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SCHISTORCHIID TREMATODES OF MARINE FISHES OF INDIA, WITH CONSIDERATIONS ON THE STATUS OF THE GENUS *MEGACREADIUM* NAGATY, 1956 AND FAMILY SCHISTORCHIIDAE YAMAGUTI, 1942

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ABSTRACT

The present study is a brief report on the digenetic trematode fauna of marine fishes of the Gulf of Manaar and Coromandel Coast belonging to the family Schistorchiidae Yamaguti, 1942. It comprises four species out of which one is described as new. This forms the first record of this family from the Indian coasts. *Schistorchis carneus* Luhe, 1906, described from Sri Lanka Coast falling on the side of the Gulf of Manaar is being recorded from the puffer fish, *Tetrodon hispidus* from Mandapam situated along the Gulf coast. The new species is *Schistorchis longivesiculurus* from the fish *Siganus oramin* from Tuticorin and Karaikal, and *Schistorchis* sp. from an unidentified parrot fish from Keelakkarai is not assigned to any species it is based on a single specimen which is crushed. *Schistorchis skrjabini* Parukhin, 1963, originally described from South China Sea, is being recorded from Vellar Estuary at Porto-Novo.

Interesting observations have also been recorded regarding the nature of musculature surrounding the oral opening, and its bearing on the validity of the genus *Megacreadium* Nagaty, 1956 *vis-a-vis* *Schistorchis* Luhe, 1906. On the basis of a combination of characters present in *Schistorchis*, the family Schistorchiidae has been held valid.

INTRODUCTION

The present study is a brief account of the trematode fauna of marine fishes of the Gulf of Manaar and Coromandel coast (Bay of Bengal) belonging to the family Schistorchiidae Yamaguti, 1942. This forms the first record of the occurrence of the members of this family along the Indian Coasts. So far the family has eight valid species. Of these, three have been reported from Ghardaga (Red Sea), one from South Modragam, Pearl Banks of Sri Lanka (Gulf of Manaar) and the rest from Naha, Okinawa (East China Sea) ; South China Sea ; Macassar, Celebes (Java Sea) ; Queensland, Australia (Coral Sea) and Hawaii. The distributional pattern of the members of the family that emerges is that they occur in the fishes of the Indian Ocean and Pacific Ocean. No member of this family has been reported so far from the Atlantic Ocean. The present report of four species is an important and interesting contribution to the knowledge of the family Schistorchiidae from the Bay of Bengal. At the same time it also shows that the schistorchiid fauna of the Bay of Bengal resembles that of the Far East countries in the Pacific Ocean.

The various species of the family Schistorchiidae have been found to occur in the stomach and intestine of the fishes of the

unrelated families Tetrodontidae, Scaridae, Siganidae, Triacanthidae, Balistidae, Monacanthidae and Zanclidae.

All measurements are in micron unless otherwise stated. The diagrams have been drawn with the aid of a Camera lucida.

Family : SCHISTORCHIIDAE Yamaguti, 1942

Subfamily : SCHISTORCHIINAE Skrjabin, 1959

Schistorchis longivesiculurus n. sp.
(Figs. 1 & 2)

Host : *Siganus oramin* Schneider ; streaked spine foot ; Siganidae.

Location : Intestine.

Locality : Tuticorin (Gulf of Manaar) ; Karaikal (Coromandel coast).

Number of specimens : Several from both localities.

Specimens deposited : Z. S. I. Reg. Nos. W 7281/1 and W 7282/1.

DESCRIPTION

Body 7·658-15.482 mm long, 1.100-1.306 mm wide, elongate, sides almost parallel, ends rounded. Cuticle unarmed. No eye-spot pigment. Acetabulum 453-825 in diameter, globular, nearer anterior end of body. Oral sucker 508-868 in diameter, globular. Suckers widths ratio 1 : 0.81-0.94 taking width of oral sucker as one. Oral aperture ventroterminal. No prepharynx. Pharynx 261-387 long, 343-524 wide, squarish ; esophagus absent ; cecal bifurcation immediately behind pharynx ; ceca arcuate, extending up to posterior end of body (in the specimens from Tuticorin the condition of cecal ends is undetermined because they are obliterated by vitelline follicles, but in some of the specimens from Karaikal the cecal ends seem to be in comm-

