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ON THREE DIGENEAN TREMATODES (FAMILY BUCEPHALIDAE) FROM MARINE TELEOST FISHES WITH NEW RECORD FROM THE RED SEA

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ABSTRACT

Three bucephalid species (Trematoda: Digenea: Bucephalidae) belonging to different genera were recorded and redescribed for the first time from the Red Sea fishes. These worms include: *Prosorhynchoides arcuatus* (Linton, 1900) Bray, 1984 from the pyloric caeca and intestine of *Variola louti*, *Myorhynchus pritchardae* Durio and Manter, 1968 from the intestine of *Epinephelus malabaricus*, and *Bucephalopsis strogylurae* (Hopkins, 1954) Yamaguti, 1958 from the intestine of *Hyporhamphus gambarur*. In starved fishes (Kept alive in the aqurium), individuals of *P. arcuatus* were only found in the pyloric caeca, but in freshly caught fishes, they were found aggregated in the anterior intestine. This backward migration of the worms was briefly discussed. The thorough redescription of *M. pritchardae* (the type and the only species in the genus) revealed that *Myorhynchus* is actually a synonym of the genus *Prosorhynchus* Odhner, 1905. Therefore, *M. pritchardae* was renamed as *P. pritchardae* (Durio and Manter, 1968) as a new combination. Also, the broadened redescription of *B. strogylurae* revealed that *B. hemirhamphi* Fischthal and Nasir, 1974 is actually a synonym of this species.

INTRODUCTION

Bucephalidae Poche, 1907 is a large family of digenean trematodes, parasitizing marine and freshwater fishes. In this family, the trematode has no suckers, but provided with a muscular attachment organ at its anterior end termed as "rhynchus". The characteristics of this organ are of great taxonomic importance in separating some bucephalid genera from each other. To date, about 25

genera are known in the family Bucephalide, but the validity of many genera remains equivocal, since data for the precise systematic determination of these genera is still inadequate (Stunkard, 1974; Smyth, 1994; Shalaby and Hassanine, 1996). Also, the taxonomic position of many bucephalid species is in a state of considerable uncertainty.

So far, no papers other than those of Nagaty (1937), Parukhin (1976), Shalaby and Hassanine (1996), and Hassanine (2001) are published to describe or identify the bucephalid trematodes of the Red Sea fishes. In the present study, three bucephalid species belonging to different genera were recorded and redesdcribed for the first time from the Red Sea fishes. However, a special comment on each species is given.

MATERIAL AND METHODS

In November 2001, a random sample of fish including *Variola louti* (local name= Sherifa), *Epinephelus fasciatus* (local name= Twina), *Hyporhamphus gambarur* (local name= Kerman) was collected from the coasts of Sharm El-Sheikh, Northern Red Sea, Egypt (Fig.1). The first two species belong to the family Serranidae, and the third to the family Belonidae. Some fish individuals were immediately dissected, while the others were kept alive in a small aquarium for 2-3 days. Standard parasitological techniques were used to examine the alimentary canal of fish. Digenean trematodes were removed from their host fishes under a dissecting microscope, kept alive in sea water diluted to 1% salinity as recommended by Schroeder (1971), and observed under a research compound microscope. Intensity of infection was measured as the number of worms recovered per infected fish (mean/host). The worms were fixed in alcohol-formalin-acetic (AFA) under slight coverslip pressure, and preserved in 70% ethyl alcohol. Whole mounts were stained by alum carmine, cleared in terpineol, and mounted in Canada balsam. Figures were drawn with the aid of a camera lucida. Mounted specimens were deposited in the Helminthological Collection of the Red Sea Fishes, Marine Science Department, Faculty of Science, Suez Canal University, Ismailia, Egypt.

RESULTS AND DISCUSSION

Three bucephalid species belonging to different genera were collected from the examined fishes:

1- Genus: *Prosorhynchoides* Dollfus, 1929

***P. arcuatus* (Linton, 1900) Bray, 1984**

Fig. (2)

Host: *Variola louti* (no. infected/no. examined= 17/40).

Site of infection: pyloric caeca and intestine.

Intensity of infection: 532 worms/host.

