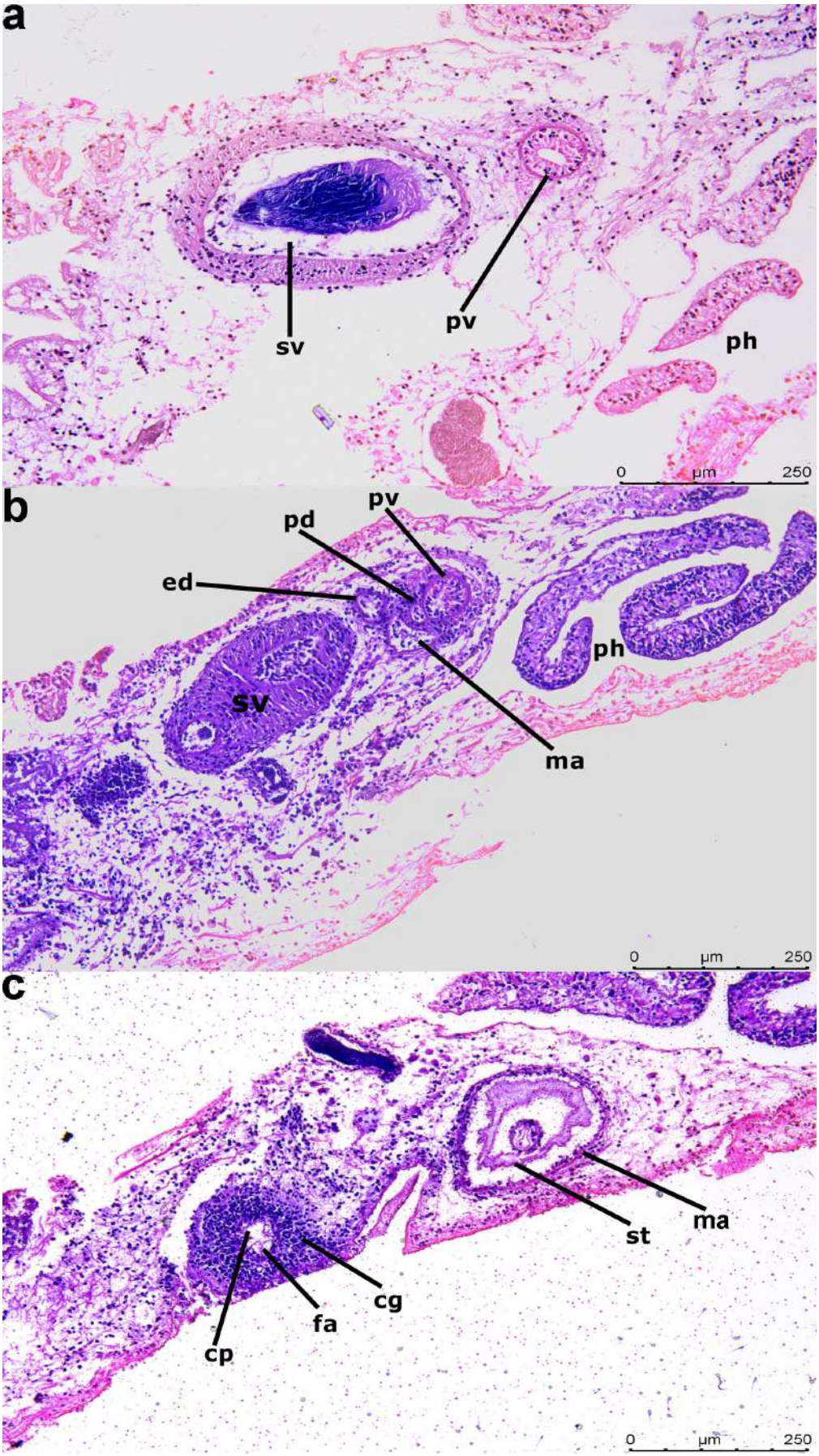

FIGURE 7. *Pseudoceros stellans* **sp. nov.** (Holotype: IO/IT/POY/00006); a, b—male reproductive system; c—female reproductive system and stylet.