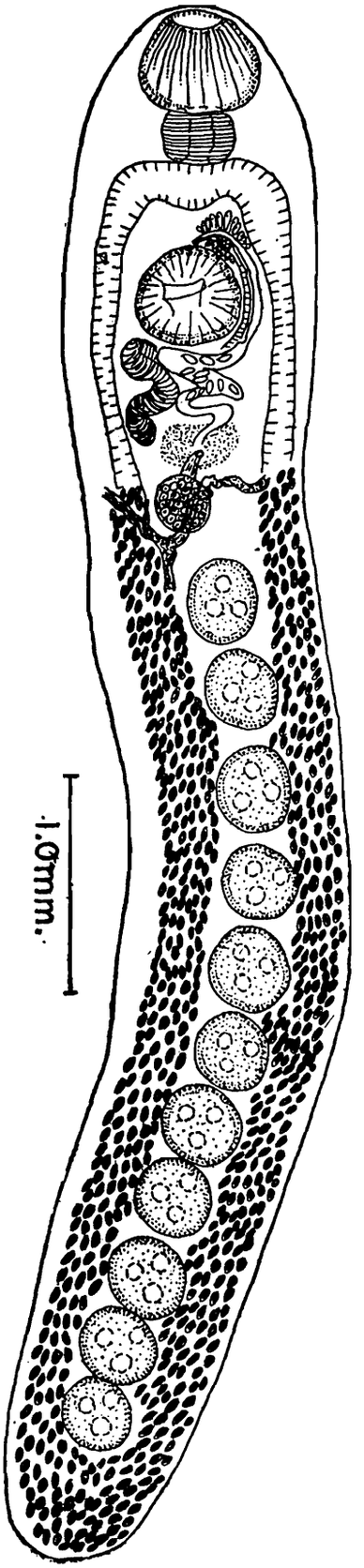

Fig. 1. *Schistorchis longivsiculurus* n. sp. Ventral view of the specimens from Karaikal

unication with the exterior). Some space between cecal bifurcation and acetabulum present.

Testes 11, 447-799 in diameter, round, entire, in one row along median line from behind ovary to short of posterior end of body, contaguous or not Seminal vesicle long, winding, with thick muscular walls, extending far behind acetabulum, obliterated by close coils of uterus in some specimens. Pars prostatica surrounded by prostate gland cells towards anterior end of male duct. No cirrus sac. Genital pore immediately preacetabular. Ovary 247-481 in diameter, globular, preacetabular, median, smaller than testis. Seminal receptacle present. Mehlis' gland immediately anterior to ovary. Vitelline reservoir in the ovarian region. Vitellaria follicular, follicles cecal, from posterior level of acetabulum or some distance behind it to posterior end of body. Uterus preovarian, terminal part joning with male duct to form a common duct. Eggs 42-77 by 28-51.

Excretory vesicle undetermined.

Remarks : The present species is characterised by : (i) a wide space between intestinal bifurcation and acetabulum, and (ii) a wide, long winding, tubular seminal vesicle with thick muscular walls. In some specimens it is rendered indiscernible due to the close coils of uterus.

It comes very close to *S. sigani* Yamaguti, 1942 from an allied species of fish host, *Siganus puella*, from Naha, Japan, but markedly differs from it in (i) having a long winding seminal vesicle (retort-shaped in *S. sigani*), (ii) having the walls of the seminal vesicle very muscular and thick (only a membrane in *S. sigani*), (iii) having only one row of 10-11 testes (two rows in *S. sigani*), (iv) having eggs measuring 59×35 in Karaikal specimens and