Description (based on 50 mounted specimens):

The body is elongate, cylindroid, spined, usually arcuate, and measures 1.73-2.88 mm long by 0.19-0.30 mm wide. The rhynchus (attachment organ) is round, sucker-like, without tentacular appendages, and measures 0.10- 0.15 mm in diameter. The ventral mouth is situated at the middle of the second fourth of the body, and directly surrounded by a globular pharynx, measuring 0.06-0.10 mm long by 0.05-0.08 mm wide. The pharynx opens directly into a muscular sac-like intestine directed backwards. The two testes are round in shape, slightly separated, oblique or tandem, and situated anteriorly in the second half of the body; anterior testis measures 0.12-0.16 mm in diameter, while the posterior one measures 0.11-0.18 mm in diameter. The cirrus pouch is cylindroid, directed bacwards, extending in the posterior fourth of the body, and measures 0.41-0.60 mm long by 0.07-0.11 mm wide. It contains a slightly saccular seminal vesicle, a long tubular pars prostatica surrounded by few prostatic cells, and a short ejaculatory duct. This duct opens into a saccular genital sinus opening to the outside through the genital pore, which lies ventrally near the posterior end of the worm. The ovary is round, situated between the intestine and the anterior testis, and measures 0.09-0.14 mm in diameter. Mehlis' gland is present and well developed. The uterus is highly convoluted between the testes and cirrus pouch, then extends towards the posterior end to open into the genital sinus. The vitelline follicles are small, pre-ovarian, and arranged in two lateral rows extending in the second fourth of the body. The eggs are numerous, ovoid, yellowish, and each measures 17-21 µm long by 10-14 µm wide. The excretory vesicle is tubular and extending anteriorly to near the rhynchus; the excretory pore is postero-terminal.

Prosorhynchoides arcuatus was first described as *Gasterostomum arcuatus* by Linton (1900), who collected it from the fish *Sarda sarda* at Woods Hole. Eckmann (1932) transferred this species to the genus *Bucephalopsis* (Diesing, 1855) Nicoll, 1914 as *B. arcuatus* (Linton, 1900) Eckmann, 1932. Yamaguti (1958) considered the two genera *Prosorhynchoides* Dollfus, 1929 and *Bucephaloides* Hopkins, 1954 as synonyms of *Bucephalopsis* (Diesing, 1855) Nicoll, 1914. Velasquez (1959) seemed unaware of the study of Yamaguti (1958), and transferred *B. arcuatus* (Linton, 1900) Eckmann, 1932 to the genus *Bucephaloides* Hopkins, 1954 to become *B. arcuatus* (Linton, 1900) Velasquez, 1959 as a new combination. For the second time, Yamaguti (1971) synonymized the two genera *Prosorhynchoides* and *Bucephaloides* with *Bucephalopsis* (Diesing, 1855) Nicoll, 1914. But Srivastava and Chauhan (1973) resurrected *Prosorhynchoides* Dollfus, 1929 as a valid genus, and suggested a number of new combinations. These arguments were accepted by Margolis and Arthur (1979). Also, Bray (1984) concurred with Srivastava and Chauhan's (1973) arguments, and transferred *Bucephalopsis arcuatus* (Linton, 1900) Eckmann, 1932 to the genus *Prosorhynchoides* Dollfus, 1929 to become *P. arcuatus* (Linton, 1900) Bray, 1984 as a new combination. This species was recorded in different localities; in the Gulf of Mixco by Nahhas and Short (1965), in Florida by Anderson (1970), in South Africa by Bray (1984), and in Rio de Janeiro, Brazil by Cohen *et al.* (1996). In the present study, *P. arcuatus* (Linton, 1900) Bray, 1984 was recorded and redescribed for the first time from the Red Sea. However, the fish *Variola louti* represents a new host record for this species.

In starved fishes (Kept alive in the aqurium for 2-3 days), individuals of *P. arcuatus* were only found or segregated in the pyloric caeca, but in freshly caught fishes that feed quietly in the field, they were found aggregated in the anterior intestine. Thus, the backward migration of the worms (short-term migration) was associated with the movement of food in the gut. In an experimental study on a similar case, MacKenzie and Gibson (1970) observed that in the starved flounder *Platichthys flesus*, individuals of the digenean trematode *Podocotyle* sp. were predominately found in the rectum, but when starved flounders were force-fed, the trematodes migrated into the anterior intestine. However, they prevented this migration by cutting the bile ducts, suggesting that the trematodes were attracted to bile. The physiological reasons behind this migration would be very interesting. Accordingly, the present author suggests that the site

selection by an intestinal trematode is a continuing process, through which the trematode selecting optimum sites along one of the environmental gradients in the intestine.