Newman and Cannon, 1994; *P. josei* Newman and Cannon, 1998; *P. kylie* Newman and Cannon, 1998; *P. laingensis* Newman and Cannon, 1998; *P. leptostictus* Bock, 1913, *P. lindae* Newman and Cannon, 1994; *P. nigropunctatus* Dixit, Raghunathan and Chandra, 2017 and *P. vishnui* Dixit, Raghunathan and Chandra, 2017) but the colour, size, arrangement, density and distribution of spots varies from species to species and is used for species identification. *Pseudoceros josei*, in terms of background colour and spots size and arrangement shows some affinity with the presently described species but it doesn't have black marginal band. The spots turn white towards the margin (Newman and Cannon, 2005) which is opposite in case of *P. stellans* **sp. nov.** where spots turns yellow towards margin. *Pseudoceros astrorum* is also characterised by dark brown background with spots but it has a white marginal rim which is not present in *P. stellans* **sp. nov.** *Pseudoceros kylie* also possess dark brown background with cream microdots but has bright orange broken band just before the rim while the marginal band is black and continuous in *P. stellans* **sp. nov.** Other species such as *P. laingensis* (purple spots), *P. leptostictus* (small black and orange spots), *P. lindae* (golden yellow spots), *P nigropunctatus* (black spots with cream halo) and *P. vishnui* (purple to violet spots) possess spots with different types of colours, distribution and different type of marginal bands. Thus, in the light of above mentioned characters and comparisons, *P. stellans* **sp. nov.** is reported as a new species to science.