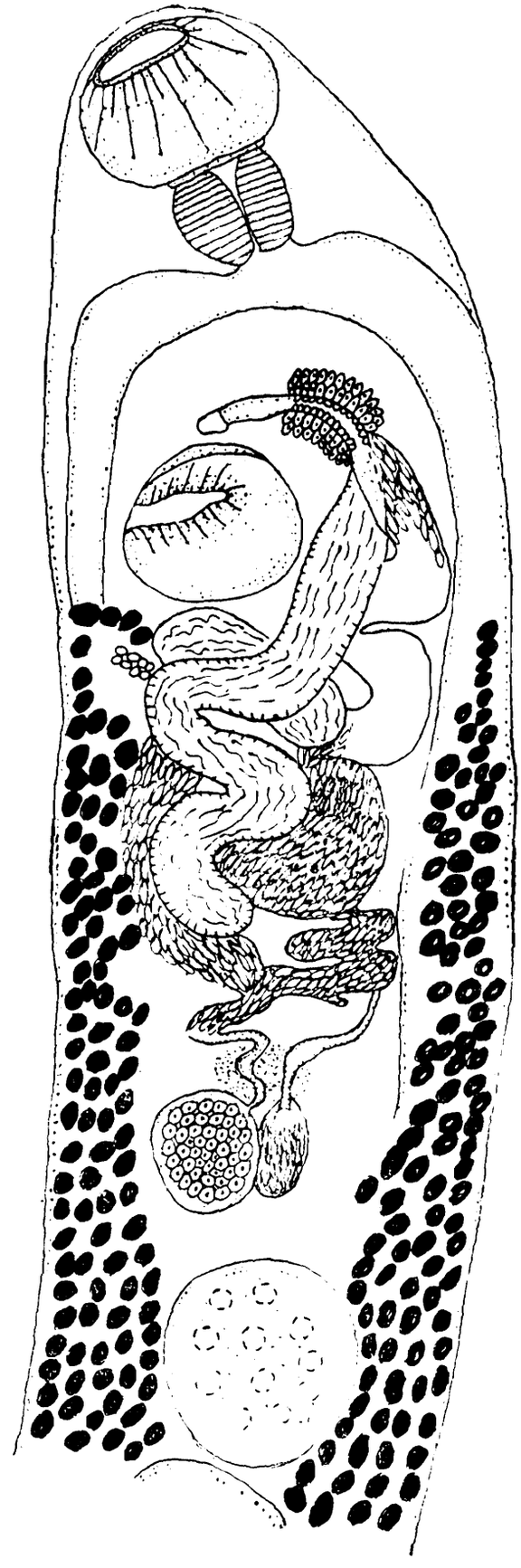

Fig. 2. *Schistorchis longivesiculurus* n. sp. Anterior half of the specimen from Tuticorin.

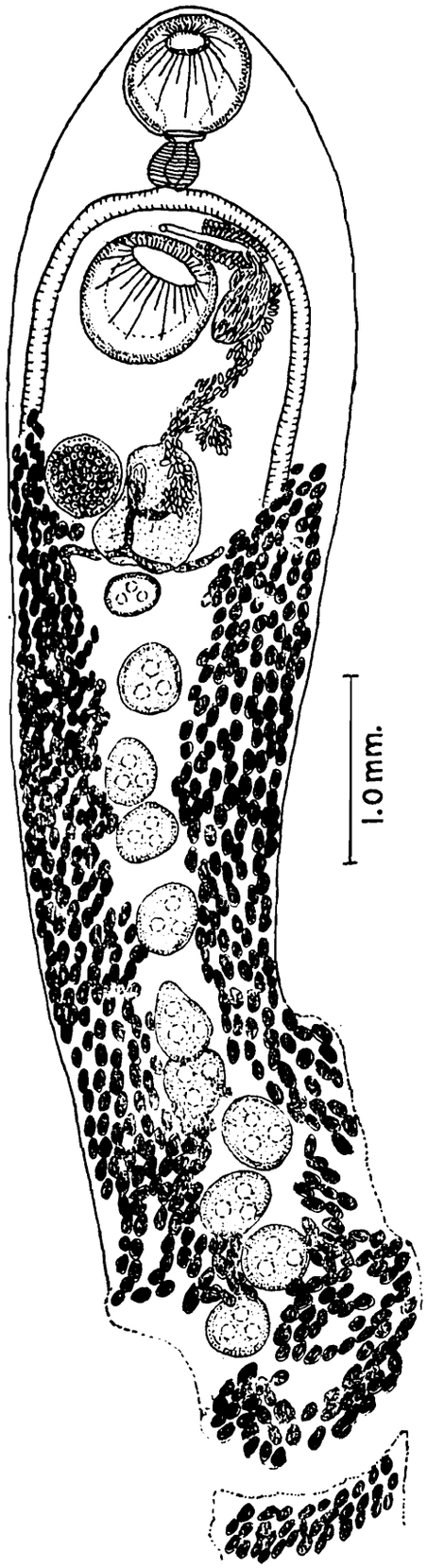

Fig. 3. *Schistorchis* sp. Ventral view.

