STUDIES ON PARASITES OF INDIAN FISHES. V ACANTHOCEPHALA[1]

By

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The Acanthocephalan parasites of Indian fishes have been studied by Bhalerao (1931), Datta (1936-1954), Kaw (1941 & 1951), Poddar (1937-1941), Sen (1938), Sarkar (1953), Thapar (1927 & 1931) and Van Cleave (1928).

In the course of my studies on the parasites of freshwater, marine and estuarine fishes, 9 new species of Acanthocephala and new hosts for other known species were found and are described below. In no case was any appreciable pathological effect noticed except in *Setipinna phasa*, the intestinal wall of which was perforated by a female specimen of *Acanthosentis indica*, sp. nov. The tissue at the site of perforation was swollen and reddish in colour.

Living specimens, when obtained, were washed and left in water with a drop of chloroform for about 4 or 5 hours until the proboscis was fully extended and then fixed in alcoholic or aqueous Bouin's fluid. Specimens treated with lactic acid showed clearly the cement glands, the hooks and spines but not the cuticular nuclei.

The following table shows the number of specimens of different species of fish examined and of those infected.

TABLE 1

Host species.	No. examined.	No. infected.	Parasite.
Rajiformes—			
Rhynchobatus djeddensis (Forsk.) ..	1	1	*Serrasentis longa*, sp. nov.
Pleuronectiformes—			
Cynoglossus lingua Ham.	4	2	*Neoechinorhynchus opseyi* Poddar (juvenile).
Siluroidea—			
Eutropiichthys vacha (Ham.) ..	14	1	*Neoechinorhynchus* sp. (Juvenile).

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Host species.	No. examined.	No. infected.	Parasite.
Siluroidea.—			
***Osteogeniosus militaris* Linn.** ..	26	5	*Mehrarhynchus secundus*, sp. nov.
		1	*Rhadinorhynchus indicus*, sp. nov.
Plotosus canius (Ham.)	6	3	*Heterosentis plotosi* Yamaguti.
		4	*Mehrarhynchus secundus*, sp. nov.
Tachrysurus jella (Day)	3	2	*Rhadinorhynchus indicus*, sp. nov.
Clupeiformes—			
Elops saurus Linn.	5	1	*Neoechinorhynchus ovalis*, sp. nov.
Hilsa ilisha (Ham.) .. .	58	42	*Acanthosentis indica*, sp. nov.
Nematalosa nasus (Bloch). ..	14	1	*Neoechinorhynchus nematalosi*, sp. nov.
Setipinna phasa (Ham.) ..	36	25	*Acanthosentis indica*, sp. nov.
Mugiloidei—			
Mugil dussumieri Cuv. & Val. ..	2	2	*Neoechinorhynchus elongatus*, sp. nov.
Mugil subviridis Cuv. & Val. ..	4	1	*Neoechinorhynchus elongatus*, sp. nov.
Mugil tade Forsk. .. .	2	1	*Neoechinorhynchus bangoni*, sp. nov.
Percoidei—			
Pama pama (Ham.)	18	2	*Mehrarhynchus secundus*, sp. nov.
		1	*Neoechinorhynchus* sp. (juv.).
Polynemiformes—			
Polynemus paradiseus Linn.. ..	28	4	*Neoechinorhynchus topseyi*, Poddar.
Polydactylus sextarius Bl. Schn. ..	6	5	*Raorhynchus polyneme*, gen. *et* sp. nov.
Cyprinoidei—			
Labeo gonius	1	1	*Acanthosentis betuai*, sp. nov.

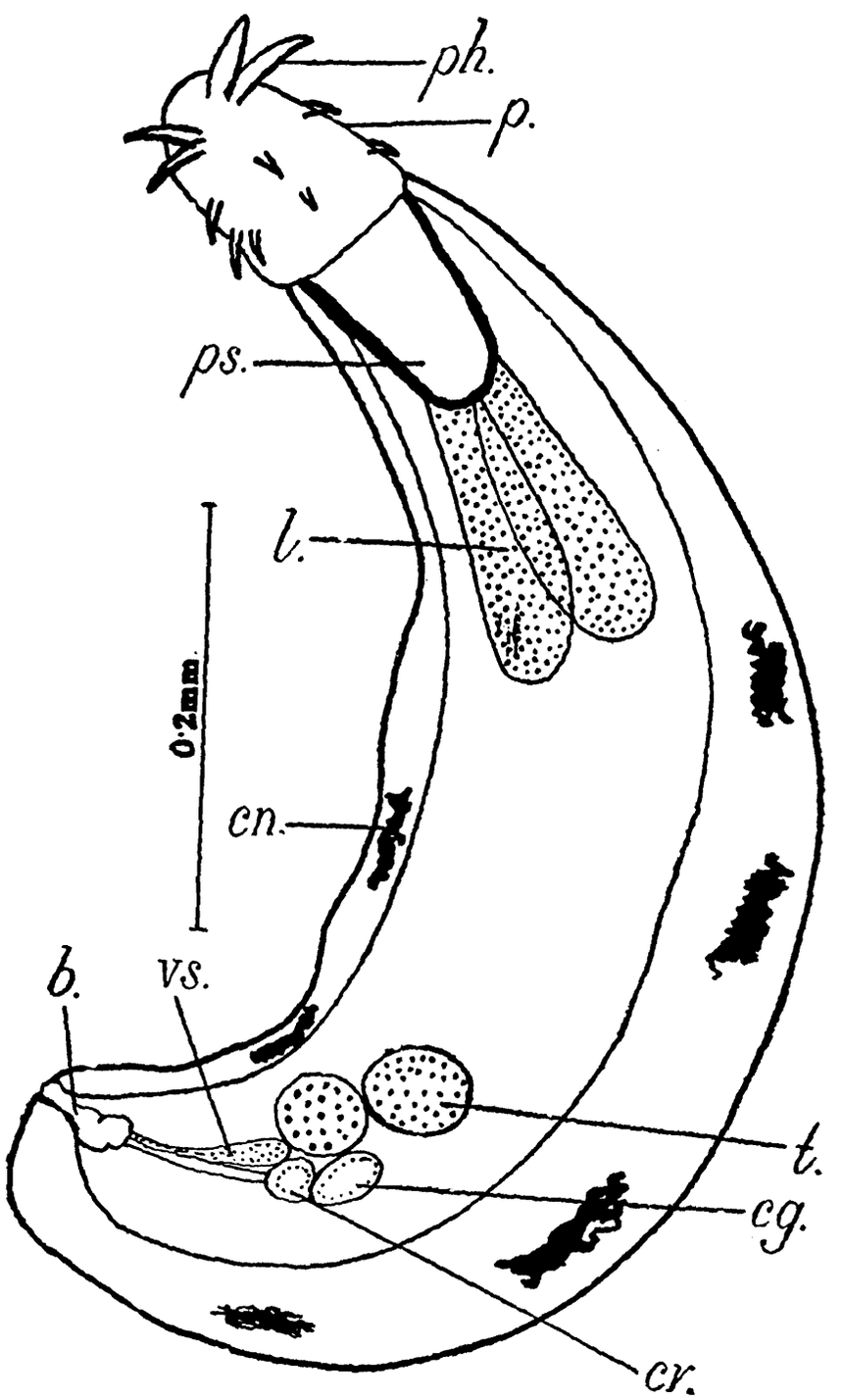
NEOECHINORHYNCHIDAE

Neoechinorhynchus Hamann

Neoechinorhynchus ovalis, sp. nov.

(Text-fig. 1)

Five specimens (three females and two males) of a new species of *Neoechinorhynchus* were obtained from the intestine of one *Elops*



TEXT FIG. 1.—*Neoechinorhynchus ovalis*, sp. nov. Complete worm (male).

b., bursa ; *cg.*, cement gland ; *cn.*, cuticular nuclei ; *cr.*, cement gland reservoir *l.*, lemnisci ; *p.*, proboscis ; *ph.*, proboscis hook ; *ps.*, proboscis sheath ; *t.*, testis.

saurus from the Chilka Lake in October 1952. Only in one male was the proboscis everted, to which my measurements refer.

Body short, plump and oval. Proboscis with longer sheath. Two equal lemnisci, not reaching the testes. Anterior part of the trunk tapered in the region of proboscis sheath, but swollen posteriorly. Cuticular nuclei amoeboid, two ventral and four dorsal. Testes spherical and tandem, in posterior quarter of body. Cement gland pyriform, at the same level as and smaller than posterior testis. Cement gland reservoir half the size and rounded, followed by elongated tapered vesicula seminalis. Bursa small, about the same diameter as reservoir. Uterus, uterine bell and vagina in posterior quarter of body of female. Eggs not developed.

Measurements[1].—Male 0·725×0·217 ; trunk of female (proboscis not everted) 0·652×0·203 ; proboscis 0·114×0·091 ; proboscis sheath 0·098×0·06 ; proboscis hooks, first row 0·060—0·068, second and third row 0·053 ; lemnisci 0·247×0·045—0·049 ; uterine bell, uterus and vagina 0·152 long.

Remarks.—This species is characterised by its small size and the relative size of the proboscis hooks. (First row to second and third row as 1 : 0·828), posterior position of the male genitalia in the last quarter of the body and the small and equal lemniscus. Other species of *Neoechinorhynchus* in which the second and third rows of proboscis hooks are equal are *N yalei* (Datta), *N prolixus* Van Cleave and Timmons, and *N. topeseyi* Poddar. The present form differs from all others in size of the hooks and of the body and lemnisci.

Neoechinorhynchus nematalosi, sp. nov.

(Text-fig. 2 *a* & *b*)

Three specimens (two females and one male) of a new species of *Neoechinorhynchus* were obtained from the intestine of a single specimen of *Nematalosa nasus* from the Chilka Lake. Unfortunately the male was lost during the preparation of permanent mount but its measurements taken in fresh condition are given below :

Body long with the anterior part of the trunk thinner followed by a slight swelling of the dorsal wall and a thin posterior portion. Proboscis globular, its sheath long and constricted slightly in the middle. Lemnisci very long with slightly swollen ends and not reaching testis and thinner in the anterior portion. Proboscis hooks, unequal in three rows. Testes two, oval and tandem. Cement gland oval, cement gland reservoir and vesicula seminalis small. Bursa not clearly seen. Uterine bell and uterus confined to posterior part in the female. Eggs elliptical.

