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Parasitic Worms mainly from Celebes. Part 2. Monogenetic trematodes of fishes

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Parasitic Worms mainly from Celebes. Part 2. Monogenetic trematodes of fishes*

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Abstract

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PARASITIC WORMS MAINLY FROM CELEBES

Part 2. Monogenetic trematodes of fishes

With 9 Plates

By

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I. DACTYLOGYRIDAE Bychowsky, 1933

1. *Ancyrocephalus macrogaster* n. sp.

Pl. I, Fig. 1.

Habitat. Gill of *Gerres punctatus* (Bleeker).

Material and locality. 14 whole stained mounts; Macassar.

Body small, only 0.3 – 0.43 mm long; body proper divided into two distinct portions; anterior portion subcylindrical, including head and neck as far back as eye spots, 45 – 65 μ long, 26 – 36 μ wide at base of head; posterior portion oblong oval, or elliptical, flat, occupying greater part of body, 0.1 – 0.156 mm in maximum width at or near middle. Haptor short, 64 – 90 μ wide, well constricted off from body proper; dorsal paired hook measuring 18 – 27 μ from free end of dorsal root to height of curve of blade, its dorsal root much longer (12 μ) than ventral root; bar flexed at middle like a coat-hanger, varying from 33 μ to 42 μ transversely from end to end; ventral hook 19 – 21 μ wide at base, whose dorsal and ventral corners form a knob-like rudimentary root respectively, 20 – 25 μ from end of ventral root to height of curve of blade, 30 – 32.5 μ from tip of blade to end of dorsal root; bar T-shaped, transverse arm 32 – 42 μ long, median stem 14 – 19.2 μ long: hooklets 10 – 12 μ long.

Head trapezoidal, with a series of 4 swollen ducts of sticky glands on each side. Eye spots of two pairs. Pharynx 22 – 36 μ long by 11 – 36 μ wide. Esophagus practically lacking. Ceca simple, terminating near posterior end of body proper.

Testis spherical to oval, 75 – 100×60 – 80 μ, situated in intercecal field at junction of middle with posterior third of whole body. Vas deferens apparently not forming seminal vesicle. Cirrus consisting

of a filiform chitinous tubule 54 – 72 μ long and a trumpet-like base 6 – 10 μ wide, forming an almost complete loop; its distal end passing between two rami of cheliform accessory piece which is 18 – 21 μ long, and whose root reaches to the base of the cirrus. One of the rami of the latter is claw-like and about 5 μ long, while the other is a simple, slightly curved rod 6 μ long. An inconspicuous transversely elongated prostatic reservoir is seen on the right side of the cirrus, and the prostate cells lie convergently at the right end of it just behind the right pharyngeal glands. Genital pore ventral to intestinal bifurcation.

Ovary oval, ellipsoidal or fusiform, 60 – 110 × 30 – 48 μ, overlapping testis ventrally, in median line or a little to right of it. Shell gland at about midbody. Uterus wide, short, median. No eggs observed. Vagina forming a sigmoid, narrow, chitinous tubule 36 – 60 μ long, opening on ventral surface near right margin of body a little behind genital pore, enclosed in a sheath of longitudinal muscle fibers; vaginal duct winding irregularly, containing sperm, opening into germiduct from right side immediately behind junction of the latter with the vitelline duct. Receptaculum seminis round, 18 – 21 μ wide, ventral to transverse vitelline duct. Vitelline gland surrounding ceca on all sides and extending along entire length of wide posterior portion of body proper, with a comparatively wide transverse vitelline duct.

This species is characterized by the body shape, the structure of the male and female copulatory apparatuses, and the T-shaped transverse bar of the ventral haptoral hooks. The specific name refers to the large abdominal portion of the worm.

2. *Ancyrocephalus bilobatus* n. sp.
Pl. I, Fig. 2.

Habitat. Gill of *Drepane punctata* (Linné).

Material and locality. Several mature specimens stained and mounted, a few more mounted in lactophenolgelatine; Macassar.

Body approximately fusiform except for head and haptor. Latter constricted off from body proper, 0.8 – 1.05 mm long by 0.15 – 0.23 mm wide. Dorsal haptoral hook with strongly curved blade, 57 – 66 μ from tip of dorsal root to height of curve of blade; ventral root rudimentary; connecting bar 65 – 78 μ long, slightly arcuate for greater middle portion, flexed in opposite direction near each end;

ventral hook much stouter than dorsal one, 63 - 72 μ from end of ventral root to height of curve of blade , dorsal root nodular, somewhat flattened ; connecting bar rather simple, 80 - 90 μ long. Marginal hooklet 12 - 14 μ long. On each side of the large hooks there is an elongate saccular cement gland reservoir provided with circular muscle fibers, and containing coagulated secretory product. Cement gland cells are massed behind posterior end of vitellaria. The retractors of the hooks, massed on each side into a powerful bundle, are encircled by a transverse muscle ring and then divided each into an outer and an inner branch running forward to be split up into individual fibers. The inner branch gives a tufty appearance as it merges into the ventral subcuticular parenchyma.