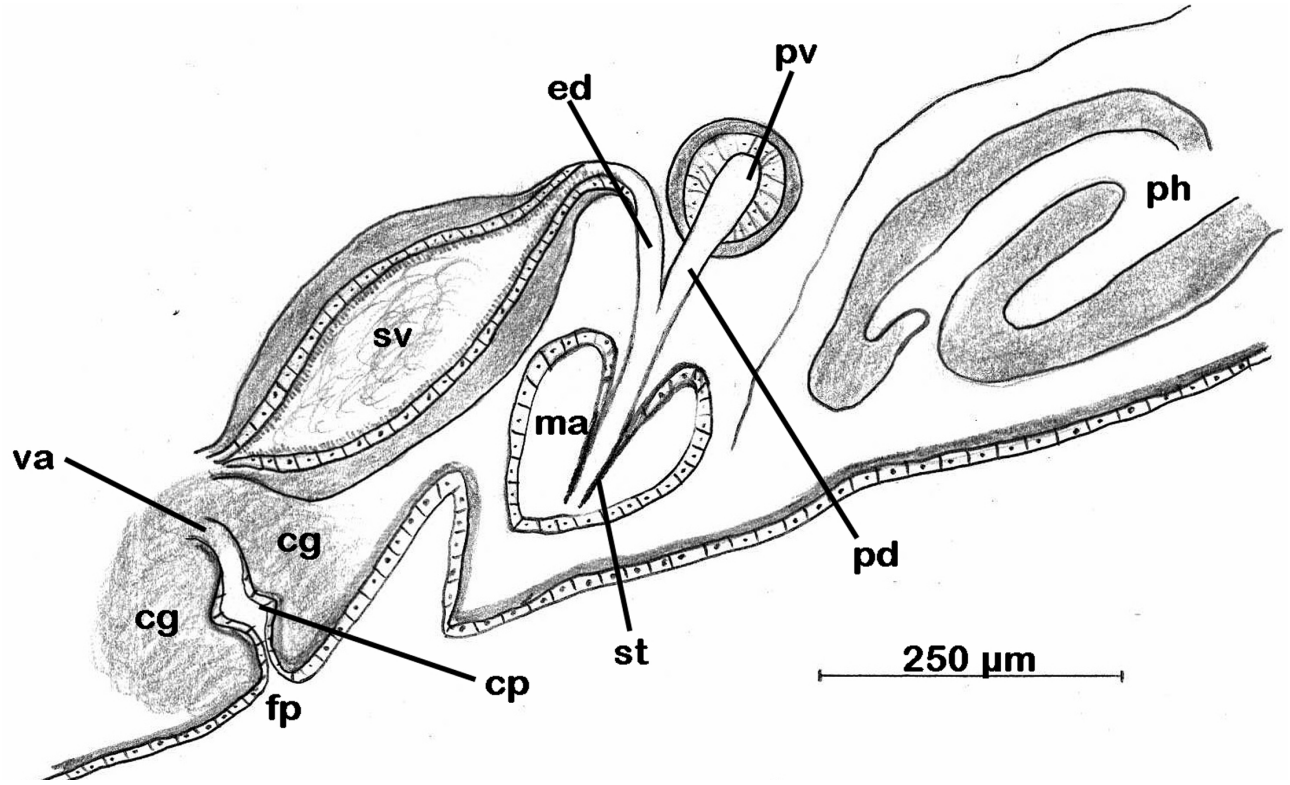

FIGURE 8. *Pseudoceros stellans* **sp. nov.** diagrammatic reconstruction of male and female reproductive system.

Discussion

The taxonomic knowledge regarding polyclads especially from Indian waters is relatively less when compared to other tropical countries of the world. Prior to this study, only 19 species (Table 1) are reported from Lakshadweep waters (Laidlaw, 1902; Apte and Pitale, 2011) out of which 7 were described as new to science from these islands (Table 1). Out of seven described species, only two species presently belong to the genus *Pseudoceros* from these islands. Since 1902, there is not even a single description of any polyclad from Lakshadweep archipelago. The present description, after a gap of 116 years, of two new species from this archipelago is a clear indication of understudied biodiversity of these islands. The present study will mark as a beginning of new era of polyclad research from these islands which are the only atolls of the country. Being atolls and because of their position in tropical zone, these islands harbours vast coral reefs with plenty of coral reef associated faunal communities. Both intertidal and sub tidal

zones are home to many known and unknown species of sponges and ascidians which are the main food source of polyclads. There are a total of 38 islands in Lakshadweep archipelago and out of which, including this study, only 3 islands are surveyed till date. More number of surveys are required in order to evaluate reef biodiversity and status of polyclad fauna in remaining islands.

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References

Apte, D. & Pitale, R.D. (2011) New records of polyclad flatworms (Platyhelminthes: Turbellaria) from coral reefs of Lakshadweep Island, India. *Journal of the Bombay Natural History Society*, 108 (2), 109−113.

Bahia, J., Padula, V., Passeri Lavrado, H. & Quiroga, S. (2014) Taxonomy of Cotylea (Platyhelminthes: Polycladida) from Cabo Frio, southeastern Brazil, with the description of a new species. *Zootaxa*, 3873 (5), 495–525. https://doi.org/10.11646/zootaxa.3873.5.3

Bock, S. (1913) Studien über Polycladen. *Zoologiska Bijdrag fran Uppsala*, 2, 31−344.

Bulnes, V.N. & Torres, Y. (2014) *Pseudoceros astrorum*, a new species of Polycladida (Cotylea, Pseudocerotidae) from Northeastern Brazil. *Zootaxa*, 3881 (1), 94−100. https://doi.org/10.11646/zootaxa.3881.1.7

Cuadrado, D., Moro, L. & Noreña, C. (2017) The Polycladida (Platyhelminthes) of the Canary Islands. New genus, species and records. *Zootaxa*, 4312 (1), 038–068. https://doi.org/10.11646/zootaxa.4312.1.2

Dixit, S. & Raghunathan, C. (2013) Polyclads of Andaman and Nicobar Islands. *Journal of the Andaman Science Association*, 18 (2), 165–169.