Measurements.—Male 2·333×0·244 ; female 3·248—7·0×0·29—0·68 ; proboscis 0·145×0·145 ; proboscis sheath 0·203—0·217×0·13—0·145 ; lemnisci 1·45—2·17 long ; proboscis hooks, length first row 0·076—0·083, second row 0·038—0·044, third row 0·026—0·03 ; testis 0·217×0·174 and 0·29×0·174 ; cement gland 0·217×0·145 ; eggs 0·019—0·026×0·0057

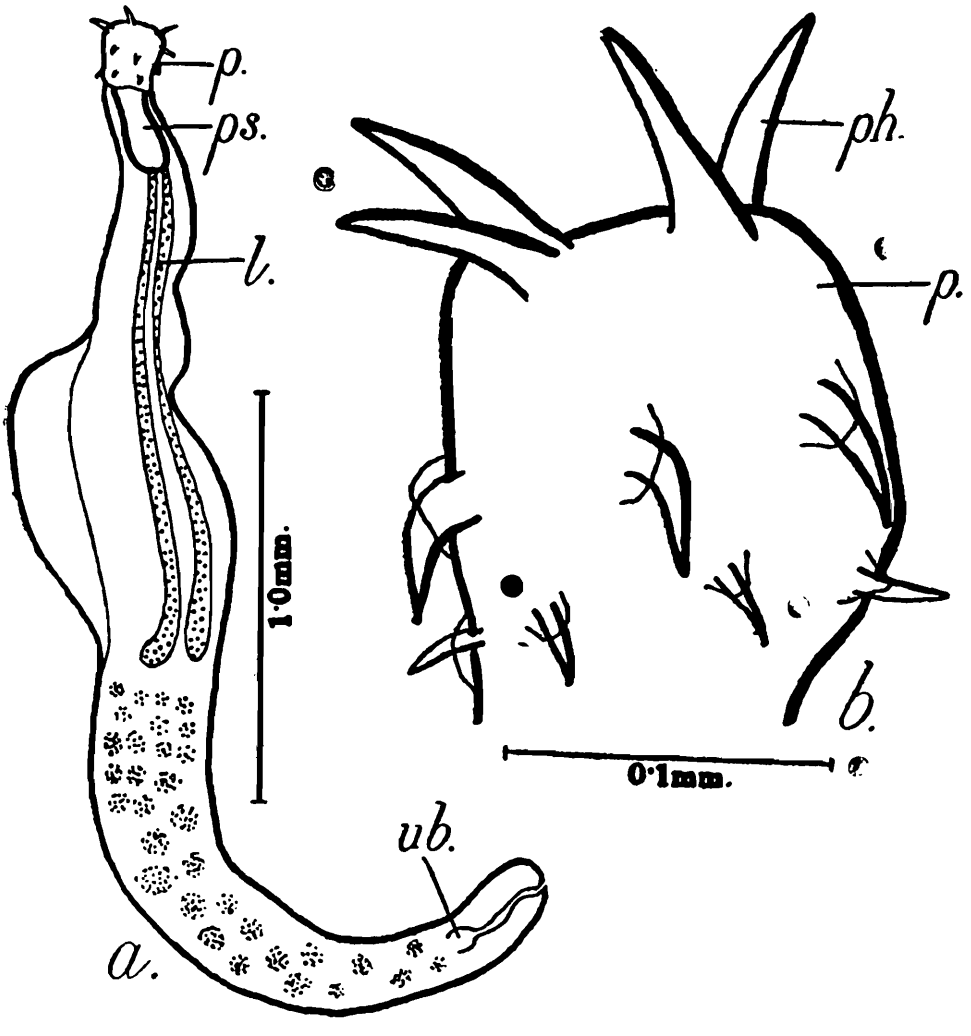
[1] All measurements are in millimeters.

Remarks.—This species is characterised by a swelling in the middle of the body wall, and tapering at the posterior and specially at the anterior end, and the ratio of the size of proboscis hooks.

Neoechinorhynchus bangoni, sp. nov.

(Text-fig. 3)

Many specimens of a new species of *Neoechinorhynchus* were obtained from the intestine of *Mugil tade* (local Bengali name *Bangon*),



TEXT-FIG 2.—*N. nematalosi*, sp. nov.

(*a*) Complete worm (female). (*b*) Proboscis.

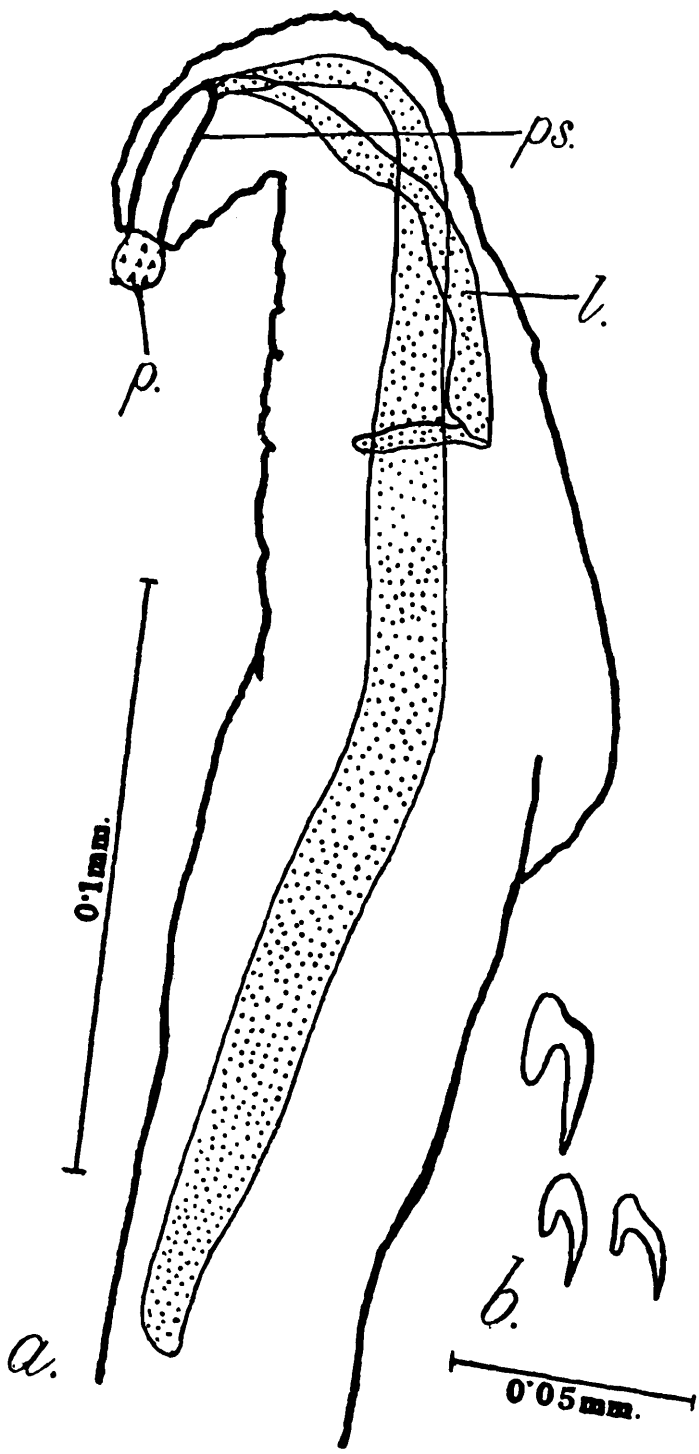
l., lemnisci; *b.*, proboscis ; *ph.*, proboscis hook; *ps.*, proboscis sheath; *ub.*, uterine bell.

caught from the fish farm at Ghutiyari Sharif near Calcutta. The specimens were given to me by Dr. T. V R. Pillay. As the parasites were obtained from the preserved specimens of fish, they were neither fully extended nor in a good state of preservation.

The males and females are both very long though the males are the smaller. Proboscis short and globular with a long sheath and six hooks in each of the three circular rows. Hooks of the anterior row longer

than those of the posterior two rows which are equal in size. Lemnisci unequal, one of them two to three times as large as the other, the longer not reaching the testis.

Testes two, elongate oval, the anterior the longer. Cement gland oval, and its reservoir and vesicula seminalis pyriform. Male genitalia in posterior half of the body. Female genital ducts obscured by the elliptical eggs.



TEXT-FIG. 3.—*N. bangoni*, sp. nov.
(*a*) Anterior part of body. (*b*) proboscis hooks of first and third row.
l., lemnisci ; *p.*, proboscis ; *ps.*, proboscis sheath.

Measurements.—Male 9·0—12·0×0·725—0·94 ; female 15·0—20·0 ×0·65—0·94 ; proboscis 0·076—0·118×0·089—0·106 ; proboscis sheath

0·391—0·71×0·101—0·162 ; lemnisci 1·45—2·07×0·059—0·072 and 2·081 —3·99×0·101—0·162 ; proboscis hooks 0·026—0·038 ; 0·019—0·023 and 0·019—0·021 ; testis, anterior 0·94—1·45×0·212—0·36, posterior 0·87—1·305×0·212—0·362 ; cement gland 0·65—1·88×0·26—0·536; eggs 0·034—0·038×0·007—0·013.

Remarks.—*N. bangoni*, sp. nov. resembles *N cristatus* Lynch, *N. venustus* Lynch, *N distractus* Van Cleave, *N australis* Van Cleave, and *N. prolixus* Van Cleave and Temmons in having the two lemnisci markedly unequal in size. In *N distractus*, *N prolixus* and *N bangoni* only the longer lemnisci fails to reach the testes while in three other related species the long lemniscus reaches the anterior testis or beyony it. The new species differs from these species in the size of the proboscis and proboscis hooks.

Neoechinorhynchus elongatus, sp. nov.

(Text-fig. 4)

Thirtyfive male and female specimens of a new species of *Neoechinorhynchus* were obtained from the intestine of one *Mugil subviridis* from the Chilka Lake in May 1951 and of two *M. dussumieri* from Bay of Bengal at Madras in April 1954. This species differs from *N. chilkaensis* Poddar and *N. agilis* (Rudolphi) described from *Mugil cephalus* from the Chilka Lake.

Females nearly twice the size of males. Body long and tapering at posterior end in both the sexes. Proboscis small and globular, with three rows of hooks unequal in size and its sheath more than three times as long. Two equal lemnisci not reaching the two oblong testes. Cement gland as long as testes with its reservoir pyriform. Vesicula seminalis long. Male genital organs occupying more than the posterior half of the body. Female genital ducts obscured by elliptical eggs.

Measurements.—Male 5·3—7·1×0·75—0.87 ; female 9·0—13·2×1·45—1·6 ; proboscis, male 0·116×0·087—0·101, female 0·145×0·116 ; proboscis sheath, male 0·337—0·435×0·101—0·116, female 0·651×0·145 ; lemnisci 1·45—1·49×0·087—0·101 ; testis 0·58—0·72×0·333—0·348 ; cement gland 0·652—0·797×0·406 ; cement gland reservoir 0·507×0·29 ; seminal receptacle 0·174—0·188 wide ; proboscis hooks 0·049 ; 0·03 and 0·019 long ; eggs 0·11×0·0266.

Remarks.—This species differs from *N agilis* and *N. chilkaensis* in the size of the proboscis and its hooks. The size of the anterior rows of hooks is similar to those of *N. hutchinsoni* Datta and *N mansabalensis* Kaw but the other two rows of hooks differ in all the three species.

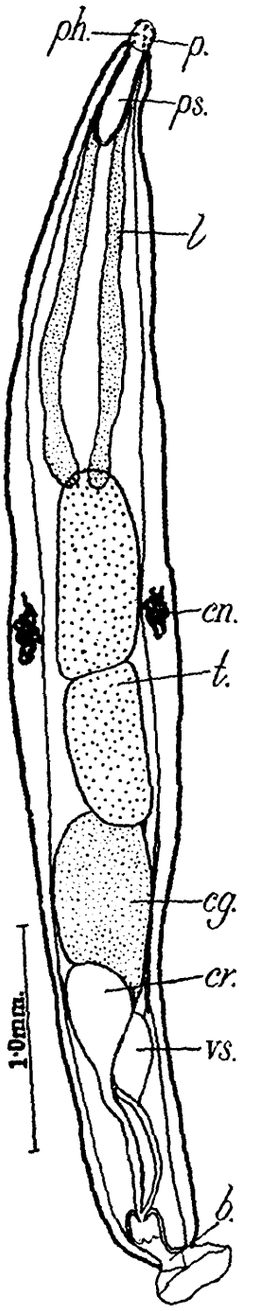
Neoechinorhynchus topseyi Poddar

(Text-fig. 5 *a*, *b* & *c*)

Five specimens of juvenile stage of *N. topseyi* were obtained from the intestine of *Polynemus paradiseus* (its definitive host) and *Cynoglossus*,

lingua from the estuary of the Matla river at Canning in the month of Nov. 1952. Adult forms of this parasite have not been recorded from *Cynoglossus lingua.*

Body elongated, proboscis globular, its sheath twice as long. Proboscis hooks of first two row much longer than those of the second and third rows. Lemnisci long and narrow. Rudiments of female



TEXT FIG. 4.—*N. elongatus* sp. nov. (male).

b., bursa ; *cg.*, cement gland ; *cn.*, cuticular nuclei ; *cg.*, cement gland reservoir ; *l.*, lemnisci ; *p.*, proboscis ; *ph.*, proboscis hook ; *ps.*, proboscis sheath ; *vs.*, vesicula seminalis.

genitalia present. Ovary in one oval mass in the middle of body. Cuticular nuclei long and thin, four on one side and two on the other.

