Article

Pseudocerotid polyclads (Platyhelminthes, Turbellaria, Polycladida) from Andaman and Nicobar Islands, India

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Abstract

Pseudocerotid polyclads belonging to the genera *Pseudoceros* Lang, 1884, *Pseudobiceros* Faubel, 1984 and *Thysanozoon* Grube, 1840 are newly reported from Andaman and Nicobar Islands of India. Specific determinations are based primarily on color and color pattern. The present study adds nine new pseudocerotid polyclads to Indian waters.

Keywords polycladida; flat worm; Andaman and Nicobar Islands; India; new record.

1 Introduction

The polyclads are the most primitive free living flatworms of the phylum Platyhelminthes. These worms are dorso-ventrally flattened and display a solid or acoelomate in which no body cavity and a loose tissue parenchyma of mesenchymal origin fits the space between the internal organs and body wall. These turbellarians are vary in shape from oval to elongate and range in size from microscopic forms to species that are more than 60 cm long, although most are less than 10 mm in length. Turbellarians are primarily aquatic and the great majority is marine. Although there are a few pelagic species, most of them are bottom dwellers and live in sand or mud, under stones and shells or on seaweeds. Many species are common component of the interstitial fauna. They also are known from the deep-sea (Quiroga et al., 2006).

Pseudocerotid polyclads have been poorly represented in the past and, since most animals lose their color and pattern on fixation, reliable documentation of color patterns have been rare (Newman and Cannon 1995). Although free living polyclad flatworms are conspicuous inhabitants of coral reefs (Hyman, 1954; 1959; Prudhoe, 1985; 1989; Newman and Cannon, 1994a, b) there are few comprehensive taxonomic accounts of these worms from tropical waters. The diversity of this group, however, is not well known, because their collection, handling, and identification are difficult (Hyman 1954, 1959; Newman and Cannon 1994a, b, 1996a, b, 1997, 1998, 2000, 2002; Newman et al., 2003).

Newman and Cannon (1994) recognized both *Pseudoceros* and *Pseudobiceros*; and furthermore, affirmed species within genera of Pseudocerotidae were most easily identified by their color and pattern. They determined that the habit of an intradermal stabbing style of insemination suggests morphological isolating mechanisms due to differences in the male copulatory apparatus (stylet) would be unlikely to have evolved. Previous to 1984, it was believed that the majority of conspicuous and flamboyantly colored pseudocerotid

flatworms belonged to the genus *Pseudoceros* Lang, 1884. However, Faubel (1984) clearly separated the genus *Pseudobiceros* from *Pseudoceros* on the basis of its double male copulatory system. *Pseudobiceros* includes the biggest and often most colorful of the polyclad flatworms. These are the only polyclads which actively swim with exaggerated undulations of their ruffled margin (Newman and Cannon, 1997).

Laidlaw (1902) reported 15 species of turbellaria belonging to 6 family and 7 genera, among them 10 species belonging to 5 family and 6 genera were reported from Laccadive Islands. This is the first available report on the marine flatworms from India. Since then, no detailed studies are available for these animals from Indian waters. In fact, little is known about the diversity and biology of free-living flatworms from this region. In order to fill up the gap of over a century the present study was carried out on the reef dwelling polyclads of Andaman and Nicobar Islands. Among other flatworm species, members of the family Pseudocerotidae were very conspicuous and the species reported here for the first time from Indian waters.

2 Material and Methods

Detailed underwater survey using SCUBA was conducted in the coral reef areas of Andaman and Nicobar Islands from April 2009 to June 2010 to study the availability of polyclads (Fig. 1). Photographs were taken using Canon Powershot A850 with housing and Sony Cybershot TSC900 with housing. Flatworms were handpicked and brought alive to the laboratory for taxonomic identification. However, most specimens were autolysed during sampling or at some stage of fixation. Furthermore, within the Pseudocerotidae, species have been recognized solely on the basis of their color patterns (Newman and Cannon 1994, 1995, 1998). Reliability of the use these color patterns for species diagnosis has been confirmed with molecular data (Goggin and Newman, 1996; Litvaitis and Newman, 2001). The morphological features and measurements of the specimen were examined by using the stereo-zoom microscope (Leica, Model DFC 500).

