

THE SPECIES OF ACANTHOCEPHALA DESCRIBED
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INTRODUCTION

Meyer's (1932-33) monograph on the Acanthocephala contains a list of the descriptions of all of the species up to that time. Since 1933 a number of new species of Acanthocephala have been described in journals published in various parts of the world; hence it seemed that an organized list of these descriptions would be useful to those interested in taxonomic studies of these parasites.

The Acanthocephala, or thorny-headed worms, are entirely parasitic, and occur in the intestines of all classes of vertebrates. Thorough discussions of the morphology of the Acanthocephala may be found in Meyer's (1932-33) monograph and in the section on Acanthocephala by Rauther in Kükenthal's *Handbuch der Zoologie* (1928-33). However, it seems desirable to describe here some of the general morphological features. The worm is composed of a proboscis armed with sharp hooks, a neck, and a trunk or body proper. The proboscis is retractile and may be withdrawn into the proboscis sheath, which is contained in the body proper. The body proper is unsegmented and cylindrical or flattened in form. In some species delicate body spines are present. The body wall consists of an outer cuticula, a hypodermis, and an inner muscular layer. The syncytial hypodermis is penetrated by a branching lacunar system peculiar to the Acanthocephala. A pair of ribbon-shaped extensions of the hypodermis, the lemnisci, extend backward from the neck into the body cavity. The body cavity is without an epithelial lining and is therefore not a true coelom. The proboscis sheath lies within the anterior region of the body and may be regarded as forming a distinct division of the body cavity. The ligament, which consists of a strand of connective tissue enclosing the reproductive organs, extends from the proboscis sheath to the posterior extremity of the body. Digestive organs are completely lacking and nourishment is absorbed through the body wall. A pair of lateral longitudinal nerve branches, the retinacula, extend posteriorly from the cerebral ganglion, which is located in the proboscis sheath. When excretory organs are present, they resemble true protonephridia and open into the genital ducts. The sexes are always separate. Ovaries are present in the female only during the larval stage, and they dissociate very early into "ovarian balls" from which the eggs develop. The body cavity of the mature female is completely filled with these ovarian balls and eggs which have separated from them. The eggs develop into oval or spindle-shaped embryos covered with three or four sheaths before being discharged

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through the uterine bell. The ensheathed embryos are voided with the feces of the host and are capable of withstanding severe environmental conditions for many months. However, they do not develop further until they are ingested by a suitable intermediate host, which is usually an arthropod. If the infected arthropod is eaten by a suitable vertebrate host, the adult stage of the parasite develops. In some cases a second intermediate host is required for the completion of the life cycle. Immature forms are sometimes found encysted in the body cavity, mesenteries, or visceral organs of a vertebrate which is serving as an intermediate or transport host.

This paper does not represent a critical evaluation of the Acanthocephala, as actual specimens have not been examined, and many of the descriptions are incomplete. It is quite likely that many of the species listed will be reduced to synonymy. In some cases it is obvious that a species has not been assigned to the correct genus, and therefore some new combinations have been created. The synonyms are listed below the name of each species. It is readily admitted that in a paper of this nature many errors existing in the literature will be perpetuated and emphasized. The purpose of the paper, however, is to serve as a reference source for those interested in the taxonomy of the Acanthocephala and not as a critical review. The writer apologizes for errors and omissions which must inevitably occur in a study of this kind.

Some of the original descriptions are very lengthy, and these have been condensed to include only the characteristics which have most diagnostic value. These are chiefly body size; shape and size of proboscis; shape, size, and number of proboscis hooks; number and distribution of body spines, if present; size of proboscis sheath; shape and size of lemnisci; shape and size of eggs (ensheathed embryos); shape and size of testes; number, shape, and size of cement glands. The measurements given in this paper for the diameter or width of the body, proboscis or other structure which is not uniformly wide always refer to the maximum width or diameter unless otherwise stated.

The history of the taxonomy of the Acanthocephala has been outlined by Van Cleave (1948) who has shown clearly that the characteristics of this group demand their recognition as a separate phylum. The phylum is composed of two classes, the Metacanthocephala and the Eoacanthocephala. The class Metacanthocephala is divided into three orders, the Palaeacanthocephala, the Archiacanthocephala, and the Sphenacanthocephala. The class Eoacanthocephala is divided into two orders, the Gyraacanthocephala and the Neoacanthocephala. The length of this paper makes it necessary for it to appear as a continued paper in more than one number of the *Journal*. The bibliography will appear at the end of the last section. The classification followed is based in part on Meyer's (1932-33) monograph and in part on the papers of Van Cleave (1936a, 1948), Van Cleave and Lincicome (1940), and others. The asterisks indicate the families

and genera which have been described since 1933, and also the genera containing species which have been described since 1933. The descriptions of these new families, genera, and species occur in the text of this paper.

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PHYLUM ACANTHOCEPHALA

CLASS METACANTHOCEPHALA VAN CLEAVE, 1948

ORDER PALAEACANTHOCEPHALA MEYER, 1931

Family Acanthogyridae Meyer, 1931

Genus *Acanthogyrus* Thapar, 1927

Family Rhadinorhynchidae Travassos, 1923

*Genus *Illiosentis* Van Cleave and Lincicome, 1939

Genus *Leptorhynchoides* Kostylev, 1924

Genus *Polyacanthorhynchus* Travassos, 1926

*Genus *Rhadinorhynchus* Luehe, 1911

*Genus *Tegorhynchus* Van Cleave, 1920

Genus *Telosentis* Van Cleave, 1923

*Genus *Pseudorhadinorhynchus* Achmerov and Achmerova, 1941

*Family Gorgorhynchidae Van Cleave and Lincicome, 1940

Genus *Aspersentis* Van Cleave, 1929

Genus *Cleaveius* Subramanian, 1927

*Genus *Filisoma* Van Cleave, 1928

*Genus *Gorgorhynchus* Chandler, 1934

*Genus *Micracanthorhynchina* Strand, 1936

(*Micracanthorhynchus*, Harada, 1935, syn.)

(*Micracanthocephalus*, Harada, 1938, syn.)

*Genus *Nipporhynchus* Chandler, 1934

Genus *Serrasentis* Van Cleave, 1923

*Genus *Rhadinorhynchoides* Fukui and Morisita, 1937

*Genus *Mehrarhynchus* Datta, 1940

Family Polymorphidae Meyer, 1931

SUBFAMILY POLYMORPHINAE MEYER, 1931

*Genus *Polymorphus* Luehe, 1911

Genus *Filicollis* Luehe, 1911

*Genus *Corynosoma* Luehe, 1911

*Genus *Bolbosoma* Porta, 1908

*Genus *Arhythmorhynchus* Luehe, 1911

SUBFAMILY CENTRORHYNCHINAE MEYER, 1931

*Genus *Centrorhynchus* Luehe, 1911

(*Gordiorhynchus* Meyer, 1931, syn.)

*Genus *Pseudoporrorchis* Joyeux and Baer, 1935

SUBFAMILY PLAGIORHYNCHINAE MEYER, 1931

- *Genus *Plagiorhynchus* Luehe, 1911
- *Genus *Prosthorhynchus* Kostylev, 1915
- *Genus *Oligoterorhynchus* Monticelli, 1914
- *Genus *Porrorchis* Fukui, 1929
- Genus *Sphaerechinorhynchus* Johnston, 1929
- *Genus *Lucheia* Travassos, 1919

Family Fessisentidae Van Cleave, 1931

- Genus *Fessisentis* Van Cleave, 1931

Family Echinorhynchidae Cobbold, 1879

SUBFAMILY ECHINORHYNCHINAE TRAVASSOS, 1919

- *Genus *Acanthocephaloides* Meyer, 1933
- *Genus *Acanthocephalus* Koelreuter, 1771
- *Genus *Echinorhynchus* (Zoega) Müller, 1776
- *Genus *Hypoechinorhynchus* Yamaguti, 1939
- *Genus *Echinorhynchoides* Achmerov and Achmerova, 1941
- *Genus *Paracanthocephalus* Achmerov and Achmerova, 1941
- *Genus *Bolborhynchus* Achmerov and Achmerova, 1941

SUBFAMILY CAVISOMINAE MEYER, 1933

- Genus *Cavisoma* Van Cleave, 1931

*Family Pomphorhynchidae Yamaguti, 1939

- *Genus *Pomphorhynchus* Monticelli, 1905
- *Genus *Longicollum* Yamaguti, 1935
- *Genus *Tenuiproboscis* Yamaguti, 1935

*Family Arhythmacanthidae Yamaguti, 1935

- *Genus *Arhythmacanthus* Yamaguti, 1935
- *Genus *Heterosentis* Van Cleave, 1931

*Family Diplosentidae Tubangui and Masilungan, 1937

- *Genus *Diplosentis* Tubangui and Masilungan, 1937

ORDER ARCHIACANTHOCEPHALA MEYER, 1931

Family Gigantorhynchidae Hamann, 1892

- *Genus *Mediorhynchus* Van Cleave, 1916
- *Genus *Gigantorhynchus* Hamann, 1892
- *Genus *Heteracanthorhynchus* Lundström, 1942

Family Oligacanthorhynchidae Meyer, 1931

- *Genus *Oligacanthorhynchus* Travassos, 1915
- *Genus *Nephridiorhynchus* Meyer, 1931
- Genus *Nephridiacanthus* Meyer, 1931
- *Genus *Travassosia* Meyer, 1933
- Genus *Hamanniella* Travassos, 1915
- *Genus *Prosthenorchis* Travassos, 1915
- Genus *Macracanthorhynchus* Travassos, 1917

Family Moniliformidae Van Cleave, 1924

- *Genus *Moniliformis* Travassos, 1915

Family Pachysentidae Meyer, 1931

- Genus *Pachysentis* Meyer, 1931
- *Genus *Oncicola* Travassos, 1916
- Genus *Echinopardalis* Travassos, 1918

ORDER SPHENACANTHOCEPHALA BYRD AND DENTON, 1949

Family Apororhynchidae Shipley, 1899

- *Genus *Apororhynchus* Shipley, 1899

CLASS EOACANTHOCEPHALA (VAN CLEAVE, 1936)

ORDER GYRACANTHOCEPHALA (VAN CLEAVE, 1936)

Family Pallisentidae Van Cleave, 1928

- *Genus *Pallisentis* Van Cleave, 1928
- *Genus *Acanthosentis* Verma and Datta, 1930
- Genus *Neosentis* Van Cleave, 1928

Family Quadrigyridae Van Cleave, 1920

- *Genus *Quadrigyrus* Van Cleave, 1920
- *Genus *Hemigyryus* Achmerov and Achmerova, 1941
- *Genus *Raosentis* Datta, 1946

ORDER NEOACANTHOCEPHALA (Van Cleave, 1936)

Family Neoechinorhynchidae Van Cleave, 1919

- *Genus *Neoechinorhynchus* Hamann in Stiles and Hassall, 1904
- Genus *Tanaorhamphus* Ward, 1917
- Genus *Gracilisentis* Van Cleave, 1919
- *Genus *Octospinifer* Van Cleave, 1919
- Genus *Pandosentis* Van Cleave, 1920
- *Genus *Eosentis* Van Cleave, 1920
- *Genus *Atactorhynchus* Chandler, 1935
- *Genus *Eocollis* Van Cleave, 1947
- *Genus *Paulisentis* Van Cleave and Bangham, 1949

Family Hebesomidae Van Cleave, 1928

- Genus *Hebesoma* Van Cleave, 1928

*Family Tenuisentidae Van Cleave, 1936

- *Genus *Tenuisentis* Van Cleave, 1936

RHADINORHYNCHIDAE Travassos, 1926

ILLIOSENTIS Van Cleave and Lincicome, 1939

"Rhadinorhynchidae, in which the posterior extremity of the female is modified into dorso-posterior and ventro-posterior protuberances, the dorsal of which bears the genital opening. Situated in the body in a cleft between the protuberances is a fan-shaped muscular organ. Posterior extremity of [female] bearing cuticular spines [in some species]. Anterior body spines present in both sexes. Proboscis relatively long, with a heavy investing cuticular covering. A circle of hooks at proboscis base, in alignment with the longitudinal rows on the remainder of the proboscis, but with the ventral hooks of this

basal circle greatly enlarged. Lemnisci about one and one-half times as long as receptacle. Eight cement glands elongate, pyriform to clavate. Testes broadly contiguous. Brain within anterior extremity of the receptacle at base of proboscis. Genotype: *Illiosentis furcatus*."

Illiosentis furcatus Van Cleave and Lincicome, 1939. Males 4-9.8 x 0.32-0.52 mm.; females 5.6-21.5 x 0.35-0.62 mm. A group of two or three spines present on either side of genital opening of the female in the dorso-posterior protuberance. Proboscis elongate, clavate, 1.06-2.97 x 0.178-0.341 mm. anteriorly and 0.142-0.244 posteriorly. Hooks in 14 (range 12-15) longitudinal rows of 26-33 each. Limits of basal region of proboscis marked by location of a pair of lateral papillae. Basal proboscis hooks of three distinct types. Anterior hooks 0.051-0.077 mm. in males, 0.051-0.089 mm. in females. Middle hooks of males 0.036-0.066 mm., females 0.046-0.077 mm.; dorsal hooks of males 0.040-0.071 mm., females 0.036-0.086 mm. Proboscis receptacle somewhat longer than proboscis. Brain located within proboscis, anterior to the receptacle at the level of the basal hooks on the proboscis. A papilla on each lateral surface of the proboscis is located at about the level of the eleventh hook from the proximal region of the proboscis. Lemnisci long, cylindrical, about 1.5 times the length of the proboscis receptacle. Male genitalia confined to posterior half of body. Testes broadly contiguous, followed by a series of eight elongate, pyriform to clavate cement glands. Embryos 0.067-0.074 x 0.008-0.010 mm. Host: *Menticirrhus americanus* (Pisces), Louisiana.

Illiosentis cetratus Van Cleave, 1945a. Females 20-37 mm. x 0.55-0.77 mm.; males 15-27 mm. x 0.44-0.66 mm. Genital papillae and spines absent. Body spines numerous, restricted to a single uninterrupted zone at the anterior end of the body; 0.038-0.042 mm. in length. Proboscis elongate, clavate somewhat larger in the female than in the male; 1.6-2 mm. in length by 0.245-0.385 mm. in diameter. Proboscis hooks usually in 16 longitudinal rows with 19-24 hooks in each longitudinal row. A pair of small, rounded, lateral papillae near base of proboscis, at level of from 8-14 hooks from posterior extremity of proboscis. Hooks in basal circle reaching 0.070-0.084 mm. on ventral surface, but usually less than 0.070 mm. on dorsal. On remainder of proboscis hooks are 0.042-0.091 mm. near the middle, but near the anterior tip they are 0.049-0.084 mm. long. Embryos within the body of gravid females, about 0.058-0.072 mm. long by 0.008-0.012 mm. in diameter. Hosts: *Menticirrhus undulatus*, and less frequently in *Roncador stearnsi* and *Umbrina roncador* (Pisces), California.

Rhadinorhynchus meyeri Heinze, 1934a. Description based on one female. Length about 28 mm. Anterior part of body shows a blind sac-like swelling. Deep folds encircle the entire body posterior to the swollen region. Body spines deeply embedded in cuticula extend as far back as proboscis sheath. Proboscis club-shaped, about 2.7 x 0.27 mm. Hooks in 22 longitudinal rows, about 43 in each row. Hooks of basal circle distinctly larger than others. Eggs ellipsoid, 0.100 x 0.030 mm. Host: *Scomber pelamys* (Pisces), Indian Ocean. It is apparent from Heinze's illustration of this parasite that the anterior "swelling" is in reality a protrusion of a part of the proboscis sheath through an accidental opening in the body wall. When this "swelling" is disregarded, this species does not differ strikingly from *R. katsuwonis* Harada, 1928. *R. katsuwonis* possesses a slightly larger body (35 mm.), a somewhat smaller proboscis (2.4 mm. in length) and a slightly smaller number of proboscis hooks (22 longitudinal rows with 39 in each). Since different specimens of a single species show considerable variation in such characteristics as these, and since Heinze's description is based on a single specimen, it seems possible that Heinze's specimen may belong to the same species as Harada's specimens. This opinion is supported by the fact that the host of Harada's specimens is *Euthymus vagans* which belongs to the same family, Scombridae, as *Scomber pelamys*, the host of *R. meyeri*; it is well known that the Acanthocephala do not display a very marked host specificity. Van Cleave (1940) states that

Rhadinorhynchus katsuwonis is a direct synonym for *Nipporhynchus ornatus* (Van Cleave, 1918). It seems probable that *R. meyeri* is also a synonym for *Nipporhynchus ornatus* (Van Cleave, 1918).

