Pseudocerotid Polyclads of Lakshadweep Islands

A photographic guide to Pseudocerotid marine flatworms of Lakshadweep Islands

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PREFACE

Polyclads, commonly called as marine flatworms are some of the most colourful animals one can find underwater. Though available from intertidal to deep sea habitats, these animals are still meagrely studied all over the world taxonomically and ecologically. The present e-book is an attempt to cumulate the research done by Centre for Marine Living resources and Ecology (CMLRE), on these worms from Lakshadweep waters from April 2018 to February 2020 and to bring out a photographic guide for tentative identification of these worms. This e-book contains species under family Pseudocerotidae which are known for their extraordinary colours and patterns. With sections about collection, preservation, up to date nomenclature and species information, this e-book will act as a reference guide for students, researchers, underwater photographers and any marine biologist with an interest in these colourful underwater beauties.

INTRODUCTION TO POLYCLADS

The phylum Platyhelminthes represents group of unsegmented worms with a head, tail end and are considered as most primitive bilaterally symmetrical animals. These triploblastic worms were first animals to evolve with three layers (ectoderm, endoderm and mesoderm) without having a true coelom. It is obvious to think about parasitic worms reading the term Platyhelminthes (as mostly all parasites infecting animals and humans belong to this phylum) but, there is an order named as Polycladida which comprises of beautiful and intriguing coloured free living marine flatworms, which are an ace predators with a very complex body systems despite of being primitive and one of the oldest living creatures on earth. The word polyclad consists of two words *i.e. poly* - many and *clade* - branches, and these worms are named so because of their highly branched gut.

The order Polycladida is divided into two sub orders based on presence or absence of sucker on ventral side. The suborder Cotylea comprises of polyclads with ventral sucker while absence of ventral sucker classify them under the suborder Acotylea. Polyclads are cosmopolitan being most colourful and populous in tropical waters yet studies regarding these worm are meagre and awaits serious attention. These worms are found from intertidal to deep waters and are an important members of coral reef ecosystem. They feed mostly on sponges and ascidians. However, serious ecological and behavioral studies are still needed to prove their roles in coral health.

STUDY AREA

Lakshadweep Islands, the only atoll islands of our country are among major coral reefs present in Indian EEZ. These islands harbour some of finest and highly biodidiverse coral reefs in our country. The present work on polyclads is result of biodiversity surveys undertaken from April 2018 – February 2020 to record marine biodiversity in Lakshadweep Islands. Five Islands namely Agatti, Amini, Kadmat, Kiltan and Kavaratti were surveyed. The survey sites were surveyed by scuba diving in subtidal region and hand picking method in intertidal regions.

COLLECTION

Polyclads indeed are very attractive but collecting them is certainly a challenge. They can be collected in intertidal areas beneath rocks or boulders; while diving in subtidal areas, they can be spotted either crawling on substratum or beneath any hard structures like dead corals, rocks, boulders, wooden logs and even discarded plastic pieces. Due to their small size, cryptic nature and ability to fit in small spaces, it is always very difficult to spot a flatworm and it is even more difficult to lift and get them into a container. They are too fragile to be picked up by hands, thus must be collected by using paint brush and kept in separate containers as they secrete mucous when touched or stressed which can be toxic for other flatworms in same container. The process of being autolyse under stress conditions is another major challenge that a biologist have to tackle between the time of collection and preservation. The role of good quality photography is of utmost importance in polyclad taxonomy, thus photographs were taken *in-situ* and *ex-situ* to record the actual colours and patterns while the specimens were alive. Most of the colours during the course of fixation and preservation faded away leaving behind a cream coloured or transparent worm, thus the importance of good quality photograph can not be neglected for identification of a polyclad.

PRESRVATION

Polyclads have always been notorious and difficult to preserve for taxonomic study. Therefore many biologists ignored this group. They are very sensitive organisms and can shrink or disintegrate even on a slightest change in water quality, thus simply placing a worm in formalin will not serve the purpose of taxonomic studies. A shrunken specimen can be of no use for a taxonomic study and identification. Ten percent frozen formalin buffered with seawater is used which ensures that animals do not disintegrate or shrink and preserved flat for microscopic, histological studies and museum storage, though the colours are always lost during preservation (Newman & Cannon, 2003). The animal is first floated on a piece of paper and placed on the frozen formalin surface where after coming in contact with cold surface, animals tend to flatten. Further with a help of paint brush, animal is pressed gently in order to keep it flat during the course of fixation. 70% ethanol can be used for long term storage.

IDENTIFICATION

Identification of a polyclad is based on external as well as internal characters. External characters like shape and size of pharynx, number and position of eyes, number of gonopores, presence or absence of sucker and most importantly colour patterns are studied for identification. For generic and species level identification and especially for similarly coloured species, histological studies of male and female reproductive structures and molecular studies have to be carried out to confirm the identity as well to describe an undescribed species. The shape and arrangement of structures like seminal vesicle and prostatic vesicle are very important in determination of the family and genus as well.