Dixit, S., Raghunathan, C. & Chandra, K. (2017a) Two new marine flatworms (Polycladida: Pseudocerotidae) from Andaman & Nicobar Islands, India. *Zootaxa*, 4221 (1), 111–122. https://doi.org/10.11646/zootaxa.4221.1.5

Dixit, S., 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://doi.org/10.11646/zootaxa.4269.4.5

Dixit, S., Sivaperuman, C. & Raghunathan, C. (2015) Three new records of polyclad flatworms from India. *Marine Biodiversity Records*, 8, e29. https://doi.org/10.1017/S1755267214001043

Dixit, S., Sivaperuman, C. & Raghunathan, C. (2018a) Description of two new pseudocerotids (Rahabditophora: Rhabditophora; Polycladida) from Andaman & Nicobar Islands, India. *Zootaxa,* 4403 (2), 365–377. https://doi.org/10.11646/zootaxa.4403.2.8

Dixit, S., Sivaperuman, C. & Raghunathan, C. (2018b) Erratum. *Zootaxa,* 4442 (4), 600–600. https://doi.org/10.11646/zootaxa.4442.4.10

Dixit, S., Bulnes, V.N. & Raghunathan, C. (2018c) Neotype designation for the marine flatworm, *Acanthozoon alderi* (Polycladida: Cotylea: Pseudocerotidae), from India with comments on the taxonomical Status of the Genus. *Zoological Studies,* 57, 45. https://doi.org/10.6620/ZS.2018.57-45

Faubel, A. (1984) The Polycladida, Turbellaria. Proposal and establishment of a new system. Part II. The Cotylea. Mitteilungen aus dem Hamburgischen *Zoologischen Museum und Institut*, 81, 189–259.

Jie, W.B., Gan, B.Q., Cgen, V.Y. & Kuo, S.H. (2016) *Pseudoceros magangensis*: a new species of pseudocerotid flatworm (Platyhelminthes: Polycladida) from Taiwan. *Platax*, 13, 33–50.

Laidlaw, F.F. (1902) The marine Turbellaria with an account of the anatomy of some species. *In:* Gardiner, J.S. (Ed.), *The Fauna*

