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Polylabris bengalensis sp. nov. (Monogenea, Microcotylidae) from siganid fishes of the Visakhapatnam coast, Bay of Bengal, India

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Abstract

A new species *Polylabris bengalensis* (Monogenea, Microcotylidae) is described from the gills of the siganid fishes, *Siganus javus* and *S. oramin* from the coast of Visakhapatnam, Bay of Bengal, India. It most closely resembles *P. mamaevi* but differs in having unequal caeca terminating at different levels in the haptor, in the follicular testis forming a compact mass, in the presence of a thick layer of concentric muscles surrounding the genital atrium and in the terminal part of the male copulatory organ not recurved. The validity of various species of *Polylabris* recorded from siganids from different geographical regions is discussed.

Keywords

Monogenea, gill parasite, *Polylabris bengalensis* sp. nov., siganids, *Siganus javus*, *S. oramin*, Bay of Bengal, India

Introduction

The microcotylid genus *Polylabris* Euzet et Cauwet, 1967 (Monogenea), characterised by the presence of a sclerotised conical male copulatory organ, comprises 20 nominal species recorded from a wide range of marine fishes spread over 13 families (Hayward 1996, Yang *et al*. 2007). Three species of the genus have been recorded from siganid fishes namely *P. mamaevi* Ogawa et Egusa, 1980 from *Siganus stellatus* from the Gulf of Oman, Arabian Sea (Mamaev and Parukhin 1976) and *S. fuscescens* and *S. oramin* from the South China Sea (Yang *et al*. 2007), *P. sigani* Dillon, Hargis et Harrises, 1983 from *S. fuscescens* in Western Australia (Dillon *et al*. 1983) and from *S. rivulatus* from the Gulf of Eilat on the Red Sea (Diamant *et al*. 1999) and *P. virgatarum* (Tubangui, 1931) from *S. virgatus* from the Philippines (Tubangui 1931). Hayward (1996) in a review of *Polylabris*, considered *P. mamaevi* and *P. virgatarum* as species inquirendae, in view of the inadequate information available on their morphology, especially the details of the structure of the copulatory organ. However, Yang *et al*. (2007) redescribed *P. mamaevi* and restored its valid status.

During our studies on helminth parasites of the streaked spinefoot, *Siganus javus* (Linnaeus) and the white spotted spinefoot *S. oramin* Bl. & Schn. (= *P. canaliculatus* (Park)) collected from the Visakhapatnam coast, the Bay of Bengal, a microcotylid monogenean of the genus *Polylabris* was found to be common on the gills. Closer study indicated that the parasite was a new species and a full description is provided here. This constitutes the second species of the genus to be reported from India. The other Indian species *P. indica* Hayward, 1996 (syn. *Bivagina sillaginae* Woolcock, 1936) Yamaguti, 1963 of Gupta and Khullar (1968) was however, considered as a species inquirenda (Hayward 1996).

Materials and methods

Freshly caught samples of *Siganus javus* and *S. oramin* obtained from local fishermen along the Visakhapatnam coast were brought to the laboratory wrapped in ice bags. Altogether forty individuals of *S. javus* and seven *S. oramin* were subjected to parasitological study during August 2008, March 2009 and December 2009. The gills were excised, placed in Petri dishes containing sea water and examined for ectoparasites. The monogeneans found were collected in saline, allowed to relax, fixed in AFA solution, stained with alum carmine, cleared in creosote and mounted in Canada balsam.

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A few specimens were mounted in ammonium picrate glycerin medium of Lim (1991), for observing details of the hard parts of the haptor and organization of the terminal genitalia. Illustrations were prepared with the aid of a camera lucida. Measurements, all in micrometres, were taken from unflattened stained specimens using an ocular micrometer and are presented as the range followed by the mean in parentheses. Body length includes the haptor. Type specimens were deposited in the U.S. National Parasite Collection, Beltsville, Maryland, USA (USNPC), the helminth collections of the Natural History Museum, Cromwell Road, London (BMNH), and the Zoological Survey of India (ZSI), Calcutta, India.

Results

Microcotylidae (Taschenberg, 1879)
Prostatomicrocotylinae Yamaguti, 1968
Polylabris Euzet et Cauwet, 1967

***Polylabris bengalensis* sp. nov. (**Figs 1–4)

Type host: *Siganus javus* (Linnaeus) (streaked spinefoot); other host: *S. oramin* Bl. et Schn. (white spotted spinefoot) (Siganidae).