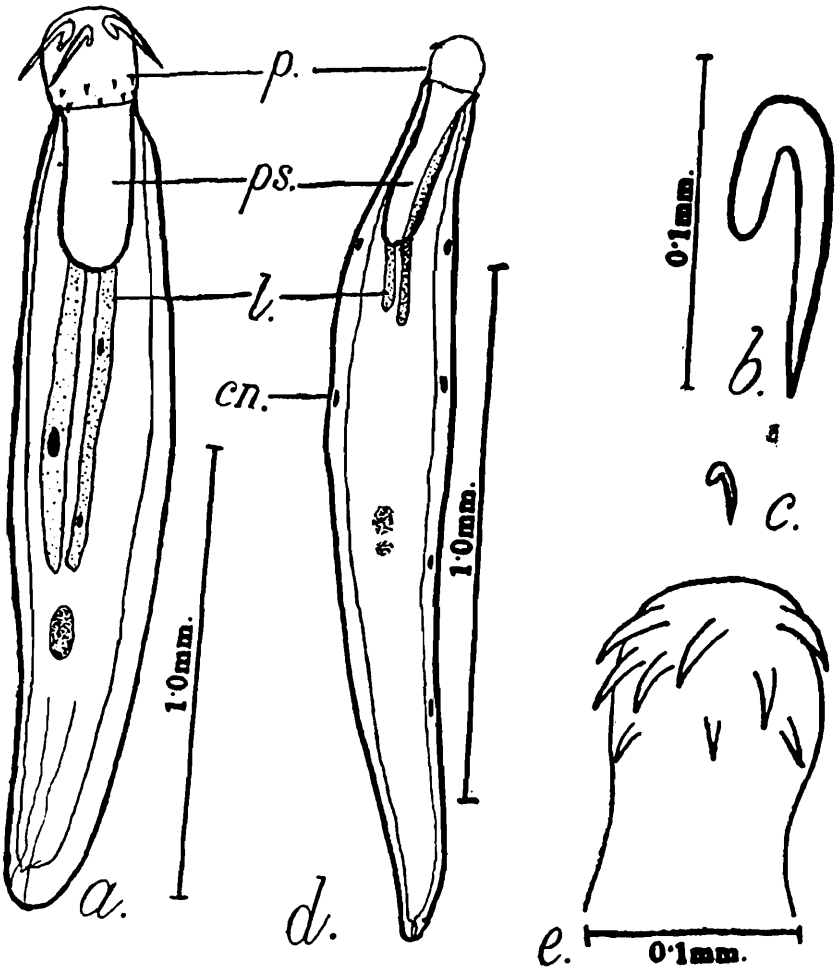
Measurements.—Length 0·957—1·058, breadth 0·145—0·188 ; proboscis 0·087—0·101×0·087 ; proboscis sheath 0·166—0·188×0·058 ; proboscis hooks, first row 0·087, second and third row 0·022.

Neoechniorhynchus sp.

(Text-fig. 5 *d* & *e*)

Three juvenile specimens of a species of *Neoechinorhynchus* were obtained from the intestine of one *Pama pama* and one specimen of the same species from *Eutropiichthys vacha* from the River Ganga at Buxar (Bihar).

Body long, proboscis globular, proboscis sheath cylindrical. Lemnisci long, thin and equal. Proboscis hooks of first and second row nearly equal in size and larger than that of the third row. Cuticular nuclei six on one side and two on the other. Rudiments of genital organs present in mid body.



TEXT-FIG. 5 *a-c.*—*N. topseyi* Poddar ; *d-e. Neoechinorheynchus* sp.

(*a*). Juvenile form. (*b*) Hook of first row. (*c*) Proboscis hook of third row. (*d*) Complete worm. (*e*) Proboscis.

cn., cuticular nuclei ; *l.*, lemnisci ; *p.*, proboscis ; *ps.*, proboscis sheath.

Measurements.—Length 1·45—1·696 ; breadth 0·203—0·217; proboscis 0·188×0·101; proboscis sheath 0·244×0·072; proboscis hooks first row 0·041, second row 0·038, third row 0·022—0·026.

Including the six new species of *Neoechinorhynchus* described above there are at present 33 species of *Neoechinorhynchus* known of which 13 occur in India.

There is very little variation in the genus *Neoechinorhynchus* and the specific differentiation is based on absolute dimensions of the

proboscis and its hooks and of the lemnisci and the eggs. The part of the body occupied by the male genitalia and the posterior extent of lemnisci, though useful characters, may sometimes be misleading.

QUADRIGYRIDAE

Acanthosentis Verma & Datta

Acanthosentis indica, sp. nov.

(Text-fig. 6 *a*)

Several specimens of a new species of *Acanthosentis* were obtained from the intestine of *Setipinna phasa* and *Hilsa ilisha* from the river Ganga at Buxar, from the estuaries of Hooghly and Matla rivers and from the Chilka lake. In Hilsa from river Ganga the infection was more during December and January than in September when over 100 parasites in each fish were obtained. In *Setipinna phasa* the infection was always much less. Maximum parasite population per fish varied between 20 to 30.

Males and females are more or less of the same size. Body long. Proboscis small and globular with three rows of six hooks each. Body spines in the anterior rows are bigger than in the posterior rows. Proboscis sheath long with a single muscular layer and nerve ganglion near its posterior end. Lemnisci long and rather narrow, slightly unequal but not reaching the anterior testis.

Anterior part of trunk beset with 19—20 rows of short and recurved spines as in the rose plant. Cuticular nuclei 3 each on dorsal and ventral side.

Testes oval, overlapping. Cement gland a single syncytial mass, spherical, a little wider but not so long as testis. Cement gland reservoir club shaped. Vesicula seminalis pyriform and long. Bursa nearly as wide as testis. Uterine bell triangular funnel shaped, and attached to the genital ligament anteriorly. Uterus and vagina long. Genital pore postero-lateral. Eggs elliptical with three shelled membranes.

Measurements.—Female 7·26—8·55×0·768—0·899 ; male 7·48—8·26 ×1·01 ; proboscis 0·145—0·217×0·08—0·11, proboscis sheath 0·406—0·435—0·116—0·145 ; lemnisci 1·36—1·98×0·11—0·21 ; testis 1·087× 0·58 and 0·87×0·45 ; cement gland 0·942×0·551 ; cement gland reservoir 0·435×0·29 ; vesicula seminalis 0·145 long, bursa 0·7× 0·43 ; eggs 0·026 —0·03×0·0076—0·0095.

Acanthosentis betwai, sp. nov.

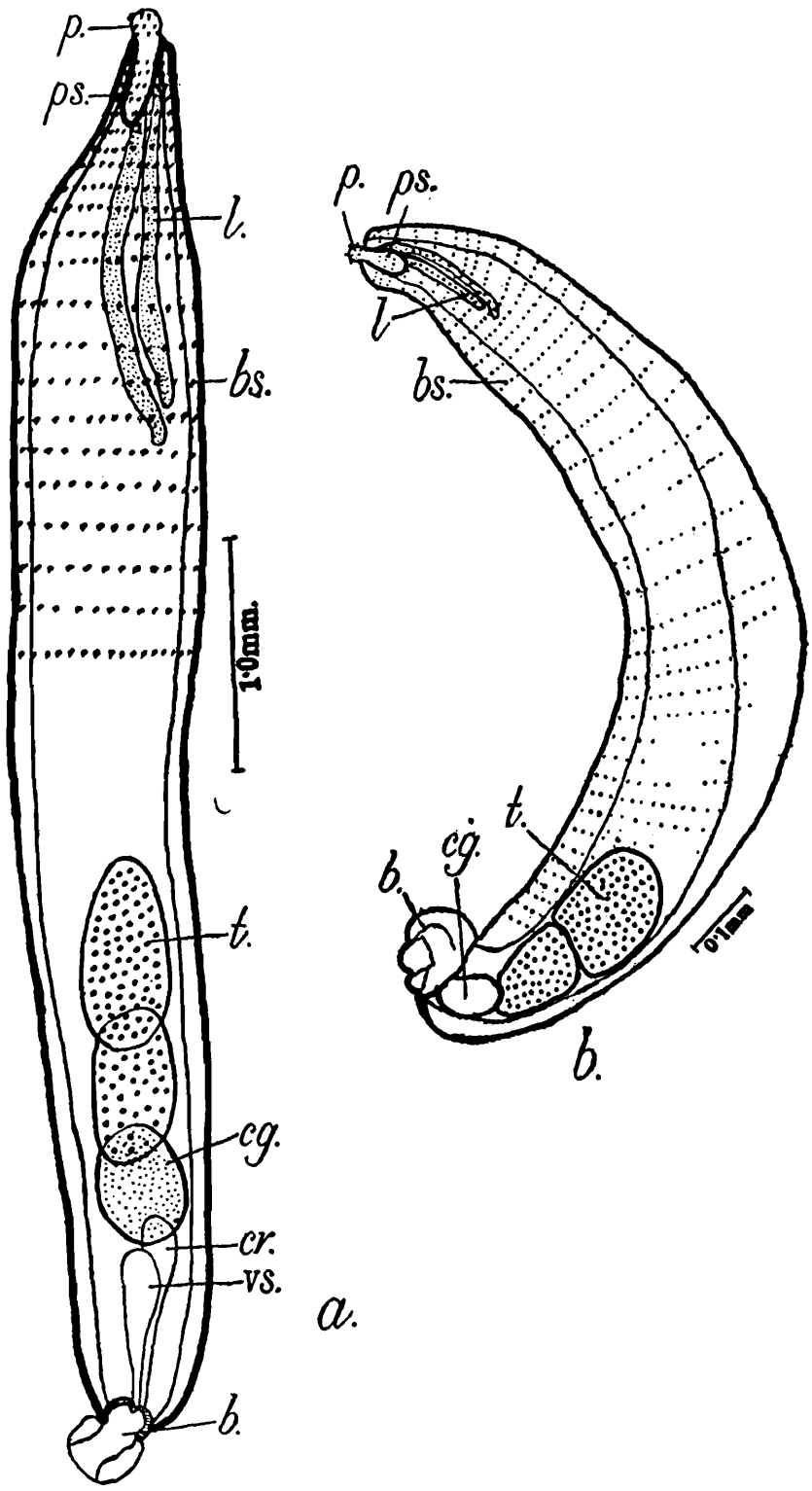
(Text-fig. 6 *b*)

Three specimens (two females and one male) were obtained from one *Labeo gonius* obtained at Bhopal from the River Betwa in July 1954.

Body long and thick, female longer and thicker than male. Body spines in 42—44 rows extending upto the posterior testis in case of male and nearly to the end of body in case of female. Proboscis small and globular. Proboscis sheath long, thicker in the posterior part. Lemnisci slightly unequal. Testes oval, anterior one bigger than the posterior one. Cement gland small and lateral to pyriform vesicula seminalis.

Uterine bell cup shaped. Uterus and vagina long. Eggs oval and smooth-shelled.

Measurements.—Male 8·75×1·25, female 9·83×2·08; proboscis 0·127—0·133×0·127; proboscis sheath 0·435—0·483×0·145; lemnisci 1·04×0·145, proboscis hooks, first row 0·057—0·068, second row



TEXT-FIG—*6a.*—*Acanthosentis indica*, sp. nov. (male); *b.* *Acanthosentis betwai*, sp. nov. (male).

b., bursa; *bs.*, body spine; *cg.*, cement gland; *cr.*, cement gland reservoir; *l.*, lemnisci; *p.*, proboscis; *ps.*, proboscis sheath; *t.*, testis; *vs.*, vesicula seminalis.

