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On a two new species of *prodistomum* linton, 1910 (lepocreadiidae odhner, 1905) from marine water fish

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Abstract
Digenean flat, thick, oval, leaf-like, non-segmented in appearance and are obligate parasites. Their body usually covered by tegument which either smooth or spiny. Marine water fishes were collected, dissected and examine thoroughly and fixed in AFA fixative and dehydrated in descending grades of alcohols. After that's parasites were stained with acetoalum carmine and dehydrated in ascending grade of alcohol. Two new species of digenean of family Lepocreadiidae Odhner, 1905 were recovered from marine water fish *Fistularia petimba* and *Rastrelliger kanagurta* from Goa and Tamil Nadu, India. Five specimens of *Prodistomum santoshi* n. sp. recovered from the 25 marine water fish *F. petimba* while four specimens of *Prodistomum tripathi* n. sp. form were recovered from ten marine water fish *R. kanagurta* respectively.

Keywords: digenean, fish, marine water, *prodistomum*, trematoda

Introduction

Trematodes are small parasitic flat worms and they complete their life cycle on two hosts, one is definitive host vertebrates and intermediate host is mollusks (that's may be freshwater snails as well as land snails). Trematode's parasites are named on their organs of attachments that's suckers, trematos means "pierced with holes"

van Beneden [1] divided the Trematoda into two groups on the basis of life cycle: Monogeneses (a single generation in the life-cycle) and Digeneses (those in which a sexual generation alternates with asexual generations.

Digenean flat, thick, oval, leaf-like, non-segmented in appearance and are obligate parasites. Their body usually covered by tegument which either smooth or spiny. All digenetic trematodes are hermaphrodite, having both male and female sexual organs with exception family Schistosomidae [2]. They are capable of self-fertilization but must meet up with another worm for cross-fertilization. being a notable exception.

The worms of trematodes are wide spread in nature and found in almost all animals in every part of the world. Lepocreadiidae is one of the major families found in the intestine of marine fishes in all oceans. Several systems for the classification of family Lepocreadiidae into subfamilies were given by different authors [3–5]. Yamaguti [6] divides into 24 subfamilies which was later restricted into only three family by Bray [5] as: Lepocreadiinae [7], Aephnidiogeninae[8] and Lepidapediinae [3]. After the molecular study based on phylogenetic study, Bray and Cribb [9] considered subfamilies Aephnidiogeninae and Lepidapedinae to family level as Lepocreadiidae, Aephnidiogenidae [8], and Lepidapedidae [3]. Therefore, family Lepocreadiidae consist of only one subfamily, the Lepocreadiinae.

Adult trematode parasitizes in the definitive host, in different organs such as in lungs, liver, intestine and stomach. Member of Lepocreadiinae [7] most widely distributed in tropical and subtropical shallow-water fishes, except few species [10–11]. The intensity of infection may depend upon the number of individual or worms in the host body and may also differ from time to time or place to place.

The aim of this study was to extend the knowledge of existing species of subfamily Lepocreadiinae [7] from India.

Materials and Methods

Marine water fishes were collected and identified using key of FAO species identification sheets, Western Indian Ocean. The fishes were dissected and alimentary canal, liver, kidney, gall bladder, heart and gills were put in physiological saline (0.87%). The isolated organs of fishes examine thoroughly for trematodes parasites. Isolated parasites were kept in normal saline and fixed in AFA fixative (Alcohol 50%, Formalin and Acetic acid: 100:6:2.5 ratio) for 24 hours and preserved in 70% alcohal. After the fixation parasites brought to normal condition by dehydrating descending grades of alcohols (90%, 70%, 50% & 30%) and then washed into the water. After that's parasites were stained with acetoalum carmine and dehydrated in alcohol (30%, 50%, 70%, 90% and absolute). Dehydrated parasites were cleared in xylene and mounted in DPX. Diagrams were drawn using Camera Lucida, attached to Phase Contrast Microscope (Olympus CX-41). All measurements were taken in millimetre (mm) unless otherwise mentioned. Specimens were deposited in "The Official Registry of Zoological Nomenclature" at Zoo bank. The parasites were identified using conventional morphological criteria [12–15].

Results and Discussion

Five specimens of *Prodistomum santoshi* n. sp. and four specimens of *Prodistomum tripathi* n. sp. form were collected from the 25 marine water fish *Fistularia petimba* and ten marine water fish *Rastrelliger kanagurta* respectively.