Head trapezoidal, with or without distinct median and lateral incisions, 86 - 108 μ in diameter, with 3 or 4 swollen sticky gland ducts on each side. The transversely elongated sticky gland cells are placed one behind another in the shoulder region dorsolateral to the posterior end of the pharynx and dorsal to the esophagus. Eye spots lacking. Mouth opening ventrally at widest part of head. Pharynx barrel-shaped. 45 - 60 × 30 - 36 μ. Esophagus about 50 μ long in the type, in which it bifurcates about 0.16 mm from the anterior extremity. Ceca simple, terminating behind testis somewhat covergently toward each other.

Testis divided into two fusiform or elliptical lobes of unequal length, the longer left lobe 0.15 - 0.18 mm long by 35 - 60 μ wide, extending longitudinally on the left of median line opposite ovary and right lobe of testis which lies immediately behind the ovary and measures 0.07 - 0.15 mm long by 30 - 50 μ wide. The two lobes appear to be connected with each other by a narrow bridge at the level of the anterior end of the right lobe, and are separated one from the other by a free median slit, on the ventral side of which there are longitudinal muscle fibers continuous with the paired tufty fibers mentioned above. The vas deferens arising from the anterior end of the left lobe of the testis proceeds straight forward and forms just inside the left cecum a fusiform vesicula seminalis 20 - 30 μ wide, from the anterior end of which a narrow duct originates and passing between the cirrus and the muscular prostatic reservoir opens into the second vesicula seminalis at its anterior end. The latter is oval, about 18 μ wide, and lies longitudinally between the two prostatic reservoirs, and opens into the cirrus by

means of a narrow ejaculatory duct. There are two prostatic reservoirs of different shape and structure ; one is dorsal, elliptical, 50 – 75 μ long by 18 – 24 μ wide, and provided with a very thick wall of longitudinal muscle fibers, and contains in its tubular lumen fine secretion granules received from the prostate cells lying in front and by the left side of it ; the other is a narrow (6 – 9 μ wide), elongated claviform, thin-walled tube containing a little finer granules than those of its fellow and extends a little obliquely ventral to the second seminal vesicle. A prostatic duct, resulting from union of a few narrow ducts coming from the right side of the base of the cirrus as well as from behind it, appears to open sideways into the thin-walled prostatic reservoir. Cirrus tubular, narrow, 80 – 100 μ long, with button-shaped base 6 μ wide behind two prostatic reservoirs and second vesicula seminalis, running forward somewhat windingly and projecting usually a little out of genital pore. Genital pore midventral, 0.2 – 0.24 mm from anterior extremty.

Ovary elongate oval to elliptical, 80 – 100×30 – 60 μ, situated at about midbody on the left of median line immediately in front of left lobe of testis. Uterus midventral ; no eggs observed. Vagina narrow, tubular, not chitinous, provided with longitudinal cuticular folds and circular muscle fibers, opening ventrally very close to right margin of body a little behind level of base of cirrus, continued backwards and inwards and passing into a narrower non-muscular vaginal duct which opens into the pyriform receptaculum seminis 30 – 33 μ long by 18 – 22 μ wide and lying in the median field between the anterior end of the ovary and that of left lobe of testis. Vitellaria extending along esophagus and intestinal limbs as usual.

This species is easily distinguished from any of the known members of the genus by the bilobed testis, hence the specific name.

3. *Ancyrocephalus spinicirrus* n. sp.
Pl. I, Fig. 3.

Habitat. Gill of *Drepane punctata* (Linné).

Material and locality. Two mature specimens were stained and mounted in toto, another was mounted in lactophenolgelatine ; Macassar.

Body approximately fusiform, 0.625 – 0.85 mm in length, with maximum width of 0.11 – 0.125 mm behind middle or in front of it. Haptor 90 – 110 μ in diameter, well marked off from body proper.