0·038—0·053, third row 0·024—0·041, body spines 42—44 rows (all over the body); testes, anterior 0·942×0·652, posterior 0·797×0·435: egg 0·015 in diameter; uterus and vagina 0·942 long.

TABLE 2

Comparative measurements of eight species of *Acanthosentis*

	A. antespinus Verma & Datta, 1929	*A. betwai* sp.nov.	*A. dattai* Poddar, 1938	*A. holospinus* Sen, 1938	*A.indica* sp. nov.	*A. sircari* Poddar, 1941	*A. tilapae* Baylis, 1947	*A. acanthas* Cable & Quick, 1954
Total length	♀0·85—4·5 ♂0·8—2·4	9·03 8·75	1·34—3·34 1·67—9·46	1·6—9·4 0·9—2·4	7·26—8·55 5·54—7·48	2·94—11·89 3·11—4·76	3·0—8·0 2·5—3·5	8·4—15·6 9·12
Breadth	♀0·25—1·1 ♂0·18—0·07	2·08 1·25	0·44—0·9 0·24—0·42	0·2—0·7 0·2—0·4	0·79—0·92 0·72—1·16	0·39—1·01 0·48—0·67	0·38—1·88 0·8—1·1	0·56—0·97 0·956
Proboscis	0·04—0·25 × 0·04—0·15	0·127—0·133 × 0·127	0·12 × 0·05	0·1 × 0·05	0·145—0·217 × 0·08—0·11	0·188 × 0·115	0·11 × 0·1	0·104—0·128 0·13—0·14
Proboscis sheath	0·17—0·38 × 0·04—0·18	0·435—0·483 × 0·145	0·42 × 0·12	0·3 × 0·8	0·4—0·435 × 0·116—0·145	0·265 × 0·15	..	0·5—0·68 long
Body spines	30 rows in anterior part.	42—44 rows all over body.	All over body	..	20—24 rows in anterior part of body.	Spines in anterior part of body.	All over body	31 rows in anterior part of body.
Lemnisci	Equal	Equal	Slightly unequal	..	Equal	Unequal, one × 2 of other.	..	Unequal
Proboscis hooks I	0·072	0·057—0·068	0·05—0·057	..	0·041—0·045	0·055	0·046—0·048	0·063—0·081
II	0·054	0·038—0·053	0·03—0·038	..	0·038	0·048	0·012	0·023—0·024
III	0·048	0·024—0·041	0·026—0·034	..	0·026—0·031	0·018	0·01	0·013—0·027
Ratio of hooks I/III	1·5	1·6	1·92	..	1·57	3·05	4·7	1·8
Eggs	0·026 × 0·008	0·015 broad	0·026 long	0·1 long	0·026—0·03 × 0·007	..	..	0·028—0·032 × 0·005—0·006
Host & Locality	*Mystus gulio* Allahabad. Chilka & Calcutta	*Labeo gonius* Bhopal	*Barbus ticto Barbus stigma* Bengal.	*Barbus stigma* Bengal	*Hilsa ilisha, Setipinna phasa* Bengal Orissa & U.P.	*Basbora elonga* Bengal.	*Tilapia lidole* Africa.	*Acanthurus cocrulens & A. bahianus,* Puerto Rico.

Remarks.—Baylis (1947) considers *A. dattai* as a synonym of *A. holospinus*. There are then seven valid species in the genus including the two new ones described here. All except *A. indicus* and *A. acanthuri* are from freshwater fishes. *A. indicus* resembles *A. antespinus* in the spines being confined to the anterior part of the body, and in the size of the eggs but differs in the proboscis hooks being smaller than in the latter species and also in the size of the body. *A. betwai* resembles *A. holospinus* (and *A. dattai*) in having spines all over the body but the two species differ in size of the proboscis hooks and the size of various parts of the body. An artificial key to the 7 species is given below :

1. Lemnisci unequal, one nearly twice of the other	*A. sircari*
1. Lemnisci nearly equal . ..	2
2. Body spines in anterior part of body ..	3
2. Body spines all over the body ..	5
3. Apical rows of proboscis hooks more than 50 μ long	4
3. Apical row of proboscis hooks less than 50 μ in length ..	*A. indicus*
4. Body long, lemnisci unequal, ratio of size of proboscis hooks of I & III row nearly 3·5	*A. acanthuri*
4. Body small, lemnisci equal, ratio of size of proboscis hooks of I & III row nearly 1·5	*A. antespinus*
5. Ratio of size of I & III row of proboscis hooks less than two	*A. betwai*
5. Ratio of size of I & III row of proboscis hooks nearly two	*A. holospinus*
5. Ratio of size of I & III row of proboscis hooks nearly five	*A. tilapae*

RAORHYNCHIDAE fam. nov.

Raorhynchus,[1] gen.nov.

Raorhynchus polynemi, sp. nov.

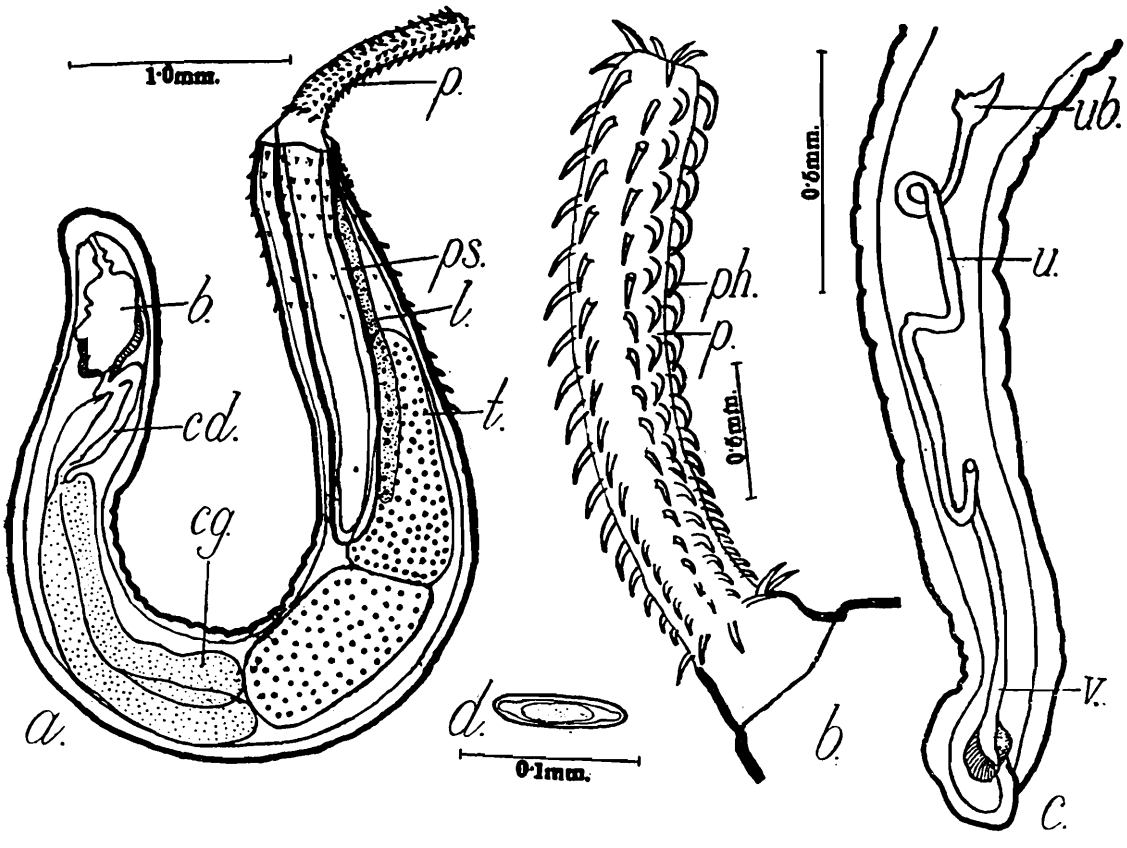
(Text-fig. 7)

Over twentyfive male and female specimens of a new Acanthocephalan parasite were obtained from the intestine of three specimens of *Polydactylus sextarius* from the sea at Puri in December 1953 and 1954. The living parasites were all dorsally curved and deep orange in colour. As they do not fall under the generic characters of hitherto known genera of Acanthocephala, it has become necessary to create a new genus and new family to accommodate them.

Body dorsally reflexed and uniformly thick. Females much longer than males. Proboscis long, studded with a large number of curved hooks arranged in 11-12 long rows of 22-24 hooks each. Hooks on dorsal side smaller, thicker and more curved than the more slender

[1] The genus is dedicated to and named after Dr. H.S. Rao, D. Sc., F.N.I., Chief Research Officer, Central Inland Fisheries Research Station, Calcutta.

ventral hooks. Both dorsal and ventral hooks become smaller posteriorly. The hooks of the last row are abruptly larger than those in penultimate row; they are long, slender and arcuate. Thus the proboscis hooks vary in size dorsoventrally as well as anteroposteriorly. Neck small and without spines. Trunk with spines in the anterior part, in eight rows dorsally and 12 rows ventrally. Proboscis sheath long and double walled. Lemnisci equal and slightly smaller than proboscis sheath. Testes two, oval and reaching half way upto the proboscis sheath. Anterior testis longer than posterior. Cement glands two, tubular and long with their thick ducts opening near the penis. Vesicula seminalis small, near bursa which is circular when everted. Uterine bell thistle-shaped. Uterus long and convoluted. Vagina with sphincter muscles and opening laterally. Eggs three shelled and smooth with the middle one drawn out at the two ends as protuberances.



TEXT-FIG. 7.—*Raorhynchus polynemi*, gen. *et* sp. nov.

(*a*). Complete worm (male). (*b*). Proboscis. (*c*). Posterior part of female. (*d*) Egg.

b., bursa; *cd.*, cement gland duct; *cg.*, cement gland; *l.*, lemnisci; *p.*, proboscis; *ph.*, proboscis hook; *ps.*, proboscis sheath; *t.*, testis; *u.*, uterus; *ub.*, uterine bell; *v.*, vagina.

Measurements.—Female 4·42—9·5×0·551—0·696; male 6·06—6·29 ×0·62—0·652; proboscis 0·725—1·23×0·116—0·145; proboscis sheath 1·45—1·986×0·188—0·203; neck 0·087×0·217; lemnisci 1·23—1·52×0·145; testes, anterior 0·797—1·087×0·275—0·333; posterior 0·58—0·768×0·333; cement gland (width) 0·217—0·29; uterus and uterine bell 3·03; egg 0·076×0·015.

Remarks.—*Rhadinorhynchus terebra* (Rudolphi) has also two cement glands, a long proboscis, and dorsoventral differentiation of its hooks which are in 24—26 rows each with 36—37 hooks. This species is

therefore transferred to this present new genus and made the type species by order of priority. *R. polynemi*, sp. nov. differs from *R. terebra* in having 11-12 rows with 22-23 hooks on its proboscis.

Diagnosis of RAORHYNCHIDAE

Palaeacanthocephala. Body long and curved with rows of spines on its anterior part. Proboscis long with 12-24 rows of hooks which are dorsoventrally as well as antero-posteriorly differentiated in shape and size. Proboscis sheath with two layers and extending upto or beyond the anterior testis. Lemnisci equal and smaller than proboscis sheath. Testis long. Two cement glands.

Type and only genus.—*Raorhynchus*.

Generic diagnosis.—Same as above.

Type-species.—*R. terebra* (Rudolphi).

GORGORHYNCHIDAE

Serrasentis Van Cleave

Serrasentis longa, sp. nov.