Rhadinorhynchus epinepheli Yamaguti, 1939. Description based on two females. Body over 20 mm. long. Proboscis cylindrical, with slight fusiform swelling at middle, about 1 x 0.3 mm. Hooks in 16 longitudinal rows of 12-13 each. Subapical hooks up to 0.100 mm. long; basal hooks 0.060 mm. Proboscis sheath 2.1-2.3 x 0.26-0.35 mm. with brain in middle. Neck conical, 0.4-0.44 mm. long. Trunk strongly contracted a little in front of middle and forms a slender false neck anterior to this point of contraction. Anterior ventral surface of trunk covered with numerous spines 0.033-0.040 mm. long, ensheathed in cuticular folds and arranged in transverse rows for a distance of about 1 mm. Lemnisci 2.75 x 0.175 mm. Eggs 0.096-0.111 x 0.036-0.045 mm. with polar prolongations of middle membrane; filaments inside of outer shell forming a compact layer. Host: *Epinephelus akaara* (Pisces), Japan.

Rhadinorhynchus peltorhamphi Baylis, 1944. Males 2.5-8 x 0.55-1.4 mm. Females 2.5-16 mm. x 0.5-1.7 mm. Without body spines. Proboscis cylindrical or slightly clavate, 0.3-0.7 x 0.12-0.24 mm. Proboscis hooks in 12-18 longitudinal rows of 9-11 hooks each. Hooks of 6-10 ventral rows much larger than others. Largest hooks 0.110 mm. in length; smallest 0.028 mm. Proboscis sheath 0.45-0.9 x 0.12-0.26 mm. Lemnisci variable in length. Six pyriform cement glands. Eggs fusiform, 0.092-0.102 x 0.022-0.024 mm. Host: *Peltorhamphus novae-zelandiae* (Pisces), New Zealand. If the observation that this species has six cement glands is correct, it is not a member of the genus *Rhadinorhynchus*, as this genus is characterized by the presence of eight cement glands. However, the writer has not been able to determine from this description to which genus this species should be assigned, and it is therefore left in the genus *Rhadinorhynchus* for the present.

Tegorhynchus pectinarius Van Cleave, 1940. Description based on two females. Body slightly fusiform, anterior part clothed with spines 0.030-0.048 mm. long, extending backward almost three-fourths the length of the body. Body proper 8.4-8.8 mm. long. Proboscis about 1.4 mm. long; armed with 12 longitudinal rows of about 28-30 hooks each. A series of six or seven hooks at the base of each longitudinal row forms a closely set, comblike series of thorns. Each of the four middorsal rows of hooks has one very heavy, strongly recurved hook with an exaggerated root immediately anterior to the basal comb. These peculiarly modified heavy hooks have a length of about 0.027 mm., while the large, recurrent root is almost twice the length of the hook proper. In the two dorsalmost rows, either the space immediately anterior to the hook with the enlarged root is devoid of hooks, or the hooks are represented by poorly formed vestiges for a space corresponding to the positions of four hooks in adjacent longitudinal rows. In the six ventral rows of hooks, the basal comb of six or seven thorns is followed anteriorly by two very heavy thornlike hooks. Anteriorly the remaining hooks show little regional differentiation, except that hooks on the ventral surface are somewhat heavier and more strongly recurved than those on the corresponding region of the dorsal surface. The hyaline cuticular membrane surrounding the proboscis is not so pronounced as in *Tegorhynchus brevis* but surrounds each hook in a sheath much as in the genus *Leptorhynchoides*. Lemnisci very thin and much coiled, a little longer than the length of the receptacle. Embryos within one gravid female 0.084-0.093 x 0.021-0.024 mm. Genital extremity of female rather bluntly truncated. Host: *Medialuna* (?) (Pisces), Costa Rica.

PSUDORHADINORHYNCHUS Achmerov and Achmerova, 1941

Rhadinorhynchidae provided with a comparatively small proboscis; hooks not numerous. Brain near bottom of proboscis sheath. Body armament irregular. Eight cement glands. Dorsal and ventral proboscis hooks equal in size and shape.

Pseudorhadinorhynchus markewitchi Achmerov and Achmerova, 1941. Body 5.42-6.75 x 1.15-1.35 mm. Proboscis 0.630 x 0.090 mm. with 14 longitudinal rows of 13-14 hooks each. Anterior hooks 0.028 mm. long; middle, 0.056 mm.; posterior, 0.016 mm. Proboscis sheath 0.480 x 0.180 mm. with brain at base. Lemnisci with a nucleus near the middle; size of lemnisci 0.33 x 0.09 mm. in female; 1.27 x 0.07 in male. Testes irregular oval, 0.46 x 0.3 mm. Eight bulb-like cement glands. In a longitudinal optical section 33 ventral and 28 dorsal body spines may be counted. Hosts: *Pseudaspilus leptcephalus*, *Parabramis pekincensis* (Pisces), Amur River, Asia.

Pseudorhadinorhynchus pseudaspilii Achmerov and Achmerova, 1941. Description based on one female. Body 8.4 x 1.05 mm. Body spines 0.028 mm. long; in a longitudinal optical section nine spines may be counted ventrally and five dorsally. Proboscis cylindrical, 0.535 x 0.150 mm. with ten longitudinal rows of seven-eight hooks each; length of hooks 0.045-0.050 mm. Proboscis sheath 0.750 x 0.090 mm. Lemnisci 2.1 mm. in length with a nucleus in the middle. Eggs spindle-shaped, 0.068 mm. in length. Host: *Pseudaspilus leptcephalus* (Pisces), Lake Orel-Chla, U. S. S. R. The characteristics given here do not seem sufficiently diagnostic to establish a new genus; it is difficult to determine from the descriptions of the species whether these parasites represent new species or not. An examination of actual specimens is necessary before the validity of this genus and these species can be established.

GORGORHYNCHIDAE Van Cleave and Lincicome, 1940

"Palaeacanthocephala of diverse range in body length. Proboscis clavate or cylindrical in form, sometimes globular, and usually short. Proboscis hooks may show dorso-ventral differentiation. Proboscis sheath doubled-walled. Anterior spination on body may be in single or double fields or wanting. Posterior spination absent. Lemnisci about as long as proboscis sheath, usually much longer. Cement glands four in number, either very long and tubular or short and pyriform. Type genus *Gorgorhynchus* Chandler, 1934."

Filisoma microcanthi Harada, 1938. Female 35 x 0.45 mm. Without body spines. Proboscis about 0.5 x 0.07 mm. Proboscis hooks in 16 longitudinal rows, 28 in each row. Hooks 0.030-0.035 mm. in length. Proboscis sheath 1.55 x 0.12 mm. Lemnisci narrow, about equal in length to the proboscis sheath. Host: *Microcanthus strigatus* (Pisces), Formosa.

Filisoma bucerium Van Cleave, 1940. Without body spines. Females about 60 mm. long, males about 45 mm. Body very much attenuated, slightly enlarged just posterior to the posterior tip of the receptacle, in females about 0.6-1 mm. in diameter for most of its length; in males about 0.4-0.6 mm. Proboscis about 1.5-2 mm. long, slightly to strongly arcuate, armed with 16 longitudinal rows of 38-45 hooks each. Median dorsal row of hooks differentiated from all others in that they lack sharp points, but each ends in a blunt tip of hornlike appearance. Near middle of the length of proboscis the median ventral and dorsal hooks are 0.057 mm. long and 0.021 mm. in diameter at the base; dorsal but lateral to the median row the hooks are 0.043-0.051 mm. long by 0.009 mm. in diameter at base. Papillae not observed on neck or proboscis. Proboscis receptacle 2.3-4.2 mm. long. Lemnisci almost as broad as receptacle, approximately same length as receptacle. Male genitalia restricted to posterior half of body. Testes elongate, slightly separated, followed by 4 very long, tubular cement glands. Embryos 0.056-0.069 x 0.012-0.018 mm. Host: *Kyphosus elegans* (Pisces), Socorro Islands, Mexico.

Filisoma rizalinum Tubangui and Masilungan, 1946. Description based on two male specimens. Body 23-27.5 mm. x 0.4-0.5 mm. Without body spines. Proboscis 0.8-0.95 x 0.10-0.12 mm., armed with 16 longitudinal rows of 23-24 hooks each. Two submedian dorsal rows of hooks differ from the other rows in having the first 8-10 hooks of each row much larger and less pointed than

the other proboscis hooks. These larger hooks are 0.040-0.050 mm. long by 0.018-0.020 mm. wide at the base. Hooks of the other rows are larger near middle of proboscis, measuring 0.036-0.040 mm. x 0.008-0.009 mm., gradually diminishing in length posteriorly to about 0.016 mm.; hooks near anterior end 0.028-0.032 mm. x 0.006-0.008 mm. Proboscis sheath double-walled, 1.4-1.6 x 0.10-0.12 mm. Lemnisci almost as long as receptacle. Male genital organs in posterior half of body. Testes elongate, 1.05-1.60 x 0.26-0.35 mm. Cement glands consist of 4 very elongated bodies bunched together, containing numerous prominent nuclei and measuring 4.5-6.5 mm. long. Host: *Scatophagus argus* (Pisces), The Philippines.

Filisoma fidum Van Cleave and Manter, 1947. Males reaching a length of 76 mm. with maximum diameter of 1.43 mm.; females attaining 95 mm. in length by 1.6 mm. in diameter. Proboscis very long, cylindrical, 1.3-1.7 mm. in length by 0.150-0.161 mm. in width. Proboscis sheath about 1.77 mm. long. Proboscis hooks arranged in 17-20 longitudinal rows of approximately 38 each, longest hooks 0.041-0.048 mm. Hooks of dorsal and ventral surfaces not conspicuously different in size or shape, never with a single median dorsal row of modified blunt hooks as described for *F. buceyium*. Lemnisci long (approximately 9 mm.). Testes contiguous, about 3.5 mm. long. Four cement glands very long, tubular. Females not fully mature, largest embryos having a length of 0.053-0.058 mm. and width of about 0.014 mm. but without fully formed membranes. Host: *Kyphosus sectatrix* (Pisces), Dry Tortugas, Florida.

GORGORHYNCHUS Chandler, 1934

Chandler (1934) described a new genus, *Gorgorhynchus*, with *G. gibber*, described in the same paper, as type species. In this paper Chandler stated that *Rhadinorhynchus medius* (Linton, 1907) resembled the new species so closely that "there might even be some question of their specific distinctness." Van Cleave (1940) has shown that *G. gibber* is a synonym for *G. medius* (Linton, 1907). The following description is taken from Van Cleave's paper:

"*Generic diagnosis.* The genus *Gorgorhynchus* includes species parasitic in marine fishes. Body elongate and usually slender, somewhat expanded anteriorly. Body spines in a single field at the anterior extremity of the body. Proboscis cylindrical or barrel shaped, relatively stout, densely armed with numerous hooks arranged in quincunxial order of alternating longitudinal and circular rows not showing profound regional or dorsoventral differentiation. Proboscis receptacle double walled with the brain well forward toward its anterior end. Lemnisci long, slender. Male genitalia occupy more than the posterior half of the body with the testes just posterior to the widest part of the body. Testes usually separated some distance and followed by four extremely long, tubular cement glands. *Type species.* *Gorgorhynchus medius* (Linton, 1907)."

Gorgorhynchus lepidus Van Cleave, 1940. All specimens immature, 7-10 x 0.8-0.9 mm. Posterior region of body much reduced in diameter (about 0.4 mm.). Anterior region of body closely set with spines in a single continuous field which extends ventrally from 1/2 to 3/4 the length of the receptacle and dorsally from 1/4 to 1/2 the length of the receptacle. Spines 0.065-0.090 mm. long. Proboscis barrel shaped, 0.8-1.6 x 0.46-0.5 mm., armed with 20 longitudinal rows of 14-16 hooks each. Near middle of proboscis the ventral hooks are 0.106-0.120 mm. long, dorsal hooks in corresponding location 0.096-0.118 mm. long. Proboscis sheath 1.7-2.2 mm. long with brain near anterior end. Lemnisci very long, at times more than 3 times the length of the receptacle, one usually considerably longer than the other. A small rounded papilla 0.020-0.023 mm. in diameter on each lateral surface of proboscis slightly anterior to level of the posteriormost hooks. Testes ovoid, about 0.3 mm. long. Cement glands 4, very long, tubular. Host: *Cratinus agassizii* (Pisces), Galapagos.

Gorgorhynchus clavatus Van Cleave, 1940. Mature females 2½ x 1.8-2.4 mm. Male specimens broken; entire length not observable. Body spines in a single field, extending ventrally 1/2 to 3/5 the length of the receptacle; dorsally 1/4 to 2/5. Body spines 0.048-0.084 mm. long. Proboscis cylindrical, 1.25-1.5 x 0.51-0.58 mm. armed with 20 longitudinal rows of 13-15 hooks each. Longest hooks near anterior end of proboscis, 0.120-0.142 mm. long on ventral surface, those on dorsal somewhat shorter. One small papilla on each mid-lateral surface of the proboscis at level of basal hooks. Lemnisci very long. Proboscis sheath 3.23 mm. long with brain located about 1/3 the distance from anterior extremity. Testes contiguous, about 1.5 mm. long. Embryos 0.105-0.120 x 0.036-0.043 mm. Host: *Paralabrax humeralis* (Pisces), Galapagos.

MICRACANTHORHYNCHINA (Harada, 1935) Strand, 1936

(*Micracanthorhynchus* Harada, 1935; *Micracanthocephalus* Harada, 1938.) Body very small, fore-body with about 20 transverse rows of minute spines of which the anterior 10-11 rows form complete rings, but those behind are incomplete dorsally. Proboscis club-shaped; proboscis hooks similar to those in the genus *Acanthocephalus*; root of hook composed of a posterior and an anterior process. Proboscis sheath double-walled. Testes close behind one another; four pear-shaped cement glands. Integument with small scattered nuclear fragments; lacunar system with chief vessels lateral united by pseudometameric transverse commissures. Parasites of fresh-water fish. This genus was originally named *Micracanthorhynchus* by Harada in 1935. In 1936 Strand noticed that this name was preoccupied and assigned the name *Micracanthorhynchina* to this genus. In 1938 Harada, apparently unaware of Strand's paper, renamed his genus *Micracanthocephalus*.

Micracanthorhynchina motomurai (Harada, 1935) n. comb. (*Micracanthorhynchus motomurai* Harada, 1935.) Body spindle-shaped; males 1.6-3.5 x 0.35-0.5 mm.; female 3.2 x 0.5 mm. Proboscis club-shaped, 0.3-0.5 x 0.15 mm. Proboscis hooks in 12 longitudinal rows of 8 hooks each, occasionally 9. Average length of hooks 0.050 mm.; smallest hooks 0.018 mm. long. Fore-body with 18-22 transverse rows of minute spines; posterior 10-11 rows incomplete dorsally; length of spines 0.020 mm. Lemnisci about the same length as proboscis sheath. Testes globular, in middle third of body. Four cement glands. Host: *Zacco* sp. (Pisces), Korea.

Micracanthorhynchina dakusuiensis (Harada, 1938), n. comb. (*Micracanthocephalus dakusuiensis* Harada, 1938.) Body spindle-shaped; male 4 x 0.8 mm.; female 7.6 x 1.3 mm. Proboscis cylindrical, 0.48 x 0.15 mm.; hooks in 12 longitudinal rows of 9 each. Anterior portion of trunk covered with small spines; they form 9 complete rings anteriorly, limited to the ventral side posteriorly. Proboscis sheath 0.7 x 0.24 mm. with brain in middle. Testes elongate, oval. Six cement glands. Eggs 0.063 x 0.016 mm. Host: *Zacco temmincki* (Pisces), Formosa. Van Cleave and Lincicome (1940) placed this genus in the family Gorgorhynchidae since the description of the genotype agreed with the concept of this family. Concerning Harada's observation of 6 cement glands in the above species, Van Cleave and Lincicome made the following statement: "The present writers in reviewing the Gorgorhynchidae and the Rhadinorhynchidae have found in each family complete agreement in the number of cement glands present in the representatives of all the genera. Consequently we question either the generic assignment of *M. dakusuiensis*, or the correctness of Harada's observation that this species has six cement glands."