63×42 in Tuticorin specimens (75-81×42-50 in *S. sigani*), and (v) in having vitellaria extending upto acetabulum in bigger specimen but remain short of it in smaller specimens as in *S. sigani*.

The new species can also be compared with *Schistorchis stenosoma* Hanson, 1953 from *Cantherines pardalis* from Hawaii, which resembles it in having a single row of 10-12 testes, extent of vitellaria, and in communication of ceca to the exterior. But the new species differs from Hanson's species in the sucker ratio (oral sucker is much larger than acetabulum in *S. stenosoma*), nature and shape of seminal vesicle (saccular in *S. stenosoma*), and in the presence of characteristic wide space between cecal bifurcation and acetabulum (absent in *S. stenosoma*).

The other important thing is that in mounted specimens from Tuticorin, the cecal ends are obliterated by vitellaria but in the specimens from Karaikal it is discernible that they open to the exterior. This is in contrast to the condition of cecal ends as described by Yamaguti (1942) in his species *Schistorchis sigani* in which they have been mentioned to be ending blindly. Probably this is so because he described his species on the basis of a single specimen and ani are often not easy to be detected.

Schistorchis sp. (Fig. 3)

Host	:	*Callyodon* sp. ; parrot-fish ; Scaridae
Location	:	Intestine.
Locality	:	Keelakkarai (Gulf of Manaar, Bay of Bengal).
Number of specimen	:	One, crushed in the posterior part ; collected by Dr. T. D. Soota and Party in 1975.

Specimen deposited : Z. S. I. Reg. No. W 7283/1

DESCRIPTION

Body roughly 8.50 mm long, 1.760 mm wide. Cuticle smooth. No eye-spot pigment. Oral sucker 687 in diameter. Mouth ventro-terminal. Acetabulum 756 in diameter, situated at a distance of 1,251 from anterior end of body. Suckers almost equal. Prepharynx present. Pharynx pear-shaped, 233 long, 275 wide ; oesophagus absent. Cecal bifurcation almost in middle of suckers. Ceca arcuate after cecal bifurcation (the condition of the cecal ends could not be ascertained because the posterior part of the body of the solitary specimen is crushed, presumably ending blindly).

Testes 11, in one row in mid-line, 316-412 long, 275-316 wide, almost spherical, entire. Cirrus sac absent. Seminal vesicle saccular, retort-shaped, extending up to almost mid-level of and sinistral to acetabulum, pars prostatica short, surrounded by prostate gland cells, ejaculatory duct narrow. No cirrus. Genital pore immediately in front of acetabulum.

Ovary 453 long, 412 wide, spherical, smooth, between acetabulum and anterior most testis, submedian, larger than the largest testis. Seminal receptacle larger than and sinistral to ovary. Vitelline reservoir anterior to anterior testis ; vitelline duct traversing laterally ; viteltillaria follicular extending from posterior end of body to level of ovary. Uterus preovarian, terminal part differentiated into metraterm joining with terminal part of male genitalia to form common duct. Eggs 45-77 by 35-52.

Excretory vesicle could not be ascertained.

Remarks : The solitary specimen detailed above is comparable to *Schistorchis callyodontis* Yamaguti, 1942, the other species in the genus described from a parrot-fish from Naha, Japan, and there-after reported from Ghardaga, Red Sea by Nagaty (1962). However, the present specimen markedly differs from Yamaguti's species in sucker ratio, posterior extent of seminal vesicle, single linear row of testes, shape of the body, and position of ovary with respect to the anterior extent of vitellaria, and anterior extent of vitellaria with respect to the acetabulum. It also resembles *Schistorchis haridis* Nagaty, 1957 from the fish *Pseudscarus harid* from Red Sea, but Nagaty's species differs from the present specimen in having acetabulum larger than the oral sucker, large pharynx, ovary much nearer to acetabulum, shape and extent of seminal vesicle, and position of genital pore which is to the left of acetabulum rather than median. Thus it is clear that the present single specimen represents a species quite distinct from related ones in the genus. The author is inclined to consider it a new species but because the description is based on a single specimen which is crushed and broken in the posterior part, it is not assigned to a new species for the time being.

