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SUNDANONCHUS G. N. (MONOGENEA, TETRAONCHOIDIDAE) FROM TWO MALAYSIAN FRESHWATER FISHES[1]

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Abstract. Three species of *Sundanonchus* g. n. (Tetraonchoididae) were obtained from two freshwater fish species. They are *Sundanonchus micropeltis* sp. n. and *S. foliaceus* sp. n. from *Ophicephalus micropeltes* and *S. triradicatus* sp. n. from *Pristolepis fasciatus*. This paper also presents the amended characteristics of the family Tetraonchoididae Bychowsky, 1951 (to accommodate the new genus *Sundanonchus*) as well as a key to the genera of Tetraonchoididae.

This paper presents the descriptions of three new species of monogeneans from the Malaysian Peninsular, which belong to the order Tetraonchidea Bychowsky, 1957. Since they do not fit into any of the existing genera of Tetraonchidea, a new genus (*Sundanonchus*) has been created to accommodate them. This new genus is subsequently included into the family Tetraonchoididae Bychowsky, 1951; consequently the characteristics of this family have to be amended.

MATERIALS AND METHODS

The monogeneans were recovered alive from freshly removed gills of *Ophicephalus micropeltes* (both adults and juveniles) and *Pristolepis fasciatus* collected from Tasek Bera, Pahang (3°5′ N and 102°38′ E). Some specimens were mounted on glass slides and fixed unstained in ammonium-picrate-glycerine and glycerine-gelatine, while some were stained with hydrochloric carmine and eosin. The monogeneans were also studied alive under a phase contrast microscope. The measurement techniques and terminology used were according to Gussev (1976 and pers. comm.). In all three species 20 specimens were measured. The measurements of the holotype and the paratypes (in ranges within parentheses) are to the nearest micrometer (μm). Drawings were done with the aid of a Leitz drawing device.

DESCRIPTIONS

Sundanonchus g. n.

Diagnosis: Tetraonchoididae. Cephalic glands present. Four eye-spots in larval stages; in adult two (as in *S. foliaceus* sp. n.) or four (with or without the tendency of the posterior pair to merge. as in *S. micropeltis* sp. n. and *S. triradicatus* sp. n. respectively). Haptor well delimited from body, shape variable; four anchors; two connective bars, dorsal bar paired (as in *S. micropeltis* sp. n. and *S. triradicatus* sp. n.) or single as in *S. foliaceus* sp. n., usually slightly sclerotized; 16 tetraonchid-gyrodactylid type of marginal hooks. Single intestinal tract. Single testis; copulatory organ consists of a coiled tube

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and a pipe-like accessory piece. Ovary usually ovoid, dextral and compact; vagina single, usually dextral; seminal receptacle oval, in anterior-dorsal region of ovary; follicular vitellaria in four sections and connected by an x-shaped duct in medial region at level of vagina. Parasites of gills of freshwater fishes of Peninsular Malaysia of the order Perciformes (Ophicephalidae and Nandidae). For differential diagnosis see the key and comments on the taxonomic position of the new genus.

The proposed genus is named *Sundanonchus* because Peninsular Malaysia is in the Sundaland, a subregion of the Oriental zoogeographical region.

Type species: *Sundanonchus micropeltis* sp. n.

Taxonomic position of *Sundanonchus* g. n.

Sundanonchus g. n. belongs to the order Tetraonchidea Bychowsky, 1957 because of the presence of 16 tetraonchid-gyrodactylid type of marginal hooks and a single intestinal tract (Bykhovsky et al. 1965). The present issue is the accommodation of this new genus: to include it in one of the existing families (Tetraonchidae Bychowsky, 1937; Tetraonchoididae Bychowsky, 1951; Bothitrematidae Bychowsky, 1957 and Amphibdellidae Bychowsky, 1957) or to create an entirely new family. For the present and prior to a more complete study and review of Tetraonchidea, it has been decided to include *Sundanonchus* g.n. into one of the existing families.