(Text-fig. 8 *a* & *b*)

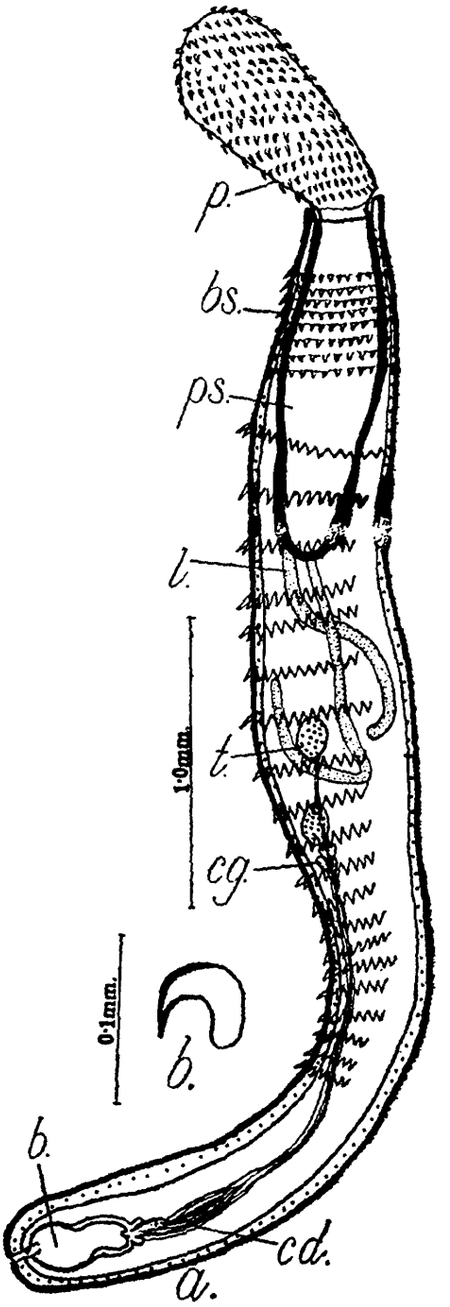
The new species is based on a single male specimen obtained from the intestine of *Rhynchobatus djeddensis* obtained from the sea at Puri in October 1952.

Body long, slightly thinner at posterior end. Proboscis club-shaped wider anteriorly, having 22 spiral rows of 17—18 hooks each. Hooks curved with their roots longer than the body. Neck small and smooth. Anterior part of body with 9 rows of spines each with 10—12 spines and covered with cuticle followed by 19 incomplete rows of fused spines which extend to the posterior $\frac{3}{4}$ part of the body.

Proboscis sheath in two layers, one and a half times longer than proboscis. Lemnisci long, thin and unequal and reaching beyond the testes which are small, oval and not contiguous. Cement glands four, pyriform, situated a little behind the posterior testis with very long ducts. Bursa muscular with ring like sphincter.

Measurements.—Total length 4·93 ; breadth, anterior part 0·377, middle 0·557, posterior 0·348 ; proboscis 0·87 ×0·377 ; proboscis sheath 1·35×0·29 ; neck 0·232×0·319 ; proboscis hooks 0·057, root 0·068, breadth at base 0·019 ; body spines 0·049×0·015 ; spines of comb 0·0418 ×0·015 ; testes 0·087×0·13.

Remarks.—Including the present form there are now five species of *Serrasentis*. Datta (1954) has described a new species *S. chauhani* from the mesentry of intenstine wall of *Psettodes erumie* and *Lutianus johnii* from Bombay. The present species differs from all the others in the size and number of proboscis hooks, and rows of cuticular and collar spines on the body. In *S. socialis* there are 18-23 rows of



TEXT-FIG. 8.—*Serrasentis longa* sp. nov.

(*a*) Complete worm (male). (*b*). Proboscis hook.

b., bursa ; *bs.*, body spine ; *cd.*, cement gland duct ; *cg.*, cemant gland ; *l.*, lemnisci ; *p.*, proboscis. *ph.*, proboscis hook ; *ps.*, proboscis sheath ; *t.*, testis.

cuticular and collar spines, in *S. chauhani* 22 rows and in the present species 19 rows. The body is also smaller in size than in the other species.

Mehrarhynchus Datta

Mehrarhynchus secundus, sp. nov.

(Text-fig. 9 *a-c*)

Several male and female specimens of *Mehrarhynchus* Datta, were obtained from the intestine of *Plotosus canius* caught from the Chilka Lake and the estuary of Matla river at Port Canning. The same parasite was obtained from the intestine of *Pama pama* and *Osteogeneiosus militaris* from Chilka Lake.

Males and females nearly of the same size. Proboscis flexed at an angle with the body, club-shaped and broader anteriorly. 16-18 curved hooks in 18-20 longitudinal rows on the proboscis. Root of hook longer than the barb. Neck small without spines. Trunk long and tapering posteriorly, with its anterior part having 9-10 rows of small spines covered with a basal chitinous sheath. Proboscis sheath long, having the nerve ganglion near its posterior end. Lemnisci two, unequal and smaller than proboscis sheath.

Testes spherical to oval, tandem and slightly overlapping. Anterior testis behind or just touching the proboscis sheath. Four pyriform cement glands with long ducts arranged in two pairs. Vesicula seminalis pyriform. Cement gland ducts open near penis. Bursa with thick muscular wall and oval in shape when everted. Uterine bell funnel-shaped, in posterior one third of body. Uterus and vagina long and thin. Vaginal opening with sphincter muscle. Eggs not present.

Measurements.—Female 1·84—2·697 × 0·29—0·4 ; male 2·07—2·49 × 0·377—0·49 ; proboscis 0·551—0·797 × 0·244—0·304 ; proboscis sheath 0·493—0·754 × 0·0145—0·217 ; proboscis hooks 0·049—0·053 ; body spine 0·019—0·022 ; lemnisci 0·785 × 0·029 ; testis 0·116—0·145 × 0·145—0·188 ; cement gland 0·065 wide ; seminal vesicle 0·10 wide ; bursa 0·259 × 0·145 ; uterine bell 0·076 × 0·053 ; uterus 0·087 × 0·049 ; vagina 0·149 × 0·038.

Remarks.—This is the second species of the genus *Mehrarhynchus*, the first being *M. prashadi* Datta from *Pangasius pangasius*. The two differ in the size of the body, and in the number and size of the proboscis hooks. This genus should appropriately be placed in the family *Gorgorhynchidae* Van Cleave and Lincicome, 1940 (see discussion on page 84).

ECHINORHYNCHIDAE

Heterosentis Van Cleave

Heterosentis plotosi Yamaguti, 1935

(Text-fig. 9 *d*)

Several specimens of this species were obtained from the intestine of *Plotosus canius* from the Chilka Lake and from the estuary of the Matla river at Port Canning.

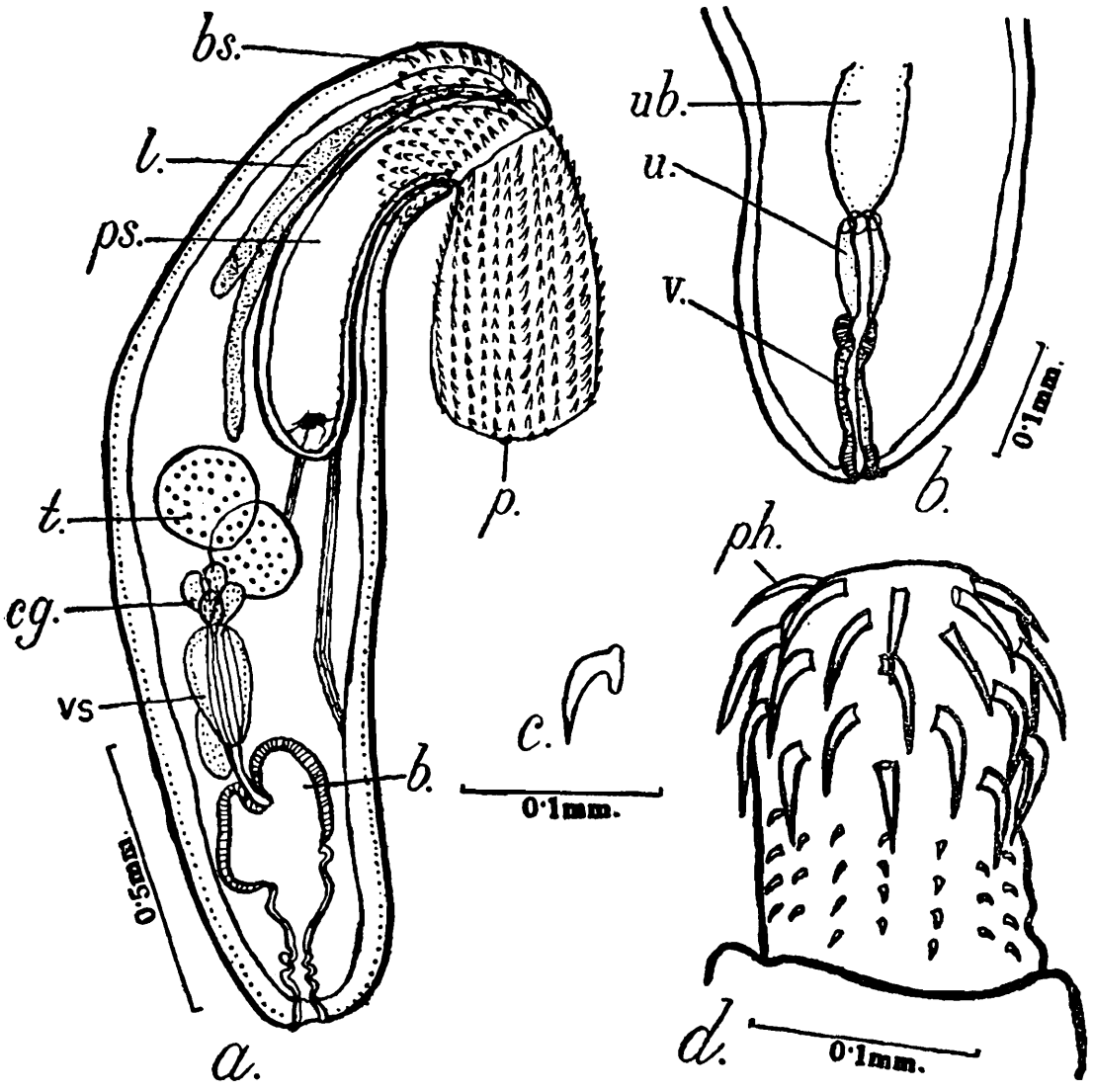
Yamaguti (1935 and 1937) and Fukui and Morishita (1936) described this species from *Plotosus anguillaris* of Japan. The new record in India of this parasite is from a related host. The measurements of this parasite from India are shown in Table 3.

Table 3

Showing characters of species of *Heterosentis* Van Cleave, 1931.