Systematics

Family: Lepocreadiidae Odhner, 1905
Subfamily: Lepocreadiinae Odhner, 1905

Genus: *Prodistomum* Linton, 1910
***Prodistomum santoshi* n. sp.**
(Figure 1 and 2a-c)

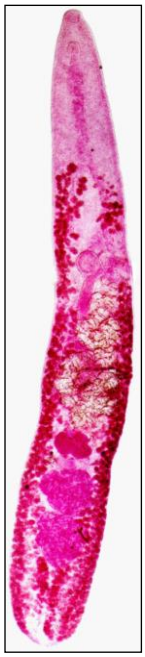

Fig 1: Light Microphotograph of *Prodistomum santoshi* n. sp. collected from *F. petimba* from Goa, India

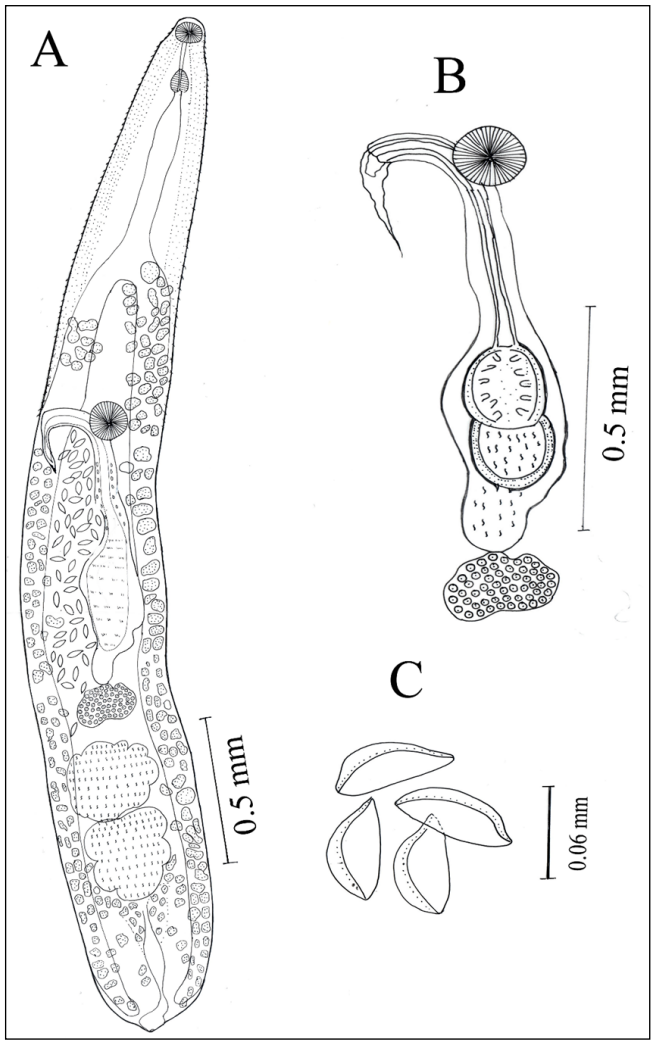

Fig 2: Line diagram of *Prodistomum santoshi* n. sp. (a), enlarged view of cirrus sac (b), and eggs (c).