Schistorchis skrjabini Parukhin, 1963

(Figs. 4 & 5)

Host : *Triacanthus brevirostris* Schlegel, short-nosed tripod fish, Triacanthidae.

Location : Intestine.

Locality : Vellar estuary at Porto-Novo (Coromandal coast, Bay of Bengal).

Number of specimens : Six ; collected by Dr. T. D. Soota & Party in 1975.

Specimens deposited : Z. S. I. Reg. Nos. W7284/1 and W7285/1

DESCRIPTION

Body 1.925-6.682 mm long, 0.536-1.966 mm wide. No eye-spot pigment. Cuticle smooth. Acetabulum 137-275 long, 110-357 wide, situated at 756-1058 from anterior end of body, differentiated into a muscular portion surrounding mouth without lobes and a highly cellular portion. Oral sucker larger than acetabulum. Suckers width ratio 1 : 0.036-0.463 taking width of oral sucker as one. Prepharynx absent ; pharynx 91-206 long, 96-343 wide ; no oesophagus ; cecal bifurcation immediately behind pharynx ; ceca arcuate ; ani formed.

Testes 11, 96-550 in diameter, round to irregular in shape, in some specimens indented, arranged in 2-3 rows in middle part of body, inter-cecal. No cirrus sac. Seminal vesicle globular, extending beyond acetabulum posteriorly, and continued anteriorly as pars prostatica surrounded by prostate cells and

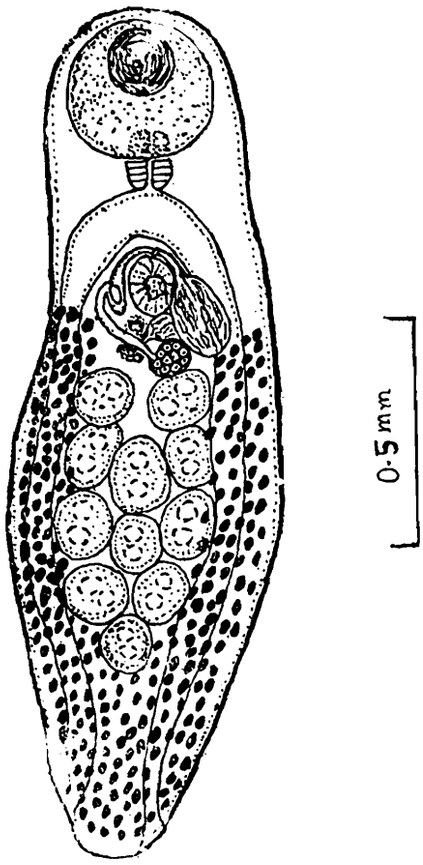

Fig. 4. *Schistorchis skrjabini* Parukhin, 1963. Ventral view showing three rows of testes.

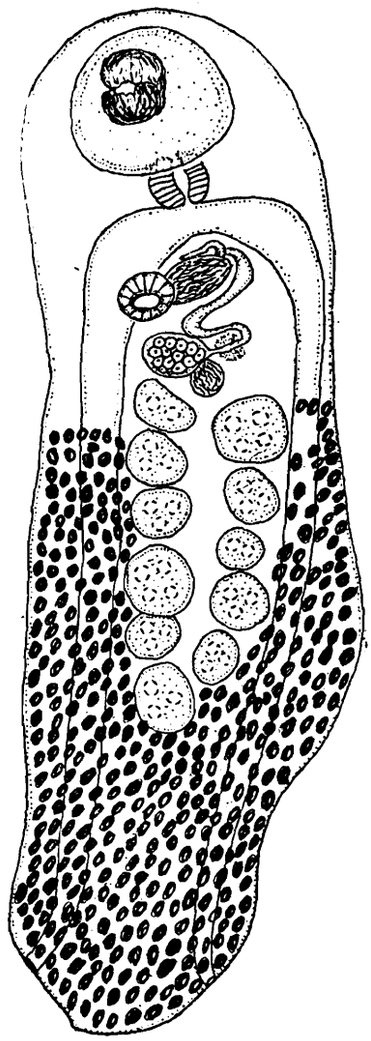

Fig. 5. *Schistorchis skrjabini* Parukhin, 1963. Ventral view showing two rows of testes.

ejaculatory duct in form of a narrow tube. No cirrus. Genital pore immediately infront of acetabulum.