Comparative analyses of the existing families indicate that the family most able to accommodate *Sundanonchus* g.n. is Tetraonchoididae Bychowsky, 1951 because:
1. it is a heterogenous family (Bykhovsky et al. 1965) (see the Key) hence it is more able to accommodate new related forms;
2. of the structural similarities of the copulatory organs, vaginal apparatus and tetraonchid-gyrodactylid type of marginal hooks between the species of *Sundanonchus* g.n. and the species of Tetraonchoididae (especially *Pavlovskioides*, *Pseudotetraonchoides* and *Paratetraonchoides* species) (see Bykhovsky et al. 1965);
3. of the existence of x-shaped vitellarial duct in *Sundanonchus* g.n., which is a familial characteristic of Tetraonchoididae (see Bykhovsky et al. 1965), and
4. although most of the existing genera of Tetraonchoididae are found in purely marine species, *Pavlovskioides* as exemplified by *P. pearsoni* Bychowsky, Gussev et Nagibina, 1965 from *Anguilla reinhardti* is also found in estuarine system, while *Sundanonchus* is a freshwater genus.

With the inclusion of *Sundanonchus* g.n. into Tetraonchoididae, there are now eight genera in this family (Bykhovsky et al. 1965, Dillon and Hargis 1968, Machida 1978). Therefore the characteristics of the family has to be amended and the key to the genera of Tetraonchoididae by Dillon and Hargis (1968) be updated because of the existence of *Heteropavlovskioides* Machida, 1978 and *Sundanonchus* g.n.

The possible relationship between *Sundanonchus* g.n. and the previous genera (see Key) is difficult to postulate. The relationship may be one of parallel evolution from a common ancestor, with one branch giving rise to the freshwater genus *Sundanonchus* and the other to the marine genera of *Tetraonchoides*, *Pseudotetraonchoides*, *Allotetraonchoides*, *Heteropavlovskioides*, *Neopavlovskioides* and *Pavlovskioides*.

Amended diagnosis of Tetraonchoididae Bychowsky, 1951

Head organs connected by ducts to cephalic glands. Haptor with accessory disc (as in *Allotetraonchoides*) or without, variable in shape, usually round or bilobed; anchors present, two (as in *Tetraonchoides*, *Pseudotetraonchoides*, *Allotetraonchoides*, *Heteropavlovskioides*, *Neopavlovskioides* and *Pavlovskioides*), four (as in *Sundanonchus* g.n.) or absent (as in *Paratetraonchoides*); one or two transverse bars of variable shape; 16 tetraonchid-gyrodactylid type of marginal hooks; dorsal surface of haptor with (as in *Tetraonchoides*) or without sucker-shaped pulvilli; ventral surface of haptor with or without pits; septa present (as in *Heteropavlovskioides*) or absent. Intestine single. Testis single, usually postovarian; copulatory organ consists of a coiled tube and a pipe-like accessory piece. Ovary compact, occasionally folded, usually submedian; vagina present, single or double (as in *Neopavlovskioides*; this unusual existence of double vagina should be rechecked (Gussev, pers. comm.)); follicular vitellaria usually divided into four sections at the level of the vagina and connected by an x-shaped duct. Eye-spots present or absent in adults and numbers variable from two to four.

KEY TO GENERA OF TETRAONCHOIDIDAE BYCHOWSKY, 1951

1.	Anchors present	2
	Anchors absent	*Paratetraonchoides* Bychowsky et al., 1965
2.	Two anchors	3
	Four anchors	*Sundanonchus* g. n.
3.	Vagina single	4
	Vagina double	*Neopavlovskioides* Dillon et Hargis, 1968
4.	One transverse bar	5
	Two transverse bars	7
5.	Sucker-shaped pulvilli absent on dorsal surface of ophistohaptor	6
	Sucker-shaped pulvilli present on dorsal surface of ophistohaptor	*Tetraonchoides* Bychowsky, 1951
6.	Opisthohaptor with four septa on ventral surface	*Heteropavlovskioides* Machida, 1978
	Opisthohaptor without four septa on ventral surface	*Pavlovskioides* Bychowsky et al., 1965
7.	Opisthohaptor without accessory disc	*Pseudotetranchoides* Bychowsky et al., 1965
	Opisthohaptor with accessory disc	*Allotetraonchoides* Dillon et Hargis, 1968