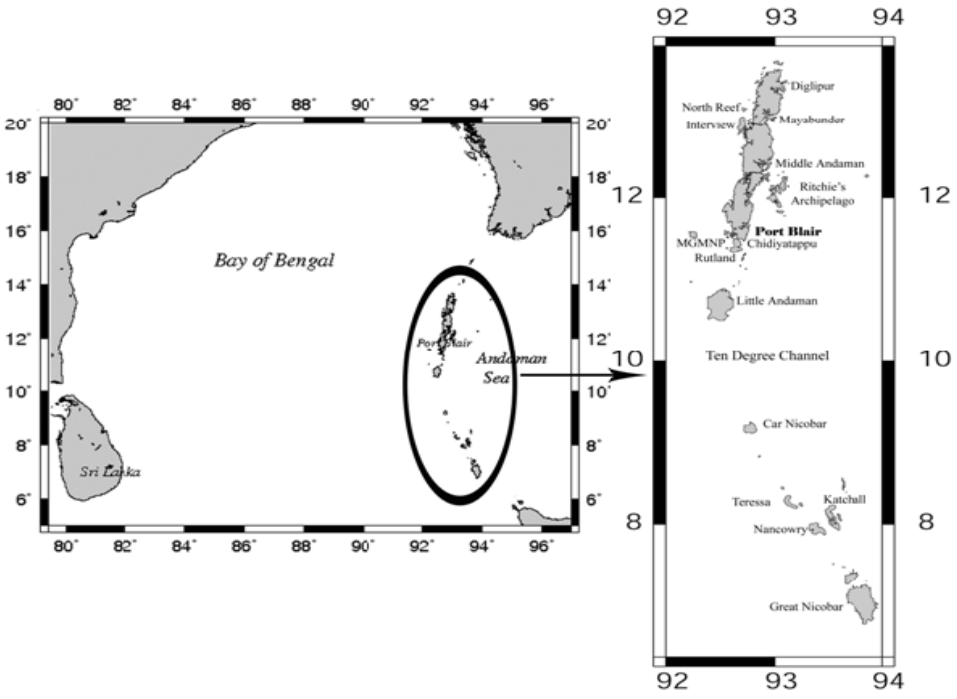

Fig. 1 Map showing the areas surveyed.

3 Results and Discussions

The presently studied specimens under the family Pseudocerotidae are of moderate size, averaging from 15 mm to 70 mm in length with a greatly flattened and more or less oval shape (Fig. 2). A pair of anterior marginal or dorsal pseudo-tentacles are present. Many are brightly colored, eyes numerous. Intestine elongate and centrally located, with many highly branched diverticula. Key characters of 9 species of polyclads belongs to 3 genera identified from Andaman and Nicobar Islands are presented here.