PREVIOUS WORKS ON POLYCLADS FROM LAKSHADWEEP ISLANDS

Polyclads are one of the most understudied marine faunal groups of our country. Despite the occurrence of high biodiverse reef in Indian waters, the studies regarding these worms are scanty.

Prior to studies done on polyclads by CMLRE in Lakshadweep, only two works were published (Laidlaw, 1902) and (Apte and Pitale, 2011) from these islands. Recently (Dixit et al. 2019) description of two polyclads as new to science is a result of research initiated by CMLRE on these worms after a gap of many years.

CLASSIFICATION

Phylum : Platyhelminthes Miniot, 1876
Class : Rhabditophora Ehlers, 1895
Order : Polycladida Lang, 1884
Suborder : Cotylea Lang, 1884
Superfamily : Pseudocerotoidea Faubel, 1984
Family : Pseudocerotidae, Lang, 1884

Genus:

Acanthozoon Collingwood, 1876
Pseudobiceros Faubel, 1983
Pseudoceros Lang, 1884
Bulaceros Newman & cannon, 1996

*Only recorded genera during the survey period are mentioned

Acanthozoon fuscobulbosum Dixit, Sivaperuman & Raghunathan, 2018

Type Locality: Great Nicobar Island, India

Description: Background body colour cream. Margin darker with pinkish tinge and rim of small transverse and crisscrossed white lines. Dorsal surface covered with numerous brown and bulbous papillae of variable sizes. Median area elevated with less papillae. Cerebral eye cluster horseshoe shaped and tentacular eyes present only on lower half of pseudotentacles which are erect and black with white tips. Cerebral eye cluster with about 35 eyes and about 7 eyes on each tentacles within the black coloured region. Size – 1 to 3 cm.

Distribution: Lakshadweep Islands (Agatti, Kavratti) and Andaman and Nicobar Islands.

Pseudobiceros apricus Newman & Cannon, 1994

Type Locality: Heron Island, Australia.

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. Size – 1 to 4 cm

Distribution: Lakshadweep Islands (Agatti), Andaman and Nicobar Islands, India; Heron Island and Queensland, Australia; Eilat, Red Sea.

Pseudobiceros damawan Newman & Cannon, 1994

Type Locality: Laing Island, Papua New Guinea

Description: Body semi-transparent, mottled opaque white and grey with widely spreaded out black spots all over the dorsum. Median region slightly elevated with cream colour. Marginal band is thick made up of reddish orange colour with white transverse streaks. A very thin black rim is present on the periphery of the body. Pseudotentacles ear like and erect. Size – 2 to 4 cm.

Distribution: Lakshadweep Islands (Agatti), Andaman and Nicobar Islands, India; Australia; Indonesia; Micronesia; Marshall Islands; Papua New Guinea and South Africa.

Pseudobiceros gratus (Kato, 1937)

Type Locality: Koruna, Japan; Holotype lost during World War II (Poulter, 1975)

Description: Background colour white to grey, four black longitudinal stripes out of which two are in median region and other two near margin. Median stripes are broader than marginal stripes. A thin black rim surrounds whole body. Margins highly ruffled; pseudotentacles erect and ear like with white tips. Ventrally grey in colour with a thin black rim. Size – 2 to 5 cm.

Distribution: Lakshadweep (Agatti Island) and Andaman and Nicobar Islands, India; Australia; Hawaii; Indonesia; Japan; Marshall Islands; Mauritius; Micronesia; Mozambique; Papua New Guinea; Philippines; Red Sea and Sri Lanka.

Pseudobiceros hancockanus (Collingwood, 1876)

Type Locality: Singapore (exact locality unknown)

Description: Background colour dark grey to black. Marginal bands three: inner bright orange, middle transparent grey followed by a thin white rim. Ventral surface light brown with same three marginal bands as seen from dorsal surface. Pseudotentacles black, ear-like and pointed, bordered by white rim and noticeable white tips. A small white triangular area present between the pseudotentacles. Cerebral eyespot in a clear uncoloured area with a thin white line starting from white triangle transecting the eyespot cluster. Median area can be darker. Size – 2 to 6 cm.

Distribution: Lakshadweep Islands (Agatti, Kavratti, Kadmat) and Andaman and Nicobar Islands, India; Australia; Hawaii; Indonesia; Mauritius; Micronesia; Papua New Guinea; Red Sea and Singapore.