2- Genus: *Prosorhynchus* Odhner, 1905
New synonym: *Myorhynchus* Durio & Manter, 1968
***P. pritchardae* (Durio & Manter, 1968) new combination**
Fig. (3)
Host: *Epinephelus malabaricus* (no. infected/no. examined= 7/24).
Site of infection: intestine.
Intensity of infection: 11 worms/host.
Description (based on 35 mounted specimens):

The body is elongate, fusiform, slightly dorso-ventrally flattened, spined, and measures 1.20-2.20 mm long by 0.42-0.70 mm wide at its middle. The rhynchus is conical in shape, strongly muscular, provided with two ventral flaps, and measures 0.30-0.45 mm in length. The mouth is midventral immediately pre-equatorial, and directly surrounded by a globular pharynx, measuring 0.05-0.08 mm in diameter. The oesophagus is narrow, relatively short, 0.06-0.11 mm long, and leads into a saccular intestine directed forwards. The two testes are round in shape, symmetrical in position (one on each side of the pharynx), nearly equal in size, and measure 0.12-0.18 mm in diameter; while in contracted specimens, the testes are arranged diagonally. The cirrus pouch is long, cylindroid, directed backwards, extending sinistrally in the posterior half of the body, and measures 0.53-0.80 mm long by 0.12-0.20 mm wide. It contains a highly coiled saccular seminal vesicle, a long pars prostatica surrounded by numerous prostatic cells, and a short ejaculatory duct. This duct projects into a tubular genital sinus opening to the outside through the genital pore, which lies ventrally near the posterior end of the worm. The ovary is round in shape, situated medially at a very short distance in front of the testis, and measures 0.07-0.11 mm in diameter. The uterine loops are long and highly coiled in the posterior half of the body; the terminal uterine loop leads into the genital sinus. The vitelline follicles are arranged in two lateral short series, one on each side of the ovary. In contracted specimens, the ovary was pushed anteriorly by the uterine loops to lie anterior to the vitelline follicles. The eggs are numerous, yellowish, provided with smooth shells, and each measures 28-35 µm long by 22-25 µm wide. In some contracted specimens, the shell of most eggs were shrunken to form a number of

pointed projections. The excretory vesicle is saccular and overlapping the distal portion of the cirrus pouch anteriorly; the excretory pore is postero-terminal.

Based on a single mounted specimen, Durio and Manter (1968) described *Myorhynchus pritchardae* as a new bucephalid genus and species from the intestine of a serranid fish at New Caledonia. They stated that *Myorhynchus* is closely similar to the genus *Prosorhynchus* Odhner, 1905; but in the former, the rhynchal muscles have a unique arrangement, the ovary is situated anterior to the vitelline follicles, and the egg shell is spined. To date, no descriptive information other than Durio and Manter's (1968) original data is available for this genus, where *Myorhynchus pritchardae* Durio and Manter, 1968 is the type and the only species. It is well known that the rhynchus is a muscular organ, and its shape and tentacular appendages (if present) are usually used as taxonomic characters in separating some bucephalid genera from each other. Based on a single mounted specimen (flattened), and without histological examination, Durio and Manter (1968) briefly described the arrangement of the rhynchal muscles in *Myorhynchus pritchardae*, and considered this arrangement as a taxonomic difference of generic value. In fact, the arrangement of the rhynchal muscles was not mentioned or described in all other genera of the family Bucephalidae. Therefore, the characteristics of these muscles in *Myorhynchus* cannot be compared with those of any other genus in the family. Accordingly, such characteristic cannot be used as a taxonomic difference to distinguish *Myorhynchus* from other genera in family Bucephalidae. The above redescription of *Myorhynchus pritchardae* is broadened, since it is based on 24 perfectly relaxed specimens and 11 contracted specimens. In relaxed specimens (Fig. 3, A), the ovary is immediately pre-testicular, and the egg shell is quiet smooth. Such characteristics may be greatly affected by the contraction of the worm (Fig. 3, B), where the ovary was pushed anteriorly by the uterine loops to lie anterior to the vitelline follicles. However, the shell of most eggs was shrunken to form a number of pointed projections. These projections were wrongly described as spines by Durio and Manter (1968), but their illustration [Fig. 6, page 144] clearly shows that these projections were not spines. Following this analysis, it is obvious that the single specimen used in the original description of *Myorhynchus pritchardae* was a contracted specimen. Accordingly, all the characteristics used by Durio and Manter (1968) to establish the genus *Myorhynchus* or to differentiate

it from the genus *Prosorhynchus* Odhner, 1905 were invalid generic differences. In view of the above information, it is concluded that *Myorhynchus* is actually a synonym of the genus *Prosorhynchus* Odhner, 1905. Thus, *Myorhynchus pritchardae* Durio and Manter, 1968 should be renamed as *Prosorhynchus pritchardae* (Durio & Manter, 1968) as a new combination. To avoid any further confusion, it is suggested that a large number of perfectly prepared specimens should be examined before describing or establishing new taxa.