Type locality: Visakhapatnam coast, Bay of Bengal.

Site of infection: gills.

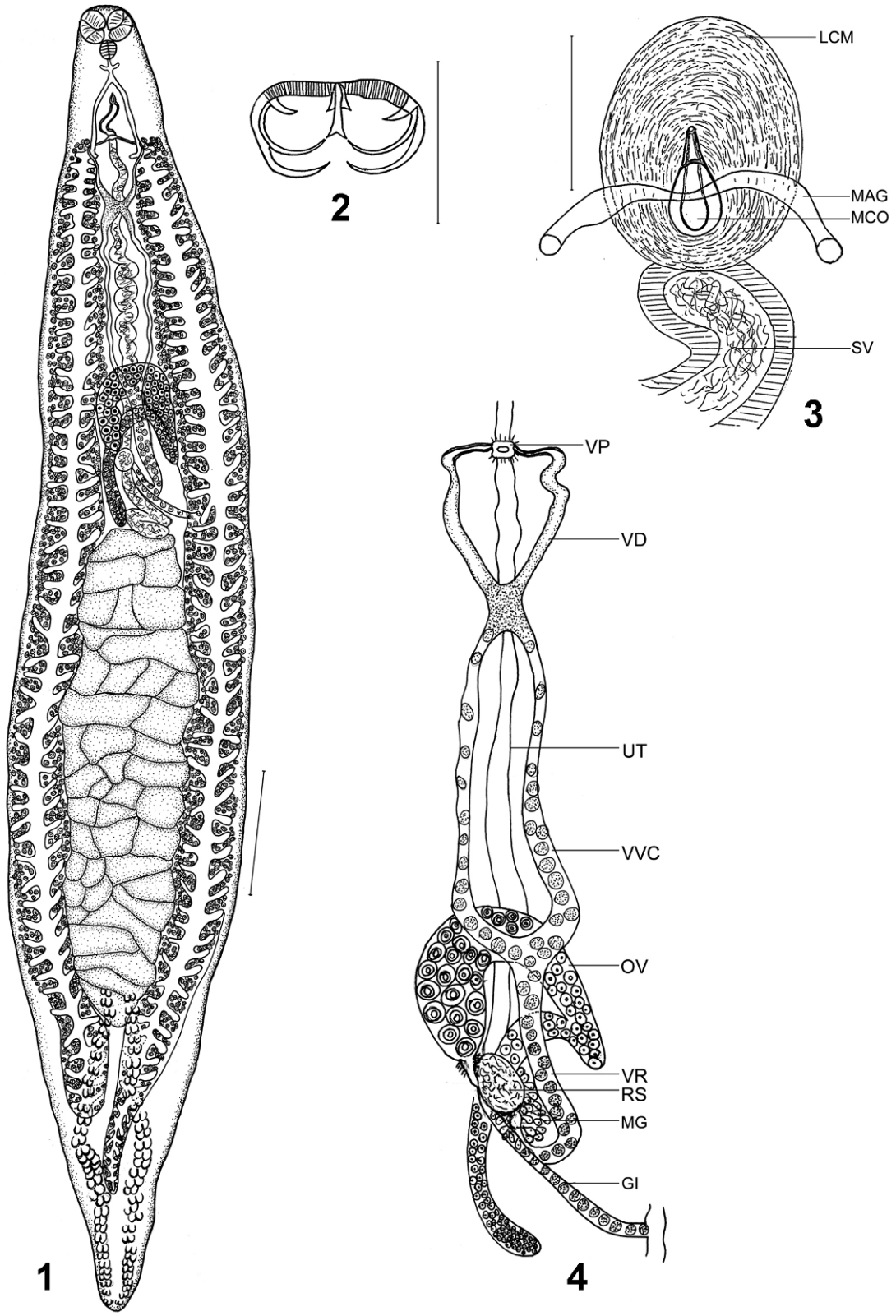
Infection details: Of the 40 *S. javus* examined, 20 were infected with *P. bengalensis* sp. nov. and a total of 356 flukes were obtained, the prevalence and mean intensity are 50% and 17.8, respectively. An additional 8 flukes were obtained from 4 out of seven *S. oramin* examined. The prevalence and mean intensity in this host are respectively 57.1 and 2.0. The collection comprised individuals in different stages of maturity, the majority being large and gravid.