Ovary globular to elongate, 96-233 long, 96-371 wide, smaller, than testes, pretesticular. Mehlis' glands present. Vitellaria follicular, commencing from posterior level of acetabulm to posterior end of body. Uterus preovarian, anterior portion joining with terminal part of male tube to form common duct. Eggs not formed. Seminal receptacle present.

Excretory vesicle undetermined.

Remarks : The present specimens broadly conform to the original description of *Schistorchis skrjabini* Parukhin, 1963 which has been reported from South China Sea from fishes *Triacanthus brevirostris* and *Abalistis stellaris*. The oral sucker in the present specimens is differentiated into a small muscular part around short mouth opening and the rest of it is highly cellular. In some specimens there seems to be a tendency of forming muscular lips or small lobes around the mouth. This differentiation in the structure of the oral sucker has not been mentioned in *Schistorchis skrjabini* by Parukhin (1963), but in the illustration some demarcation seems to have been shown around the mouth. It may be pointed out that the differentiation of the structure of the oral sucker into a muscular part around the mouth and a cellular part is in varying degrees in all the six specimens.

Schistorchis carneus Luhe, 1906
(Fig. 6)

Host : *Tetrodon hispidus* Linn., spotted puffer fish, Tetrodontidae

Location : Intestine.

Locality : Mandapam (Gulf of Manaar)

No. of specimens : 2, one broken into two pieces ; collected by Dr. T. D. Soota & Party in 1975.

Specimens deposited : Z. S. I. Reg. Nos. W 7286/1

DESCRIPTION

(Based on contracted specimens) Body 5.596-6 mm long, 2.076-3.052 mm wide, almost rectangular in shape with roundish or truncated ends. Tegument thick, aspinose, crenulated (probably due to contraction). Acetabulum 343-522 in diameter, globular with weak musculature, situated near anterior end just behind arch of cecal bifurcation. Oral sucker 1,196-1,306 in diameter, much larger than acetabulum, subterminal ; mouth opening small surrounded by strong circular muscles, margin of anterior part of musculature notched or indented, remaining part of oral sucker highly cellular. Sucker ratio 1 : 0.43, with oral sucker as 1, or 7 : 3 approx. Prepharynx indiscernible, pharynx large, partly overlapped by oral sucker and acetabulum ; oesophagus indiscernible ; ceca arcuate just after bifurcation, extending up to posterior end of body ; ani formed.

Testes 11, 206-330 long, 206-316 wide, in two lateral groups of 5 and 6 on either side of mid-line, intercecal, unequal, entire. No cirrus sac. Seminal vesicle elongated pear-shaped extending posterior to acetabulum from left side, narrowing anteriorly to form short pars prostatica surrounded by prostate gland cells ; ejaculatory duct short. Terminal male duct skirting round left side of acetabulum. Genital pore immediately preacetabular.

Ovary, 316-412 long, 302-330 wide, pretesticular, dextral tc median line, globular or a

bit transversely elongated, entire. Shell gland follicular, extending to level of acetabulum.