Micracanthorhynchina hemirhamphi (Baylis, 1944) n. comb. (*Micracanthocephalus hemirhamphi* Baylis, 1944.) Males 3-4.3 x 0.46-0.67 mm.; females 4.5-6.5 x 0.8-0.97 mm. Posterior end of female bent ventrally at a sharp angle; immediately behind the genital aperture there is a blunt finger-like appendage about 0.08-0.1 mm. long. Proboscis clavate, 0.55-0.65 x 0.16-0.2 mm. Hooks in 12 longitudinal rows of 9-11 each; length of hooks 0.016-0.120 mm.

Anterior region of body with about 15-17 transverse rows of spines, the more posterior rows incomplete dorsally. Proboscis sheath 0.8-1.1 x 0.15-0.2 mm. Lemnisci club-shaped, shorter than proboscis sheath. Four club-shaped cement glands. Eggs 0.056-0.062 x 0.015-0.016 mm. Host: *Hemirhamphus intermedius* (Pisces), New Zealand.

NIPPORHYNCHUS Chandler, 1934 (emend. Van Cleave and Lincicome, 1940)

The following description is taken from Van Cleave and Lincicome's (1940) paper: "Gorgorhynchidae with long proboscis, armed with many rows of hooks which are longer and stouter on ventral surface than on dorsal. Basal row of hooks forming a complete circle without differentiated ventral crescent. Proboscis sheath double-walled. Anterior region of body usually beset with spines which may be in single or double fields. Lemnisci ribbon-shaped, about as long as proboscis sheath. Testes elongated, cylindrical, or club-shaped and may be paired."

Nipporhynchus trachuri (Harada, 1935) Van Cleave and Lincicome, 1940. (*Rhadinorhynchus trachuri* Harada, 1935.) Body somewhat thickened anteriorly, dorsally curved. Female 10 x 0.6 mm. Male about 7.5 x 0.6 mm. Body spination in two regions, an anterior girdle and posterior to this a region limited chiefly to the ventral side. Spines 0.050-0.060 mm. long. Ventral spines reach posterior end of proboscis sheath in female but do not extend this far back in male. Proboscis cylindrical, 1.7 x 0.15 mm., in the fixed condition bent almost at right angles to the body. Proboscis hooks in 12 longitudinal rows with 22-24 in each. Ventral hooks 0.070-0.080 mm. long, dorsal 0.055-0.070 mm. Proboscis sheath 1.6 x 0.15 mm. Lemnisci little longer than receptacle. Testes 0.7 x 0.4 mm., a little behind the middle of the body. Eggs 0.073 x 0.020 mm. Host: *Trachurus japonicus* (Pisces), Japan.

Nipporhynchus aspinosus (Fukui and Morisita, 1937) n. comb. (*Rhadinorhynchus aspinosus* Fukui and Morisita, 1937; *Rhadinorhynchus* (*Neorhadinorhynchus*) *aspinosus* (Fukui and Morisita, 1937) Yamaguti, 1939.) Body of males 14-16 x 1.0-1.15 mm.; females 16-23 x 0.95-1.1 mm. Proboscis 0.8-1.03 x 0.13-0.2 mm. Hooks in 17-18 longitudinal rows of 16-19 each. Size of hooks 0.035-0.063 mm. Proboscis sheath 1.6-1.9 x 0.14-0.32 mm. Neck 0.15-0.2 mm. long. Lemnisci 2.2-3 x 0.12-0.2 mm. Testes 0.8-2.4 x 0.3-0.6 mm. Cement glands 1.3-2 x 0.18-0.3 mm. Eggs 0.069-0.090 x 0.015-0.020 mm. Without body spines. Host: *Teuthis fuscescens* and *Xesurus scalprum* (Pisces), Japan. The original description of this species was made on the basis of one male specimen. Later Yamaguti (1939) obtained more specimens and redescribed the species. On the basis of the naked trunk and lack of dorsoventral differentiation of proboscis hooks, Yamaguti, in the same paper, proposed a new subgenus, *Neorhadinorhynchus*, for this species and *Rhadinorhynchus nudus* Harada, 1938. Yamaguti also relegated the genus *Rhadinorhynchoides* Fukui and Morisita, 1937, to subgeneric rank, thus dividing the genus *Rhadinorhynchus* into three subgenera, *Rhadinorhynchus*, *Neorhadinorhynchus*, and *Rhadinorhynchoides*. Van Cleave and Lincicome (1940) have assigned *Rhadinorhynchus nudus* to the genus *Nipporhynchus*, and since the lack of dorsoventral differentiation in the proboscis hooks of *R. (N.) aspinosus* appears to be the only characteristic of this species which is not in agreement with the definition of *Nipporhynchus*, it seems to the writer that this species should be assigned to the genus *Nipporhynchus*.

Nipporhynchus nudus (Harada, 1938) Van Cleave and Lincicome, 1940. (*Rhadinorhynchus nudus* Harada, 1938.) Body somewhat thickened anteriorly, curved dorsally. Body spines lacking. Males 5 x 0.6 mm.; females 4.2 x 0.5 mm. Neck conical, 0.45 mm. in length and 0.15 mm. in breadth at the base. Proboscis cylindrical, 1 x 0.1 mm. Hooks in 14 longitudinal rows, 24-25 in each. Hooks 0.043-0.060 mm. in length. Proboscis sheath 1.85 mm. long; brain anterior to the middle. Lemnisci shorter than proboscis sheath. Four tubular cement glands. Host: *Trachurus japonicus* (Pisces), Formosa.

Nipporhynchus carangis (Yamaguti, 1939) n. comb. (*Rhadinorhynchus carangis* Yamaguti, 1939.) Males 9-11 x 0.6-0.75 mm. Proboscis cylindrical, 1.9-2 x 0.2 mm., armed with 10 longitudinal rows of 35-36 hooks each. Apical hooks about 0.045 mm. long. Ventral hooks 0.063-0.075 mm. long, heavier than dorsal hooks, which are 0.060-0.085 mm. long, both diminishing in size toward base of proboscis. Basal hooks larger than preceding, measuring 0.080-0.090 mm. ventrally and 0.066-0.075 dorsally. Neck 0.17-0.2 mm. long. Trunk beset anteriorly for a distance of 2-2.5 mm. with spines 0.020-0.030 mm. long. Proboscis sheath 3.2-3.6 mm. long with retinacula penetrating about the middle. Lemnisci 1.8-2 mm. long, somewhat enlarged posteriorly. Testes subglobular to elliptical, 0.5-0.75 x 0.28-0.55 mm. Four cement glands elongated. Host: *Caranx mertensi* (Pisces), Japan. This species is ascribed to the genus *Nipporhynchus* chiefly because of the presence of four cement glands and the prominent arcuate hooks at the base of the proboscis.

Nipporhynchus ditrematis (Yamaguti, 1939) n. comb. (*Rhadinorhynchus ditrematis* Yamaguti, 1939.) Description based on one female and three male specimens. Males 8.5-11 mm. long; female 19.3 x 0.875 mm. Proboscis of male 1.1-1.6 x 0.15-0.24 mm. with 15-16 longitudinal rows of 24 hooks each, 0.045-0.075 mm. long; basal hooks distinctly longer than preceding. Proboscis of female 1.5 x 0.2 mm. with 18 longitudinal rows of hooks 0.057-0.087 long. Proboscis sheath 2.3-2.7 x 0.2-0.3 mm. with brain a little behind the middle. Trunk spines of male up to 0.080 mm. long; arranged in two groups, an anterior group of 16 and a posterior group of 18; in one male specimen the two groups are continuous, consisting of 70 spines arranged in 10 transverse rows. Trunk spines of female up to 0.093 mm. long; in two distinct groups, 16 anterior spines in 3 transverse rows, 41 posterior spines in 8 transverse rows. Lemnisci about the same length as proboscis sheath. Cement glands in two tandem pairs. Eggs elliptical, 0.072-0.076 x 0.015-0.018 mm. Host: *Ditrema temminckii* (Pisces), Japan. This species is assigned to the genus *Nipporhynchus* because of the prominent arcuate hooks at the base of the proboscis and the presence of four cement glands.

RHADINORHYNCHOIDES Fukui and Morisita, 1937

Body cylindrical, without spines on trunk and neck. Proboscis cylindrical; proboscis hooks larger on ventral than on dorsal side, and on posterior than on anterior part. Proboscis sheath cylindrical, double-walled, with brain in middle. Lemnisci finger-like, as long as, or somewhat shorter than, proboscis sheath. Testes in middle of body, arranged tandem. Four cement glands, elongate, parallel. Parasitic in fish.

Rhadinorhynchoides miyagawai Fukui and Morisita, 1937. Description based on one male and two females. Male 7.5 x 1.2 mm.; mature female 18 x 1.2 mm. Proboscis hooks in 15 longitudinal rows of 5 each; length of hooks 0.075-0.105 mm.; those on ventral side larger than those on dorsal side. Proboscis sheath 1.05 x 0.18 mm., with brain in middle. Lemnisci 0.97 x 0.18 mm. Genital organs of male in posterior half of body. Four cement glands, each 2.45 mm. long. Eggs 0.087 mm. x 0.022 mm.; middle shell shows polar swellings. Host: *Salvelinus malma* (Pisces), Japan. Fukui and Morisita placed this genus in the family Centrorhynchidae, but, from their description, it seems to the writer that this genus is more closely related to the members of the family Gorgorhynchidae. Yamaguti (1939) relegated the genus *Rhadinorhynchoides* to a subgenus in the genus *Rhadinorhynchus*.

MEHRARHYNCHUS Datta, 1940

Body of small size with a long cylindrical proboscis, armed with fine recurved hooks. Anterior region of body armed with regular rows of small, triangular spines in both sexes. Proboscis sheath double-walled, with brain near base. Four club-shaped cement glands. Lemnisci long, filamentous, bifurcated near

the end. Adult in fishes. Datta assigned this genus to the family Rhadinorhynchidae, but since the number of cement glands is four instead of eight, it should be placed in the family Gorgorhynchidae.

Mehrarhynchus prashadi Datta, 1940. Males 4.6-6.7 x 0.68-0.79 mm.; female 7.96 x 1.53 mm. Proboscis cylindrical, with 20-22 longitudinal rows of 12-14 hooks each. Anterior region of body with 12-13 rows of 15-17 spines covered by cuticular folds. Proboscis sheath nearly twice as long as proboscis. Lemnisci thin, cylindrical, longer than proboscis sheath, bifurcated at ends as finger-like diverticula. Proboscis 0.95 x 0.33 mm.; proboscis hooks 0.055-0.080 mm. in length. Body spines 0.025 mm. long. Proboscis sheath 1.83 x 0.29 mm. Lemnisci 2.71 x 0.15 mm. Eggs 0.065 mm. long. Host: *Pangasius pangasius* (Pisces), Calcutta.

POLYMORPHIDAE Meyer, 1931

POLYMORPHINAE Meyer, 1931

Polymorphus capellae Yamaguti, 1935. Body of male 25 mm. long; female 30 mm. long. Body spines 0.021-0.024 mm. long; arranged in 40 or more longitudinal rows. Proboscis more or less swollen behind the middle, 0.36-0.8 x 0.14-0.22 mm. Hooks in 17-18 longitudinal rows of 14-16 each. Anterior hooks strongly recurved, with rod-shaped roots; posterior hooks shorter, rootless. Largest hooks 0.054 mm. in length. Neck cone-shaped, 0.33-0.5 mm. in length. Proboscis sheath 0.9-1.5 x 0.16-0.23 mm. Brain in middle of proboscis sheath or a little behind. Testes elliptical, 0.8-1.38 x 0.26-0.47. Eggs 0.090-0.105 x 0.021-0.027 mm. Outer egg shell with numerous longitudinal filaments attached to its inner surface. Host: *Capella solitaria* (Aves), Japan.

Polymorphus frontospinosus Tubangui, 1935. Sexual dimorphism not strongly marked. Body more or less claviform, gradually tapering towards posterior extremity to a knoblike process which is especially noticeable in the female. Males 9.5-12 x 1.8-2.2 mm.; females 12.5-15 x 2-2.5 mm. Cuticle from anterior end to posterior level of proboscis sheath in both sexes covered with numerous minute spines 0.010-0.012 mm. long. Proboscis subcylindrical, 0.7-0.92 x 0.25-0.34 mm. Hooks in 18-20 longitudinal rows of 14-15 each. Largest hooks near middle of proboscis; these large hooks measure 0.046-0.049 mm. in length and are provided with rectangular roots 0.049-0.062 x 0.016-0.021 mm. Neck absent. Proboscis sheath double-walled, 1.28-2 x 0.28-0.5 mm. Brain just posterior to middle. Lemnisci slightly longer than, or at most one and a half times as long as, proboscis sheath. Testes small, oval, one obliquely behind the other. Six tubular cement glands, compacted into an elongate mass. Eggs 0.104-0.121 x 0.029-0.033 mm. Host: *Nycticorax nycticorax* (Aves), Luzon.

Polymorphus paucihamatus Heinze, 1936. Males 8.7-9.2 x 1.8-2.2 mm.; females 8 x 2 mm. First third and last fifth of body set off from remainder of body and bent ventrally. Very small body spines present. Proboscis elongate, oval, 0.76 x 0.27 mm. Hooks in 12 longitudinal rows of six each. Lemnisci club-shaped, about 2 mm. in length. Testes oval, 1-1.3 x 0.65-0.95 mm. Six cement glands. Eggs 0.094-0.096 mm. x 0.022-0.026 mm. Host: *Larus glaucoides* (Aves), locality unknown.

Polymorphus marilis Van Cleave, 1939. Males 8-9 mm. long. Females 13-14 mm. long with an average diameter of 1.5 mm. Neck 1.2 mm. long with a diameter of 0.35 mm. at its base. Body spines confined to front end of body. Proboscis elongate ovoid, approximately 0.38 mm. x 0.23-0.27 mm., armed with 16 or 17 longitudinal rows of seven or eight hooks each. Hooks at base of proboscis 0.042-0.044 mm. long; at tip 0.054-0.060 mm.; on remainder of proboscis 0.057-0.066 mm. Proboscis sheath 1.33-1.42 mm. long. Lemnisci short, compact, about twice as long as receptacle. Male genitalia occupy about four-fifths the length of body cavity. Cement glands long and tubular. Embryos

within gravid females 0.102-0.120 mm. long x 0.012-0.017 mm. in diameter, with polar prolongations of the middle membrane. Type host: *Nyroca marila* (Aves), Oklahoma.

Polymorphus cucullatus Van Cleave and Starrett, 1940. Males 11-13 mm. x 1.5 mm.; females about 10 mm. x 1.5 mm. A short, tapering neck present. Body swollen in the region of proboscis sheath, followed by a slight constriction. Cuticular spines of body proper restricted to the swollen portion of the body, anterior to the constriction, about 0.026-0.042 mm. long. Proboscis about 0.95 x 0.38 mm. Proboscis armed with 22 longitudinal rows of 12 hooks each, those at the base of the proboscis 0.042-0.055 mm. long; at tip 0.073-0.085 mm.; on middle, expanded zone 0.067-0.073 mm. Proboscis sheath about 1.7 mm. long. Lemnisci about twice as long as the receptacle. Male genitalia extend about 0.6 the length of the body cavity. Testes contiguous, elongate, from 1.1-1.3 mm. long x 0.5-0.6 mm. Cement glands four, long, tubular. No mature embryos observed. Type host: *Lophodytes cucullatus* (Aves), Illinois.