Holotype NHMUK 2011.6.241 in BMNH; paratypes 6 nos. in BMNH 2011-2.3.1-2; 6 in USNPC 10421; 6 in ZSI W9264/1, W9265/1 and 6 in Zoology Department, Andhra University.

Description (based on 25 whole mounts and measurements of 16) (Figs 1–4). Body lanceolate, total length 2544–4480 (3780), maximum width 368–768 (618) at level of ovary. Haptor triangular, 608–1088 (848) in length, not well demarcated from body, extends anteriorly to level of posterior margin of testes, armed with 32–39 (34) pairs of clamps arranged symmetrically in two parallel rows. Clamps of typical microcotylid type, bilaterally symmetrical, dissimilar in size, largest at middle of haptor, 40–44 × 76–82, smallest at posterior end, 16–28 by 20–44, and medium sized at anterior end 28–36 by 52–64. Paired buccal suckers elliptical, septate, 48–66 (57) by 56–72 (66), prepharynx short, pharynx spherical, 40–68 (46) in diameter, oesophagus short, with lateral diverticula in anterior part. Intestinal bifurcation in front of copulatory organ. Intestinal caeca broad with lateral and median diverticula, extend into haptor, unequal in length, left one longer, terminates in posterior third and right one slightly shorter, terminates in middle third of haptor; terminal part of caeca usually distended.

Common genital pore midventral, at base of caecal bifurcation, at a distance of 144–272 (230) from anterior end of body. Genital atrium unarmed surrounded by a thick layer of concentric muscles. Testes follicular, follicles numerous, compactly arranged in intercaecal region of middle third of body; entire testicular zone measuring 832–1792 (1401) long, with anterior testis follicle at a distance of 1040–1872 (1486) from anterior end. Vasa efferentia not observed; vas deferens a wide sinuous tube extending anteriorly along intercaecal field from testes almost to male copulatory organ (MCO); continues as thick-walled sigmoid seminal vesicle lying immediately posterior to copulatory organ and opening into MCO as short thick-walled ejaculatory duct. MCO pyriform, broad posteriorly, narrow anteriorly, tapers distally but tip not dorsally recurved, 44–60 (54) long 24–32 (29) wide, consists of inner tube and outer sheath. Inner tube cylindrical with sclerotized walls, somewhat distended basally, not reaching base of outer sheath. Outer sheath fibrous, with sclerotized ventral wall and thin dorsal wall, extending anteriorly to tip of inner tube. Paired lateral ducts of male accessory glands narrow, constricted distally, with proximal bulbous expansion; two ducts unite to form common male accessory gland duct opening into MCO through small pore on dorsal side of outer sheath, some distance from base.

Ovary in form of question-mark, pretesticular, at a distance of 960–1440 (1144) from anterior end, proximal part in front of testes, narrow, filled with small germinal cells, extends anteriorly as narrow tube, loops to right to continue as wide distal part, consisting of large primary oocytes. Oviduct short, originates from distal part, receives genito-intestinal canal, a narrow thick-walled tube filled with vitelline cells and occasionally ova, opening usually into left caecum and rarely into right caecum. Seminal receptacle small, spherical, attached to basal part of oviduct. Mehlis' gland at base of ovary comprises few cells scattered around ootype. Uterus straight, thin-walled, extends anteriorly along midline, lies dorsal to seminal vesicle, opens into genital atrium. Vitelline reservoir prominent, elliptical, lies adjacent to ovary, joins oviduct through common vitelline duct. Ovo-vitelline duct leads to ootype. Two broad vitello-vaginal ducts extend anteriorly, overlying caecal branches, join a little posterior to vaginal pore to form a prominent X-shaped deeply staining structure filled with sperm or vitelline cells. Two vaginal ducts diverge from X-shaped structure, turn around respective caeca, continue as narrow thick-walled transverse ducts, opening through common vaginal pore situated midventrally a little posterior to genital pore. Vitelline follicles in lateral fields of body, commence a little anterior to vaginal pore, extend along the length of caeca, and terminate in haptor at different levels along with caeca. Only three out of several individuals examined contained egg, one each in the uterus. Egg oval, 180–192 by 96–100 in size, with long polar filaments, filament at one end extremely long, coiled.