	H. fusiformis (Yamaguti)	*H. heteracanha* (V. Linstow).	*H. neobythits* (Yamaguti)	*H. plotosi* (Yamaguti)	*H. rhinoplagusi* (Yamaguti)	*H. spinicaudatus* (Cable & Quick)
♀Total length	5—6	4·75—5·85	8—12·5	5·29	3·16—7·18	..
♂		4·94	5·4—7·3	2·39—2·52	2·45—3·67	2·02
♀Breadth	2—2·3	0·4—0·79	..	0·72	0·5—0·8·	..
♂		0·59	..	0·36—0·5	0·5	0·52
Proboscis	0·34—1·43 long	0·3 × 0·17—0·2	0·5—0·65 × 0·13—0·2	0·17—0·29 × 0·11—9·2	0·3—0·29 × 0·11—0·2	0·32 × 0·07
Proboscis hooks (number and arrangement).	apical hooks 18, sub-apical 2, alternate rows of 7 hooks, basal 14 rows of 2—3 hooks.	10 long rows of 3—4 hooks each.	17—18 long rows of 11—13 hooks each, apical large, basal small.	Six spiral rows of 5 hooks anteriorly 13—14 long rows of 3—4 hooks each, posteriorly.	14 long rows of 10 hooks each.	10 diagonal longitudinal rows of 13 hooks each. Posterior 4 rows reduced in size.
Proboscis : hooks-size	apical 0·045—0·063 sub-apical 0·188—0·21, basal 0·024—0·069.	..	0·03—0·072	anterior hook 0·057—0·064, Posterior hooks 0·015.	Large hooks 0·042—0·063 : basal hooks 0·016—0·024.	Anterior hooks 0·028—0·03, Posterior hooks 0·012.
Host : Locality	*Spheriodes* sp : Japan	*Atherinichthys microlepidotes* Europe. :	*Neobythites macropus* : Japan.	*Plotosus anguillaris P. canius* : Japan & India.	*Rhinoplagusia japonica* : Japan.	*Halichoeres bivittatus* : Puerto Rico.

Three other species *Arhythmacanthus fusiformis* Yamaguti, 1936, *Acanthocephaloides neobytithis* Yamaguti, 1939 and *A. rhinoplagusi* Yamaguti, 1936 are also transferred to this genus and their measurements are also given in Table 3. The reasons for this transfer are discussed on page 85.



TEXT-FIG. 9 *a-c.—Mehrarhynchus secundus*, sp., nov.; *d. Heterosentis plotosi* Yamaguti, Proboscis.

(*a*). Complete worm (male). (*b*). Posterior part of female. (*c*). Proboscis hook.

b., bursa; *bs.*, body spine; *cd.*, cement gland duct; *cy.*, cement gland; *l.*, lemnisci; *p.*, proboscis; *ph.*, proboscis hook; *ps.*, proboscis sheath; *t.*, testis; *u.*, uterus; *ub.*, uterine bell; *v.*, vagina.

RHADINORHYNCHIDAE

Rhadinorhynchus Lühe

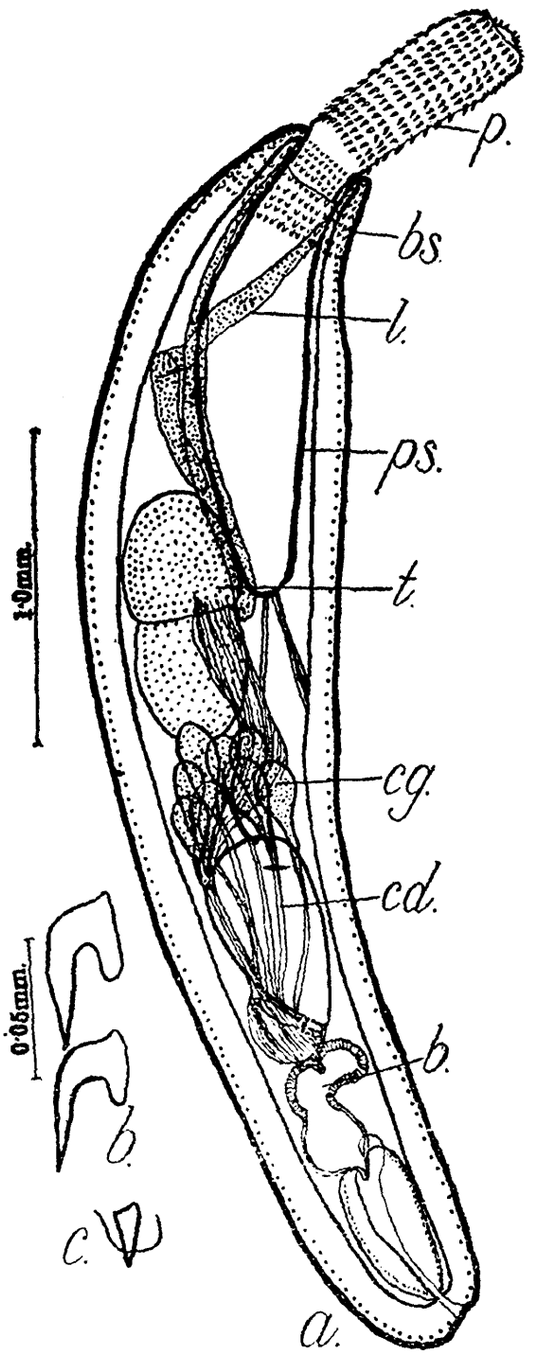
Rhadinorhyncus indicus, sp. nov.

(Text-fig. 10 *a-c*)

Several male and female specimens of this parasite were obtained from the intestine of *Tachysurus jella* from the sea at Puri and from the Chilka lake. Two males and two females of the same species were obtained from the intestine of another related Siluroid fish *Osteogeneiosus militaris* from the Chilka Lake.

The males are slightly smaller than the females. Proboscis long with 14 curved hooks in each of the 20—22 longitudinally arranged rows. Neck short and spineless. Trunk long and cylindrical with 6—9 circular

rows of body spines in the anterior region. Last row with 36 spines. The two lemnisci are slightly unequal but do reach the posterior testis. Proboscis sheath long with two layers and reaching the anterior testis. The testes are oval, overlapping and in the anterior half of the body. Cement glands 8, small and pyriform with their ducts opening into the ejaculatory duct. Vesicula seminalis pyriform. Bursa occupying pos-



TEST-FIG. 10.—*Rhadinorhynchus indicus*, sp. nov.

(*a*) Complete worm (male. (*b*) Proboscis hooks. (*c*) Body spine.

b., bursa; *bs.*, body spine; *cd.*, cement gland duct; *cg.*, cement gland; *l.*, lemnisci; *p.*, proboscis; *ph.*, proboscis hook; *ps.*, proboscis sheath; *t.*, testis.

terior third of the body. The body was so full of eggs that the female genital ducts could not be made out. Eggs ellipsoidal with three coverings in other species.

Measurements.—See Table 5.

Out of the 23 species shown in Table 4 only six are retained in this genus. Of these, only in two species the males are known. The inadequately described *R. alosae* is unrecognised. The measurement of the valid species are given in Table 5.

TABLE 4

Species	Author	Present generic position	Remarks
1. *alosae*]	Hermann, 1782	*Rhadinorhynchus*	Not recognised as valid species
2. *aspinosus*	Fukui & Morishita, 1937.	*Neorhadinorhynchus*	
3. *carangis*	Yamaguti, 1939	*Nipporhynchus*	
4. *ditrematis*	Yamaguti, 1939	*Nipporhynchus*	
5. *epinepheli*	Yamaguti, 1939	*Rhadinorhynchus*	Male not known.
6. *exilis*	Van Cleave, 1928	*Rhadinorhynchus*	Male not known.
7. *horridus*	Lühe, 1912	*Rhadinorhynchus*	Male not known.
8. *johnii*	Baylis, 1929	*Aspersentis*	
9. *katsuwonis*	Harada, 1928	*Nipporhynchus*	(Syn. of *ornatus*.)
10. *medius*	Van Cleave, 1918	*Gorgorhynchus*	
11. *meyri*	Heinze, 1934	*Rhadinorhynchus*	Male not known.
12. *miyagawai*	Fukui & Morishita, 1937.	*Rhadinorhynchus*	
13. *niloticus*	Meyer, 1933	*Tenuisentis*	
14. *nudus*	Harada, 1938	*Neorhadinorhynchus*	
15. *ornatus*	Van Cleave, 1918	*Nipporhynchus*	
16. *peltorhamphi*	Baylis, 1944	*Acanthocephalus*	
17. *pristis*	Lühe, 1911	*Rhadinorhynchus*	
18. *selkerki*	Van Cleave, 1920		(Syn. of *pristis*.)
19. *tenuicornis*	Van Cleave, 1918	*Telosentis*	
20. *terebra*	Rudolphi, 1819	*Raorhynchus*	
21. *trachiuri*	Harada, 1935	*Nipporhynchus*	
22. *whecleri*	Baylis, 1929	*Aspersentis*	
23. *indicus*, sp. nov.		*Rhadinorhynchus*	

From Table 5 it is clear that *R. indicus*, sp. nov. differs from all the other species in the number and size of proboscis hooks which are not differentiated dorsoventrally and in the absence of last row of larger hooks on the proboscis.

Table 5

		R. epinepheli	R. exilis	R. horridus	R. indicus	R. meyri	R. pristis
Size		♀20	♀12×0·96	♀19×0·75	♀6·27—7·55×1·07—1·21 ♂4·9—5·8×0·84—1·01	♂25×1·4	♂75·0 long ♂20·0×0·6—0·9
Proboscis hooks.	No. of long rows	16	12	14—16	18—20	22	14—16
	No. of hooks per row.	12—13	32	31	14	43 26	
	Size	Subapical, 0·1, basal 0·06.	0·071 0·024.0·041	..	0·041 0·041	..	..
Proboscis		1×0·3	2·5×0·13	1·5×0·18	0·6—0·79×0·29—0·36	0·7×0·32—0·36	..
Proboscis sheath		2·1—2·3×0·26—0·35	..	..	1·45—1·59×0·29—0·36	..	..
Last row of larger hooks proboscis		absent	absent	present	absent	..	present
Body spines		·033—0·04	0·012—0·018 long.	'Enormous size'.	0·022 long. 9—12 rows.	..	..
Egg		0·096—0·11×0·036—0·045	0·053—0·059×0·012	..	0·079×0·019.	0·1×0·03	0·12×0·02

Discussion.—Meyer (1931) gave a detailed classification of Acanthocephala based on the characters of the proboscis and the cement glands. Other attempts at classification of this group in recent years are by Travassos (1926), Thapar (1927) and Witenberg (1932). Van Cleave (1936 & 1948) emended the classification of Meyer and raised the Acanthocephala to the status of a Phylum, bringing about necessary changes in the families in his various publications on the basis, mainly of the cement glands. Southwell and MacFie (1925), Thapar (1927) and Baylis (1944) consider the cement glands unsuitable as taxonomic criteria. I agree with Van Cleave (1949) that cement glands could serve as one of the basic characters for distinguishing families and genera if taken together with the hook pattern of the proboscis, spination of the trunk, elongation and/or bulging of the neck or trunk. In such a scheme of classification the male assumes a very important position.

In this paper I have confined myself to the consideration of only those families of Acanthocephala which parasitise fishes and have therefore left out the order Archiacanthocephala, and the family Polymorphidae of the order Palaeacanthocephala. On the basis of the number of cement glands the various families can be arranged as follows :

1. Cement gland one syncytial mass	..	Neoechinorhynchidae and Quadrigyridae.
2. Two cement glands	..	Acanthogyridae, Diplosentidae and Raorhynchidae.
3. Four cement glands		Gorgorhynchidae.
4. Six cement glands	.. ..	Echinorhynchidae and Pomphorhynchidae.
5. Eight cement glands		Rhadinorhynchidae.

This arrangement is probably not phylogenetic but with our present knowledge it may be helpful in systematic studies. A key to the various families is given on page 86.