3- Genus: *Bucephalopsis* (Diesing, 1855) Nicoll, 1914

***B. strogylurae* (Hopkins, 1954) Yamaguti, 1958**

New synonym: *B. hemirhamphi* Fischthal & Nasir, 1974

Fig. (4)

Host: *Hyporhamphus gambarur* (no. infected/no. examined=8/23).

Site of infection: intestine.

Intensity of infection: 15 worms/host.

Description (based on 32 mounted specimen):

The body is elongate, fusiform, spined, and measures 1.70-2.66 mm long by 0.49-0.73 mm wide at its middle. The rhynchus is sub-terminal, well developed, sucker-like, round in shape, and measures 0.25- 0.37 mm in diameter. At a short distance behind the rhynchus, there is a conspicuous bunch of gland cells on each side. The ventral mouth is situated anteriorly in the middle third of the body, and directly surrounded by a globular pharynx measuring 0.09-0.14 mm in diameter. The pharynx opens directly into a muscular sac-like intestine directed forwards. The two testes are oval in shape, tandem, contiguous, and situated dextrally in the middle third of the body. The anterior testis measures 0.19-0.26 mm in transverse diameter, while the posterior one measures 0.21-0.29 mm in transverse diameter. The cirrus pouch is relatively long, cylindroid, directed backwards, extending sinistrally in the posterior third of the body, and measures 0.38-0.57 mm long by 0.10-0.17 mm wide. It contains a round seminal vesicle, a long pars prostatica surrounded by numerous prostatic cells, and a short ejaculatory duct. This duct opens into a saccular genital sinus opening to the outside through the genital pore, which lies ventrally near the posterior end of the worm. The ovary is oval in shape, immediatly situated anterior to the testes, and measures 0.11-0.18 mm in diameter. Mehlis' gland is present and well developed. The uterine loops are long, ascending anteriorly to near the rhynchus, then descending to occupy most of the available space between the pharynx and the cirrus pouch, then coiled dextral to the

cirrus pouch to open into the genital sinus. The vitelline follicles are arranged in two lateral symmetrical bunches, one on each side of the intestine. The eggs are numerous, ovoid, yellowish, and each measures 21-25 µm long by 12-16 µm wide. The excretory vesicle is saccular and extending anteriorly to the level of the anterior testis; the excretory pore is postero-terminal.

Hopkins (1954) proposed *Bucephaloides* to replace the generic name *Bucephalopsis* (Diesing, 1855) Nicoll, 1914. However, he described *Bucephaloides strogylurae* as a new bucephalid species from the intestine of *Strongylura marina* (a fish in Port Aransas, Texas). Yamaguti (1958) synonymized *Bucephaloides* with *Bucephalopsis*, considering the second as the valid generic name. Accordingly, *Bucephaloides strogylurae* Hopkins, 1954 was renamed as *Bucephalopsis strogylurae* (Hopkins, 1954) Yamaguti, 1958. For the second time, Yamaguti (1971) confirmed that *Bucephaloides* was a synonym of *Bucephalopsis*. To date, more than 60 species have been described under the genus *Bucephalopsis*. Of these species, some are well-established, others are poorly described, and some are still known by their original descriptions, while some are only described from cercariae or metacercariae (but the adult forms are still unknown), and some are closely similar and hardly distinguished from each other by minor differences. Therefore, the validity of many species has long been in dispute. So far, *Bucephalopsis strogylurae* (Hopkins, 1954) Yamaguti, 1958 is only known by its original description, where most of the body measurements are lacking. In the present study, this species was redescribed for the first time from *Hyporhamphus gambarur* inhabiting the Red Sea. However, the given redescription is broadened to include all the body measurements that are usually used in the identification of digenean trematodes. Based on a single specimen, Fischthal and Nasir (1974) described *Bucephalopsis hemirhamphi* as a new species from the intestine of *Hemirhamphus brasiliensis* (a fish in Venezuela). They stated that *B. hemirhamphi* is closely similar to *B. strogylurae* (Hopkins, 1954) Yamaguti, 1958; but in the former, the body size is smaller, the cirrus pouch extends forwards to the level of the anterior testis, the excretory vesicle extends anteriorly to the pharyngeal level, and the vitelline follicles are situated at the pharyngeal level. According to the taxonomic rules, such characteristics are minor and may occur in contracted worms or during fixation and further preparation of the specimens for study. However, *B. hemirhamphi* was described from a single specimen, and the illustration (Fig. 3, page 74 of Fischthal and

Nasir (1974)] clearly shows that the specimen was a small, highly contracted, and in a bad condition. Therefore, all the characteristics used by Fischthal and Nasir (1974) to establish *B. hemirhamphi* or to distinguish it from *B. strogylurae* were invalid specific differences. Accordingly, it is concluded that *B. hemirhamphi* Fischthal and Nasir, 1974 is actually a synonym of *B. strogylurae* (Hopkins, 1954) Yamaguti, 1958.