Dorsal hook 45 – 48 μ from tip of dorsal root to height of curve of blade, ventral root reduced ; connecting bar 42 – 51 μ long, divided at each end into two nodular points. Ventral hook 51 – 57 μ from dorsal corner of its ventral root to height of curve of blade ; connecting bar 42 – 48 μ long, with a median fall and a pair of submedian rises on anterior face. Marginal hooklets 12 μ long. Head trapezoidal, 45 – 70 μ wide, with a more or less distinct median incision in front. Swollen ducts of sticky gland along the sloping sides of head ; gland cells massed together in shoulder region. No eye spots. Mouth opening ventrally as usual at base of head. Pharynx elliptical, 45 – 56 × 28 – 36 μ. Esophagus short ; ceca simple, terminating blindly at junction of posterior two thirds of body.

Testis oval, 60 × 30 – 45 μ, situated at posterior half of middle third of body, with its anterior end overlapping ovary. Vesicula seminalis fusiform to elliptical, 12 – 18 μ wide, just anterior to base of cirrus. Cirrus narrow, tubular, about 0.18 mm long, turned back on itself at a distance of 45 – 50 μ from the base, where there is a backwardly or laterally directed rose-thorn-like spine at the height of the curve. At the distal end projecting out of the genital pore it shows a pedicellaria-like swelling. Genital pore 165 μ from anterior extremity. There are two prostatic reservoirs ; the anterior is fusiform or elongate claviform, thin-walled, 75 – 90 μ long by 12 – 15 μ wide and lies longitudinally dorsal to the distal portion of the cirrus on the right of the median line, containing very fine granules ; the posterior with thicker wall of spiral muscle fibers is approximately fusiform, 0.1 – 0.13 mm long by 33 – 45 μ wide and lies in the left submedian field with its middle part sinistrodorsal to the doubled-up portion of the cirrus and its posterior end reaching to transverse vitelline duct, containing fine secretion granules ; the duct arising from the posterior end of the reservoir proceeds forward dorsal to the descending portion of the cirrus and opens into the base of the latter.

Ovary oval, 35 – 45 × 30 μ, situated at about midbody or immediately behind it, anterodextral to testis. Uterus midventral, containing an egg filament alone in the type. Vagina fusiform, 75 – 90 × 27 – 33 μ, with thick cuticle, opening on right margin of body at a level just anterior to base of cirrus. Vaginal duct narrow, short, connecting vagina with receptaculum seminis which lies in the median line between the musclar prostatic reservoir and

the ovary. Vitellaria extending in lateral field along digestive tract between pharynx and cement gland at posterior end of body proper.

This species is characterized by the cirrus being provided with a spine at the point of its turning. The specific name refers to this feature.

4. *Ancyrocephalus platycephali* n. sp.
Pl. I, Fig. 4.

Habitat. Gill of *Platycephalus indicus*.

Material and locality. Some ten mature specimens stained and mounted; Macassar.

Body elongate, attenuated in front of haptor, more or less distinctly constricted at neck, 0.4 – 0.8 mm in length, 0.07 – 0.13 mm in maximum width at about junction of anterior with middle third. Haptor 80 – 130 μ in diameter; dorsal hook 45 – 57 μ from tip of dorsal root to height of curve of blade, ventral root reduced; connecting rod 50 – 66 μ long, approximately coat-hanger-shaped, with its outer ends inclosed in a subcylindrical sheath of longitudinal and circular muscle fibers which is about 30 μ long by 18 μ wide and attached to the inner side of the base of the dorsal hook. To the end of the dorsal root of the dorsal hook are attached two muscle bundles, one of which runs to the tip of the ventral root of the ventral hook, while the other merges into the dorsal subcuticular muscle layer of the body proper. Ventral hook 60 – 66 μ from tip of ventral root to height of curve of blade; dorsal root reduced to a mere flat elevation; connecting bar shaped like a coat-hanger different from that of dorsal hook, 56 – 63 μ long. To the end of the prominent ventral root of the ventral hook is attached a powerful double muscle bundle which is fastened together with its fellow of the other side at the posterior end of the body proper and then runs forward in the ventral median field. Marginal hooklets about 9 μ long.

Head with a distinct median notch and a pair of more or less prominent lateral lobes, at the level of which it measures 45 – 66 μ in width. Sticky gland ducts distended with secretion granules along each side of head; gland cells lying beside pharynx and anterior end of esophagus. Two pairs of eye spots between mouth aperture and pharynx. Pharynx subglobular, 24–45×24–36 μ. Eso-

phagus short. Ceca simple, terminating blindly a little behind testis.