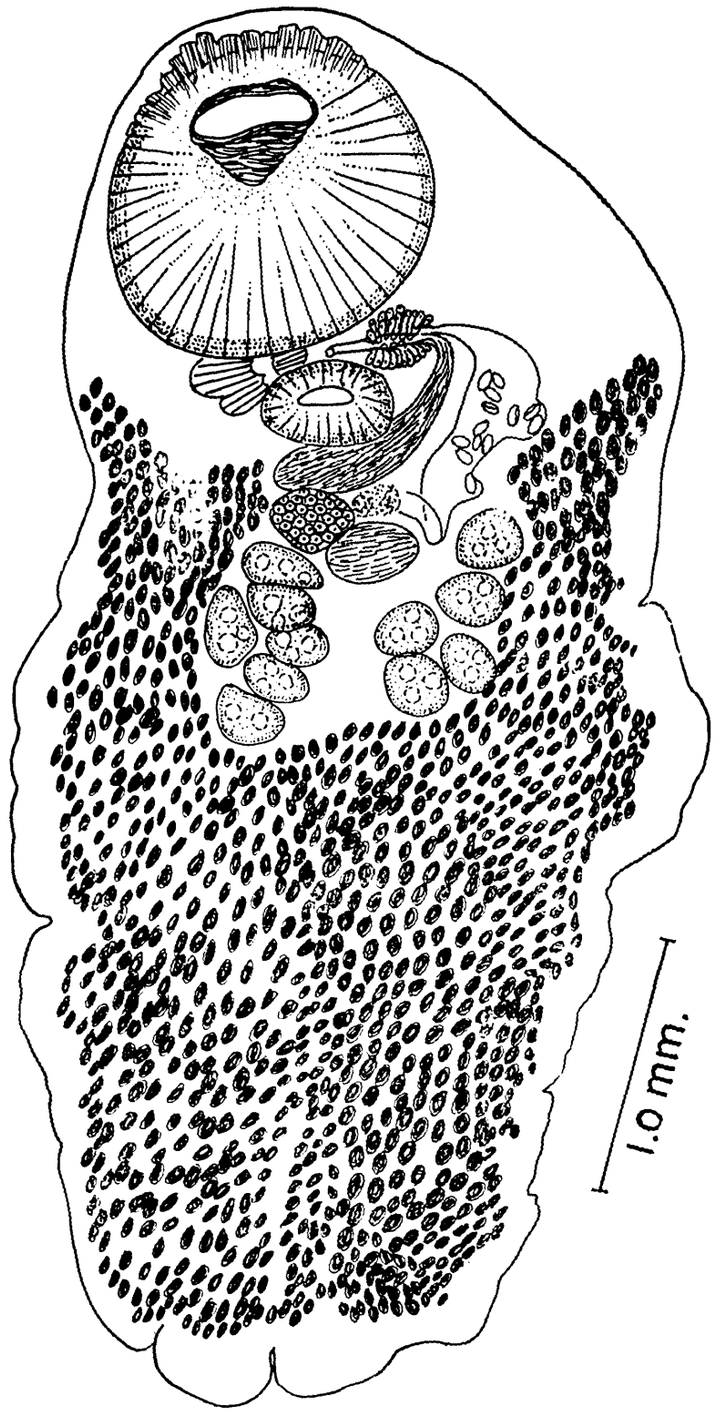

Fig. 6. *Schistorchis carneus* Luhe, 1906. Ventral view.

lying sinistral to ovary. Seminal receptacle present between ovary and testes. Vitellaria Uterus short, preovarian, windding anteriorly, terminal part joining male duct to form

common duct, or male and female ducts enter into a genital sinus. Eggs 56-59 by 38-42.

Excretory vesicle undetermined.

Remarks : The present two specimens are referred to *Schistorchis carneus* Luhe, 1906 (=*Pleorchis oligarchis* Johnston, 1913 from *Tetradon hispidus* from Queensland, Australia). Odhner (1928) considered Johnston's species conspecific with *Schistorchis carneus* Luhe, 1906. He cut serial sections of his specimens and found that ani, which were originally described to be absent, were present. It is on the basis of this synonymy and revelation that ani are present in *Schistorchis carneus* that the present two specimens are assigned to this species. Moreover, they have been collected from a nearby locality in the same short stretch of water (Gulf of Manaar) and from the same fish genus.

Status of Megacreadium Nagaty, 1956 vis-a-vis Schistorchis Luhe, 1906.

Luhe (1906) established the genus *Schistorchis* and described the type species *S. carneus* from the puffer fish *Tetrodon stellatus* from South Modragam Paar, Pearl Banks of Sri Lanka (Ceylon), the Gulf of Manaar. This description contained a few errors, particularly with respect to the formation of ani, absence of cirrus sac and differentiation of strong muscles around the small mouth opening. The adequate and correct description of *Pleorchis oligarchis* Johnston, 1913 and its subsequent synonymy with *Schistorchis carneus* Luhe, 1906 brought to light the correct nature of the structure of the oral sucker in this type species. The opening of the oral sucker is small and surrounded by strong circular muscles sometimes covering the mouth opening, and the rest of the structure is highly cellular. In my specimens, which have been collected and from the same small stretch of waters from where the type species was described and from the same fish host from which Johnston (1913) described his species, the muscles around the mouth have assumed a somewhat different form (*i.e.*, anterior lobation or indentation) but essentially the whole structure remaining the same.