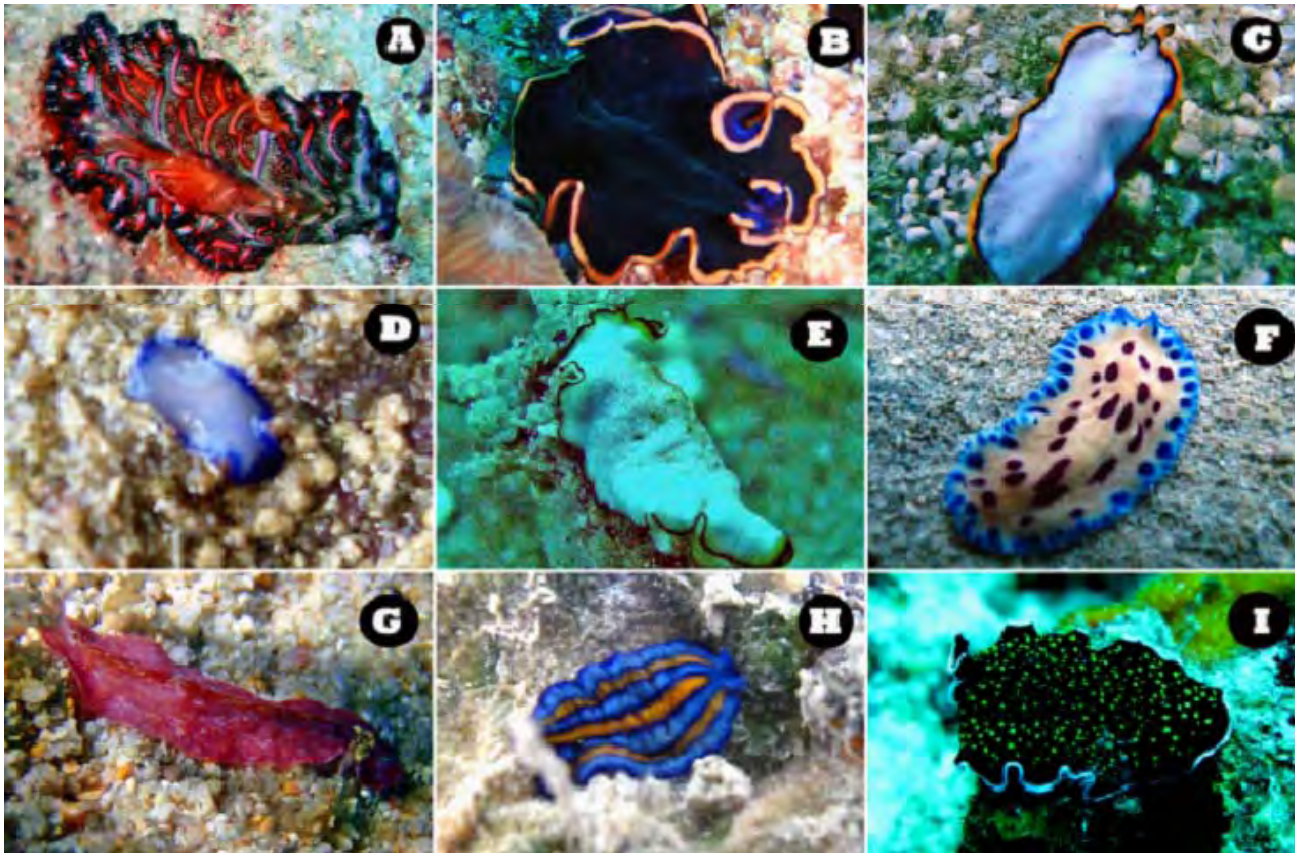

Fig. 2 (A) *Pseudobiceros bedfordi* (B) *Pseudobiceros hymanae* (C) *Pseudoceros confuscus* (D)*Pseudoceros indicus* (E) *Pseudoceros intermittus* (F) *Pseudoceros* sp (G) *Pseudoceros rubronanus* (H) *Pseudoceros tristriatus* (I) *Thysanozoon nigropapillosum.*

Phylum: Platyhelminthes Gegenbaur, 1859
Class: Turbellaria Ehrenberg, 1831
Order: Polycladida Lang, 1884
Sub-Order: Cotylea Lang, 1884
Family: Pseudocerotidae Lang, 1884

Body oval or oblong, smooth or papillate, with prominent tentacles derived from margin, sucker central. Pharynx ruffled, anterior, gut anastomosing. Male copulatory complex (single or double) just behind pharynx, penis usually armed with stylet; female complex single, uterus may be greatly branched.

Genus: *Pseudobiceros* Faubel, 1984

Flamboyantly or cryptically colored. Body soft and delicate, raised medially, elongate oval, tapering posteriorly, margin with numerous deep ruffles. Pseudotentacles well developed. Cerebral eye spot small, horseshoe shaped.

1. Pseudobiceros bedfordi (Laidlaw, 1903)

Material examined: Havelock Island, Ritchie's Archipelago; 1 specimen; size 70 mm, animal was found crawling on bare rock.

Diagnosis: The only species of the genus *Pseudobiceros* having a typical dorsal color pattern. Have transeverse streaks. Body black in color, yellow dots all over the body except on the pink streaks.

2. Pseudobiceros hymanae Newman and Cannon, 1997

Material examined: South Button Island, Ritchie's Archipelago; 1 specimen; size 65 mm, animal was found on algal tuft.

Diagnosis: Background velvety black, opaque; margin with two distinct bands, rusty orange with narrow black rim. Pseudotentacles black with the same marginal bands laterally only.

Genus: *Pseudoceros* Lang, 1884

Combination of smooth dorsal surface, tentacles as upfolds of the anterior margin, and ruffled pharynx.