Testis elliptical, 30 – 90×15 – 38 μ, situated a short distance behind midbody. Vas deferens not turning round left cecum, opening into cirrus without forming a definite vesicula seminalis. Cirrus a little widened at base, twisted spirally at distal portion which is provided with a spiral wing 12 – 18 μ wide. The pointed distal end usually projects out of the genital pore. The proximal portion, somewhat constricted near the base, is enclosed in a bulb of fine slightly oblique muscle fibers, part of which extends over the wing of the cirrus. There are two prostatic reservoirs; the one, lying dextrodorsal to the cirrus, is elongate saccular, 30 μ long by 12 μ wide in the type and opens into the cirrus by the backwardly produced duct; the other is approximately elliptical, 70 – 90×24 – 33 μ, and lies somewhat obliquely in the dorsal median field between the cirrus and the vagina; the duct arising from its posterior end runs forward along with the vas deferens. The prostate cells extend longitudinally dorsal to the intestine and vitellaria between the intestinal bifurcation and vagina. Genital pore immediately behind intestinal bifurcation.

Ovary oval, 25 – 60×18 – 35 μ, equatorial; no eggs observed. The vaginal opening which lies in the right submedian field at about the junction of the anterior two thirds of the body leads into a wide cavity, whose chitinous wall is folded and into which projects from behind a large muscle bulb of somewhat irregularly spiral fibers, At the base of the vaginal cavity is a small claw-like spine pointing backwards The vaginal duct connecting the vaginal cavity with the germiduct appears to be twisted spirally just behind the muscle bulb mentioned above. Vitellaria extending along esophagus and intestine as usual; transverse vitelline ducts joining germiduct in front of ovary, ventral to shell gland, which is rather poorly developed.

5. *Haliotrema alatum* Yamaguti 1942

Habitat. Gill of an unidentified fish of Mullidae.

Material and locality. Some ten mature specimens fixed in acetic sublimate under cover glass; Macassar.

Body elongate. 0.55 – 0.7×0.14 – 0.16 mm. Haptor 100 – 135 μ in diameter; dorsal hook 57 – 66 μ from tip of dorsal root to height of curve; dorsal bar 57 – 63 μ long, rather straight; ventral hook 57 –

70 μ from tip of ventral root to height of curve; ventral bar coat-hanger-shaped, 48 – 63 μ long.

Head 75 – 90 μ broad, pharynx 30 – 40 × 27 – 35 μ. Testis 90 – 110 × 45 – 60 μ. Prostatic reservoir longitudinally elongated, directed forward, 15 μ wide; prostate cells divided into two groups, an anterior and a posterior. Ovary elliptical, 45 – 60 × 25 – 30 μ. Vagina subcylindrical, 54 – 60 × 27 – 30 μ, giving rise to narrow vaginal duct near its base. Receptaculum seminis elongate, 12 μ in diameter.

Though somewhat smaller in body size the present worm may safely be referred to *H. alatum* Yamaguti, 1942, from the allied fishes, since the other measurements agree well with those given in my original description.

6. *Haliotrema lutiani* n. sp.
Pl. II, Fig. 7.

Habitat. Gill of *Lutianus* sp.

Material and locality. 6 mature specimens fixed in acetic sublimate, stained and mounted as usual; Macassar.

Body elongate, somewhat fusiform, 0.65 – 0.9 mm long by 0.11 – 0.16 mm wide in ovariotesticular zone. Haptor short, 75 – 105 μ wide, well constricted off from body proper, with two pairs of hooks and 7 pairs of hooklets 12 - 15 μ long. Dorsal hooks 33 – 36 μ long from tip of dorsal root to height of curve of blade, wider apart from each other than ventral hooks, with dorsal root much longer and stouter than ventral root; bar 33 – 40 μ long, only a little curved at middle, with blunt ends; ventral hooks 30 – 36 μ long from tip of ventral root to height of curve of blade, both roots stumpy, ventral root slightly longer; bar 22 – 25 μ long, nearly straight, with rounded ends. Cement gland well developed at posterior end of body proper.

Head 50 – 60 μ wide, divided into three lobes, with 3 pairs of gland ducts distended with secretory product. Mouth opening ventrally at base of head; pharynx round, muscular, 36 – 54 × 33 – 54 μ; sticky glands immediately lateral to pharynx. Two pairs of eye spots may or may not be present in front of the pharynx. Esophagus short; ceca simple, united posterior to testis.

Testis elliptical, 0.15 – 0.24 × 0.06 – 0.11 mm, occupying greater part of middle third of body with its center a little behind midbody,

Vas deferens running around left cecum and then dorsal to prostatic cells just inside cecum. No definite vesicula seminalis. Cirrus forming a semicircular, filiform, broad-based chitinous tubule with its convexity directed dorsally, enclosing in its concavity the recurved duct of the anterior prostatic reservoir and the distal end of the vas deferens. There are two prostatic reservoirs ; the anterior lying just behind the cirrus is ovoid, very small (about 10 μ in diameter in the type), provided with a thin muscular wall, and contains very fine granules ; its forwardly directed duct is widened as it turns back on itself before opening into the base of the cirrus ; the posterior is very much elongated and has a membranous wall, containing opaque secretion product. It lies longitudinally inside the left cecum slightly behind the anterior reservoir with the gland cells on each side, and tapers anteriorly to a narrow duct which appears to open into the proximal end of the duct of the anterior reservoir. Genital pore midventral, just behind intestinal bifurcation, 0.15 – 0.18 mm from anterior extremity.