Pseudobiceros hymanae Newman & Cannon, 1997

Type Locality: Madang, Papua New Guinea

Description: Background colour black with velvety appearance, opaque; margin made up of two distinct bands, first orange followed by a narrow black rim. Pseudotentacles square, black with the same marginal bands. Ventrally black in colour with same marginal bands. Cerebral eyespot cluster present but not clearly visible due to black background. Size – 1 to 4 cm.

Distribution: Lakshadweep Islands (Agatti) and Andaman and Nicobar Islands, India; Australia; Indonesia; Maldives; Papua New Guinea; Solomon Islands and South Africa.

Pseudobiceros stellae Newman & Cannon, 1994

Type Locality: Heron Island, Australia.

Description : Background colour grey to black and translucent on the edges. Dorsum is speckled with numerous white dots and clusters of dots are arranged in flower like pattern Median area elevated. Margins slightly ruffled, Pseudotentacles squared. Eye cluster horseshoe shaped present in clear area (devoid of pigment) between pseudotentacles. Size – 2 to 6 cm.

Distribution: Lakshadweep Islands (Agatti & Kavratti), India; Heron Island and Queensland, Australia; Eilat, Red Sea.

Pseudoceros bicolor Verrill, 1901

Type Locality: Birds Island, Bermuda.

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. Size – 2 to 4 cm.

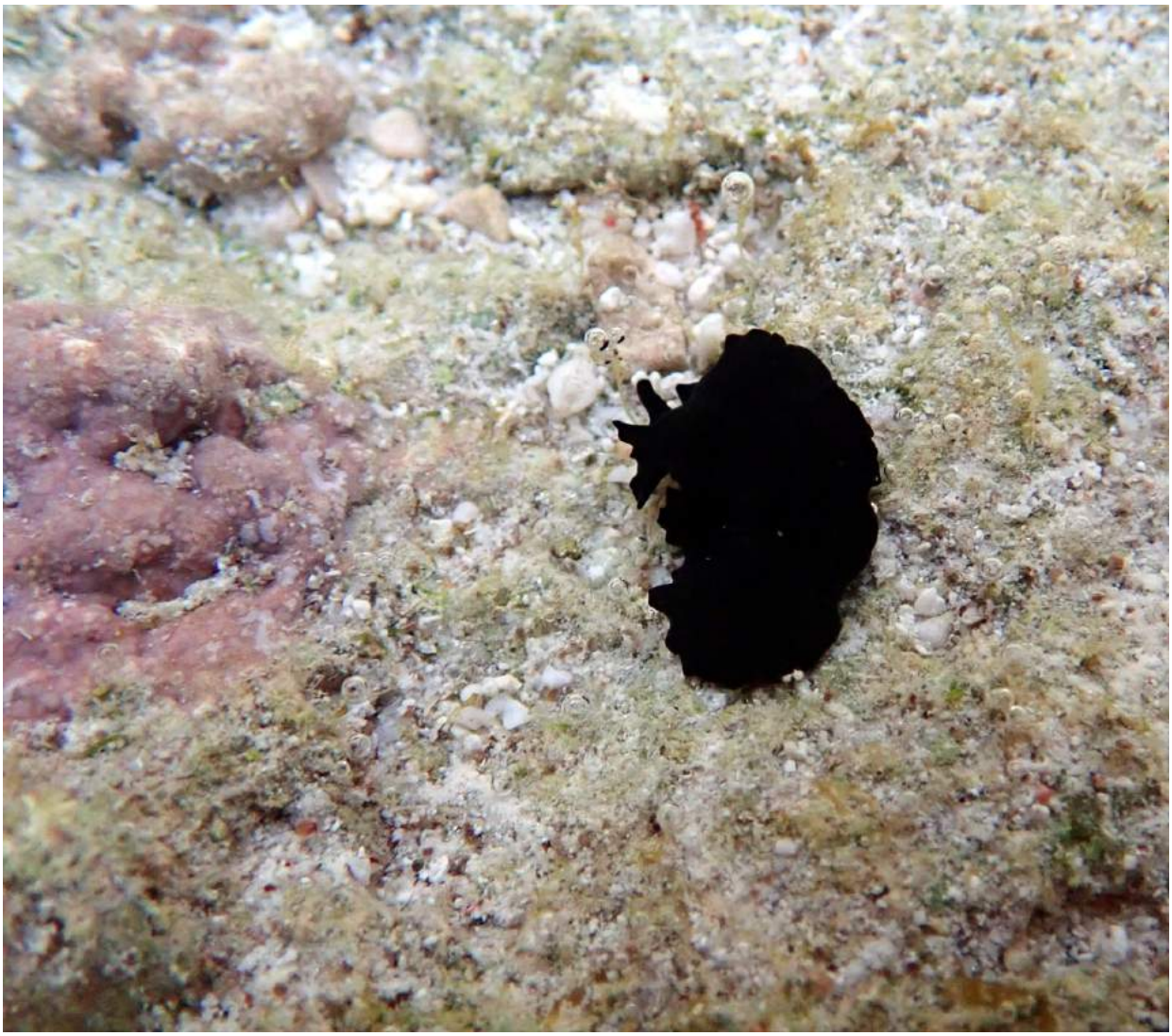
Distribution: Lakshadweep Islands (Agatti); Bermuda; Colombia; Jamaica; Belize; Hounduras; Panama; Brazil.