Polymorphus acutis Van Cleave and Starrett, 1940. Males approximately 4 mm. long with an average diameter of 0.9 mm. Immature females from 3 to 6.5 mm. long, with a diameter of about 0.8 mm. Neck 0.95 mm. long x 0.28 mm. at base. Proboscis ovoidal, slightly elongate, approximately 0.45 mm. long x 0.15 mm. Proboscis armed with 16 longitudinal rows of 11 or 12 hooks each. Hooks at base of proboscis 0.032-0.042 mm. long; at tip 0.040-0.045 mm.; in middle 0.040-0.042 mm. Proboscis sheath 0.66-0.72 mm. long. Lemnisci more than twice the length of the receptacle. Mature embryos not observed. Type host: *Anas platyrhynchos platyrhynchos* (Aves), Illinois.

Polymorphus eroliae Yamaguti, 1939. Description based on two mature males. Body 30-32 mm. long x 1-1.15 mm. broad at somewhat swollen anterior part of trunk. Proboscis slightly enlarged near base, 0.57-0.75 x 0.25 mm., containing elongate proboscis vesicle. Proboscis hooks 0.048-0.060 mm. long, in 18 longitudinal rows of 12-13 each; three posterior hooks of each row resemble rose-thorns, having short anterior and posterior roots, while the others are V-shaped in profile having rod-shaped roots. Neck conical, 0.9-1.25 x 0.65-0.75 mm. at base. Proboscis sheath 1.5-1.9 x 0.35-0.36 mm., perforated by retinacula at its middle. Body spines 0.030-0.035 mm. long, extending for a distance of 2.25-2.4 mm. from anterior extremity of trunk. Lemnisci elongate, club-shaped, 1.65-1.9 x 0.25-0.3 mm. Testes elliptical, 1.75-2 x 0.5-0.65 mm., one immediately behind the other, at about middle of anterior third of trunk. Cement glands very long, tubular, placed by twos in tandem. Säftigen's pouch 1.15-1.3 mm. x 0.35-0.38 mm. Bursal cap with two anterior diverticula and about 18 slender digitiform rays 0.25 mm. long x 0.045 mm. broad. Host: *Erolia alpina sakhalina* (Aves), Japan.

Polymorphus altmani (Perry, 1942) Van Cleave, 1947d. (*Filicollis altmani* Perry, 1942.) Body elongate, nearly cylindrical, with division of body surface by two strictures. Males 10.5 mm. long (8.5-12); females 12.5 mm. long (10.5-14). Neck about 1.38 mm. long; width at base 0.44 mm. Both sexes with minute body spines, confined to anterior part of body. Proboscis oblatly spheroidal, 0.62-0.8 x 0.5-0.96 mm., with 28 (25-30) longitudinal rows of 11 (9-12) hooks each. Basal hooks 0.05-0.07 mm. long; apical hooks 0.03-0.05 mm.; other hooks 0.03-0.06 mm. Proboscis sheath 1.7-2.75 mm. long. Lemnisci shorter than sheath. Testes spherical or ovoid. Four cement glands, long and tubular. Hard shelled embryos 0.060-0.070 x 0.022-0.030 mm. Type hosts: *Melanitta perspicillata* and *Melanitta deglandi* (Aves), California.

Polymorphus major Lundström, 1942. Adult males 16-18.5 x 2.2-3.5 mm.; females 21-27 x 3.2-4 mm. Proboscis ovoid, 0.6-0.7 x 0.4-0.5 mm. with 16-20 longitudinal rows of seven-nine hooks each. Hooks 0.081-0.099 mm. in length. Neck 1.2-1.5 mm. long. Body spines extend to level of posterior end of proboscis sheath or a little farther; they measure 0.030-0.033 mm. in length.

Proboscis sheath 1.7-2.7 mm. long. Lemnisci 1.8-3.2 x 0.9 mm., sac-like. Testes 1.3-1.6 x 0.6-1 mm. Cement glands about 6 mm. long. Eggs 0.090-0.096 x 0.030-0.039 mm. Host: *Bucephala clangula clangula* (Aves), Sweden.

Polymorphus meyeri Lundström, 1942. Males 7-10 x 1-1.8 mm.; females 12-14 x 2-2.8 mm. A slight constriction divides the body into two regions, the posterior about twice as long as the anterior. Proboscis ovoid, 0.3-0.4 x 0.3 mm. with 16-17 rows of six hooks each. Hooks 0.042-0.063 mm. in length. Neck 0.7 mm. in length. Proboscis sheath 0.8-1.2 mm. long. Lemnisci 1.1-2.2 mm. in length, enlarged posteriorly. Testes 0.6-0.9 x 0.4-0.5 mm. Anterior testis in anterior body region; sometimes both testes are in this region. Cement glands tubular. Eggs 0.096-0.108 x 0.018 mm. Type host: *Anas platyrhynchos platyrhynchos* (Aves), Sweden.

Polymorphus strumosoides Lundström, 1942. This species resembles the genus *Corynosoma*. The body shows a slight constriction somewhat anterior to the middle. Adult males 4.8-5 x 0.6-1 mm.; females 5-5.5 x 0.9-1.1 mm. Proboscis cylindrical with a slight swelling somewhat back of the middle; size of proboscis 0.5 x 0.2 mm. Proboscis hooks in 16-18 longitudinal rows of 11-14 each. Hooks 0.027-0.051 mm. in length. Anterior part of body covered with spines 0.027-0.030 mm. long; the spines extend ventrally almost to the constriction, dorsally about a third as far back. Proboscis sheath 1 mm. long. Lemnisci 0.8-0.9 x 0.3 mm. Testes 0.4-0.5 x 0.2-0.3 mm. Four cement glands, 1.7-1.8 mm. long. Eggs 0.102-0.111 x 0.018-0.021 mm. Type host: *Bucephala clangula clangula* (Aves), Sweden.

Polymorphus sp. Lundström, 1942. One immature female, 7.8 x 1.7 mm. Proboscis ovoid, 0.7 x 0.5 mm., with 18 (20?) longitudinal rows of nine or ten hooks each. Body spines 0.024-0.030 mm. long. Proboscis sheath 1.8 mm. long. Lemnisci about 1 mm. long, sac-like. Type host: *Somateria mollissima mollissima* (Aves), Sweden.

Polymorphus sp. Lundström, 1942. All specimens (five males and two females) immature. This species resembles *P. minutus* except for the color, which is white, while *P. minutus* is described as orange-red. Host: *Spatula clypeata* (Aves), Sweden.

Polymorphus diptoinflatus Lundström, 1942. Males 4.6-5.4 x 0.8-1 mm. Females 5.7-6 x 0.7-1.1 mm. Body of both sexes divided by a constriction into anterior and posterior regions, the posterior being twice as long as the anterior. The anterior and posterior extremities of the body are much smaller in diameter than the middle region. Anterior region of the body provided with spines 0.021-0.024 mm. long. Proboscis ovoid, 0.5-0.6 x 0.2 mm., armed with 14 longitudinal rows of seven-nine hooks each. Hooks 0.045-0.069 mm. long. Neck almost twice as long as proboscis. Proboscis sheath 1.2-1.25 x 0.18-0.28 mm. Lemnisci 0.7-1 x 0.015 mm. At least one testis is located in anterior region of body and sometimes both. Eggs 0.090-0.100 x 0.018 mm. Type host: *Anas p. platyrhynchos* (Aves), Sweden.

Polymorphus trochus Van Cleave, 1945b. With the characteristics of the genus *Polymorphus*, modified from Meyer (1932) to include his genus *Profilicollis*. Body of females 4.5-7.8 mm. long; males, about 3.8 mm. Greatest diameter slightly back of front end of body-proper. Swollen trunk region set with numerous cuticular spines. Neck, sub-cylindrical to barrel-shaped, slightly reduced in diameter at both ends, 0.4-1.1 mm. long and 0.35-0.54 mm. in maximum diameter. Proboscis in female pear-shaped, much inflated at base, with a short, greatly reduced nipple-like termination. Proboscis of females about 0.38-0.56 mm. long; from 0.30-0.49 mm. in maximum diameter. Proboscis of observed males, without conspicuous inflation, about 0.385-0.560 mm. long; 0.210 mm. in maximum diameter and 0.140 mm. in terminal portion.

Most of the hooks near middle zone of proboscis about 0.035 mm. long, many at both ends somewhat shorter. Embryos within body of mature females 0.075-0.084 mm. x 0.014-0.020 mm. Host: *Fulica americana* (Aves), Ohio, New York, Illinois.

Polymorphus kenti Van Cleave, 1947d. (*Filicollis* (probably *sphaerocephalus*) Harrington and Pillsbury, Bull. Bowdoin Coll., vol. 4, pp. 8-9 (mimeographed), 1938, and Harrington, *Ibid.*, vol. 6, pp. 14-17 (mimeographed), 1939.) Body somewhat inflated, cylindrical; trunk and large spheroidal proboscis connected by a very narrow cylindrical neck. Anterior end of trunk in young male bearing uniform minute cuticular spines whose roots only could be seen. No spines demonstrated on body of an immature female. Over-all dimensions of an immature female about 10 mm. in length, distributed as follows: trunk 6.1 mm., neck 2.5 mm., proboscis 1.5 mm. Maximum diameter of trunk 1.07-1.79 mm.; neck 0.46 mm. wide at base x 0.3-0.5 mm. wide near its middle. Spheroidal proboscis armed with about 27 longitudinal meridional series of 10 or 11 hooks each. Hooks difficult to observe because of their small size. Hooks 0.053-0.058 mm. long x about 0.008 mm. in thickness at the bend. Proboscis sheath about 5 mm. long, extending through entire length of neck and about 2.5 mm. into interior of trunk. Lemnisci about 2.1 mm. long. Embryos not observed. Cement glands of male obscured but seem to be four in number. Definitive host: *Larus argentatus smithsonianus* (Aves), Canada.

Sub-genus *FALSIFILICOLLIS* Webster, 1948b

"*Polymorphus*. Proboscis of adult of either sex greatly inflated and of spheroidal shape. Neck slender and elongate. Type species, *Polymorphus (Falsifilicollis) altmani* (Perry, 1942) Van Cleave, 1947."

Polymorphus (Falsifilicollis) texensis Webster, 1948b. Males 11-15 mm. long; female 18 mm. Proboscis spherical, about 1 mm. in diameter, with 22-24 longitudinal rows of 8-10 hooks each. Hooks 0.033-0.051 mm. long. Neck 1.89-2.07 mm. long. Proboscis sheath 3.1-3.5 mm. long. Lemnisci 1.76-2.42 mm. long. Testes oval, in anterior half of trunk. Four tubular cement glands. Eggs 0.058-0.073 x 0.018-0.022 mm. Host: *Crocethia alba* (Aves), Texas.

Corynosoma wegneri Heinze, 1934b. Size of body in both sexes about 4.5 mm. in length; maximum width 1.02 mm. Anterior part of body swollen; ventrally a broad obtuse cone rises out of which the proboscis projects. The cone is heavily spined and the rest of the body bears a heavily spined border. Spines around genital opening of male, but lacking in female. Proboscis 0.84 x 0.2 mm. with 15-16 longitudinal rows of 10-11 hooks each. First six hooks larger than others and possess roots. Eggs 0.108 x 0.030 mm., with polar elongations of second membrane. Host: *Phoca hispida* (Mammalia), Greenland.

Corynosoma australe Johnston, 1937. Body length in both sexes 3-4 mm. Anterior part of body in the form of a disc about 1.3 mm. in diameter with numerous small spines. Similar spines present on ventral surface of anterior part of body region posterior to disc. Proboscis 0.7 x 0.2 mm. with 18 longitudinal rows of 13-14 hooks each. Largest hooks 0.040 mm. in length. Proboscis sheath double-walled, 1.1 x 0.25 mm., with brain in middle. Lemnisci thin, narrow, about half the length and breadth of proboscis sheath. Testes 0.040 mm. in diameter, in disc region of body. Three pairs of cement glands. Posterior end of body provided with two circlets of spines which are much larger than other body spines. Host: *Arctocephalus forsteri* (Mammalia), Australia.

Corynosoma turbidum Van Cleave, 1937b. Female about 4 mm. long. Proboscis about 0.65 mm. in length with a swollen mid-region about 0.28 mm. in diameter, anterior and basal regions much smaller. Proboscis hooks in 16 longitudinal rows of 11 or 12 each. One large mid-ventral hook attaining a

length of 0.168-0.174 mm., while hooks in adjacent rows at same level are distinctly smaller. Hooks on narrow anterior region of proboscis 0.048-0.066 mm. long; on basal region 0.060-0.072 mm. Body spines around genital orifice 0.018-0.024 mm. Embryos within gravid females 0.072-0.096 x 0.018-0.024 mm., with polar swellings of middle membrane. Males not observed. Host: *Phalacrocorax neglectus* (Aves), South Africa.

Corynosoma clavatus Goss, 1941. Length of female 3.32 mm.; male 1.4 with neck retracted. When the neck is everted in the female, the position of the demarcation between the neck and trunk is 1.25 mm. from the anterior end. A part of the neck is armed (sic). Proboscis hooks in 14 longitudinal rows of 10 or 11 each; size of hooks 0.007-0.074 mm. Lemnisci small and band-like. Testes 0.29 x 0.19 mm. Cement glands pear-shaped, 0.14 x 0.13 mm. Eggs 0.170 x 0.029 mm. Hosts: *Phalacrocorax varius*, *P. ater*, *Microcarbo melanoleucus* (Aves), Australia.

Corynosoma phalacrocoracis Yamaguti, 1939. Body 6.5-7.55 x 2.2-2.5 mm. Proboscis bottle-shaped, 0.62-0.65 mm. long, with maximum breadth of 0.33-0.35 mm. at about junction of middle with posterior third. Proboscis hooks in 17 longitudinal rows of 10-12 each; apical hooks 0.051-0.057 mm. long; subapical hooks 0.060-0.065 mm. long; on the anterior part of the bulbous swelling is an undulating circle of 17 very stout hooks 0.080-0.105 mm. long; the hooks posterior to this circle are 0.050-0.068 mm. long. Proboscis sheath 1.4-1.65 x 0.37-0.5 mm. Neck conical, unarmed, 0.6-0.7 mm. long by 0.6-0.63 mm. broad at base. Trunk spines 0.030-0.045 mm. long, covering bulb in 22 transverse rows, extending on ventral side to near posterior extremity. No genital spines. Lemnisci about 1 mm. long. Eggs ellipsoidal, twice as long as broad; size of living eggs 0.105-0.135 x 0.054-0.070 mm. Host: *Phalacrocorax pelagicus pelagicus* (Aves), Japan. Since the hind body of *Corynosoma* may be introverted, thus concealing the genital spines, and, since the genital spines of the female are often lost when the copulatory cap is shed (Van Cleave, 1945e), it is conceivable that the statement concerning the lack of genital spines may be due to inadequate observation.

Corynosoma mergi Lundström, 1941. Males 4.5-4.9 x 1.3-1.5 mm. Females 5.9-7.7 x 1.7-1.8 mm. Body pear- to club-shaped; anterior region enlarged, spined. Length of spines 0.014-0.028 mm. Spines separated into two groups by a spine-free region. Genital opening of female surrounded by spines 0.007-0.014 mm. in length, but spines are lacking in this region of male. Proboscis cylindrical or somewhat enlarged in the middle, 0.50-0.56 x 0.20-0.25 mm., armed with 15-16 longitudinal rows of 8-10 hooks each. Hooks 0.030-0.056 mm. in length. Neck 0.34-0.5 mm. long. Proboscis sheath 1.02-1.27 mm. long. Lemnisci sac-like, 0.51-0.76 mm. in length. Cement glands oval, in two groups of three. Eggs 0.075 x 0.025 mm., with polar prolongations of middle membrane. Host unknown, Sweden.

Corynosoma cetaceum Johnston and Best, 1943. Males 3-7 mm.; females 1.7-3 mm. in length. Anterior disc-like region 1.3-1.7 mm. in diameter in males, 1.3-2 mm. in females. This region covered with spines 0.05 mm. in length; each spine surrounded by a protuberance of cuticle. Similar body spines extend ventrally in the female to level of the genital aperture; in the male body spines extend to posterior fifth of body. Genital aperture is not surrounded by spines in either sex. Proboscis hooks in 18 longitudinal rows of 14-16 each. Proboscis sheath 1.3 x 0.3 mm. Testes side by side. Cement reservoir U-shaped. Copulatory bursa with 18 sensory rays. Eggs 0.130 x 0.045 mm. Hosts: *Delphinus delphis* and *Tursiops truncatus* (Mammalia), Australia. Concerning the absence of genital spines in this species, it is possible that they were overlooked. As pointed out by Van Cleave (1945e), the hind body in males of *Corynosoma* is often introverted so that the spines are not readily visible, and the genital spines of females are often lost when the copulatory cap is shed.