Ovary longitudinally elongated oval, 70 – 75×30 – 35 μ, situated immediately anterior to testis, with its posterior end overlapping anterior end of testis ventrally. Shell gland complex at about junction of anterior with middle third of body. Receptaculum seminis round, 20 μ in diameter in the type, dorsal to transverse vitelline duct. Uterus running straight forward in ventral median field, containing no eggs. Vitelline gland extending along ceca from behind pharynx to near cement gland. Vagina cylindrical, extending obliquely on the right of median line and reaching to near receptaculum seminis ; vaginal duct narrow, very short. Vaginal aperture ventral to right cecum, 0.21 – 0.25 mm from anterior extremity.

This species differs from any of the known members of the genus in the structure of the male terminal genitalia.

7. *Haliotrema caesionis* n. sp.
Pl. III, Fig. 8.

Habitat. Gill of *Caesio kuning* (Cuv. et Valenc.).

Material and locality. 7 mature specimens stained and mounted as usual ; Macassar.

Body approximately fusiform, 0.72 – 0.84 mm in length with maximum width of 0.1 – 0.15 mm at junction of posterior two thirds. Haptor 50 – 70 μ wide, tapering posteriorly, narrower than body

proper, from which it is not distinctly marked off; dorsal hook 56 – 60 μ from tip of dorsal root to height of curve of blade, with rudimentary ventral root; connecting bar 30 – 33 μ long, with distinct median notch; ventral hook 50 – 52 μ from tip of ventral root to height of curve of blade, with rudimentary dorsal root; connecting bar 24 – 30 μ long, with a median projection, the tip of which is connected with each arm by a narrow bridge. Marginal hooklets about 10 μ long. To the anterior end of each root of the dorsal and ventral hooks is attached a muscle bundle which is continued into the body proper and split up into individual fibers to be merged into the ventral subcuticular layer.

Head 3-lobed, with prominent frontal lobe, 36 – 51 μ wide at level of mouth aperture. Two pairs of small eye spots present. Pharynx 25 – 45 × 20 – 30 μ. Esophagus very short; ceca simple, united posterior to testis.

Testis oval, 90 – 130 μ long by 45 – 70 μ wide, situated a little behind midbody. Vas deferens forming an S-shaped curve before turning round left cecum. There is no definite vesicula seminalis, though the inflated proximal portion of the vas deferens lying between the testis and the ovary may serve as such. Cirrus forming a narrow C-shaped tube, 60 – 110 μ long, with a basal disc 14 – 17 μ in diameter, without any accessory piece. There are two small pyriform prostatic reservoirs; one in front of the base of the cirrus and the other behind it, measuring respectively 21 – 30 × 15 μ and 20 – 24 × 10 – 15 μ. The prostate cells are massed dorsally around the cirrus and prostatic reservoir. Genital pore midventral, 0.14 – 0.16 mm from anterior extremity.

Ovary oval to elliptical, 45 – 60 × 18 – 40 μ, separated from testis by inflated proximal portion of vas deferens, with shell gland immediately in front. No eggs observed. Vagina not chitinous, though provided with fine muscle fibers all round, with wide shallow opening close to right margin of body, connected with germiduct by a narrow vaginal duct running obliquely backward. No definite receptaculum seminis observed. Vitellaria extending in lateral fields from pharynx to cecal ends, transverse ducts joining together immediately in front of shell gland.

This species is characterized by the peculiar shape of the ventral connecting bar, the course of the vas deferens, the C-shaped cirrus with a discoid base, etc.

8. *Haliotrema upenei* n. sp.
Pl. II, Fig. 5.

Habitat. Gill of *Upeneus* sp.

Material and locality. 8 mature specimens subjected to cover glass pressure when fixed in acetic sublimate, stained and mounted; Macassar.