Sundanonchus micropeltis **sp.n.** Fig. 1

Host: *Ophicephalus micropeltes* (Cuvier) (Ophicephalidae)
Locality: Tasek Bera, Pahang, Location: gills
No. of specimens collected: 50 from 2 host's individuals
Type material: Holotype (UMMT1) and 5 paratypes (UMMtl-UMMt5) in the Department of Zoology, University of Malaya, Kuala Lumpur. Paratypes in USNM Helm. Coll. (No. 77322) and in the Helm. Coll., Institute of Parasitology, Czechoslovak Academy of Sciences, České Budějovice (No. 346).

Description: Monogenean of 588 (799—1279)×109 (106—187). Four granulated eye-spots, posterior pair with tendency to merge. Haptor well delimited from body proper. Alimentary system consists of a single intestinal tract which terminates just before haptor and a round pharynx.

Two pairs of anchors: ventral anchors, length 46 (40—46), inner root 20 (16—21) and knob-like outer root; dorsal anchors morphologically similar to ventral anchor but slightly smaller, length 34 (34—42), inner root 16 (14—22) and knob-like outer root. Two connective bars: ventral bar V-shaped, while dorsal bar paired and tendon-like. 16 marginal hooks of tetraonchid-gyrodactylid type, length 15 (15—16).

Female reproductive system consists of a single ovary, vagina, seminal receptacle, uterus and vitellaria. Ovary located in first one-third of body, on the right side, dorsal to intestine. Uterine pore located slightly below copulatory organ, on ventral side.

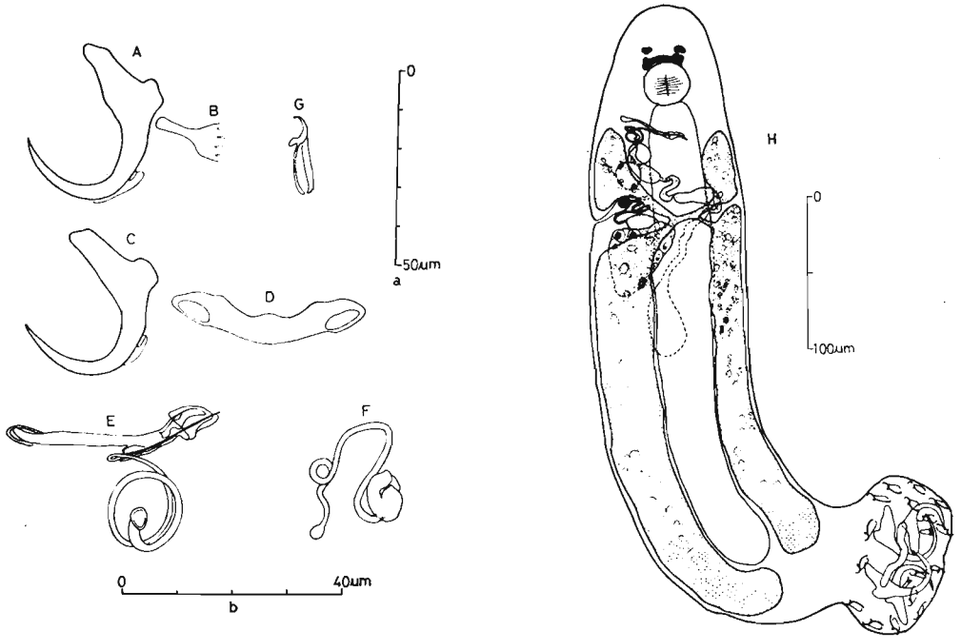


Fig. 1. *Sundanonchus micropeltis* sp. n. A — Dorsal anchor, B — Part of the paired dorsal bar, C — Ventral anchor, D — Ventral bar, E — Copulatory organ, F — Vaginal armament, G — Marginal hook, H — Ventral view.