Corynosoma obtusens Lincicome, 1943b. Body small, almost in form of inverted L, anterior end swollen into bulb and bent ventrally; 2.2-3 mm. long in females, 2-2.8 mm. in males. Maximum thickness of posterior body 0.4-0.7 mm. in females, 0.3-0.5 in males. Anterior bulbous part of body closely set with spines; trunk with spines only on ventral surface, in females extending all the way to genital pore, in males most of way but separated from genital spines by area devoid of armature. Spines on fore part of body 0.028-0.052 mm. long in females, 0.032-0.050 mm. in males; spines on posterior trunk of females 0.028-0.046 mm. long, of males 0.030-0.040 mm. long. Male genital spines set in about six rows, approximately 30 in number and 0.028-0.048 mm. long. Proboscis bent at obtuse angle from axis of body, swollen near base, 0.528-0.616 mm. long in females, about 0.546 mm. in males; width at swollen region 0.180-0.204 mm. in females, 0.144-0.180 mm. in males. Proboscis hooks in 16-19 longitudinal rows of 12-13 each. Length of hooks from tip to swollen area 0.036-0.056 mm.; below swollen area 0.016-0.040 mm. Lemnisci extending about three-fourths the length of proboscis sheath. Testes located well forward, side by side. Cement glands six (eight ?) (sic), pyriform, grouped in a cluster closely behind testes. Eggs 0.068-0.090 mm. x 0.020-0.028 mm. with polar outpocketings. Host: *Zalophus californianus* (Mammalia), California.

Corynosoma anatum Van Cleave, 1945c. Body lacking conspicuous enlargement of the spine-covered fore body. Genital extremity in both sexes provided with a small number of cuticular spines, irregularly scattered. Body length 4.2-8.6 mm., maximum diameter 0.9-1.7 mm. Proboscis about 0.55 mm. x 0.28-0.29 mm. armed with 14 longitudinal rows of eight or nine hooks each. Largest hooks approximately 0.088 mm. long and 0.023 mm. thick at the bend; those near the tip and base somewhat more slender; basal hooks 0.047-0.059 mm. long; near the tip, 0.059-0.082 mm. Hard shelled embryos 0.1-0.112 mm. x 0.02-0.023, with a bulge on the second membrane at each pole. Host: "duck," Texas.

Corynosoma graxida Alegret, 1941. The writer has not seen the description of this species. Host: *Phalacrocorax auritus floridanus* (Aves), West Indies.

Bolbosoma thunni Harada, 1935. Females 8-9.5 x 0.4 mm., strongly arched dorsally. Forebody, as far as the proboscis receptacle reaches, thickened and forming a bulb. Bulb spination in two rings, the anterior narrower, consisting of small spines; the posterior a little broader and consisting of larger spines. Anterior spines 0.026 mm., posterior 0.035 mm. Proboscis oval, 0.65 x 0.4 mm. Hooks in 16-19 (usually 18) longitudinal rows of eight each. The hooks measure 0.076-0.120 mm. Proboscis receptacle 1.5 x 0.36 mm., double-walled, brain in middle. Lemnisci 0.75 x 0.17 mm. Eggs 0.080-0.088 x 0.024-0.026 mm. Host: *Thunnus thynnus* (Pisces), Japan.

Bolbosoma nipponicum Yamaguti, 1939. Body length up to 45 mm. in male, 60 mm. in female; breadth 1.2-4 mm. Proboscis slightly constricted in front of posterior swelling, 0.4-0.65 x 0.3-0.44 mm. Proboscis hooks in 17-23 longitudinal rows of five-six each; apical hooks 0.075-0.087 mm. long; sub-apical hooks 0.080-0.100 mm.; basal hooks about 0.045 mm. Proboscis sheath 1.1-1.75 x 0.35-0.48 mm. Neck conical, 0.5-0.6 mm. long. Trunk strongly attenuate at about middle of anterior third; the part anterior to this forms a bulb 3-8.5 mm. long x 2-4 mm. broad and is covered with spines which extend backwards beyond the middle of the bulb; the spines become heavier and more numerous posteriorly, measuring up to 0.180 mm. long. Lemnisci plump, digitiform, extending a short distance back of proboscis sheath. Testes oval, 1-2 x 0.6-1.05 mm., in anterior half of middle third of trunk. Two pairs of long tubular cement glands. Eggs 0.120-0.186 x 0.027-0.038 mm. Host: *Balaenoptera rostrata* (Mammalia), Japan.

Arhythmorhynchus duocinctus Chandler, 1935. Chandler's (1935) description was based on immature forms from the mesenteries of a fish, *Paralichthys lethostigmus*. In 1943 Lincicome described adult forms from a black-crowned

night heron; the following description is taken from Lincicome's paper: Body spindle-shaped, anterior half to three-quarters swollen in three distinct regions: (1) that which follows the neck and which bears a band of spines; (2) middle region bearing a band of spines; (3) region bearing no spines, continuous with the posterior portion of body. Body length of females 6-10 mm., male 6.7 mm. Maximum width of female 1.1-2.1 mm., male 1.4 mm. Body spines 0.020-0.036 mm. long; anterior band immediately behind neck, 0.316-0.352 mm. wide, composed of eight-nine rings of 40-60 spines each; posterior band 0.334-0.387 mm. wide, composed of 9-14 rings. Proboscis spindle-shaped, 0.830-0.890 mm. long in females and 0.780 mm. in male; maximum width 0.299-0.316 mm. for females, 0.299 mm. for male. Proboscis hooks in 19-20 longitudinal rows of 15-17 each. Length of hooks 0.050-0.074 mm. Neck 0.570-0.930 mm. long in females, 0.530 mm. in male. Proboscis sheath 1.77-2.2 mm. long in females, 1.67 mm. in male; brain in mid-region. Lemnisci reaching to anterior testis in male, in females extending beyond posterior end of proboscis sheath. Testes in anterior half of body, 0.6 x 0.3 mm. Four cement glands, about 2.9 mm. long. Eggs with polar outpocketings, 0.080-0.110 x 0.020-0.032 mm. Host: *Nycticorax nycticorax hoactli* (Aves), New York.

Arhythmorhynchus invaginabilis succicus Lundström, 1942. Description based on one immature male. Combined length of the proboscis, neck and fore body is 4.7 mm. Inverted hind body measures 2.5 mm. The spine-covered part of the fore body is 0.5 mm. in length. Proboscis 1 x 0.2 mm. with 24 longitudinal rows of 19 or 20 hooks each. Length of hooks 0.039-0.051 mm.; roots up to 0.039 mm. in length. Neck 0.9 mm. long. Proboscis sheath 2 mm. long. Lemnisci 1.6 mm. long. Testes about 0.2 x 0.1 mm. This subspecies is distinguished by the following characteristics: (1) all of the hooks have roots; (2) the dorsal and ventral hooks are essentially the same size; (3) the posterior hooks have manubria as well as roots; as the roots become shorter the manubria become longer, and the last two hooks of each row have manubria only. Host: *Anthus spinoletta littoralis* (Aves), Sweden.

Arhythmorhynchus anser Florescu, 1941. Body elongate with an ovoid enlargement near anterior end of trunk in both sexes; in the male the testes are located in this enlargement. Males 44-63 x 1.1 mm.; at the level of the enlargement 1.55 mm. in diameter. Females 61-70 x 1.33 mm.; at the level of the enlargement 1.83 mm. in diameter. Region of body anterior to enlargement covered with spines. Neck very long and bearing a dorsal globular protuberance. Length of neck in male 3.3 mm.; width at the level of protuberance 1.15 mm. Length of neck in female 3.46 mm.; maximum width 1.13 mm. The proboscis projects ventrally from the neck protuberance and is elongate fusiform. Proboscis of male 0.95 mm. in length; maximum width 0.48 mm. Proboscis of female 1.46 mm. long; maximum width 0.5 mm. Proboscis hooks in 22 longitudinal rows of 22 each. Proboscis sheath of male 4.67 x 0.22 mm.; female 4.04 x 0.37 mm. Lemnisci 4-4.2 x 0.5-0.67 mm. Anterior testis 2 x 0.85 mm.; posterior testis 2.45 x 0.95 mm. Two cement glands 37.86 mm. in length. Eggs 0.123 x 0.033 mm. Host: *Larus argentatus cachinnans* (Aves), Roumania.

Arhythmorhynchus comptus Van Cleave and Rausch, 1950. Body with slight inflation near anterior end. Proboscis short, spindle-shaped. Males 23-32 x 0.635-0.807 mm. Females 40-55 x 0.8-1 mm. Proboscis 0.32-0.48 x 0.17-0.40 mm. Neck 0.35-0.80 mm. long. Proboscis armed with 15 or 16 longitudinal rows of eight or nine hooks each; largest hooks 0.444-0.448 mm. long. A field of spines 1-2.5 mm. long encircles anterior extremity of trunk with anterior spines closely set but progressively more widely dispersed. Testes each 1-1.5 mm. long in anterior part of body. Two cement glands each 13-24 mm. long. Eggs 0.093-0.101 x 0.022-0.026 mm. Hosts: *Erolia pilocnemis conesi*, *Erolia alpina pacifica*, *Aphriza virgata* (Aves), Alaska.

CENTRORHYNCHINAE Meyer, 1931

Centrorhynchus reptans Bhalerao, 1931b. Males 3.14-3.3 x 0.71-0.925 mm. Proboscis 0.77 mm. long, composed of a globular and a cylindrical portion. Hooks in 24 horizontal rows. Anterior hooks 0.057 mm. long, posterior 0.029-0.039 mm. Proboscis sheath 0.87-0.96 mm. long; brain just back of middle. Testes obliquely situated, 0.168 x 0.13 mm. Three cement glands, long, tubular. Host: *Naja hannah* (Reptilia), India.

Centrorhynchus insularis Tubangui, 1933. Body elongate, swollen anteriorly. Males 15-22, females 33-40 mm. in length. Anterior portion of proboscis ovoid, 0.6-0.64 mm. x 0.32-0.34 mm. in male; 0.6-0.8 x 0.32-0.36 mm. in female, with 16-18 longitudinal rows of 32-34 hooks each. Posterior portion of proboscis about as long as anterior, with 16-20 longitudinal rows of 19-20 hooks each. Anterior hooks 0.070-0.075 mm. long, posterior 0.036-0.044. Proboscis sheath 1.6-1.7 x 0.37-0.43 mm. in male, 1.7-2.1 x 0.4-0.46 mm. in female. Lemnisci about twice as long as proboscis sheath. Testes in middle of swollen body region in male, 0.95-1.2 x 0.46-0.52 mm. Cement glands closely bunched together, 10-11.5 mm. long. Eggs 0.045-0.055 x 0.022-0.025 mm. Host: *Haliastur intermedius*, *Butastur indicus*, *Spilornis baha* (Aves), the Philippines. The posterior portion of the proboscis was incorrectly called the neck by Tubangui.

Centrorhynchus maryasis Datta, 1933. Males 5.5-15 x 1.3-2 mm.; females 4-18 x 1.3 mm. Proboscis armed with 24-28 longitudinal rows of 14-16 hooks each. Size of hooks 0.037-0.056 mm. Proboscis sheath double-walled. Male genitalia occupy posterior two-thirds of body. Host: *Urocissa melanocephala occipitalis* (Aves), Northern India.

Centrorhynchus elongatus Yamaguti, 1935. Body 13-33 mm. long or longer, very slightly enlarged at anterior third of trunk. Proboscis 0.63-1.06 x 0.21-0.36 mm. Hooks 0.033-0.063 mm., in 25-33 longitudinal rows of 14-18 each. Proboscis sheath 0.7-1.5 mm. long. Lemnisci reaching to near anterior testis or a little farther. Testes 0.56-1.17 x 0.3-0.7 mm., directly tandem or a little separated from each other, in anterior third of trunk. Muscular bursa cap with 14 digitiform rays 0.3-0.5 mm. in length. Eggs 0.072-0.084 x 0.027-0.030 mm. Host: *Otus bakkamoena semitorques* and *Asio otus otus* (Aves), Japan.

Centrorhynchus turdi Yamaguti, 1939. Males 2.8-9.85 mm. x 0.8-1.8 mm.; females 8-19 x 1-1.8 mm. Proboscis 0.25-0.5 x 0.18-0.35 mm. Proboscis hooks in 26-34 longitudinal rows of 11-14 each; length of hooks 0.027-0.054 mm. Proboscis sheath 0.62-1.18 x 0.16-0.38 mm. Neck 0.18-0.3 mm. long. Lemnisci 0.5-1.6 x 0.12-0.3 mm. Testes elliptical, 0.38-1.3 x 0.28-0.7 mm., in anterior half of trunk. Cement glands 1-2 mm. long. Bursal cap with 14 plump rays. Eggs 0.078-0.090 x 0.024-0.027 mm. Type host: *Turdus cardis cardis* (Aves), Japan.

Centrorhynchus bubonis Yamaguti, 1939. Description based on three mature females. Body cylindrical, 12.5-16 x 1.5-2.2 mm. Proboscis 0.43-0.45 x 0.35-0.4 mm., truncate in front and swollen at middle. Proboscis hooks 0.040-0.060 mm. long, in 35 longitudinal rows of 13-14 each, extending over neck to near its base. Proboscis sheath 1.2-1.5 x 0.3-0.5 mm. Eggs 0.063-0.075 x 0.026-0.030 mm. Host: *Bubo bubo tenuipes* (Aves), Japan.

Centrorhynchus conspectus Van Cleave and Pratt, 1940. Females 28-55 x 1-1.5 mm. with conspicuous swelling near posterior end; males 23-35 mm. long, lacking the conspicuous posterior swelling. Proboscis 1.1-1.75 mm. long (0.835 mm. in one specimen). Proboscis hooks in 26-28 longitudinal rows (32 in one specimen) of 16-19 each. Hooks divided into two groups; anterior four or five hooks with narrow, much elongated roots anterior to the line of insertion of the receptacle and a series of 12-15 smaller hooks posterior to the insertion. Hooks in basal series of two different types. Those at base of proboscis are simple, while those on anterior swollen region consist of two

or three hooks with recurved cleft roots, some of which have conspicuous lateral projections. The four or five anterior hooks 0.050-0.065 mm. long (0.073 mm. in one specimen); roots of these terminal hooks 0.052-0.088 mm. long. Hooks on enlarged portion of proboscis just posterior to insertion of receptacle 0.039-0.065 mm. long. Thorns at base of proboscis 0.040-0.057 mm. long. Lemnisci very long, often extending 1.5 mm. beyond posterior tip of receptacle. Male genitalia occupy about three-fourths the length of the body. Four extremely long cement glands. Fully embryonated eggs 0.050-0.078 x 0.021-0.026 mm. (average 0.068 x 0.021 mm.). Type host: *Strix varia varia* (Aves), North Carolina.

Centrorhynchus scanensis Lundström, 1942. Males 7.4-8.3 x 1 mm.; females 10-14.5 x 1.5-1.8 mm. Proboscis composed of an anterior ovoid, and a posterior conical part; the boundary between the two marked by a constriction and by the insertion of the proboscis sheath. Size of proboscis 0.6-0.7 x 0.3-0.4 mm. Hooks in 22 longitudinal rows of 10-11 each. Length of hooks 0.030-0.054 mm. Proboscis sheath 1 mm. long; lemnisci 1-1.4 mm. in length. Testes 0.9-1 x 0.4 mm. Cement glands 1.4-1.8 mm. in length. Eggs 0.078-0.084 x 0.021-0.024 mm. Type host: *Turdus merula merula* (Aves), Sweden.

Centrorhynchus olssoni Lundström, 1942. Males 27-32 x 0.8-1 mm.; females 50-60 x 1-1.4 mm. In both males and females the posterior end of the body shows a vesicular enlargement. This is either globular or drawn out into a point and is bent at an angle with the rest of the body. Proboscis 0.8-1 x 0.4-0.5 mm. Hooks in 32-34 longitudinal rows of 16 each. Length of hooks 0.036-0.066 mm. Proboscis sheath 1.5-1.7 mm. in length. Lemnisci 2.3-3.7 mm. long. Testes 1-1.3 x 0.5 mm. Eggs 0.057-0.063 x 0.024 mm. Type host: *Strix aluco aluco* (Aves), Sweden.