Body flattened subcylindrical, 0.8 – 1.15×0.2 – 0.28 mm, widest at level of testis where it may be more or less constricted. Haptor usually well marked off from body proper, 0.1 – 0.15 mm in diameter; dorsal hook 63 – 69 μ from tip of long dorsal root to height of curve of blade, ventral root blunt-conical, connecting bar 54 – 69 μ long, bifid at each end; ventral hook 60 – 63 μ from tip of longer ventral root to height of curve of blade dorsal root blunt-conical; connecting bar bowed, 51 μ lineally from end to end. Dorsomedial to the tip of the longer ventral root of the ventral hook is a small elliptical muscle bulb, which appears to be in direct connection with the muscle bundle arising from the said root and joining the bundle from the dorsal root of the dorsal hook. The two bundles thus formed converge toward each other, and then each of them is split up into two divergent arms running forward along the outer side of the vitellaria. The two bulbs are also connected with each other by a weak transverse bundle. Marginal hooklets 10 μ long.

Head 84 – 116 μ in diameter, with a pair of more or less prominent lateral lobes; head organs conspicuous. Two pairs of small eye spots present. Pharynx oval to barrel-shaped, 36–60×30–42 μ; esophagus short, ceca united near posterior end of body proper.

Testis oval, 0.1 – 0.18×0.075 – 0.13 mm, just postequatorial. The vas deferens turning round the left cecum forms a vesicular swelling outside the cecum and then another (30 – 38×15 μ) on the left of the anterior prostatic reservoir after curving round the anterior end of this reservoir, so that there are two seminal vesicles. The narrow ductus ejaculatorius enters the basal cup of the accessory copulatory organ along with the duct of the prostatic reservoir to open into the cirrus. The chitinous copulatory organ consists of a whip-like cirrus proper, 0.19 – 0.21 mm long by 3 – 5 μ wide at the base, and its accessory; the latter is surrounded by muscle fibers running in different directions and made up of two portions, between which the cirrus proper takes its origin; the proximal

portion is cup-shaped and receives the ejaculatory duct as well as the prostatic duct at the center; the distal portion is flattened and strongly curved upon itself as if it were the gubernaculum for the cirrus, and terminates in two lobes of dissimilar size and shape, the shorter one of which being produced at the inner corner into a hair-like filament about 14 μ long. In front of the copulatory organ lies longitudinally an elliptical or elongate saccular prostatic reservoir provided with fine circular muscle fibers and measuring 36 – 60 μ long by 24 – 33 μ wide; at the anterior end it receives the prostate cells and at the posterior it joins a slender prostatic duct coming obliquely from behind and probably representing an atrophied posterior prostatic reservoir. The large vesicular prostate cells are divided by the terminal genital organs into two groups, an anterior and a posterior. Genital pore separated from intestinal bifurcation by prostate complex and terminal vesicula seminalis.

Ovary subglobular to oval, 45 – 90×33 – 86 μ, just pretesticular, giving rise at its anterior end to the germiduct which is covered anterodorsally by the receptaculum seminis. No eggs observed. Vagina tubular, lined with cuticle and provided with inner longitudinal and outer circular muscle fibers, opening ventrally near right margin at about junction of anterior with middle third of body; vaginal duct narrow, winding, with cuticular lining and muscular coat similar to, but thinner than, that of vagina, forming at its posterior end a small elliptical bulb which opens directly into the receptaculum seminis. The latter receptacle is oval, 36 μ long by 30 μ wide in the type, and gives rise on its left side to a very narrow duct which soon turns back on itself and appears to terminate blindly as in *Haliotrema japonense* Yamaguti, 1934 (1937, p. 12). Vitellaria extending along entire length of intestine.

This species agrees with *Haliotrema japonense* Yamaguti in the prostatic complex, vesicula seminalis and receptaculum seminis, but differs distinctly from it as well as from other related species in the structures of the male and female copulatory organs.

9. *Metahaliotrema scatophagi* n. g., n. sp.
Pl. II, Fig. 6.

Habitat. Gill of *Scatophagus arsus* (Cuv. et Valenc.).

Material and locality. A dozen mature specimens fixed in acetic sublimate, stained and mounted; Macassar.

Body elongate, spatulate, 0.5 – 0.7 mm in length, with maximum width of 0.084 – 0.15 mm at about middle. Haptor 70 – 100 μ in diameter, constricted off from body proper, with two pairs (a dorsal and a ventral) of hooks with a supporting bar for each pair, and 7 pairs of marginal hooklets 12 – 15 μ long. Ventral hook 48 – 57 μ long from height of curve to anterior end of its enlarged base on which a short chitinous rod 15 – 24 μ long by 8 – 11 μ wide rests, with the slightly notched broader end directed outwards ; the supporting middle bar intercalated between the bases of the two ventral hooks is 54 – 60 μ long and shows two perforations at the base of the medial trapezoidal thickening. Dorsal hook 23 – 27 μ long, its base enlarged with a prominent dorsal root and a rudimentary ventral root ; supporting bar inverted V-shaped, 24 – 30 μ long lineally from end to end with a chitinous knob immediately in front of point of flexure, A muscle band connects the two rods resting on the roots of the ventral hooks and another band coming from the body proper is attached to the blunt-pointed inner end of this rod. Cement glands well developed at posterior end of body proper.