Description
Body elongates, anterior end narrow while posterior end broad and tapering, measuring 3.64 – 3.81 (Average 3.71) mm long and 0.40 – 0.52 (0.47) mm wide. Oral sucker small, almost oval, 0.06 – 0.08 (0.073) mm long, 0.08 – 0.09 mm wide. Pigment granules appearing like eye spot present on each side dorsally pharynx region. Ventral sucker rounded, pre-equatorial, and larger than oral sucker, measuring 0.13 mm long, 0.12 – 0.18 (0.14) mm wide. Prepharynx small, oval, 0.06 mm long and 0.04 mm wide.
Intestinal bifurcation at one fourth form the anterior end of the body. Caeca long, terminate blindly at the posterior end of body. Testes, lobed, tandem, unequal in size, located posterior one third of hind body. Anterior testis 0.24 – 0.32 (0.28) mm long, 0.21 – 0.29 (0.25) mm wide. Posterior testis 0.26 – 0.34 (0.29) mm long, 0.22 – 0.27 (0.25) mm wide. Cirrus-sac claviform, extends just above the ovary. External seminal vesicle saccular. Many pars prostatica present and long ejaculatory duct.
Genital pore, median, anterior to ventral sucker. Vitellarium follicular, in lateral fields, extend from intestinal bifurcation to the hind end of body. Excretory vesicle tubular, reaching up to posterior end of the body, excretory pore terminal. Ovary lobed, pretesticular to anterior testis, 0.12 – 0.13 (0.12) mm long and 0.18 – 0.21 (0.19) mm wide. Uterus pre-ovarian, seminal receptacle post-ovarian and saccular in shape. Eggs 0.06 –0.08 (0.07) mm long, 0.03 – 0.04 (0.036) mm wide.
Host: *Fistularia petimba*, Lacepède, 1803
Locality: Goa, India
Site of infection: Intestine
Type specimen: Holotype
Zoobank Registration: The Life Science Identifier (LSID): urn:lsid:zoobank.org:pub:16BF9C5D-4A06-4E18-86CD-B46944DC449B

Remarks
The newly recovered specimen placed in genus *Prodistomum* due to its intestinal caeca terminate blindly at the posterior end of the body. The present form differs from *P. siddiqii* [16], *P. travassossi* [17], *P. vinodae* [16] and *P. waltairense* [18] due to vitellarium extends into forebody [15]. The present form grouped with *P. gaevskayae* [19], *P. orientalis* [20] and *P. mohsini* [16] due to vitellarium restricted to hind body [15]. The pharynx without any finger like processes, therefore, present form grouped with *P. orientalis* and *P. mohsini*. The present form shows some resemblance with only *P. orientalis* because oral sucker normal not infundibuliform.
The present form also differs with *P. orientalis* due to oral sucker normal but almost oval in shape while in *P. orientalis*. In the present form ventral sucker rounded, pre-equatorial, and larger than oral sucker while in *P. orientalis* ventral sucker pre-equatorial, and larger than oral sucker but spherical. In *P. orientalis* Cirrus-sac club-shaped, extends well beyond ventral sucker but in the present form claviform, extends just above the ovary. External seminal vesicle saccular. Many pars prostatica present and long ejaculatory duct. In *P. orientalis* ovary spherical but in present form lobed. The characteristic feature of the newly discovered species long body, oral sucker small, ventral sucker large, Testes two, lobed, tandem, in posterior part of hind body. Therefore, the present form considered as a new species.

Etymology: The new species is named on the honour of my sister Santosh Yadav.

***Prodistomum tripathi* n. sp.**

(Figure 3, and 4 a-d)

Fig 3: Light Microphotograph of *Prodistomum tripathi* n. sp. collected from *R. kanagurta* from Tamil Nadu, India

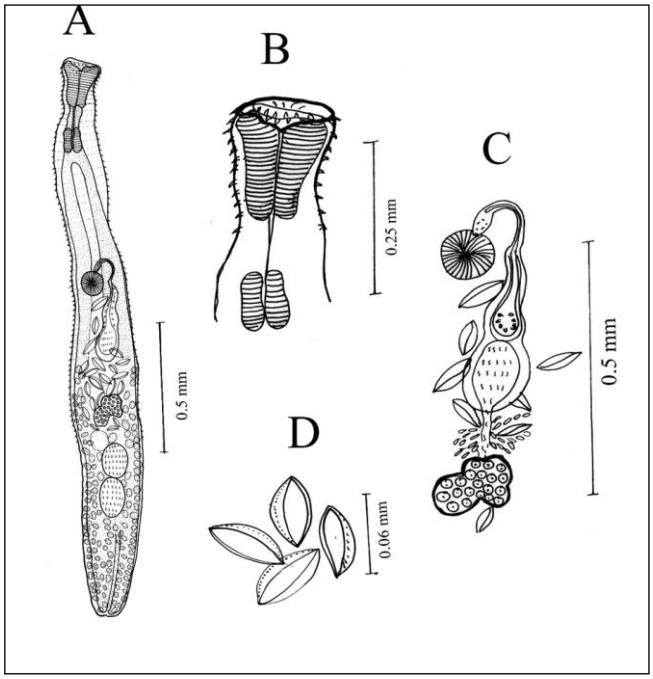

Fig 4: Line diagram of *Prodistomum tripathi* n. sp. (a), enlarged view of oral sucker and pharynx (b), enlarged view ventral sucker, cirrus sac and ovary (c) and eggs (d).