Centrorhynchus narcisae Florescu, 1942. The writer has not seen the description of this species. Host: *Circus aeruginosus aeruginosus* (Aves), Europe.

PSEUDOPORRORCHIS Joyeux and Baer, 1935

Centrorhynchinae of large size, exhibiting an enlargement of the anterior region of the body. Proboscis divided into two zones by the insertion of the proboscis sheath. The anterior zone is armed with several longitudinal rows of hooks which diminish in size below the anterior third of the proboscis. The posterior zone is not armed. The lacunar system is formed of longitudinal vessels united by numerous circular vessels. Four copulatory glands. Eggs ovoid, without polar swellings. Adults in birds. Joyeux and Baer include in this genus *Echinorhynchus bulbocaudatus* Southwell and Macfie, 1925, and *E. centropusi* Tubangui, 1933. They also state that probably *E. rotundatus* von Linstow, 1897, and *E. centropi* Porta, 1910, belong to the new genus.

Pseudoporrorchis houdemeri Joyeux and Baer, 1935. Males 36 x 1 mm.; females 50-55 x 1.3 mm. Anterior swelling marked off by constriction. Proboscis club-shaped, 0.8-1 x 0.38-0.5 mm., with 22-24 longitudinal rows of 11-12 hooks each. Largest hooks 0.092 mm. in length. The last five or six hooks distinctly smaller than first six. Proboscis sheath 1.1 x 0.38-0.4 mm. with brain in middle. Lemnisci narrow, twice as long as proboscis receptacle. Testes oval, 1.7 x 0.6 mm. Four cement glands. Eggs 0.070 x 0.031 mm. Host: *Centropus sincensis intermedius* (Aves), Indochina (?).

Pseudoporrorchis teliger Van Cleave, 1949a. Males up to 36 x 3.1 mm. Females up to 48 x 3.1 mm. Proboscis clavate, 0.75-0.86 x 0.48-0.60 mm., armed with 24-28 longitudinal rows of nine or ten hooks each. Largest hooks 0.084-0.095 mm. long with very long narrow roots, some of which bear triangular wings near posterior end. Posterior hooks with modified roots of two distinct types. Neck 0.34 mm. long. Proboscis sheath cylindrical, composed of two heavy, concentric muscle layers. Brain located far forward in sheath. Lemnisci

somewhat longer than sheath. Testes elongate ellipsoidal. Cement glands elongate, massed together. Eggs 0.053-0.059 x 0.020-0.027 mm. Hosts: *Herpestes javanicus* (mongoose) and *Felis minutus javanicus* (Mammalia), Batavia, Java.

Pseudoporrorchis centropusi (Tubangui, 1933) Joyeux and Baer, 1935. (*Echinorhynchus centropusi* Tubangui, 1933.) Body elongate, surface slightly rugose, anterior sixth or seventh enlarged, separated from rest by constriction. Males 11.5-14.5 x 0.8-1 mm.; females 20-30 x 0.9-1.25 mm. Proboscis sub-spherical to ovate, 0.4-0.5 x 0.4-0.46 mm. with 16-18 circles of eight-ten hooks each. Larger hooks 0.087-0.102 mm. long; smaller hooks 0.038-0.042 mm. Proboscis sheath 1-1.2 x 0.3-0.38 mm. with brain behind middle. Lemnisci about twice as long as proboscis sheath, each with a single large nucleus. Testes 0.9-1.04 x 0.5-0.52 mm. Cement glands long, number not determined. Eggs 0.029-0.37 x 0.014-0.018 mm. Host: *Centropus viridis* (Aves), Luzon.

PLAGIORHYNCHINAE Meyer, 1931

Plagiorhynchus odhneri Lundström, 1942. Color white. Males 5-8.4 x 0.8-1.7 mm.; females 9-11 x 1.7-2.4 mm. Proboscis long, cylindrical, 0.2-0.3 x 0.8-1.1 mm., with 18-19 longitudinal rows of 14-18 hooks each. Length of hooks 0.030-0.048 mm. Proboscis sheath 1.1-1.3 mm. long. Lemnisci 1.2-2.2 x 0.07-0.11 mm. in male; 3-3.3 x 0.1 mm. in female. Testes 0.3-0.5 x 0.6-0.8 mm. Cement glands 0.6-1.3 mm. in length. Eggs 0.096-0.111 x 0.030-0.033 mm. Type host: *Haematopus ostralegus ostralegus* (Aves), Sweden.

Prosthorhynchus limnobaeni Tubangui, 1933. Description based on two male specimens. Body size 18-20 x 1.15-1.2 mm. Proboscis cylindrical, 1-1.06 x 0.18-0.2 mm., armed with 43 alternating anteroposterior rows of eight hooks each. Hooks almost uniform in size, with well developed rectangular roots; lamina of hooks 0.050-0.054 mm. long, roots 0.045-0.048 mm. Neck absent. Proboscis sheath 2.5-2.6 x 0.37-0.45 mm. Lemnisci only slightly longer than proboscis sheath. Testes behind middle of body length, 0.86-1.35 x 0.48-0.54 mm. Host: *Limnobaenus fuscus* (Aves), Luzon.

Prosthorhynchus pittarum Tubangui, 1935. Description based on one female. Body plump, tapering towards both extremities, 10 x 2 mm. Cuticle unarmed. Proboscis cylindrical, rounded at anterior end, 0.75 x 0.2 mm. Hooks in 14 longitudinal rows of 15 each; they are 0.054-0.058 mm. long with roots 0.041-0.045 mm. long. Neck 0.12 mm. long. Proboscis sheath double-walled, 1.6 x 0.4 mm. Lemnisci narrow, 1.95 mm. long. Eggs 0.125-0.130 x 0.045-0.050 mm. Host: *Pitta atricapilla* (Aves), Luzon.

Prosthorhynchus urichi Cameron, 1936. Description based on one male and two female specimens. Male 5.5 mm. and females about 8 mm. in length. Proboscis long and cylindrical, armed with numerous spines. Proboscis retracted in all specimens, but partly everted in one showing a short neck which is free from spines. Three lemnisci are present, about twice the length of the proboscis sheath. Host: *Procyon cancrivora* (Mammalia), Trinidad, B. W. I. The condition of three lemnisci is probably due to branching of one lemniscus. Van Cleave (1942) has reported a condition of branching in one or both lemnisci in certain specimens of *Plagiorhynchus formosus*, and in his discussion of *Acanthocephala* with atypical lemnisci he makes the following comment: "As pointed out by Meyer, these anomalies represent a plasticity in organization of the lemnisci but this plasticity is much more evident in the Polymorphidae than in other families of the *Acanthocephala*."

Prosthorhynchus charadrii Yamaguti, 1939. Description based on one male and one female specimen. Male 9.6 x 1.3 mm.; female 11.5 x 1.5 mm. Proboscis of male 0.93 x 0.23 mm.; proboscis of female 1 x 0.275 mm. Hooks in 17 longitudinal rows of 17-18 each. Length of hooks up to 0.065 mm. Proboscis sheath of male 1.75 x 0.35 mm.; proboscis sheath of female 1.95 x 0.27 mm. Lemnisci of male 3 x 0.075 mm.; of female 4.15 x 0.07 mm. Testes

oval, directly tandem at second sixth of trunk, about 0.7×0.6 mm. Six cement glands, $2.9-4.5 \times 0.08-0.15$ mm. Bursal cap with 16 plump posterior rays. In the female a small nodular projection occurs behind the vulva. Eggs elliptical, $0.105-0.120 \times 0.034-0.045$ mm. Host: *Charadrius dubius* (Aves), Japan.

Prosthorhynchus genitopapillatus Lundström, 1942. Color yellow-white. Males $10-12 \times 1.6-1.9$ mm.; females $14-19 \times 2.4$ mm. The genital opening is located in a small papilla. The proboscis is inclined ventrally and is almost cylindrical. Size of proboscis $1-1.2 \times 0.2-0.3$ mm. Proboscis hooks in 16-19 longitudinal rows of 13-17 hooks each. Length of hooks $0.069-0.090$ mm. Proboscis sheath $1.4-2.4$ mm. in length. Lemnisci $2.3-2.6$ mm. long in male, $3.8-4$ in female. Testes $0.6 \times 1.2-1.4$ mm. Cement glands $1.6-4.3$ mm. in length. Eggs $0.070-0.75 \times 0.024-0.030$ mm. Host: *Turdus merula merula* and others (Aves), Sweden.

Prosthorhynchus upupae López-Neyra, 1946. Males $4.2-5.9 \times 1.1-1.4$ mm. Proboscis 0.75×0.25 mm. Hooks in 16-18 longitudinal rows of 14-15 each. Largest hooks $0.08-0.09$ mm. in length. Proboscis sheath 0.7 mm. long. Testes oval, contiguous; anterior 0.9×0.5 mm.; posterior 0.7×0.4 mm. Six pyriform cement glands, each 1.3 mm. in length. Host: *Upupa epops* (Aves), Spain.

Oligoterorhynchus malayensis Tubangui, 1935. Description based on one male. Body cylindrical, 10.5×0.9 mm. Cuticle smooth. Proboscis sub-cylindrical, rounded at anterior end, 1.1×0.22 mm. Hooks in 18 longitudinal rows of 21 each. Hooks at extremities smaller, $0.033-0.041$ mm., remaining hooks $0.041-0.049$ mm. with roots $0.037-0.042 \times 0.016$ mm. Neck absent. Proboscis sheath double-walled, 1.84×0.35 mm. Brain in front of middle. Lemnisci narrow, 2.3 mm. long. Four tubular cement glands forming a bundle 2.7 mm. long. Host: *Hypotaenidia philippensis* (Aves), Luzon.

Porrorchis ogatai Fukui and Morisita, 1936. Description based on one male and two female specimens. Body spindle-shaped; male 4.9×1.1 mm.; female 8×1.76 mm. Body without spines. Proboscis cylindrical with slender, rounded anterior end, $0.64-0.77 \times 0.19-0.23$ mm. Hooks in 18 longitudinal rows of 14-15 each. Hooks are $0.051-0.070$ mm. long. Proboscis sheath 1.6×0.3 mm. Lemnisci 2.17×0.12 mm. Four long cylindrical cement glands. Eggs 0.066×0.025 mm., without polar swellings. Host: *Merula pallida* (Aves), Japan.

Porrorchis oti Yamaguti, 1939. Description based on two mature but not gravid females. Body $51-62 \times 2.5-2.8$ mm. Proboscis $0.8 \times 0.92-0.95$ mm., rounded in front and slightly enlarged posteriorly. Hooks in 46-50 longitudinal rows of ten each. Length of hooks $0.048-0.075$ mm. The five anterior hooks of each row have a rod-shaped backward root, while the five posterior hooks have a forward root. Proboscis sheath $1.15-1.3 \times 0.8-0.95$ mm., with brain about the middle. Neck about 0.3 mm. long, unarmed. Trunk smooth, with a pair of very conspicuous lateral lacunar stems connected with each other by anastomosing branches. Lemnisci slender, tubular, $8-9$ mm. long. Uterus and uterine bell $1.5-2$ mm. in combined length. Host: *Otus bakkamoena semitorques* (Aves) Japan. An encysted juvenile specimen was found in the outer wall of the urinary bladder of *Rana temporaria ornativentris*.

Lueheia adlueheia (Werby, 1938) Van Cleave, 1942. (*Furcata adlueheia* Werby, 1938.) Males $3.5-9.23 \times 0.8-1.7$ mm.; females $11.3-15 \times 1.8-2.5$ mm. Proboscis subglobular, $0.385-0.49 \times 0.28-0.385$ mm. in males; $0.399-0.602 \times 0.315-0.525$ mm. in females. Hooks in 28 longitudinal rows of 9-10 each; length of hooks $0.017-0.042$ mm. in males; $0.02-0.062$ mm. in females. Proboscis sheath up to 1.54 mm. long. Lemnisci subdivided into three-five parts each, $0.84-2.59$ mm. in length. Testes subspherical. Four cement glands, long tubular, $0.7-3.43$ mm. in length. Eggs $0.036-0.041 \times 0.013-0.015$ mm. Host:

Turdus migratorius propinquus (Aves), Washington. Van Cleave (1942) makes the following statement concerning this genus and species: "Furcata is certainly a synonym of *Lueheia* and *P. adlueheia* is probably a direct synonym of *L. inscripta*."

ECHINORHYNCHIDAE, Cobbold, 1879

ECHINORHYNCHINAE, Meyer, 1931

Acanthocephaloides rhinoplagusiae Yamaguti, 1935. Trunk of male 2-3.1 x 0.5 mm.; female 2.5-6.4 x 0.5-0.8 mm. Proboscis nearly cylindrical, 0.3-0.5 x 0.11-0.2 mm., with 14 longitudinal rows of ten hooks each. Largest hooks in middle of proboscis, 0.042-0.063 mm. long; basal hooks 0.016-0.024 mm. Neck unarmed, 0.15-0.28 mm. long. Proboscis sheath 0.38-0.98 x 0.13-0.22 mm. Lemnisci finger-like, nearly as long as proboscis sheath. Testes oval. Ductus ejaculatorius with bulbous sphincter at proximal end. Muscular bursa cap with about 14 digitiform rays. Eggs 0.042-0.063 x 0.009-0.012 mm. with polar prolongations of middle membrane. Host: *Rhinoplagusia japonica* (Pisces), Japan. Yamaguti (1939) states that re-examination of his original material revealed body spines extending from the anterior end posteriorly for a distance of about 0.5 mm.; length of spines up to 0.012 mm.

Acanthocephaloides neobythitis Yamaguti, 1939. Males 5.4-7.3 mm. in length; females 8-12.5 mm. Proboscis subcylindrical 0.5-0.65 x 0.13-0.2 mm. Proboscis hooks 0.030-0.072 mm. long, in 17-18 longitudinal rows of 10-13 each. Trunk of male covered anteriorly with minute spines. Proboscis sheath 0.67-1 x 0.14-0.25 mm. with brain at base. Lemnisci of male 0.55-1 x 0.09-0.2 mm., broader than those of female. Lemnisci of female 1-1.3 mm. long. Testes contiguous, 0.56-0.97 x 0.23-0.43 mm. Cement glands elliptical, usually six, occasionally eight in number. Bursal cap with about 20 digitiform rays. Eggs 0.090-0.115 x 0.012-0.016 mm. Type host: *Neobythites macropus* (Pisces), Japan.

Acanthocephaloides japonicus (Fukui and Morisita, 1936) Yamaguti, 1939. (*Ptilosoma japonicum* Fukui and Morisita, 1936.) Males about 8.53 x 0.7 mm.; females 11.5-12.5 x 0.98 mm. Proboscis cylindrical, about 0.58-0.64 x 0.1-0.14 mm. Proboscis hooks in 11-12 longitudinal rows of 25 each. Proboscis sheath 0.79-1.05 x 0.15-0.56 mm. Lemnisci digitiform, 1.5-1.79 x 0.09-0.13 mm. Six pear-shaped cement glands, arranged in two sets of three. Size of each cement gland 0.35 x 0.12 mm. Eggs 0.097 x 0.022 mm.; polar swellings not marked. Hosts: *Hexagrammos otakii* and *Teuthis fuscescens* (Pisces), Japan.

Acanthocephalus minor Yamaguti, 1935. Males 1.5-2 x 0.5 mm.; females 2.3-3.1 x 0.7-0.75 mm. Proboscis 0.34-0.5 x 0.14-0.2 mm. with 14-15 longitudinal rows of seven-nine hooks each. Largest hooks 0.060-0.072 mm. in males, and 0.068-0.087 mm. in females; smallest hooks 0.042-0.060 mm. in males, and 0.054-0.066 mm. in females. Neck short. Proboscis sheath 0.32-0.55 mm. long, with brain at base. Lemnisci longer than proboscis sheath, up to 0.58 mm. The oval testes lie obliquely tandem. Six pyriform cement glands closely massed together. Eggs 0.075-0.090 x 0.011-0.018 mm. Host: *Parasilurus asotus* (Pisces), Japan.