Head with two inconspicuous lobes on each side, where three swollen ducts of sticky glands open. Two pairs of eye spots are present in front of subglobular pharynx which measures 30 – 45 μ long by 32 – 42 μ wide. Esophagus short, ceca united posteriorly at about junction of posterior two thirds of body.

Testis oval, 75 – 100×36 – 75 μ, situated just behind midbody. Vas deferens turning round left cecum, and making another abrupt turn at junction of anterior with posterior prostatic duct, whence it runs arcuately along with the unpaired prostatic duct to open into the base of the cirrus. The copulatory organ consists of a curved tubular cirrus and two accessory pieces as shown in Fig. 6. Cirrus measuring 90 – 110 μ along its curvature, 12 – 15 μ wide at base ; its distal end enlarged in form of a funnel or a trumpet. Common genital pore surrounded by circular muscle fibers, opening mid-ventrally a little behind intestinal bifurcation. There is no definite prostatic reservoir, though the prostate cells are well developed. The anterior cells are divided into two groups, one of which lies between the genital pore and the intestinal bifurcation, and the other between the cirrus and the shell gland ; the posterior cells extend dorsally from the shell gland and ovary to the lateral margin

of the body.

Ovary transversely elongated, 30 – 45 × 35 – 60 μ, situated immediately in front of testis. Shell gland well developed in front of broader end of ovary. Uterus midventral; eggs oval, 51 – 72 × 42 – 63 μ, without polar filament. Vagina and receptaculum seminis lacking. Vitellaria follicular, extending in lateral fields from behind pharynx to a short distance back of posterior cecal arch, confluent behind testis; transverse vitelline ducts are united together where the shell glands open into the germiduct.

The present genus differs from the most closely related *Haliotrema* Johnston et Tiegs, 1922, in the absence of the vagina.

10. *Metahaliotrema arii* n. sp.
Pl. III, Fig. 9.

Habitat. Gill of *Arius* sp.

Material and locality. Six mature specimens stained and mounted as usual; Bandjermasin, Borneo.

Body flattened subcylindrical, with a distinct constriction at neck as well as between body proper and haptor, the greater part between these two constrictions being nearly uniform in width, 0.37 – 0.66 × 0.06 – 0.09 mm. Haptor 60 – 80 μ in diameter; dorsal and ventral hooks similar in shape, dorsal hooks 39 – 45 μ from tip of dorsal root to height of curve of blade, with prominent ventral root; connecting bar slightly bowed with somewhat swollen ends, 36 – 39 μ long. Ventral hooks 36 – 39 μ from tip of ventral root to height of curve of blade, with prominent dorsal root; connecting bar similar in shape to that of dorsal hook, 39 μ long; marginal hooklets 13 – 14 μ long. Head trapezoidal, with more or less distinct incision in front and on each side, 48 – 81 μ wide; 3 or 4 swollen sticky gland ducts along each lateral margin of head, their gland cells in shoulder region. Two pairs of eye spots in neck region. Pharynx subglobular, 24 – 45 × 22 – 30 μ. Esophagus short; ceca simple, united posteriorly at about junction of posterior two thirds of body.

Testis elongated elliptical, 45 – 90 × 15 μ, situated in dorsal median field with its center just behind midbody, overlapping ovary for its greater part. Vas deferens turning round left cecum and swollen as it passes ventral to the latter at posterior end of anterior third of body to form an elongate saccular vesicula semi-

nalis 10-15 μ wide. Cirrus filamentous, winding in form of an &, button-shaped at base, with a sheath of longitudinal muscle fibers for the winding distal portion; chitinous accessory piece absent. There is a small pyriform prostatic reservoir 15-24 μ long by 9-13 μ wide immediately dorso-dextral to the cirrus with its middle on a level with the base of the latter or a little posterior to it. The prostate cells are comparatively large, subglobular, oval or pyriform, and extend in the dorsal intercecal field between the prostatic reservoir and the ovary; in front of the ovary they extend to near the ventral cuticle. Genital pore 0.14 mm from anterior extremity in the type 0.66 mm long.

Ovary elongated elliptical, 70-95×18-25 μ, situated at about midbody, covering testis ventrally. No eggs observed. Vagina absent. Vitellaria profusely developed along esophagus and intestine, confluent between testis and cement gland, as well as in front of prostate cells intruding ventrad.