Figs 1–4. *Polylabris bengalensis* sp. nov. **1.** Holotype ventral view. **2**. Clamp. **3.** Male copulatory organ of paratype, ventral view. **4.** Diagram of female genitalia. Scale bar = 400 µm (Fig. 1), 100 µm (Figs 2, 3). GI, genito-intestinal canal; LCM, layer of concentric muscles; MAG, male accessory gland; MCO, male copulatory organ; MG, Mehlis' gland; OV, ovary; RS, receptaculum seminis; SV, seminal vesicle; UT, uterus; VD, vaginal duct; VP, vaginal pore; VR, vitelline reservoir; VVC, vitello-vaginal canal

Discussion

Of the three species of *Polylabris* reported from siganid fishes, a detailed description is available only for *P. mamaevi* (see Mamaev and Parukhin 1976, Yang *et al.* 2007). The descriptions given for *P. sigani* and *P. virgatarum* are inadequate, in particular lacking details of the morphology of the MCO. *P. bengalensis* sp. nov. appears similar to *P. mamaevi* in most respects, including the structure of the MCO, but differs in the following: the testis in *P. bengalensis* sp. nov. is follicular, the follicles being compactly arranged and occupying a major part of the mid body. In *P. mamaevi* the testes are transversely oval and arranged linearly, forming a row occupying a smaller area; in *P. bengalensis* sp. nov. the caeca terminate at different levels in the haptor, the left caecum being longer than the right one, there is a thick layer of concentric muscles surrounding the genital atrium and the tip of the MCO is straight, not recurved. Slight differences also occur in the size of the haptor relative to body length, number of clamps, size of copulatory organ and egg size (Table I).

Hayward (1996) reviewed the genus *Polylabris* and provided a key for the separation of 17 species of the genus recognized by him as valid. For the differentiation of the various species Hayward emphasized the structure of the MCO and the number of vaginae, i.e. whether uni- or bi-vaginate. He considered characters such as number of testes and number of clamp pairs as of secondary importance to distinguish species and further expressed the view that dimensions of the body and soft organs and the presence of concentric rings of muscles around the genital atrium are not reliable characters for distinguishing species. Yang *et al*. (2007) on the other hand, suggested that all the characters including those of the male copulatory organ, clamps, testes and other organs should be taken into account for differentiation of species in this genus. Our observations on large numbers of specimens of the new species revealed no major intraspecific variations except for the course of the genitointestinal canal which opened into either the left or the right caecum. These observations clearly indicate that major differences in any one of the following characters should be given importance while erecting new taxa in this genus: number of clamps, number of testes, extent of caeca, egg size, structure of copulatory organ, number of vaginae and morphometrics. As regards the concentric zone of muscles around the genital atrium, we feel that this character provides additional support for differentiation of species.

Polylabris sigani based on a single specimen collected from *S. fuscescens* from Western Australia was initially regarded as bi-vaginate but Yang *et al*. (2007) upon reexamination of the type material, found it to be uni-vaginate. *P. bengalensis* sp. nov. differs from *P. sigani* in the number of testes (5 in *P. sigani*), number of clamp pairs (30 in *P. sigani*) and the structure of the MCO. Comparison with *P. virgatarum* recorded from *S. virgata* off the coast of Philippines is not attempted here because of the lack of sufficient data on its morphology. Table I compares the morphometrics of the 4 species of *Polylabris* reported from siganid fishes. The validity of these four species of *Polylabris* requires careful assessment. It has been suggested that *P. sigani* and *P. mamaevi* might be synonymous with *P. virgatarum* (see Hayward 1996). Pending detailed information on the morphology of the species, we support the view of Hayward and consider *P. virgatarum* as a species inquirenda.