3. Pseudoceros confuscus Newman and Cannon, 1995

Material examined: Havelock Island, Ritchie's Archipelago; 1 specimen; size 45 mm, animal was found crawling on sandy bottom in the reef.

Diagnosis: Background color cream white with 5 marginal bands, 3 bands are distinct; from inside to out; narrow opaque white; granular black; orange; granular black and narrow yellow at rim. Pseudotentacles are simple folds.

4. Pseudoceros indicus Newman and Schupp, 2002

Material examined: Aves Island, North Andaman; 1 specimen; size 15 mm, animal was found below a rock. Chidiyatappu, South Andaman; 2 specimens; size 15-20 mm, animals were found below loose rocks in intertidal region.

Diagnosis: Body elongate, oval and leaf like in shape. Background mottled cream and opaque white with well defined, separate, royal blue or dark purple spots along margin, spots uneven in size and spacing. Spots continue over the pseudotentacles.

5. Pseudoceros intermittus Newman and Cannon, 1995

Material examined: Havelock Island, Ritchie's Archipelago; 1 specimen; size 45 mm, animal was found near colonial tunicates.

Diagnosis: Background color white or white cream with three distinct, usually interrupted, marginal bands: inner wide, orange brown; middle narrow, black; bright yellow green at rim. Pseudotentacles simple folds.

***6. Pseudoceros* sp.**

Material examined: North Bay, South Andaman; 1 specimen; size 35 mm. Havelock Island, Ritchie's Archipelago; 1 specimen; size 40 mm, animal was found moving on hard corals in both the places.

Diagnosis: Background cream with widely spaced scattered purple spots, each spot is denser in the middle with fine dots outwards. Pale blue spots are continuous at the marginal side.

7. Pseudoceros rubronanus Newman and Cannon, 1998

Material examined: South Button, Ritchie's Archipelago; 1 specimen; size 30 mm, animal was found crawling in the sandy area between the coral reef.

Diagnosis: Background velvety bright red orange, pinkish red at margin with irregular white dots over the entire surface, more concentrated in a line along the margin and sometimes in irregular clusters longitudinally and medially. Pseudotentacles small bumps.

8. Pseudoceros tristriatus Hyman, 1959

Material examined: Havelock, Ritchie's Archipelago; 2 specimens; size 20-30 mm, animals were found feeding on colonial tunicates.

Diagnosis: Background color pale blue with three longitudinal orange stripes. These stripes appear faintly bordered with black and extend from shortly behind the pseudotentacles almost to the posterior end.

Genus: *Thysanozoon* Grube, 1840,

The distinguishable character of this genus is the presence of dorsal papillae. Therefore, it can clearly be distinguished from polyclads of the genera *Pseudoceros* and *Pseudobiceros*.

9. Thysanozoon nigropapillosum (Hyman, 1959)

Material examined: Jolly Buoy Island, Mahatma Gandhi Marine National Park, South Andaman; 1 specimen; size 45 mm, animal was found grazing on sponge.

Diagnosis: It is black with a pale white or yellowish white border. The dorsal surface is covered with low rounded black papillae tipped with bright yellow. Anterior tentacular folds are evident.

The two species *P. confuscus* and *P. intermittus* possess marginal bands of the same color as *P. bimarginatus* and without careful examination; these animals could easily be confused. *P. confuscus* has one extra black marginal band; *P. intermittus* possesses a black triangle between the pseudotentacles but lacks the white spot and as well it has intermittent marginal banding. The color pattern of *Pseudoceros* sp. is similar to *P. laingensis* with little different from that of by the presence of blue colored margin and purple colored spots, in contradictory to the purple or purple blue colored spots and the marginal band in the later.

Despite the dazzling colors and patterns like nudibranchs (Mollusca, Opisthobranchia, Nudibranchia), polyclads are not always obvious in their natural environment. Since polyclads have no means of forming a visual image, their colors and patterns are logically the result of selection against predation (Newman and Cannon, 1995). Due to a focused and long term sampling effort, some of the highest diversity of polyclads (more than 600 species) has been recorded from the Great Barrier Reef and the Indo-Pacific (Newman and Cannon, 2003). In contrast, polyclad diversity in the Indian waters has received no attention at all, with an exception of Laidlaw (1902).

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