Dextral vagina consists of a bladder-like opening with a sclerotized piece and a coiled vaginal duct leading into oval seminal receptacle which is situated in the anterior-dorsal region of ovary, a second duct extends horizontally from the same end, its termination is difficult to determine. This duct is more easily observed in young developing forms. Follicular vitellaria on each side of the intestine are divided into two sections at the region of the vagina, right vitellarial sections more delimited because of dextrally placed vagina; the four vitellarial sections are connected by an X-shaped duct located medially on the ventral side, in the region of vagina.

Male reproductive system consists of a testis, vas deferens, seminal vesicle and copulatory organ. Elongated testis located slightly to the right side of body, posterior-dorsal to ovary. Vas deferens arises from testis, extends obliquely upwards, loops round intestine on the left onto ventral side, ascends obliquely again, constricting then widening forming a pear-shaped seminal vesicle. Seminal vesicle, oval vesicular granulorum and prostatic reservoir (which consists of a proximal obovate and a distal lobulate structures) drain independently into the initial of the ventrally placed copulatory tube. Copulatory organ consists of a coiled tube and a grooved pipe-like accessory piece with a cap-like structure at distal end.

Differential diagnosis: See in *S. foliaceus* sp. n. and *S. triradicatus* sp. n.

The species is named *Sundanonchus micropeltis* sp.n. after its host.

Host: *Ophicephalus micropeltes* (Cuvier) (Ophicephalidae) (juvenile).
Locality: Tasek Bera, Pahang. Location: gills.
No. of specimens collected: 35 from 1 host individual.
Type material: Holotype (UMMT2) and 5 paratypes (UMMt6-UMMt10) in the Department of Zoology, University of Malaya, Kuala Lumpur. Paratypes in USNM. Helm. Coll. (No. 77323) and in IPCAS Helm. Coll., České Budějovice (No. 347).

Description: Monogenean of size 924 (912—1200)×126 (100—240), two eye-spots (four eye-spots in the larval forms), very large extensive bilobed haptors of size 294 (240—300)×420 (416—720). A single intestinal tract observed in both stained and living specimens as in *Sundanonchus micropeltis* sp. n.

Two pairs of anchors; ventral anchors, length 84 (77—92), inner root 32 (30—38) and outer root 4 (1—6); smaller dorsal anchors, length 48 (49—60), inner root 30 (25—30) and outer root 5 (2—5). Two connective bars: broad V-shaped ventral bar and slightly sclerotized V-shaped dorsal bar. 16 small marginal hooks of tetraonchid-gyrodactylid type, total length 12 (12—13).

As in *S. micropeltis* sp. n., ovoid ovary located on right side of intestine in the first two-third of body. Dextral vagina bladder-like with a sclerotized piece and a thin tube which proceeds to a small seminal receptacle which is anterior-dorsal to ovary. Follicular vitellaria divided into four sections (two on each side of single intestine) and connected by x-shaped duct at level of vaginal opening; right vitellarial sections more delimited because of dextrally located vagina. Ducts from vitellaria and seminal receptacle to ootype could not be seen clearly. Uterus seems to terminate at level of copulatory organ.

Male reproductive system also similar to that of *S. micropeltis* sp.n. Single elongated testis located along medial region slightly to the right, dorsal to intestine. Vas deferens arises from testis, ascends obliquely to left side along dorsal region, loops round intestine onto ventral side, ascends again before dilating to form pear-shaped seminal vesicle. Seminal vesicle, small elliptical vesicular granulosum and pars prostatica (which consists of an obovate proximal part and lobulate distal part), separately enter initial part of copulatory tube. Copulatory organ consists of coiled tube and a grooved pipe-like accessory piece with a "cap" at its distal end.