The family Quadrigyridae differs from the Neoechinorhynchidae only in having body spines. Travassos (1926) and Witenberg (1932) placed the former as a subfamily of the latter, a view with which Baylis (1933 and 1947) was in agreement. Meyer (1931) placed these two families under separate orders. Van Cleave (1936) resolved the divergence of views by the creation of a new order, Eoacanthocephala, divided into two suborders Gyracanthocephala (for Quadrigyridae and Pallisentidae) and Neoacanthocephala (for Neoechinorhynchidae and Hebesomidae) which were later raised by the same author (1948) to the status of an order. As seen above, these orders of Van Cleave (1948) are based on the presence or absence of the body spines, a character which can serve only for distinguishing genera or at best families. It is suggested here to suppress the order Gyracanthocephala and the family Quadrigyridae be accommodated in the Neoacanthocephala. Further families Tenuisentidae Van Cleave (1936) and Hebesomidae Van Cleave (1924) be merged with Neoechinorhynchidae and the family Pallisentidae be merged with Quadrigyridae. *Eosentis* Van Cleave, (1928), is accepted as a synonym of *Neoechinorhynchus.*

In this paper a new genus *Raorhynchus* with two cement glands is created, for which a new family Raorhynchidae had also to be created because the genus could not be included either in Acanthogyridae or Diplosentidae (both with 2 cement glands). The characters of the three families are given below in Table 6.

TABLE 6

	Acanthogyridae, Thapar	Diplosentidae, Tubangui	Raorhynchidae, fam. nov.
Proboscis	Short club-shaped	Short club-shaped	Elongate oblong
Proboscis hooks	In 3 long rows, each with 3 recurved hooks.	In 12 long rows each with 8-9 hooks.	In 12-24 long rows each of 22-37 hooks showing dorse-ventral differentiation.
Trunk	Spiny	Smooth	Spiny
Lemnisci	Long	Enclosed in a sac and coiled.	Long

Van Cleave and Lincicome (1940) included in the family Rhadinorhynchidae only those genera in which there were 8 cement glands and created a new family Gorgorhynchidae for those having 4 cement glands. The genera *Fessisentis* and *Cavisoma* created by Van Cleave (1931) in the families bearing the generic names were based on the shape of the proboscis and the number of cement glands. In this review these two genera are placed under Gorgorhynchidae and their respective families are suppressed.

Rhadinorhynchoides Fukui and Morishita (1937) was placed by its authors under Centrorhynchidae. Yamaguti (1939) made it a subgenus of *Rhadinorhynchus* having 4 cement glands, no spines on body and 15 long rows each with 5 hooks on proboscis. This genus is placed here under Gorgorhynchidae.

Neorhadinorhynchoides, a subgenus of *Rhadinorhynchoides*, was created by Yamaguti (1939) for *Rhadinorhynchoides aspinosus*, Fukui and Morishita (1937) and *R. nudus* Harada (1937). According to Yamaguti (1939) the proboscis hooks show "no marked difference in the shape and size on dorsoventral side" in this subgenus, but in both these species there are apart from dorsoventral differentiation, the proboscis with 17—25 hooks in each of the 14—18 rows and 4 cement glands. This subgenus has been raised here to the rank of a genus and placed under Gorgorhynchidae. There are now 12 genera under this family of which 7 have spines on their body. A key to the genera is given on page 86.

Meyer (1931) characterised the family Echinorhynchidae as having a long or cylindrical proboscis, six pyriform or tubular cement glands, and

body lacking spines. He included *Echinorhynchus* (Zoega) Müller, *Acanthocephalus* Koelreuther, *Acanthocephaloides* Meyer, *Cavisoma* Van Cleave, and *Pomphorhynchus* Monticelli. Later on *Longicollum* Yamaguti, *Tenuiproboscis* Yamaguti, and *Hypoechinorhynchus* Yamaguti were added to this family. *Cavisoma* has been transferred here to Gorgorhynchidae and *Tenuiproboscis, Longicollum* and *Pomphorhynchus* are placed under *Pomphorhynchidae* by Yamaguti (1939). Baylis (1944) does not recognise *Acanthocephaloides* Yamaguti. Dollfus (1951) described a new species *A. chabaunadi* but did not include *Acanthocephaloides rhinoplagusi* Yamaguti 1936, *A. neobythitis* Yamaguti 1939 and *A. japonicum* (Fukui and Morishita 1937) Yamaguti 1937. The first two species are transferred here by me to *Heterosentis* Van Cleave, as they have spines on body, 6 cement glands and proboscis hooks of two sizes. These two species (*A. rhinoplagusi* and *A. neobythitis*) are placed by Cable and Quick (1954) in a new genus *Neoacanthocephaloides* together with a new species *N. spinicaudatus*. This genus is characterised by having 6 cement glands, body spined, proboscis with two types of hooks—characters which are similar to those of *Heterosentis*. Due to these similarities *Neoacanthocephaloides* is made a synonym of *Heterosentis*.

Acanthocephaloides japonicum is taken as valid species.

Arhythmacanthus Yamaguti (1936) is characterised as having a short proboscis with 3 types of hooks, body spined and 6—8 cement glands. Yamaguti (1936) placed this genus along with *Heterosentis* in the family Arhythmacanthidae. These two genera are similar except that in *Arhythmacanthus* the middle proboscis hooks are largest and apical and posterior hooks smaller while in *Heterosentis* the anterior hooks are larger than posterior ones. It is suggested here to merge *Arhythmacanthus* in *Heterosentis* and thus *A. fusiformis* becomes *Heterosentis fusiformis* and as a result of this the family Arhythmacanthidae is also suppressed.

Meyer (1932) suggested similarities between *Heterosentis* and *Acanthocephaloides*. The hook pattern of the proboscis, the shape and number of the cement glands in these two genera is similar except that the former genus has spines on the body which the latter lacks. On this basis *Heterosentis* is placed under Echinorhynchidae. It has now six species under it, whose measurements are given in Table 3.

A key to the genera of Echinorhynchidae and Pomphorhynchidae is given on page 88.

As stated above the family Rhadinorhynchidae is restricted to six genera having 8 cement glands. A satisfactory key to these genera given by Van Cleave and Lincicome (1940) still holds good and is not repeated here.

Rhadinorhynchus peltorhamphi Baylis, 1947 has six cement glands, proboscis hooks on ventral side are smaller and body lacks spines. This species is placed under *Acanthocephalus* though its proboscis hook pattern is slightly different from that of *Acanthocephalus*.

KEY TO THE GENERA AND FAMILIES OF NEOACANTHOCEPHALA AND PALAEACANTHOCEPHALA (EXCEPT FAMILY POLYMORPHIDAE).

NEOACANTHOCEPHALA

1.	Body spines present	Quadrigyridae.
1.	Body spines absent	Neoechinorhynchidae.

Family QUADRIGYRIDAE

1.	Three transverse rows of proboscis hooks, each row with 6 hooks.	*Acanthosentis* Verma & Datta, 1929.
1.	Four transverse rows of proboscis hooks .	2.
2.	Five hooks in each row, 4 rows of body spines	*Quadrigyrus* Van Cleave, 1920.
2.	First two rows with 6 hooks and posterior two rows with 7 hooks each, 17 rows of body spines.	*Raosentis* Datta, 1946.
2.	Six hooks in each transverse row, body spines in two groups.	*Pallisentis* Van Cleave, 1928.
2.	Eight hooks in each transverse row, 5-6 rows of body spines.	*Neosentis* Van Cleave, 1928.

Family NEOECHINORHYNCHIDAE

1.	Three transverse rows of proboscis hooks .	2.
1.	More than three transverse rows of proboscis hooks.	4.
2.	Anterior part of body inflated .	*Eocollis* Van Cleave, 1947.
2.	Anterior part of body not inflated . .	3.
3.	Body small, with thick muscular band . .	*Hebesoma* Van Cleave, 1928.
3.	Body long, lacking muscular band .	*Neoechinorhynchus* Hamann, 1906.
4.	Proboscis with 4 transverse rows of 22 hooks each	*Pandosentis* Van Cleave, 1928.
4.	Proboscis with 6 diagonal rows of five hooks each.	*Paulisentis* Van Cleave, 1949.
4.	Proboscis with 8 diagonal rows of 7 hooks each	*Floridosentis* Ward, 1953.
4.	Proboscis with 8 transverse rows, anterior rows with 8 and posterior rows with 16 hooks.	*Atactorhynchus* Chandler, 1935.
4.	Proboscis with 10—16 transverse rows of 16—20 hooks each.	*Tanaorhamphus* Ward, 1918.
4.	Proboscis with 23 transverse rows of 16 hooks each.	*Tenuisentis* Van Cleave, 1936.

PALAEACANTHOCEPHALA

Family GORGORHYNCHIDAE

1.	Body with ventral pseudosegmental cuticular combs or fused rows of spines.	*Serrasentis* Van Cleave, 1928.
1.	Body without pseudosegmental cuticular combs or fused rows of spines.	2.
2.	Body spination present . . .	3.
2.	Body spination absent . . .	7.
3.	Proboscis hooks showing dorsoventral differentiation.	4.
3.	Proboscis hooks showing no dorsoventral differentiation.	5.
4.	Proboscis hooks of ventral side more than twice of dorsal side.	*Aspersentis* Van Cleave, 1929.
4.	Proboscis hooks of ventral side less than twice of dorsal side, prominent arcuate hooks present at the base of proboscis.	*Nipporhynchus* Chandler, 1934.
5.	Cement glands very long	*Gorgorhynchus* Chandler, 1934.
5.	Cement glands pear shaped .	6.
6.	Proboscis having 16 long rows of 4 hooks each.	*Cleavius* Subhramanyan, 1927.
6.	Proboscis having 12 long rows of 8—9 hooks each.	*Micracanthocephalus* Harada, 1930.
6.	Proboscis having 20—22 long rows of 12—18 hooks each.	*Mehrarhynchus* Datta, 1940.
7.	Dorsoventral differentiation of proboscis hooks.	
7.	No dorsoventral differentiation of proboscis hooks.	9.
8.	Proboscis with 15 long rows of 5 hooks each.	*Rhadinorhynchoides* Fukui & Morishita, 1931.
8.	Proboscis with 14—18 long rows of 17—25 hooks each.	*Neorhadinorhynchoides* Yamguti, 1934.
9.	Proboscis long with 14 long rows of more than 20 hooks each.	*Filisoma* Van Cleave, 1936.
9.	Proboscis cylindrical with 12—16 long rows of 6—8 hooks each. Brain at the posterior end of proboscis sheath.	*Fessisentis* Van Cleave, 1926.
9.	Proboscis cylindrical with 12 long rows 8—10 hooks each, brain in the middle of proboscis sheath.	*Cavisoma* Van Cleave, 1931.

Family Echinorhynchidae

1.	Hooks on proboscis of same size . .	2.
1.	Hooks on proboscis of different size .	3.
2.	Proboscis round, with hooks, in 10 longitudinal rows of 3 and 2 hooks, ganglion at the base of proboscis sheath.	*Hypoechinorhynchus* Yamaguti, 1939.
2.	Proboscis cylindrical with many hooks, ganglion near the middle of proboscis sheath.	*Echinorhynhus* (Zoega) Muller.
3.	Gradual decrease in size of proboscis hooks antero-posteriorly, ganglion at the base of receptacle.	*Acanthocephalus* Koelreuther, 1776.
3.	Proboscis hooks in 2 or 3 distinct size groups .	4.
4.	Body smooth	*Acanthocephaloides* Meyer, 1931.
4.	Body with spines	*Heterosentis* Van Cleave, 1931.

Family Pomphorhynchidae

1.	Anterior part of neck swollen to form a bulla, proboscis cylindrical.	*Pomphorhynchus* Monticeli, 1905.
1.	Anterior part of neck not swollen . .	2.
2.	Proboscis filiform, neck long and thin . .	*Tenuiproboscis* Yamaguti, 1936.
2.	Proboscis cylindrical, neck long, expanded on one side.	*Longicollum* Yamaguti, 1936.

Conclusion

There are at present 36 species of *Acanthocephala* known from 45 species of Indian fishes. Of these 17 are from marine and estuarine fishes and 19 from freshwater fishes. The life history of none of these species has yet been studied, though their taxonomy has received relatively greater attention. It is hoped that future work on this group will be devoted to other aspects such as life history and physiology, etc.