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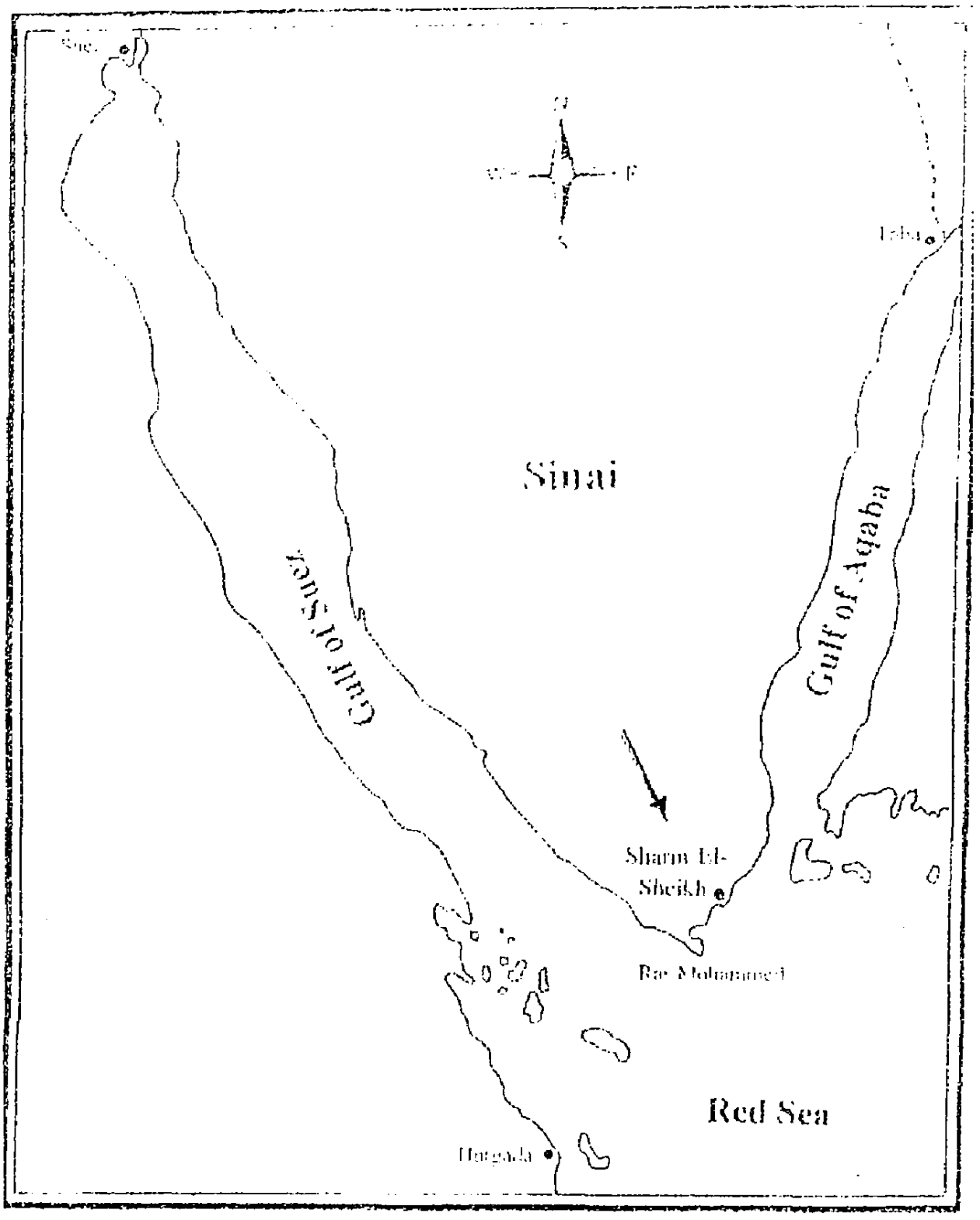

Fig. (1) : A map showing the locality of the examined fishes .