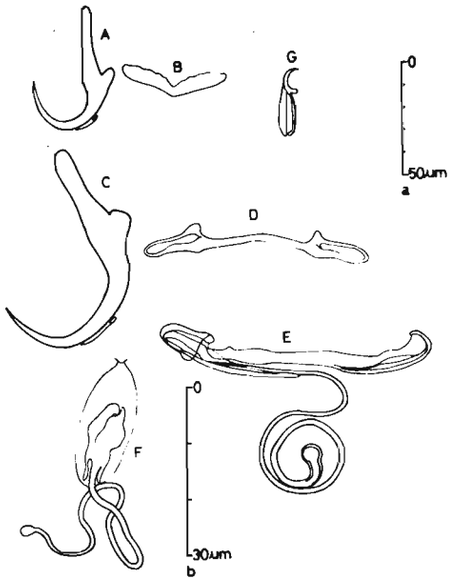


Fig. 2. *Sundanonchus foliaceus* sp. n. A — Dorsal anchor, B — Dorsal bar, C — Ventral anchor, D — Ventral bar, E — Copulatory organ, F — Vaginal armament, G — Marginal hook.

Differential diagnosis: The present species differs from *Sundanonchus micropeltis* sp.n. in having:
1. extensive foliated haptor, 2. smaller anchors, with dissimilar dorsal and ventral anchors (compared to the larger anchors of almost similar size in *S. micropeltis*), 3. thinner ventral bar with expanded ends (compared to the thicker V-shaped bar of *S. micropeltis*), 4. a single, slightly sclerotized V-shaped dorsal bar (in *S. micropeltis* it is usually paired), 5. smaller marginal hooks, total length 12 (12—13) (compared to 15 (15—16) in *S. micropeltis*, and 6. one pair of eye-spots in the adult (compared to two pairs in *S. micropeltis*), although there are two pairs in the larvae.

This species is named *Sundanonchus foliaceus* sp.n. after its foliated haptor. Although *S. foliaceus* can be obtained from fishes in the wild, they are more abundant in juvenile fish kept in the aquarium.

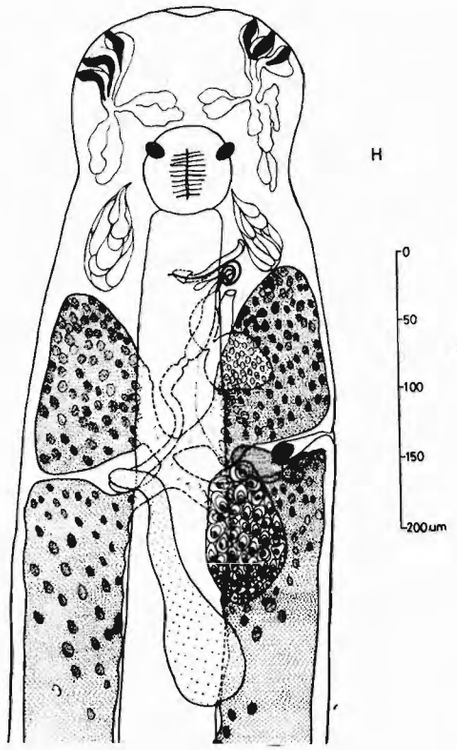


Fig. 3. *Sundanonchus foliaceus* sp. n., dorsal view.

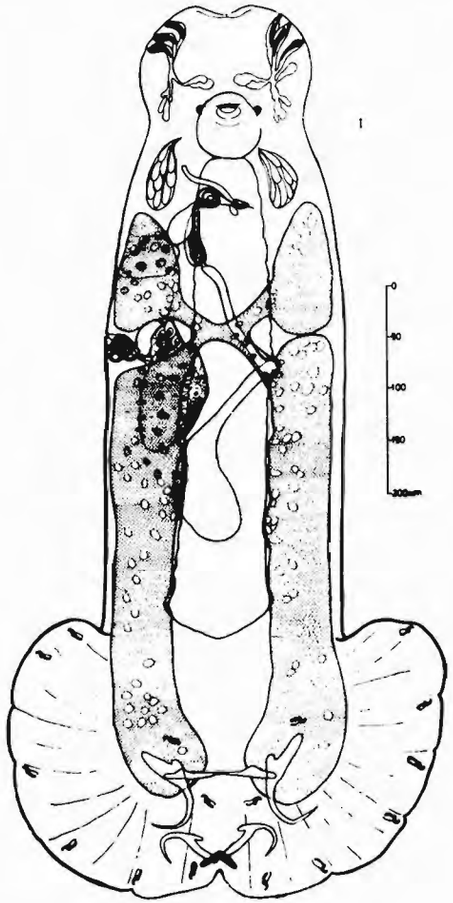


Fig. 4. *Sundanonchus foliaceus*, sp. n. ventral view.