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SUMMARY

Ten new species including one new genus and a new family of Acanthocephala are described. Descriptions of juvenile forms of *Neoechinorhynchus topseyi* Poddar and of a hitherto undescribed species of *Neoechinorhynchus* are given. *Heterosentis plotosi* Yamaguti is recorded from India for the first time. The order Gyracanthocephala is suppressed and various genera of Eoacanthocephala and Palaeacanthocephala (except family Polymorphidae) are re-arranged and key to the genera of the families is given.

CHECK LIST OF ACANTHOCEPHALA DESCRIBED FROM INDIA

I—Systematic List

Class EOACANTHOCEPHALA

Order NEOACANTHOCEPHALA

Family NEOECHINORHYNCHIDAE

Genus **Neoechinorhynchus** Hamann, 1892

Parasite.	*Host.*	*Locality.*
1. *N. agilis* (Rudolphi, 1819)	*Mugil cephalus*	Chilka lake.
2. *N. bangoni*, sp. nov. ..	*Mugil tade*	Calcutta.
3. *N. chilkaensis* Poddar, 1936.	*Mugil cephalus*	Chilka lake.
4. *N. devdevi* (Datta, 1936) ..	*Schizothorax planifrons* ..	Kashmir.
5. *N. elongatus*, sp. nov. ..	*Mugil dussumieri* ..	Madras.
	M. subviridis	Chilka.
6. *N. hutchinsoni* Datta, 1936	*Diptychus maculatus* ..	Kashmir.
7. *N. mansabalensis* Kaw, 1951.	*Oreinus sinuatus*	Kashmir.
8. *N. nematalosi*, sp. nov. ..	*Nematalosa nasus* ..	Chilka lake.
9. *N. ovalis*, sp. nov. ..	*Elops saurus*	Chilka lake.
10. *N. rigidus* (Van Cleave, 1928).	*Schizothorax zarudnyi*	Kashmir.
11. *N. rutili* (Miller, 1776) ..	*Nemachilus stoliczkae*	Kashmir.
	N. vittatus	Kashmir.
12. *N. topseyi* Poddar, 1937 ..	*Polynemus paradiseus* ..	Calcutta.
	Cynoglossus lingua (Juvenile form).	Port Canning.
13. *N. yalei* (Datta, 1936) ..	*Schizothorax esocinus* ..	Kashmir.
14. *Neoechinorhynchus* sp. ..	*Pama pama* & *Eutropiichthys vacha*.	Buxar (R. Ganga).

Family QUADRIGYRIDAE

Genus **Acanthosentis** Verma & Datta, 1929

1. *A. antespinus* Verma & Datta, 1929.	*Macrones gulio*	..	Calcutta.
2. *A. betwai*, sp. nov.	*Labeo gonius* ..		Bhopal.
3. *A. holospinus* Sen, 1938	*Barbus ticto*	..	Calcutta.
(Sp. *A. dattai* Poddar, 1938).	*B. stigma* .	..	
4. *A. indica*, sp. nov.	*Hilsa ilisha* & *Setipinna phasa.*		Ganga, Hooghly & Chilka lake.
5. *A. sircari* Poddar, 1941 ..	*Rasbora elanga*		Calcutta.

Genus **Pallisentis** Van Cleave, 1928

(Syn. *Ferzandia* Thapar, 1930)

1. *P. nagpurensis* (Bhalerao, 1931).	*Channa striatus*	..	Nagpur, Calcutta.
2. *P. nandai* Sarkar, 1953	*Nandus nandus* ..	..	W. Bengal.

Genus **Raosentis** Datta, 1947

1. *R. poddari* Datta, 1947	*Mystus cavasius* ..	..	Bengal.

Class METACANTHOCEPHALA

Order PALAEACANTHOCEPHALA

Family ACANTHOGYRIDAE

Genus **Acanthogyrus** Thapar, 1927

1. *A. acanthogyrus* Thapar, 1927.	*Labeo rohita* .. *Catla catla.*	..	..	Lucknow, Calcutta.

Family RAORHYNCHIDAE, fam. nov.

Genus **Raorhynchus**, gen. nov.

1. *R. polynemi*, sp. nov. ..	*Polynemus sextarius* ..	..	Puri and Madras.

Family GORGORHYNCHIDAE

Genus **Filisoma** Van Cleave, 1928.

1. *F. indicum* Van Cleave, 1928.	*Scatophagus argus* ..	..	Chilka.

Genus **Mehrarhynchus** Datta, 1940

1. *M. prashadi* Datta, 1940	*Pangasius pangasius*	Calcutta.
2. *M. secundus*, sp. nov. ..	*Plotosus canius, Pama pama* *Osteogeniosus militaris*	Chilka.

Genus **Serrasentis** Van Cleave, 1923

1. *S. chauhani* Datta, 1954 ..	*Lutjanus johnii* & *Psettodes erumei.*	Bombay.
2. *S. longa*, sp. nov. ..	*Rhynchobatus djeddensis*	Puri.

Genus **Cavisoma** Van Cleave, 1931

1. *C. magnum* (Southwell, 1913).	*Acanthurus strigosus* & *Serranus* sp.	Ceylon.

Family ECHINORHYNCHIDAE

Genus **Acanthocephalus** Koelreuther, 1771

1. *A. kashmirensis* Datta, 1936	*Schizothorax stoliczakae*	Kashmir.

Genus **Echinorhynchus** (Zoega) Müller, 1776

1. *E. orientalis* Kaw, 1951 ..	*Schizothorax* sp.	Kashmir.

Genus **Heterosentis** Van Cleave, 1931

1. *H. plotosi* Yamaguti, 1936.	*Plotossus canius*	Chilka lake & Mata estuary. :

Family POMPHORHYNCHIDAE

Genus **Pomphorhynchus** Monticelli, 1905

1. *P. kashmirensis* Kaw, 1941.	*Nemachilus kashmirensis*	Kashmir.
2. *Pomphorhynchus* sp. Kaw, 1951.	*Botia berdi*	Kashmir.

Family RHADINORHYNCHIDAE

Genus **Rhadinorhynchus** Lühe, 1911

1. *R. indicus*, sp. nov, ..	*Arius jella* .. .. *Osteogeniosus militaris*	Chilka lake.

2. Host List

Class PISCES

Subclass *ELASMOBRANCHI*

I. Family RHINOBATIDAE

1. *Rhynchobatus djeddensis* (Forsk). (M)[1] .. .. Serrasentis longa.

Subclass *TELEOSTEI*

Order CLUPEOIDEA

II. Family ELOPIDAE

2. *Elops saurus* Linn. (M. & E.) .. .. Neoechinorhynchus ovalis.

III. Family CLUPEIDAE

3. *Hilsa ilisha* (Ham.) (E. & FW.) .. Acanthosentis indica.

IV Family DOROSOMATIDAE

4. *Nematoïosa nasus* (Bloch) (E) .. .. .. Neoechinorhynchus nematalosi.

V. Family ENGRAULIDAE

5. *Setipinna phasa* (Ham.) (E. & FW.) Acanthosentis indica.

Order CYPRINOIDEA

VI. Family CYPRINIDAE

6. *Barbus ticto* (Ham.) (FW.)
7. *B. stigma* (Cuv. & Val.) (FW.) } Acanthosentis holospinus.

8. *Catla catla* (Ham.) (FW.) .. Acanthogyrus acanthogyrus.

9. *Diptychus maculatus* Stein. (FW.) .. .. Neoechinorhynchus hutchinsoni.

10. *Labeo gonius* (Ham.) (FW.) .. .. Acanthosentis betwai.

11. *L. rohita* (Ham.) (FW.) .. .. Acanthogyrus acanthogyrus.

12. *Oreinus sinuatus* (Heckel) (FW.) .. .. Neoechinorhynchus mansabalensis.

13. *Rasbora elanga* (Ham.) (FW.) .. .. .. Acanthosentis sircari.

14. *Schizothorax esocinus* Heckel (FW.) .. Neoechinorhynchus yalei.

15. *S. planifrons* Heckel (FW.) .. .. .. N. devdevi.

16. *S. stoliczkae* Stein. (FW.) .. .. . Acanthocephalus kashmirensis.

17. *S. zarudnyi* (FW.) .. .. Neoechinorhynchus rigidus.

18. *Schizothorax* sp. (FW.) .. .. .. Echinorhynchus orientalis.

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[1] [M.—Marine; E.—Estuarine; FW.—Fresh water]

VII. Family COBITIDAE

19. *Botia berdi* (Blyth) (FW.) .. Pomphorhynchus sp.
20. *Nemachilus kashmirensis* (FW.) .. Pomphorhynchus kashmirensis.
21. *N. stoliczkae* Stein. (FW.) .. .. } Neoechinorhynchus rutili.
22. *N. vittatus* (Heckel) (FW.) .. }

Order SILUROIDEA

VIII. Family SCHILBEIDAE

23. *Eutropiichthys vacha* (Ham.) (FW.) .. .. Neoechinorhynchus sp.
24. *Pangasius pangasius* (Ham.) (FW.) Mehrarhynchus prashadi.

IX. Family BAGRIDAE

25. *Mystus cavasius* (Ham.) (FW.) .. Raosentis poddari.
26. *M. gulio* (Ham.) (FW.) .. .. .. Acanthosentis antespinus.

X. Family TACHYSURIDAE

27. *Tachysurus jella* (Day) (M. & E.) . Rhadinorhynchus indicus
28. *Osteogeniosus militaris* (Linn.) (M. & E.) .. Mehrarhynchus secundus, Rhadinorhynchus indicus.

Family PLOTOSIDAE

29. *Plotosus canius* (Ham.) (M. & E.) . .. .. Heterosentis plotosi.

Order PERCESOCES

XII. Family POLYNEMIDAE

30. *Polynemus paradasius* (Linn.) (E) .. .. Neoechinorhynchus topseyi.
31. *Polydactylus sextarius* (Bloch) (M) .. .. Raorhynchus polynemi.
32. *Eleutheronema tetradactylum* Shaw (M. & E.) . Neoechinorhynchus topseyi.

XIII. Family MUGILIDAE

33. *Mugil cephalus* (Linn.) (M. & E.) .. .. Neoechinorhynchus agilis & N. chilkaensis.
34. *Mugil dussumieri* (Cuv. & Val.) (ME.) .. .. } Neoechinorhynchus elongatus.
35. *Mugil subviridis* (Cuv. & Val.) (E) .. .. }
36. *Mugil tade* Forsk. (E) .. .. .. Neochinorhynchus bangoni.

Order PERCOMORPHI

XIV Family SERRANIDAE

37. *Sarranus* sp. (M) .. .. Cavisoma magnum.

XV. Family LUTJANIDAE

38. *Lutjanus johnii* (Bloch) (M) .. Serrasentis chauhani.

XVI. Family NANDIDAE

39. *Nandus nandus* (Ham.) (E) .. .. .. Pallisentis nandai.

XVII. Family SCIAENIDAE

40. *Pama pama* (Ham.) (E) (FW.) .. Neoechinorhynchus sp. & Mehrarhynchus secundus.

XVIII. Family SCATOPHAGIDAE

41. *Scatophagus argus* (Cuv. & Val.) (E) Filisoma indicum.

XIX. Family ACANTHURIDAE

42. *Acanthurus strigosus* Bennett (M) .. .. Cavisoma magnum.

Order OPHICEPHALOIDEA

XX. Family CHANNIDAE

43. *Channa striatus* (Bloch) (FW.) .. . Pallisentis nagpurensis.

Order HETEROSOMATA

XXI. Family PSETTOTIDAE

44. *Psettodes erumei* (Bl. & Schn.) (M) .. Serrasentis chauhani.

XXII. Family CYNOGLOSSIDAE

45. *Cynoglossus lingua* (Ham.) (E) Neoechinorhynchus topseyi.

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