Acanthocephalus opsarichthydis Yamaguti, 1935 (*A. opsalichthydis* Yamaguti, 1935). Type male 2.77 x 0.42 mm.; type female 5 x 0.8 mm. Proboscis cylindrical, 0.42-0.65 x 0.088-0.13 mm. with nine longitudinal rows of five-seven hooks each, the roots having anterior prolongations; largest hooks 0.084-0.120 mm., smallest basal hooks 0.027-0.051 mm. in length. Neck short. Proboscis sheath 0.37-0.48 x 0.12-0.13 mm. Lemnisci usually a little shorter than the proboscis sheath. Oval testes lie directly tandem at about middle of body. Cement glands oval, 0.1-0.14 mm. long, in two rows of three. Muscular bursa cap bears numerous small papillae on its inner surface. Eggs fusiform, 0.093-0.114 x 0.013-0.017 mm., shell with filaments, middle membrane with pro-

longations. Host: fresh water fish, Japan. Yamaguti (1939) stated that the original spelling of the specific name, *opsalichthydis*, was incorrect and was due to a lapsus calami.

Acanthocephalus kashmirensis Datta, 1936. Males 1.75-8.6 x 0.44-0.99 mm.; females 3.48-14.6 x 0.57-1 mm. Proboscis cylindrical, 1.5 x 0.51 mm., with 13-18 circular rows of six-eight hooks each. Anterior hooks 0.11 mm. long, basal hooks 0.075 mm. long; roots broad and pyriform. Proboscis sheath double-walled, 1.69 x 0.44 mm.; brain near posterior end. Lemnisci little longer than proboscis sheath. Six cement glands. Eggs 0.060 x 0.010 mm. Host: *Schizopygopsis stoliczkae* (Pisces), North India.

Acanthocephalus sinensis Van Cleave, 1937a. Females 10-15 mm. in length, males 5-8 mm. Proboscis armed with 15-19 longitudinal rows of four-six hooks each. Hooks on anterior region of proboscis of males ranging from 0.053-0.094 mm., of females 0.053-0.115 mm.; on mid-region of males 0.066-0.103 mm., of females 0.079-0.115 mm.; on basal region of males and females 0.053-0.098 mm. Embryos 0.045-0.060 mm. x 0.012-0.015 mm. Hosts: *Rana nigromaculata* and *Bufo formosus* (Amphibia), China.

Acanthocephalus elongatus Van Cleave, 1937a. Description based on one immature female. "Holotype female 4.1 mm. long with a cylindrical proboscis 0.86 mm. long and 0.38 mm. in diameter. Proboscis hooks in 16 longitudinal rows of 13-15 hooks each. Hooks on anterior region 0.033-0.045 mm. long, on middle of proboscis about 0.057 mm. and near base about 0.045 mm. . . . The very slender, much elongated proboscis clearly distinguishes this species from all other members of the same genus." Type host: *Bufo formosus* (Amphibia), China.

Acanthocephalus parallelotestis Achmerov and Achmerova, 1941. Description based on one male. Body long, gradually tapering to both ends, 4.67 x 0.93 mm. Proboscis oval, 0.6 x 0.315 mm., with 16 longitudinal rows of six-eight hooks each. Anterior hooks 0.033 mm. in length, middle hooks 0.060-0.075 mm., posterior 0.045-0.055 mm. Proboscis sheath 1.125 x 0.325 mm., brain near base. Lemnisci 1.095 and 1.2 x 0.18 mm. Six pyriform cement glands. Testes long, sausage-shaped, parallel to each other, 1.55-1.8 x 0.33-0.36 mm. Host: *Hemibarbus labeo* (Pisces), Asia.

Acanthocephalus sp. Lundström, 1942. A few specimens, including one mature female, belonging to the genus *Acanthocephalus* were found in the body cavity of three fish. They could not be assigned to any of the described species; however, there was not enough material to describe a new species. Proboscis 0.8-0.9 x 0.2-0.3 mm. with 14 longitudinal rows of 10-12 hooks each. Neck 0.2-0.4 mm. in length; proboscis sheath 1.2-2 mm. long; lemnisci 1.5 mm. long. Six cement glands. Eggs 0.075-0.081 x 0.015-0.018 mm. Hosts: *Gadus callarias*, *Zoarces viviparus*, *Cottus quadricornis* (Pisces), Sweden.

Acanthocephalus van-cleavei Hughes and Moore, 1943. Body of male, exclusive of proboscis, 4.3 x 0.4 mm. Body of female, exclusive of proboscis, 3.05-6.7 x 0.33-0.7 mm. Proboscis 0.147-0.267 mm. long and 0.090-0.220 mm. in diameter, with 14-19 longitudinal rows of four-six hooks each. Length of hooks 0.030-0.105 mm. Proboscis sheath 0.200-0.600 mm. long and 0.090-0.233 mm. in diameter. Lemnisci of female subequal; the longer 0.666-1.760 mm. and the shorter 0.367-1.692 mm.; generally one branched. Lemnisci of male very unequal in size and form; the smaller diminutive, unbranched, 0.150 mm. long; the larger five-branched and 1.584 mm. long to tip of longest ramus. Seven cement glands. Eggs 0.054-0.072 x 0.012-0.018 mm. Host: *Eurycea tynerensis* (Amphibia), Oklahoma.

Acanthocephalus hastae Baylis, 1944. Males 4-8 x 0.66-1 mm.; females 6-12 x 0.6-1.6 mm. Body without spines. Proboscis cylindrical or very slightly clavate, 0.7-1.4 x 0.16-0.25 mm., with 12 longitudinal rows of 14 hooks each. Length of hooks 0.020-0.080 mm. Proboscis sheath 0.95-2.2 x 0.21-0.32 mm.

Cement glands pyriform, in two rows of three. Eggs fusiform, 0.066-0.084 x 0.02-0.024 mm., middle membrane thickened at poles, without prolongations. Hosts: *Pomadasys hasta*, *Sparus berda*, *Trachurus declivis* (Pisces), Australia.

Echinorhynchus sevani Dinnik, 1933. The writer has not seen the description of this species. Host: *Salmo ischchan* (Pisces), Lake Sevan, Armenia.

Echinorhynchus cotti Yamaguti, 1935. Males 4.2-6 x 0.44-0.63 mm.; females 6.2-10.5 x 0.7-1 mm. Dendritic hypodermal nuclei. Proboscis 0.42-0.63 x 0.11-0.15 mm. with 16-20 longitudinal rows of about 13 hooks each. Hooks up to 0.051 mm. in length. Neck very short. Proboscis sheath 0.63-1.1 x 0.15-0.25 mm. Lemnisci usually not extending beyond posterior end of proboscis sheath. Cement glands ovoid. Muscular cap with about 20 rays. Eggs 0.114-0.132 x 0.020-0.022 mm. Host: *Cottus pollus* (Pisces), Japan.

Echinorhynchus zanclorhynchi Johnston and Best, 1937. Description based on one female specimen. Length of body 10 mm. and width 0.8 mm. Proboscis cylindrical, 1 mm. long, with 14 longitudinal rows of 10-11 hooks each. Proboscis sheath 0.9 x 0.35 mm. Lemnisci shorter than sheath. Eggs 0.1 x 0.02 mm. Host: *Zanclorhynchus spinifer* (Pisces), Australasia.

Echinorhynchus lageniformis Ekbaum, 1938. Males 1.5-5 x 0.5-0.8 mm. Females 2.5-6.5 mm. in length; bulbous swelling in posterior part 1.2-2.2 mm. in diameter; diameter of cylindrical anterior region 0.4-0.7 mm. Proboscis 0.25-0.4 mm. long, cylindrical or barrel-shaped. Hooks in 14-16 longitudinal rows of eight-ten each. Apical hooks 0.045-0.050 mm. long; median 0.050-0.055; basal 0.035-0.040. Proboscis sheath 0.8-1.2 mm. long; lemnisci slightly longer. Testes placed obliquely 0.3-0.5 x 0.2-0.35 mm. Six pear-shaped cement glands 0.2-0.25 x 0.1-0.15 mm. Eggs 0.065-0.080 x 0.015-0.020 mm. Host: *Platichthys stellatus*, *Lepidopsetta bilineata* (Pisces), Departure Bay, Vancouver Island, B. C.

Echinorhynchus lotellae Yamaguti, 1939. Males 4.5-9.8 x 0.6-0.9 mm.; females 10-24 x 0.7-2 mm. Dendritic hypodermal nuclei. Proboscis cylindrical, 0.63-0.85 x 0.13-0.23 mm., with 16-19 (usually 16) longitudinal rows of 16 hooks each; length of hooks up to 0.054 mm. Proboscis sheath 1.1-1.85 x 0.22-0.32 mm. Lemnisci 0.4-1.5 x 0.075-0.28 mm. Anterior testis 0.55-0.95 x 0.37-0.48 mm.; posterior testis 0.47-0.8 x 0.36-0.43 mm. Six ovoid cement glands. Bursal cap with about 20 digitiform rays. Eggs 0.108-0.132 x 0.030-0.034 mm. Host: *Lotella phycis* (Pisces), Japan.

Echinorhynchus dissimilis Yamaguti, 1939. Description based on one male and one broken female. Male 7.9 x 1 mm.; length of female unknown, width 1.4 mm. Proboscis subcylindrical, distinctly convex ventrally but nearly straight dorsally, 0.5-0.6 x 0.42 mm. Hooks in 27-30 longitudinal rows of 10-11 each; length of hooks up to 0.054 mm. Proboscis sheath 0.95-1.25 x 0.275-0.31 mm. Lemnisci 0.85-0.95 x 0.12 mm. Anterior testis 0.95 x 0.55 mm., posterior, 0.8 x 0.5 mm. Cement glands beads-like (sic.), 0.225-0.35 x 0.2-0.26 mm. Host: *Lotella phycis* (Pisces), Japan.

Echinorhynchus lenok Achmerov and Achmerova, 1941. Description based on one male. Size of body 4.5 x 0.7 mm. Proboscis cylindrical, 0.675 x 0.225 mm., with 22 longitudinal rows of 13-14 hooks each. Anterior hooks 0.042 mm. in length, middle hooks 0.035 mm. Proboscis sheath double-walled, 0.780 x 0.265 mm., with brain in middle. Lemnisci 0.500 x 0.150 mm. Six pyriform cement glands. Host: *Brachymystax lenok* (Pisces) Amur River, Asia.

Echinorhynchus gracilis Machado, 1948. Males 9-15' x 2 mm. Females 15-22 x 3-4 mm. Proboscis 1.32 x 0.265 mm. Hooks in 16-17 circles of 14 each. Length of hooks 0.046-0.071 mm. Proboscis sheath 1.66 x 0.32 mm. Lemnisci 1.5 mm. long. Testes nearly spherical, in middle of body. Host: *Bricon hilarii* (Pisces), Brazil.

Echinorhynchus salobrensis Machado, 1948. Males 8-10 x 1-1.5 mm. Females 10-14 x 1-2 mm. Proboscis 1.16 x 0.38 mm. Hooks in 16-17 circles of 14 each. Length of hooks 0.054-0.075 mm. Proboscis sheath 1.5 x 0.4 mm. Lemnisci shorter than proboscis sheath. Testes spherical, in middle of body. Host: *Mylosoma paraguayensis* (Pisces), Brazil.

Echinorhynchus gomesi Machado, 1948. Males 10-12 x 1.5-2.5 mm. Females 20-22 x 2.5-3.5 mm. Proboscis 0.99 x 0.35 mm. with 13 circles of 14 hooks each. Length of hooks 0.041-0.065 mm. Proboscis sheath 1.2 x 0.28 mm. Lemnisci 0.91 x 0.28 mm. Testes oval, in middle of body. Six claviform cement glands. Eggs 0.168 x 0.021 mm. Host: *Mylinae* sp. (Pisces), Brazil.

HYPOECHINORHYNCHUS Yamaguti, 1939

"Generic diagnosis. *Echinorhynchidae* Cobbold, 1879. Body curved ventrad, broadest anteriorly. Proboscis ventroterminal, rounded, armed with ten longitudinal rows of few hooks. Proboscis sheath small, double-walled, with ganglion at its base. Neck short, provided with powerful retractor. Trunk smooth, thick-walled, with reticular lacunar system. Lemnisci longer than proboscis sheath. Testes directly tandem in anterior part of trunk. Cirrus projecting into atrium enclosed in a genital papilla. Cement glands in three pairs. Bursal cap with two anterior diverticula and a number of posterior rays. Ovaries floating in body cavity. Eggs three-shelled. Parasitic in marine fishes. Genotype: *Hypoechinorhynchus alaeopsis*."

Hypoechinorhynchus alaeopsis Yamaguti, 1939. Males 2.5-3.3 x 0.65-0.85 mm.; females 2.7-8 x 0.75-1.25 mm. Body curved ventrad. Proboscis 0.1-0.15 x 0.09-0.16 mm., rounded in front and somewhat constricted behind, attached to trunk ventroterminally. Proboscis hooks 25 in number, arranged in ten alternating rows; one row consisting of three hooks and the other of two hooks. Anterior hooks largest, measuring 0.069-0.096 mm.; posterior hooks smallest, measuring 0.024-0.032 mm. Proboscis sheath 0.12-0.23 x 0.09-0.14 mm. Lemnisci 0.24-0.75 x 0.048-0.11 mm., usually somewhat crumpled. Testes ovoid; the anterior 0.54-0.68 x 0.18-0.40 mm., at anterior end of trunk; the posterior 0.45-0.8 x 0.25-0.44 mm., in front of middle of trunk. Cement glands in three pairs, elliptical or elongate pyriform. Bursal cap with about 24 cylindrical rays 0.080 mm. long. Eggs 0.057-0.060 x 0.016-0.018 mm. Host: *Alaeops plinthus* (Pisces), Japan.

Echinorhynchoides Achmerov and Achmerova, 1941. Echinorhynchidae with four bulb-shaped cement glands. Cervix not elongated; no cervical swelling present.

ECHINORHYNCHOIDES DOGIELI Achmerov and Achmerova, 1941

Male 4.2 x 0.67; female 5.1 x 0.67 mm. Proboscis cylindrical, 0.600 x 0.180 mm. with 18 longitudinal rows of 12 hooks each. Anterior hooks 0.042 mm. long; middle, 0.056 mm.; posterior, 0.035 mm. Proboscis sheath 0.900 x 0.240 mm. with brain near base. Lemnisci 0.600 x 0.060 mm. with nucleus near base. Four bulb-shaped cement glands. Host: *Erythroculter erythropterus*, *Hemibarbus labeo* (Pisces), Amur River, Asia.

PARACANTHOCEPHALUS Achmerov and Achmerova, 1941

Proboscis cylindrical. Cervix passes into a long postcervical region easily distinguishable from the rest of the body; proboscis sheath and lemnisci almost fit into the postcervical region of the body. Small number of proboscis hooks. Six pyriform cement glands.

Paracanthocephalus tenuirostris Achmerov and Achmerova, 1941. Males 3.48-5.6 x 0.57-0.82 mm.; females 3.63-6.93 x 0.6-0.8 mm. Proboscis elongate with five transverse rows of six hooks each. Hooks of first row 0.082-0.087 mm. long; hooks of third row 0.100-0.119 mm.; hooks of fifth row 0.052-0.059 mm. Lemnisci 0.370-0.450 mm. long. Eggs with polar prolongations. Hosts: *Pseudaspis leptocephalus*, *Parasilurus asotus* (Pisces), Amur River, Asia.

Paracanthocephalus curtus Achmerov and Achmerova, 1941. Body short, ellipsoidal. Males 1.35-2.19 x 0.35-0.45 mm.; females 1.5-2.5 x 0.45-0.7 mm. Proboscis ellipsoid, 0.190-0.375 x 0.14-0.270 mm., with 28 hooks in eight transverse rows: four rows of four hooks each and four rows of three hooks each. Anterior hooks 0.049-0.070 mm. long; middle, 0.091-0.095 mm.; posterior, 0.063 mm. Lemnisci 0.150-0.380 mm. long with a nucleus below the middle. Testes 0.180 x 0.225 mm. Six pyriform cement glands. Hosts: *Percottus glehni*, *Liocassis ressuriensis* (Pisces), Amur River, Asia.