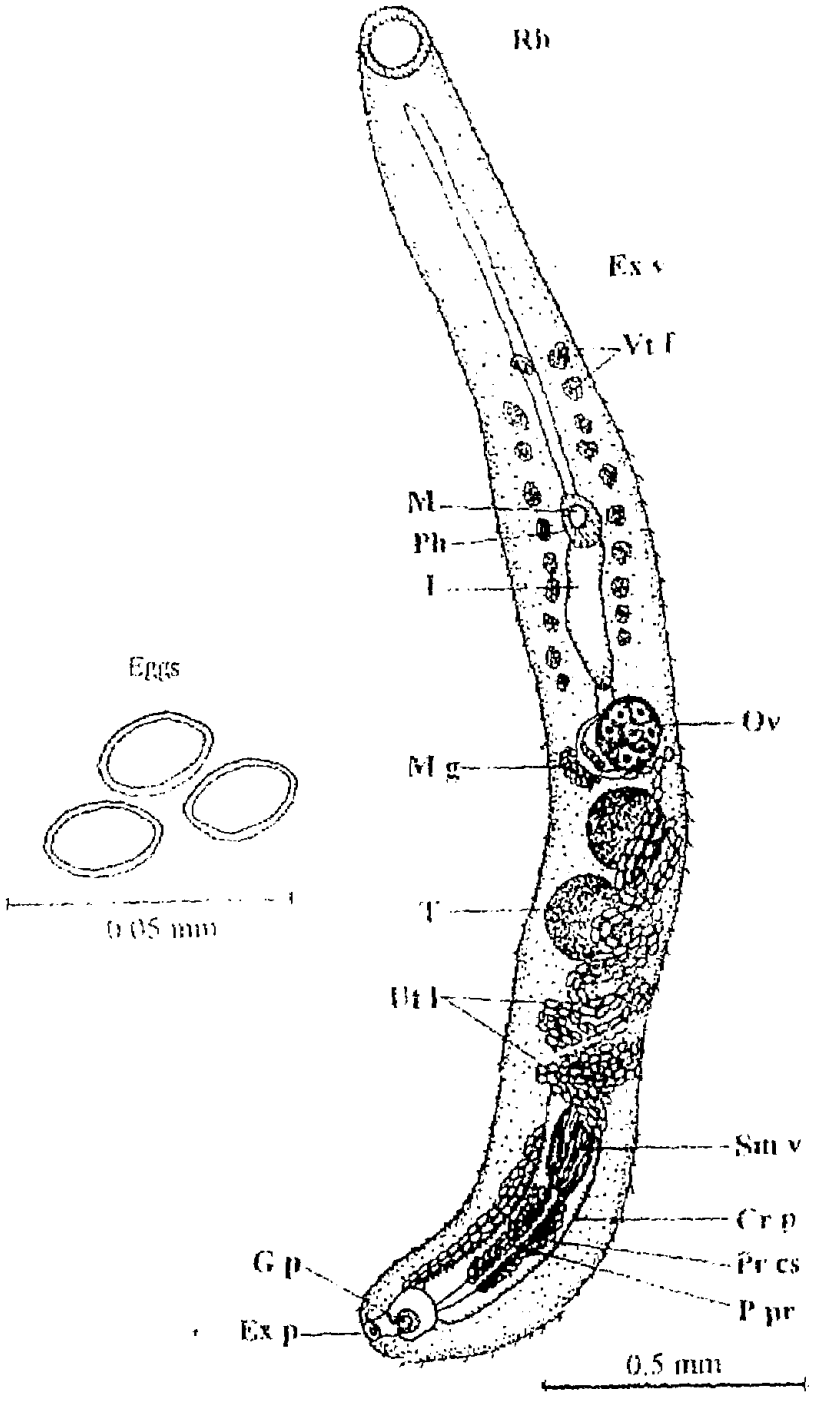

Fig.(2): *Prosorhynchoides arcuatus* (Linton, 1900) Bray, 1984. Cr p=Cirrus pouch, Ex p=Excretory pore, Ex v=Excretory vesicle, G p= Genital pore, I= Intestine, M= Mouth, M g= Mehlis' gland, Ov= Ovary, P pr= Pars prostatica, Ph= Pharynx, Pr cs= Prostatic cells, Rh= Rhynchus, Sm v= Seminal vesicle, T= Testis, Ut l= Uterine loops, Vt f= Vitelline follicles.