Sundanonchus triradicatus **sp. n.** Figs. 5, 6

Host: *Pristolepis fasciatus* (Bleeker) (Nandidae).
Locality: Tasek Bera, Pahang. Location: gills.
No. of specimens collected: 60 from 1 host individual.
Type material: Holotype (UMMT3) and 5 paratypes (UMMt11.UMMt15) in the Department of Zoology, University of Malaya, Kuala Lumpur, 1 paratype in IPCAS Helm. Coll., České Budějovice (No. 348).

Description: Monogeneans of 529 (417—521)×92 (52—63), with four eye-spots. Haptor well delimited from body. Alimentary system consists of round pharynx and single intestinal tract.

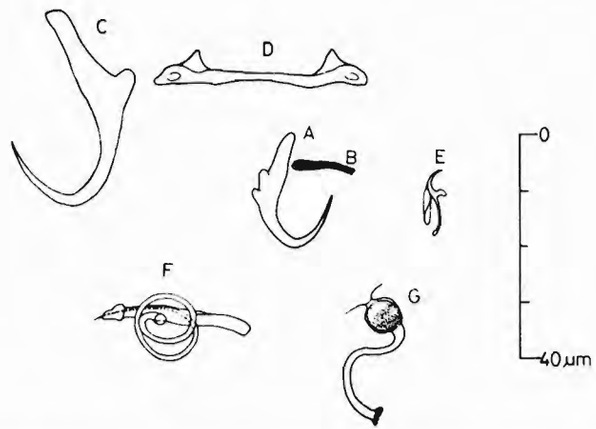


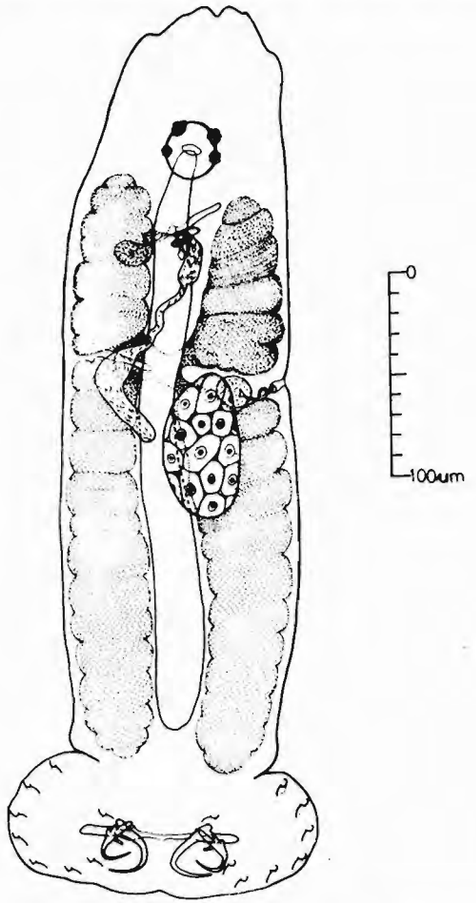
Fig. 5. *Sundanonchus triradicatus* sp. n. A — Dorsal anchor, B — Part of the paired dorsal bar, C — Ventral anchor, D — Ventral bar, E — Marginal hook, F — Copulatory organ, G — Vaginal armament.

Two pairs of anchors; ventral anchors large, length 32 (24—34), inner root 16 (10—16) and outer root 3 (2—3); dorsal anchors smaller, length 22 (16—22), with three roots: inner root (measured till outer root) 10 (5—10), middle root 2 (2—3) and outer root 2 (2—3) (it is possible that the middle root is a process of the inner root). Two connective bars; ventral bar single with expanded ends; dorsal bar paired (possibly connected by unsclerotized structure). 16 marginal hooks, length 12 (10—12) of tetraonchid-gyrodactylid type.