Parukhin (1963) described species *Schistorchis skrijabini* from South China Sea from fishes *Triacanthus brevirostris* and *Abalistis stellaris* apparently without differentiation of oral sucker into a muscular part around mouth opening and the remaining cellular part. In my specimens recovered from *Triacanthus brevirostris* from Porto-Novo (which I have assigned to *S. skrijabini*) such differentiation is present in varying degrees. Even in some the strong muscles around the lower lip are deeply indented giving rise to two posterior lobulate structures. The rest of the worm is exactly as detailed by Parukhin (1963).

The oral sucker in *Schistorchis stenosoma* Hanson, 1953 was not described to be differentiated into a muscular part around the mouth, but Manter (1963) examined its paratypes and found that distinct semicircular muscles along the posterior edge of the mouth are present.

Nagaty (1956) proposed *Megacreadium* (type species *M. tetrodontis*) the specimens of which were collected from the fish *Tetrodon* sp. from Ghardaga, Red Sea. He mainly characterised his genus in having circumoral muscular lobes. In the light of the nature of the structure of the oral suckers in my specimens assigned to *S. carneus* and *S. skrjabini*, the circumoral muscular lobes in the type species of *Megacreadium* appear to be a degree of indentation of the circumoral muscles in *S. carneus* and *S. skrjabini*, and thus there appears to be some substance for considering *Megacreadium* Nagaty, 1956 synonymous with

Schistorchis Luhe, 1906 by Sogandares-Bernal and Hutton (1959). The author also cast doubt on the validity of *Megacreadium*. The presence of eight testes in Nagaty's species is a variable character as noted by Johnston (1913). The enormous size of eggs and extension of uterus beyond genital pore anteriorly may be distinguishing *S. tetrodontis* (syn. *Megacreadium tetrodontis* Nagaty, 1956) from other species of the genus *Schistorchis*.

Status of the Family Schistorchiidae Yamaguti, 1942.

Luhe (1906), when proposed the genus Schistorchis, kept it under a new subfamily Acanthocolpinae. Poche (1925) thought that the two multitesticular genera, *Pleorchis* Railliet, 1896 and *Schistorchis* Luhe, 1906, are related to each other, and therefore he kept them under his new family Pleorchiidae. It were Cable and Hunninen (1942) who first pointed out that *Pleorchis* and *Schistorchis* are not at all closely related. They separated them and placed *Pleorchis* in the family Acanthocolpidae and proposed to keep *Schistorchis* in the subfamily Homalometrinae under Lepocreadiidae Nicoll, 1914. Almost at the same time but independently, Yamaguti (1942) also considered *Pleorchis* and *Schistorchis* as unrelated genera and proposed a new family Schistorchiidae to accommodate the latter genus. Hanson (1953) followed Cable and Hunninen, and considered *Schistorchis* a genus of Homalometrinae in the family Lepocrediidae. She further suggested that Schistorchiidae Yamaguti, 1942 should be suppressed in favour of Lepocreadiidae. Pritchard (1963) again record *Schistorchis stenosoma* Hanson, 1953 and *S. zancli* from Hawaiian fishes under the family Lepocreadiidae. Mehra (1966) did not accept a separate family Schistorchiidae Yamaguti, 1942 for the genus *Schistorchis* Luhe, 1906. On the contrary, he treated the genus under the sub-family Schistorchiinae Skrjabin, 1959 in the family Opecoelidae. Manter (1963) indicated that *Schistorchis* has some characters of the family Megaperidae Manter, 1934. Earlier Manter and Van Cleave (1951) had observed that *Schistorchis* is more closely related to *Decemtestis* Yamaguti, 1934 because both the genera have unarmed body and possess seminal receptacle thereby suggesting the affinity of *Schistorchis* to the family Opecoelidae. Nagaty (1957, '62) who has studied the genus *Schistorchis* and described species in this genus, maintains the family Schistorchiidae Yamaguti, 1942. Skrjabin (1959) has also accepted the family Schistorchiidae. The author has studied a good number of specimen of the genus *Schistorchis*, and on this basis feels to hold that the family Schistorchiidae should be maintained, at least, because of the following combination of characters :

(1) Differentiation of highly developed semicircular muscles around the small mouth opening, or not ;

(2) Follicular testes ;

(3) Formation of ani, or ceca terminating blindly ;

(4) The male female terminal ducts open into a genital sinus or unite to form a common duct skirting around the left side of the acetabulum.

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