Polylabris spp. recorded from marine fishes other than siganids appear very different from *P. bengalensis* sp. nov. The key given by Hayward (1996) for separation of these species is based on minute details of the structure of the MCO and is difficult to adopt. However, a comparison revealed *P. bengalensis* sp. nov. to be close to *P. angifer* Hussey, 1986 reported from *Acanthopagrus latus* from Kuwait and *P. rhabdosargi* Hayward, 1996 from *Rhabdosargus sarba* from Western Australia. *P. bengalensis* differs from these two species in the size of the haptor, number of clamp pairs, number of testes and copulatory organ morphology. Overall the diagnostic features of *P. bengalensis* are: the fairly large body with haptor bearing 32–39 pairs of clamps, caeca unequal in size termi-

Table I. Comparative measurements in micrometres of *Polylabris* spp. reported from siganid fishes from different geographic regions

Character	***P. sigani***	***P. virgatarum***	***P. mamaevi***	***P. mamaevi***	***P. bengalensis* sp. nov.**
Host	*Siganus fuscescens*	*S. virgata*	*S. stellatus*	*S. fuscescens* *S. oramin*	*S. javus* *S. oramin*
Locality	W. Australia	Philippines	Gulf of Oman	South China Sea	Bay of Bengal
Author	Dillon *et al*. (1983)	Tubangui (1931)	Mamaev and Parukhin (1976)	Yang *et al*. (2007)	present study
Body length	3150	1600–1900	2280–3840	1837–4122	2544–4480
Body width	620	300–350	380–660	359–595	368–768
Haptor length	800	700	680–1780	359–595	608–1088
Clamp pairs	30	48–50	25–44	27–47	32–39
Clamp size (maximum)	54	45 × 30	57–61	51–68	40–48 × 68–82
Buccal organs	61 × 54	55 × 40	50–61 × 40–48	49–74 × 49–72	48–66 × 56–72
Pharynx	46	27	40–48	32–51	32–52
No. of testes	5	18–20	18–24	9–14	numerous follicular
Copulatory organ	44 × 27	43 × 21	45–53 × 25	46–60 × 27–37	48–64 × 24–32
Egg	190 × 67		200 × 60	194–218 × 55–76	136–204 × 72–82

Table II. List of siganid fishes that serve as hosts for *Polylabris* spp. in different geographic localities

Siganid fish host	*Polylabris* spp.	Geographic locality	Author
S. virgatus	*P. virgatarum*	Philippines	Tubangui (1931)
S. oramin	*P. sigani*	W. Australia	Dillon *et al*. (1983)
S. oramin	*P. bengalensis*	Bay of Bengal	present study
S. stellatus	*P. mamaevi*	Gulf of Oman	Mamaev and Parukhin (1976)
S. fuscescens	*P. mamaevi*	South China Sea	Yang *et al*. (2007)
S. rivulatus	*P. mamaevi*	Mediterranean Sea	Pasternak *et al*. (2007)
S. rivulatus	*P. sigani*	Gulf of Eilat, Red Sea	Diamant *et al*. (1999)
S. javus	*P. bengalensis*	Bay of Bengal	present study
S. sutor	*P. mamaevi*	Kenya coast	Martens and Moens (1995) Geets *et al*. (1997)
S. spinus	*P. mamaevi (= M. mouvei)*	Guam	Tsuda *et al*. (1976)
S. luridus	*P. mamaevi*	Red Sea	Paperna *et al*. (1984)
S. argenteus	*P. mamaevi*	Red Sea	Diamant (unpublished)

nating at different levels in the haptor, follicular testis compactly arranged in the middle third of the body, presence of a thick layer of concentric muscles around the genital atrium, moderately sclerotized male copulatory organ with distal end pointed but not recurved, ducts of the male accessory glands narrow, constricted distally, opening into the MCO some distance from its base.

A detailed study of the morphology and relationships of *Polylabris* spp. infecting different species of *Siganus* from various geographic areas may provide much needed information about host/parasite co-evolution. At present 27 species are known in the genus *Siganus*. They occur in shallow waters in the Indo-Pacific and Eastern Mediterranean. *Polylabris* spp. have so far been reported from *S. fuscescens*, *S. stellatus*, *S. oramin*, *S. javus*, *S. virgata* and *S. rivulatus* (Table II). It is also suggested that *Microcotyle mouvoi* reported from *S. scutor* off the coast of Kenya by Martens and Moens (1995) and Geets *et al.* (1997) and from *S. spinus* off Guam by Tsuda *et al*. (1976) might be synonymous with *P. mamaevi* (Yang *et al*. 2007). Two more potential hosts *S. argenteus* and *S. luridus* were also suggested (Pasternak *et al*. 2007). The need for molecular data on different species for determining the evolutionary history of the group has also been indicated (Yang *et al*. 2007). Evidently *Polylabris* spp. with their siganid hosts constitutes an interesting host-parasite model for further study.

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