Description

Body elongates, spinose, measuring 2.31 – 2.90 (Average 2.605) mm long and 0.22 – 0.26 (0.24) mm wide. Oral sucker funnel shaped, 0.17 mm long, 0.14 – 0.19 (0.17) mm wide. Eye spot pigment granules absent. Ventral sucker rounded, pre-equatorial, and smaller than oral sucker, measuring 0.09 – 0.13 (0.11) mm long, 0.07 – 0.11 (0.09) mm wide. Pre-pharynx large, 0.09 – 0.15 (0.12) mm long and 0.05 mm wide. Pharynx doliform, 0.10 – 0.14 (0.12) mm long and 0.04 – 0.07 (0.055) mm wide. Intestinal bifurcation at one fourth form the anterior end of the body. Caeca long, terminating blindly at the posterior end of body. Testes, oval, tandem, almost equal in size, located posterior one third of hind body. Anterior testis 0.14 – 0.18 (0.16) mm long, 0.10 – 0.12 (0.11) mm wide. Posterior testis 0.15 – 0.18 (0.165) mm long, 0.09 – 0.12 (0.105) mm wide. Cirrus-sac claviform, extended at that's points from where vitellarium started. External seminal vesicle saccular, gland cells associated with it prominent.

Genital pore, median, posterior to ventral sucker. Vitellaria restricted to the hind end of body only. Excretory vesicle tubular, reaching up to posterior end of the body, excretory pore terminal. Ovary lobed, pretesticular to anterior testis, 0.06 – 0.08 (0.07) mm long and 0.06 – 0.07 (0.065) mm wide. Uterus pre-ovarian, seminal receptacle post-ovarian and saccular in shape. Eggs operculated, 0.05 mm long, 0.03 mm wide.

Host: *Rastrelliger kanagurta*, Cuvier, 1816

Locality: Mandapam place, Rameswaram, Tamil Nadu, India

Site of infection: Intestine

Type specimen: Holotype

Zoobank Registration: The Life Science Identifier (LSID): urn:lsid:zoobank.org:act:BFE47DF0-09D0-42F8-B8E5-C2FA07A96EAC

Remarks

The newly recovered specimen placed in genus *Prodistomum* due to its intestinal caeca terminating blindly at the posterior end of the body. According to Bray (1990) the newly discovered specimen differs from *P. polonii* [10], *P. menidiae* [22], *P. waltairensis* [18] and *P. hynnodi* [23] due vitellaria restricted to hind body only because in above mentioned species vitellarium reaching into forebody. The present form also differs from *P. gracile* [24] and *P. orientalis* [25] because in present form gland associated with external seminal vesicle prominent while in *P. gracile* and *P. orientalis* not prominent. Therefore, the present form grouped with only *P. girellae* [26].

The present form also differs with *P. girellae* because in *P. girellae* vitellarium which reaches only just anterior to the ovary while in present form reaches to uterus. In *P. girellae* cirrus sac is of the Opechona pattern, while in the present form claviform, extended at that's points from where vitellarium started. Newly discovered specimen possesses following character's: Oral sucker funnel shaped, ventral sucker rounded, pre-equatorial, and smaller than oral sucker. Pre-pharynx large, pharynx doliform. Intestinal bifurcation at one fourth form the anterior end of the body. Testes, oval, tandem, almost equal in size, located posterior one third of hind body.

Therefore, these differences are sufficient to create n new species.

Etymology: The new species is named on the honour of Prof. Madhu Tripathi.

Conclusion

The total fish production of India was 12.61 million metric tonnes (MMT) (2017-18) that's is about 0.96% of the National Gross Value Added and 5.37% to the agricultural GVA (2016-17). The contribution of marine fishery of Indian waters 5.31 MMT. India exported 13,77,244 tonnes fish and fisheries products worth Rs. 7.08 billion US $. The

helminths parasite plays important role by parasitizing host which leads to low body weight gain and stress that's affect reproduction and ultimately death, finally economic loss. Therefore, knowledge of host-parasite interactions is very necessary for the management of infectious diseases and improvement in fish production caused by trematodes. Host–parasite interaction can be only achieved by proper discovery of new parasites which infecting the fishes.

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