Bolborhynchus Achmerov and Achmerova, 1941

Body short; robust, almost rectangular postcervical region which passes into the cervix. Proboscis spherical, hooks not numerous, varying greatly as to size.

Bolborhynchus exiguus Achmerov and Achmerova, 1941. Description based on four immature individuals, containing but rudiments of gonads. Body 1.32-1.74 x 0.52-0.81 mm. Anterior part of body passes into postcervical region, 0.160-0.210 x 0.215-0.285 mm. Cervix 0.075-0.080 x 0.200-0.220 mm. Proboscis spherical, 0.225 x 0.240 mm. Proboscis hooks in five transverse rows of five each. Hooks of first row 0.145-0.148 mm. long; second 0.102-0.105 mm.; third, 0.056-0.058 mm.; fourth, 0.038-0.040 mm.; fifth, 0.013 mm. Proboscis sheath 0.235 x 0.150 mm. Lemnisci 0.450 x 0.075 mm. with nucleus near bottom. Four small tubercles near base of proboscis; they should be regarded as hook rudiments. Host: *Leuciscus waleckii* (Pisces), Amur River, Asia.

POMPHORHYNCHIDAE Yamaguti, 1939

"Family diagnosis. Related to Echinorhynchidae. Proboscis usually cylindrical, uniformly armed. Neck very long, cylindrical or spirally twisted, with or without bulbous swelling. Trunk smooth, with reticular lacunar system. Proboscis sheath long, double-walled. Lemnisci short or rudimentary. Testes in middle region of trunk. Cement glands usually compact and six in number. Bursal cap with two anterior diverticula and numerous rays. Ovary inclosed in ligament or split into numerous floating balls. Eggs three-shelled; middle shell with polar prolongations. Adults parasitic in fishes. Type genus: *Pomphorhynchus* Montic., 1905. Other genera *Longicollum* Yamaguti, 1935, *Tenuiproboscis* Yamaguti, 1935."

Pomphorhynchus sebastichthydis Yamaguti, 1939. Males 7-11 x 0.8-1.7 mm.; females 7-14.5 x 1-2.1 mm. Proboscis with claviform anterior swelling, 0.6-0.8 x 0.12-0.3 mm.; hooks in 12-14 (usually 12) longitudinal rows of 10-12 each; length of hooks up to 0.080 mm. Neck 2.2-3.9 mm. long x 0.23-0.42 mm. at base with bulla on dorsal side at anterior end; diameter of bulla 0.65-1 mm. Proboscis sheath 2.3-5 x 0.15-0.18 mm.; brain in posterior swelling of proboscis sheath. Lemnisci digitiform, corrugated or lobed, up to 1.6 mm. long. Testes directly tandem at about middle of trunk; the anterior 0.7-1.1 x 0.32-0.8 mm., the posterior 0.5-1.25 x 0.32-0.56 mm. Cement glands elliptical, in three tandem pairs. Bursal cap with 18 pointed digitiform rays. Eggs 0.060-0.066 mm. long. Host: *Sebastichthys oblongus* (Pisces), Japan.

Pomphorhynchus kashmirensis Kaw, 1941. Males 10.3-11.6 mm. in length; females 12.7 mm. Proboscis cylindrical, 0.55-0.62 x 0.25-0.36 mm., with 14-16 longitudinal rows of 11-12 hooks each. Roots of anterior hooks indistinctly forked. Basal hooks 0.041 mm. in length; others 0.022-0.028 mm. Neck elongate cylindrical, dilated into a bulla near the proboscis. Proboscis receptacle 2.2-2.8 mm. in length. Lemnisci 0.8-1.35 x 0.26-0.45 mm. Eggs spindle-shaped, 0.075-0.085 x 0.01-0.017 mm. Host: *Nemachilus kashmirensis* (Pisces), India.

Pomphorhynchus dubious (juvenile) Kaw, 1941. The following is a tentative description. Males 6.9-7.1 mm. long; females 8.75-10.3 mm. Proboscis cylindrical, 0.75-1 x 0.21-0.28 mm., with 18 longitudinal rows of 13 hooks each. Hooks 0.095 mm. in length. Host: *Rana cyanophlyctis* (Amphibia), in sub-peritoneal region, India.

LONGICOLLUM Yamaguti, 1935
(*Spirorhynchus* Harada, 1935)

"Generic diagnosis. Echinorhynchidae Cobbold, 1879; Echinorhynchinae Travassos, 1919. Proboscis short cylindrical, with hooks of different shapes. Neck unarmed, very long, more or less spiral, conspicuously expanded on convex side but not forming true bulla. Trunk elongate, nearly cylindrical, with reticular lacunar system. Proboscis sheath double-walled, extending into trunk for a short distance. Cephalic ganglion a little in front of base of proboscis sheath. Refinacula completely bifid. Short saccular lemnisci around proboscis sheath at its entrance into trunk. Testes directly tandem, equatorial or post-equatorial. Six oval or elongate cement glands. Säftigen's pouch elongate. Muscular bursa cap with two saccular anterior diverticula and numerous digitiform rays. Ovary elongate, post-equatorial, enclosed in ligament. No uterine bell. Uterus long. Vagina with single sphincter. Eggs free in cavity of trunk and neck, with delicate outer, thick middle and very distinct inner shell. Parasitic in marine fishes. Genotype: *Longicollum pagrosomi*." Since Yamaguti's description of *Longicollum* was published in February, 1935, and Harada's description of *Spirorhynchus*, the characteristics of which are identical with those of Yamaguti's genus, was not published until July, 1935, *Longicollum* becomes the valid name of this genus.

Longicollum pagrosomi Yamaguti, 1935. Proboscis 0.9-1.3 x 0.5-0.6 mm. Proboscis hooks 0.045-0.060 mm. long, in 11-15 longitudinal rows of 9-12 each. Neck up to 5 x 1.5 mm., spirally twisted, conspicuously expanded on convex side. Trunk 12-17 mm. long or longer. Lemnisci reduced to a lobed collar around proboscis sheath at its entrance into trunk. Testes elongate oval, up to 1.5 mm. long. Muscular bursa cap with 21 rays. Eggs 0.123-0.156 x 0.021-0.028 mm. Host: *Pagrosomus unicolor* (Pisces), Japan. After re-examination of his original specimens, Yamaguti (1939) observed a true uterine bell which was comparatively short and wide, measuring 0.18 mm. in diameter at the anterior opening.

Longicollum alemniscus (Harada, 1935) Fukui and Morisita, 1938 (*Spirorhynchus alemniscus* Harada, 1935; *Longicollum minor* Fukui and Morisita, 1936). Proboscis flask-shaped, 0.7 x 0.35 mm.; hooks in 11 longitudinal rows of 11 each; length of hooks, 0.024-0.035 mm. Neck 8 x 0.7 mm. Trunk up to 6 x 1.1 mm., anterior part greatly enlarged, size of body equal in both sexes. Testes in middle of body; six cement glands. Eggs 0.079 x 0.023 mm., with very delicate outer shell. Hosts: *Scatophagus argus*, *Lutianus russelli*, *Sparus maculoccephalus* (Pisces), Formosa.

TENUIPROBOSCIS Yamaguti, 1935

"Generic diagnosis. Echinorhynchidae Cobbold, 1879. Proboscis nearly filiform; hooks shorter posteriorly, with simple rod-shaped roots. Neck very long, slender, unarmed. Trunk approximately cylindrical, fairly long in female, but short in male. Proboscis sheath slender, double-walled, with cephalic ganglion at base. Lemnisci digitiform, shorter than proboscis sheath, though extending beyond its posterior end. Testes in middle third of trunk. Vesicula seminalis at posterior ends of cement ducts. Four-six (usually six) spherical to oval cement glands closely massed together. Säftigen's pouch elongate, transparent. Muscular bursa cap with two saccular anterior diverticula and numerous digitiform rays. Uterine bell with long stalk. Uterus relatively short. Outer vaginal sphincter inconspicuous, inner well defined, small. Ovarial balls small, numerous, free in trunk cavity. Middle egg shell with polar prolongations. Parasitic in freshwater fishes. Genotype. *Tenuiproboscis misgurni*." Although Yamaguti originally placed this genus in the family Echinorhynchidae, he later (1939) removed it to the family Pomphorhynchidae.

Tenuiproboscis misgurni Yamaguti, 1935. Proboscis 0.66-0.75 x 0.06-0.075 mm. in male, 1.6-1.74 x 0.06-0.1 mm. in female, with nine longitudinal rows of 18-19 hooks each; largest hooks 0.060-0.072 mm. long, smallest basal 0.027-0.036 mm. Neck up to 2.25 mm. long. Trunk 1.87-2.8 x 0.32-0.52 mm. in male, 9.4-14 x 0.6-1 mm. in female. Proboscis sheath 0.43-0.7 x 0.07-0.1 mm. in male, 1.38-2.3 x 0.15-0.22 mm. in female. Lemnisci 0.38-0.5 mm. long in male, 1.25-1.81 mm. long in female. Testes spherical to oval, 0.24-0.32 mm. long. Middle egg shell with polar prolongations 0.051-0.063 x 0.009-0.012 mm. Host: *Misgurnus fossilis* (Pisces), in stomach, Japan.

ARHYTHMACANTHIDAE Yamaguti, 1935

"Family diagnosis. Small to medium-sized Acanthocephala. Proboscis with different types of hooks. Neck short. Trunk with thick hypodermis containing numerous scattered nuclei, covered by spines on its anterior region. Proboscis sheath double-walled, with cephalic ganglion at base. Testes usually contiguous. Six-eight compact cement glands. Muscular bursa cap with two anterior diverticula and numerous digitiform rays. Adults parasitic in marine fishes. Including *Arhythmacanthus* n. g. and *Heterosentis* Van Cleave, 1931."

ARHYTHMACANTHUS Yamaguti, 1935⁵

"Generic diagnosis. Arhythmacanthidae; with family characters (v. i.). Proboscis short, with three different types of hooks. Neck short, unarmed. Trunk fusiform, with very thick hypodermis and four giant muscle cells on its inner surface at level of posterior ends of lemnisci; anterior half closely beset with spines ensheathed in scale-like cuticular folds. Proboscis sheath double-walled, with cephalic ganglion at base. Lemnisci two, occasionally four, digitiform, longer than proboscis sheath. Testes oval, contiguous, obliquely tandem, post-equatorial. Vasa efferentia wide, twisted. Six-eight pyriform cement glands massed together behind testes. Säftigen's pouch elongate. Muscular bursa cap with two saccular anterior diverticula and numerous digitiform rays. Parasitic in marine fishes. Genotype: *Arhythmacanthus fusiformis*."

Arhythmacanthus fusiformis Yamaguti, 1935. Description based on males only. Pear to spindle-shaped body, 5-6 x 2-2.8 mm. Rounded proboscis, 0.34-0.43 mm. with three different sets of hooks. At the apex there are 18 hooks, 0.015-0.053 mm. in length. Subapical hooks in two alternating rows of seven each, 0.188-0.210 mm. in length; basal hooks in 14 longitudinal rows of two-three each, 0.024-0.069 mm. in length. Neck unarmed, 0.18-0.22 mm. long, distinctly constricted off from trunk. Trunk with very thick hypodermis containing numerous scattered nuclei, covered on anterior half by minute closely set spines whose roots are deeply imbedded in scale-like cuticular folds. Four giant muscle cells at posterior end of anterior third of trunk. Proboscis sheath 0.6-0.72 x 0.25-0.3 mm.; brain in base. Two (occasionally four) finger-like lemnisci, 0.5-1.6 mm. long. Testes ovoid, contiguous, obliquely tandem. Wide vasa efferentia, conspicuously twisted. Six-eight pyriform cement glands closely massed together. Muscular bursa cap with 20 digitiform rays 0.05-0.06 mm. long. Host: *Spheroides* sp. (Pisces), Japan.

Heterosentis plotosi Yamaguti, 1935. Description based on a single male specimen. Trunk slightly fusiform, 2.18 x 0.57 mm. Proboscis 0.180 x 0.125 mm.; provided with two groups of hooks. The larger anterior hooks are arranged in six spiral rows of five each and measure 0.036-0.072 mm. Posterior hooks in 14 longitudinal rows of three-four each and measure 0.009-0.018 mm. Neck unarmed, 0.110 mm. long. Anterior part of trunk covered with very fine spines not ensheathed in cuticular folds. Proboscis sheath 0.380 x 0.120 mm. Lemnisci about 0.400 mm. long. Testes ovoid, in middle of body. Six pyriform cement glands. The proximal end of the ejaculatory duct forms a sphincter-like bulb 0.054 mm. broad. Host: *Plotosus anguillaris* (Pisces), Japan.

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- Sheppard, C. W., and A. S. Householder. 1951. The mathematical basis of the interpretation of tracer experiments in closed steady-state systems. *Jour. Applied Physics*, 22(4): 510-520. Apr.
- Sheppard, C. W., and Gertrude Beyl. 1951. Cation exchange in mammalian erythrocytes. III. The prolytic effect of x-rays on human cells. *Jour. Gen. Physiol.*, 34: 691-704.
- Shull, C. G., and E. O. Wollan (ORNL). 1951. Coherent scattering amplitudes as determined by neutron diffraction. *Physical Rev.*, 81: 527-535.
- Snell, Arthur H. (ORNL). 1951. Neutron decay: The problem and the experiments. *Nucleonics*, 8: 3-13.
- Snell, W. H., Esther A. Dick, and L. R. Hesler (Brown Univ. and Univ. of Tenn.). 1951. Notes on Boletes. VIII. *Mycologia*, 43(3): 359-364. May-June.
- Sodaro, R. M., and C. W. Sheppard (ORNL). 1951. A technique for studying vasodilation and vasoconstriction using P³²-labelled erythrocytes. *Nucleonics*, 8(6): 40-41. June.
- Storey, R. H., Leon Wish, and Jacob Furth (ORNL). 1950. Changes in the cell and plasma volumes produced by total body x-radiation. *Proc. Soc. Exptl. Biol. and Med.*, 74: 242.
- Trotter, J. R., Elliott Volkin, and C. E. Carter (ORNL). 1951. Incorporation of isotopic formate into the nucleotides of ribo- and deoxyribonucleic acids. *Jour. Amer. Chem. Soc.*, 73: 1521.
- Volkin, Elliott, and C. E. Carter. (ORNL). 1951. The preparation and properties of mammalian ribonucleic acids. *Jour. Amer. Chem. Soc.*, 73: 1516-1519.
- Volkin, Elliott, J. X. Khym, and W. E. Cohn. 1951. The preparation of desoxynucleotides. *Jour. Amer. Chem. Soc.*, 73: 1533-1536.
- Walchli, H., Ralph Livingston, and G. Hebert (ORNL). 1951. The nuclear magnetic moment of I¹²⁹. *Physical Rev.*, 82: 97.
- Weinberg, Alvin M. (ORNL). 1951. The chemical engineer and atomic energy. *Chemical Eng. Progress*. Mar.
- Wish, L., R. H. Storey, and Jacob Furth (ORNL). 1950. Rate of clearance from the blood of I¹³¹-tagged plasma: Determinations of cell and plasma volumes with radioisotopes and Evans Blue. *Fed. Proc.*, 9(1): 349.
- Wolf, Frederick T. (Vanderbilt Univ.). 1951. The cultivation of two species of *Entomophthora* on synthetic media. *Bull. Torrey Bot. Club*, 78(3): 211-220. May.

RECENT PUBLICATIONS WITH REFERENCE TO TENNESSEE OR TO TENNESSEE MATERIAL

- Higgins, Elmer. 1949. Radioactive wastes and their significance in stream ecology. *Trans. Amer. Fisheries Soc.*, 79: 217-232. Contains references to the Clinch River, Tennessee.
- Higgins, Elmer. 1951. Atomic radiation hazards for fish. *Jour. Wildlife Management*, 15(1): 1-12. Cites radioactivity level of the Clinch River, Tennessee at 3×10^{-7} mc. per cc.; several orders of magnitude below human permissible tolerance levels.
- Wall, Limas D. 1951. The life history of *Vasotrema robustum* (Stunkard, 1928). Trematoda: Spirorchiiidae. *Trans. Amer. Micros. Soc.*, 70(2): 173-184. Apr. Intermediate and definitive hosts from Cumberland R., Davidson Co., Tenn.