Male reproductive system consists of a single testis, vas deferens and copulatory organ. Elongated testis located slightly to left side of intestinal tract at region of vagina in the dorsal region. Vas deferens ascends obliquely along dorsal region to left side of intestine, winding round intestine onto ventral side of body, before dilating to form pear-shaped seminal vesicle. Seminal vesicle, prostate gland and vesicular granulosum, enter initial part of the copulatory organ separately. Copulatory organ consists of a coiled tube and a grooved accessory piece.

Female reproductive system consists of an ovary, uterus, vagina and vitellaria. Single ovary located dorsal to the intestine on the right side of body. Uterine pore opens near copulatory organ (as for the other species of *Sundanonchus*, it is difficult to observe it and it is only seen when the eggs are being passed out). Dextral vagina

consists of a thin-walled bladder-like opening with a slightly coiled tube leading into a round seminal receptacle. Vitellarial system consists of four sections connected by x-shaped duct near the vagina region.



Differential diagnosis: This species differs from the two previously described species of *Sundanonchus* in having dorsal anchors with three roots, comparatively smaller anchors and marginal hooks.

It is named *Sundanonchus triradicatus* sp.n. because of the three roots in the dorsal anchor.

Fig. 6. *Sundanonchus triradicatus* sp. n., dorsal view.

Comparative analysis of the three *Sundanonchus* species

The present three species possess similar types of copulatory organ, vaginal apparatus, 16 tetraonchid-gyrodactylid type of marginal hooks, single intestinal tract, and vitellaria and reproductive organs. The x-shaped duct between the four vitellarial portions has been observed in living specimens (of all 3 species) and some stained specimens of *S. micropeltis* and *S. foliaceus*.

S. micropeltis possesses the largest marginal hooks (15—16) compared to (10—12) and (12—13) for *S. triradicatus* and *S. foliaceus* respectively. The three species are also differentiated by the shapes and sizes of the anchors and bars. In *S. micropeltis* and *S. triradicatus* the ventral anchors are only slightly smaller than the dorsal anchors, but in *S. foliaceus* the dorsal anchor is about 1.6 times larger than the ventral anchor. Structurally the anchors of the three species are different, especially in

S. triradicatus, where the dorsal anchors have "three roots". (As already stated, the "middle root" may just be an outgrowth of the inner root. The possible function of this middle "root" is to increase the area for muscle attachment). The ventral bars in the three species of *Sundanonchus* are variable in size but similar in shape with expanded, slightly concave ends. The dorsal bar is more variable morphometrically: in *S. foliaceus* the dorsal bar is a slightly sclerotized V-shaped structure, while in *S. micropeltis* and *S. triradicatus* it is separated into two parts. (These two portions may be connected or held together by some unsclerotized structures; histochemical studies are required to determine the existence and nature of the connecting structures).

The other variable feature is the presence of four eye-spots in the adult *S. micropeltis* (where the posterior pair is merged) and *S. triradicatus* and two eye-spots in the adult *S. foliaceus*, although in all the three species the larval stages possess four eye-spots. The two hosts belong to the order Perciformes.

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SUNDANONCHUS G. N. (MONOGENEA, TETRAONCHOIDIDAE) ОТ ДВУХ ПРЕСНОВОДНЫХ РЫБ МАЛАЙЗИИ

Л. Х. Лим и Й. О. Фуртадо

Резюме. Три следующих вида рода *Sundanonchus* g. n. (Tetraonchoididae) обнаружили у двух видов пресноводных рыб: *Sundanonchus micropeltis* sp. n. и *S .foliaceus* sp. n. у *Ophicephalus micropeltes* и *S. triradicatus* sp. n. у *Pristolepis fasciatus*. Приводятся признаки семейства Tetraonchoididae Bychowsky, 1951 (включающего новый род *Sundanonchus*) и определитель родов семейства Tetraonchoididae.

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Erratum: The title of the paper from this journal 30: 377—381, 1983 should be: Ancylodiscoidins (Monogenea: Dactylogyridea) from two freshwater fish species of Peninsular Malaysia.