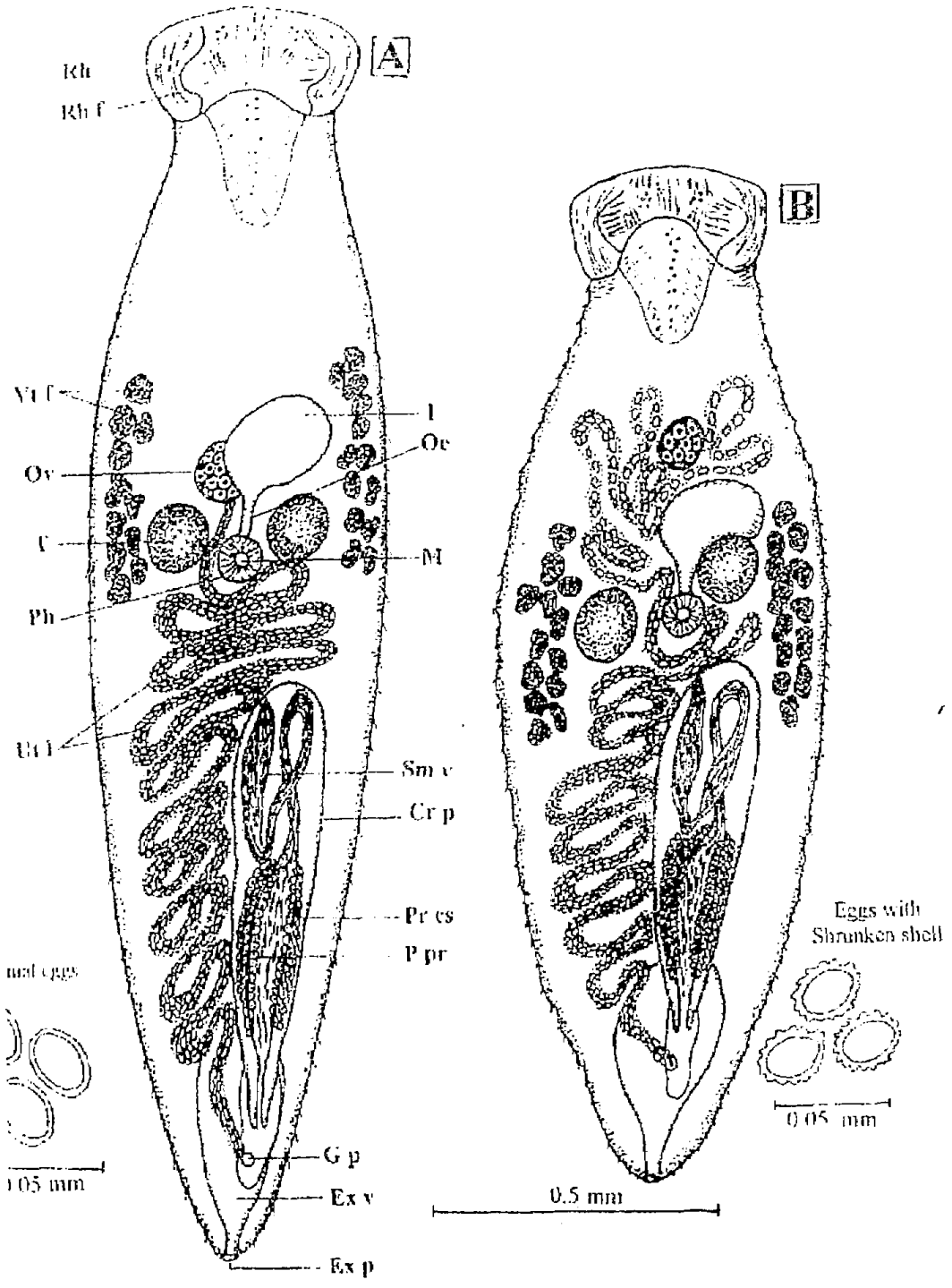

Fig.(3): *Myorhynchus pritchardae* **Durio & Manter, 1968.**
A) Perfectly relaxed specimen. B) Contracted specimen.
Cr p=Cirrus pouch, Ex p=Excretory pore, Ex v=Excretory vesicle, G p= Genital pore, I= Intestine, M= Mouth,Oe= Oesophagus, Ov= Ovary, P pr= Pars prostatica, Ph= Pharynx, Pr cs= Prostatic cells, Rh= Rhynchus, Rh f= Rhynchal flap, Sm v= Seminal vesicle, T= Testis, Ut l= Uterine loops, Vt f= Vitelline follicles.