and Geography of the Maldive and Laccadive Archipelagoes: Being the Account of the Work carried on and of the Collections made by an Expedition during the years 1899 and 1900. Vol. 1. The University Press, Cambridge, pp. 282–312.
Leuckart, F.S. (1828) Breves animalium quorundum maxima ex parte marinorum descriptiones. *Heidelberg,* 24, 15.
Litvaitis, M.K. & Newman, L.J. (2001) A molecular framework for the phylogeny of Pseudocerotidae (Platyhelminthes, Polycladida). *Hydrobiologia*, 444 (1), 177–182.
https://doi.org/10.1023/A:1017503124908
Newman, L.J. & Cannon, L.R.G. (1994) *Pseudoceros* and *Pseudobiceros* (Platyhelminthes, Polycladida, Pseudocertotidae) from eastern Australia and Papua New Guinea. *Memoirs of the Queensland Museum*, 37 (1), 205–266
Newman, L.J. & Cannon, L.R.G. (1996) New genera of pseudocerotid flatworms (Platyhelminthes; Polycladida) from Australian and Papua New Guinean coral reefs. *Journal of Natural History,* 30 (10), 1425–1441.
https://doi.org/10.1080/00222939600770811
Newman, L.J. & Cannon, L.R.G. (1997) Nine new species of *Pseudobiceros* (Platyhelminthes: Polycladida) from the Indo-Pacific. *The Raffles Bulletin of Zoology*, 45 (2), 341–368.
Newman, L.J. & Cannon, L.R.G. (1998) *Pseudoceros* (Platyhelminthes: Polycladida) from the Indo-Pacific with twelve new species from the Australia and Papua New Guinea. *The Raffles Bulletin of Zoology,* 46 (2), 293–323.
Newman, L.J. & Cannon, L.R.G. (2003) *Marine Flatworms. The World of Polyclads*. CSIRO Publishing, Clayton, 97 pp.
https://doi.org/10.1071/9780643101197
Newman, L.J. & Cannon, L.R.G. (2005) *Fabulous Flatworms: a guide to marine polyclads*. Version 1. ABRS & CSIROPublishing: Clayton, CD-ROM.
Pitale, R., Bhave, V. & Apte, D. (2014) First record of family Prosthiostomidae and *Prosthiostomum trilineatum* (Platyhelminthes: Polycladida) from the west coast of India. *Marine Biodiversity Records*, 7, 1–6.
https://doi.org/10.1017/S1755267214000128
Pitale, R. & Apte, D. (2017) First record of *Thysanozoon brocchii* (Platyhelminthes: Polycladida) from Indian waters. *Marine Biodiversity Records*, 10 (21), 1–11.
http://doi.org/ 10.1186/s41200-017-0123-0
Prudhoe, S. (1989) Polyclad turbellarians recorded from African Waters. *Bulletin of the British Museum of Natural History, Zoology, 55* (1), 47–96.
Quiroga, S.Y., Bolaños, D.M. & Litvaitis, M.K. (2004) A checklist of polyclad flatworms (Platyhelminthes: Polycladida) from the Caribbean coast of Colombia, South America. *Zootaxa*, 633, 1–12.
https://doi.org/10.11646/zootaxa.633.1.1
Rawlinson, K.A. (2008) Biodiversity of coastal polyclad flatworm assemblages in the wider Caribbean. *Marine Biology,* 153, 769–778.
https://doi.org/10.1007/s00227-007-0845-3
Sreeraj, C.R. & Raghunathan, C. (2011) New records of pseudocerotid polyclads from Andaman and Nicobar Islands, India. *Marine Biodiversity Records,* 4, e73.
http://doi.org/10.1017/S1755267211000819
Sreeraj, C.R. & Raghunathan, C. (2013) Pseudocerotid polyclads (Platyhelminthes, Turbellaria, Polycladida) from Andaman and Nicobar Islands, *India. Proceedings of the International Academy of Ecology and Environmental Sciences,* 3 (1), 36–41.
Sreeraj, C.R. & Raghunathan, C. (2015) A report on the coral reef dwelling polyclads of Nicobar Islands, India. *Proceedings of the International Academy of Ecology and Environmental Sciences,* 5 (2), 83−88.
Sreeraj, C.R., Raghunathan, C., Raghuraman, R., Sudhanshu, D. & Venkataraman, K. (2015) *Polyclads of Andaman and Nicobar Islands*. Zoological Survey of India, Kolakata, 100 pp.
Tyler, S., Artois, T., Schilling, S., Hooge, M. & Bush, L.F. (eds) (2006-2018) World List of turbellarian worms: Acoelomorpha, Catenulida, Rhabditophora. *Pseudoceros* Lang, 1884. Accessed through: World Register of Marine Species. Available from http://marinespecies.org/aphia.php?p=taxdetails&id=142241 (accessed 04 December 2018)
Velasquez, X., Bolaños, M. & Benayahu, Y. (2018) New records of cotylean flatworms (Platyhelminthes: Polycladida: Rhabditophora) from coastal habitats of Israel. *Zootaxa,* 4438 (2), 237–260.
https://doi.org/10.11646/zootaxa.4438.2.2
Verrill, A.E. (1901) Additions to the fauna of the Bermudas from the Yale Expedition of 1901, with notes on other species. *Transactions of the Connecticut Academy of Arts and Sciences* 11, 15–62.