Pseudoceros bolool Newman & Cannon, 1994

Type Locality: Heron Island, Australia.

Description: Background colour black with no markings or patterns on the body. Ventrally lighter black to grey. Pseudotentacles small and black; cerebral eyespot difficult to spot due to black body colour. Size – 4 to 8 cm.

Distribution: Lakshadweep Islands (Agatti), Andaman and Nicobar Islands, India; Australia; Indonesia; Papua New Guinea; Philippines.



Pseudoceros galatheensis Dixit, Raghunathan & Chandra, 2017

Type Locality: Galathea Wildlife Sanctuary, Great Nicobar Island, India.

Description. Small, smooth, light blue in colour and terminally rounded. Margin dark blue without any ruffles. Thin, bright yellowish-orange median line starting from behind cerebral eyespot cluster and ending before posterior margin without touching it. Pseudotentacles small, formed by simple folds of the anterior margin and dark blue with presence of 12-14 scattered eyespots on each pseudotentacle on either side. Cerebral eyespots cluster with 25-28 eyes. Size – 1 to 3 cm.

Distribution: Lakshadweep (Agatti, Kavratti & Amini), Great Nicobar Island, India; Micronesia and Indonesia.

Pseudoceros indicus Newman & Schupp, 2002

Type Locality: Moreton Bay, Queensland, Australia.

Description: Background body colour mottled cream and opaque. A characteristic and conspicuous blue margin made up of numerous medium sized blue coloured spots. Ventrally cream with tinge of purple or pink (possibly due to presence of prey in the gut). Cerebral eyespot with about 30- 40 eyes in a horseshoe shaped cluster. Size – 2 to 6 cm.

Distribution: Lakshadweep (Agatti, Kadmat), Andaman and Nicobar Islands, India; Australia; Indonesia; Maldives; Micronesia and South Africa.

Pseudoceros paralaticlavus Newman & Cannon, 1994

Type Locality: Heron Island, Australia.

Description: Background body colour black with a broad grey median band with light shade in middle and darker at margin giving the appearance of white median line. Marginal band thin white followed by a thick bright yellow/fluorescent rim on both dorsal and ventral side. Pseudotentacles small, black and with yellow rim. Horseshoe shaped eye cluster with around 30 eyes. Size – 2 to 6 cm.

Distribution: Lakshadweep (Agatti, Kadmat, Kavratti), Andaman and Nicobar Islands, India; Australia; Indonesia; Japan; Marshall Islands; Micronesia; Papua New Guinea; Reunion Islands; South Africa; Thailand and Hawaii.

Pseudoceros duplicinctus Prudhoe, 1989

Type Locality: Heron Island, Australia.

Description: Background body colour light to dark bwown. Marginal band thin light blue to cream followed by a thick yellow rim on both dorsal and ventral side. In some species thin light blue band is very light and difficult to observe. Pseudotentacles very simple and small with yellow rim. Horseshoe shaped eye cluster with around 30 eyes and very difficult to observe due to dark background. Size – 2 to 6 cm.

Distribution: Lakshadweep (Agatti, Kadmat, Kavratti), Andaman and Nicobar Islands, India; Australia; Kenya; Marshall Islands; Micronesia; Papua New Guinea.

Pseudoceros agattiensis Dixit, 2019

Type Locality: Agatti Island, Lakshadweep, India.

Description: 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. 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. Size – 2 to 4 cm.

Distribution: Lakshadweep Islands, (Agatti and Kavratti).

Pseudoceros stellans Dixit, 2019

Type Locality: Agatti Island, Lakshadweep, India.

Description : 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. Size – 2 to 3 cm.

Distribution: Lakshadweep Islands (Agatti).

Pseudoceros sp. 1

Description : Background body white with black patches on dorsum. Faint florescent median line. Marginal band white with an orange broken sub marginal Pseudotentacles are simple folding of the anterior margin, black tipped followed by orange and white. Cerebral eye cluster horseshoe shaped. Size – 1 to 3 cm.

Distribution: Lakshadweep Islands (Agatti).

Bulaceros sp. 1

Description : Background body translucent grey. Yellow medially and white spots scattered on dorsum. Black mottling in median area. Marginal band translucent and clear with many white spots followed by broken orange and black bands. Pseudotentacles knobbed distally, small and ear like. Size – 3 to 6 cm.

Distribution: Lakshadweep Islands (Agatti).

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Table of Contents