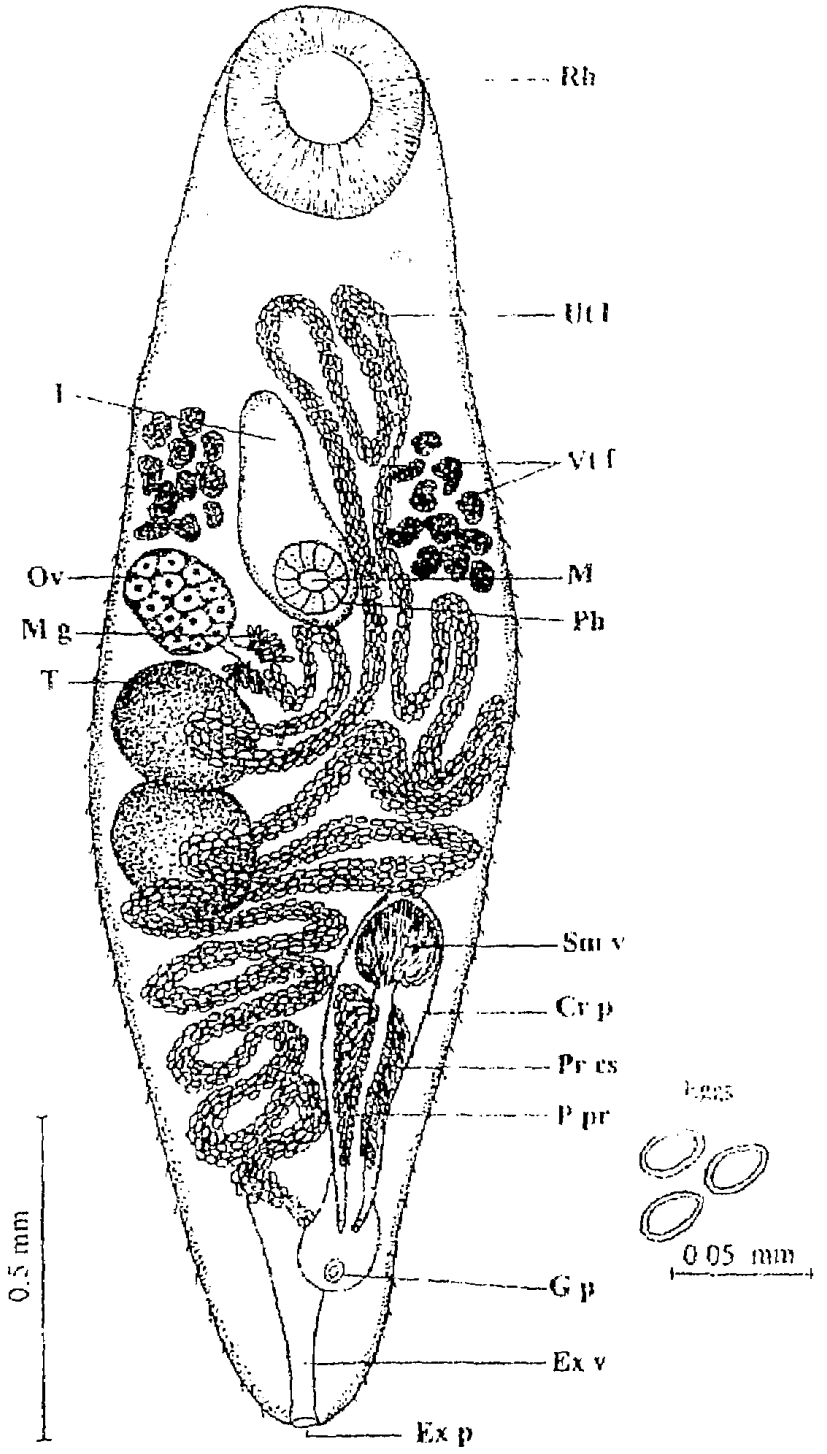

Fig.(4): *Bucephalopsis strongylurae* (Hopkins, 1954) Yamaguti, 1958. Cr p=Cirrus pouch, Ex p=Excretory pore, Ex v=Excretory vesicle, G p= Genital pore, I= Intestine, M= Mouth, M g= Mehlis' gland, Ov= Ovary, P pr= Pars prostatica, Ph= Pharynx, Pr cs= Prostatic cells, Rh= Rhynchus, Sm v= Seminal vesicle, T= Testis, Ut l= Uterine loops, Vt f= Vitelline follicles.