This species differs from the genotype in the haptoral hooks as well as in every respect of genitalia though agreeing with it in general anatomy.

Metahaliotrema n. g.

Generic diagnosis: Dactylogyridae Bychowsky, 1933. Body small, elongate. Haptor well marked off from body proper, with two pairs of large hooks supported by chitinous bars, and 7 pairs of minor hooks. Head with two pairs of head lobes containing distended ducts of sticky glands. Two pairs of eye spots present. Intestinal ceca united posteriorly. Testis postequatorial. Vas deferens turning round left cecum. No definite vesicula seminalis. Cirrus chitinous, with or without accessory pieces. Prostatic complex present. Genital pore behind intestinal bifurcation. Ovary pretesticular. Shell gland well developed. Uterus midventral. Eggs without polar filament. No receptaculum seminis. No vagina. Vitellaria follicular, extending in lateral fields from pharynx to posterior cecal arch, confluent behind testis. Parasitic on marine fishes.

Genotype: *Metahaliotrema scatophagi*.

Other species: *M. arii*.

11. *Pseudohaliotrema* (*Pseudohaliotrema*) *sphincteroporus* n. g., n. sp.

Pl. III, Figs. 10-11.

Habitat. Gill of *Siganus* sp.

Material and locality. 4 mature specimens, of which one was

stained and mounted in balsam, and the others were mounted in lactophenol; Macassar.

Body very much elongated, 0.66 – 1.12 mm long, 0.1 – 0.15 mm broad at middle third. Haptor with two pairs of large hooks and 6 pairs of hooklets as in *Haliotrema*, connected with body proper by a long slender portion containing retractors of the hooks and cement glands; dorsal hooks with a triangular dorsal and a broad truncated ventral root, measuring 39 – 42 μ from tip of dorsal root to height of curve of blade; transverse bar 30 – 36 μ long; ventral hooks with a triangular dorsal and a longer truncate ventral root, measuring 43 - 51 μ from end of ventral root to height of curve of blade; transverse bar slightly curved in form of a coat-hanger, 39 – 42 μ long; hooklet 12 – 15 μ long. Head 50 – 70 μ broad, with a large median lobe and a pair of smaller prominent lobes; sticky glands well developed along each side at level of esophagus opening on head by five pairs of swollen ducts. Mouth aperture ventral, at base of head. Pharynx globular, 30 – 45 μ in diameter. Esophagus comparatively long, bifurcating behind middle of anterior third; ceca without side branches, united posteriorly behind testis.

Testis oval, 50×30 – 35 μ, situated a little behind midbody; vas deferens running forward inside left cecum and turning back on itself behind intestinal bifurcation where it forms a distinct vesicula seminalis 18 μ wide in the type. Cirrus 78 – 90 μ long, consisting of two parts; the somewhat curved cylindrical portion receives at the base the descending ductus ejaculatorius and the attenuated ascending ducts of the two prostatic reservoirs, while the other solid portion, which is connected with the cylindrical portion by a laminate bridge, is produced forward into a bifid claw. Genital pore with a concentric muscular lamellae, to which the specific name refers, opening midventrally behind intestinal bifurcation. There are two elongate dumb-bell-shaped prostatic reservoirs lying lengthwise close together on the right of the copulatory organ, the right one measuring 100×25 μ and the left 60×15 μ in the type; the prostatic cells are divided into two groups, one of which lies anterior to the reservoirs and the other behind.

Ovary elongate saccular, anterolateral to testis, 40 – 50×20 – 40 μ. In front of the testis and ovary there is a fairly large receptaculum seminis 45 – 48 μ long by 35 – 36 μ wide, communicating

anteriorly with vaginal duct and germiduct. Uterus midventral, containing no eggs. Vagina opening ventral to right cecum at a level just posterior to cirrus and prostatic reservoirs, consisting of a cup-shaped chitinous portion and a saccular muscular portion which encloses the distal portion of the vaginal duct and extends obliquely backward to the median line. Vaginal duct very narrow, running obliquely between receptaculum seminis and chitinous vaginal cup. Vitellaria composed of numerous small follicles extending from behind pharynx to behind posterior intestinal arch, being confluent behind testis ; vitelline ducts wide, united together at about midbody with germiduct and receptaculum seminis.

12. *Pseudohaliotrema* (*Pseudohaliotrema*) *sigani* n. sp.
Pl. III, Fig. 12 ; Pl. IV, Figs. 13 - 14.

Habitat. Gill of *Siganus* sp.

Material and locality. Several mature specimens stained and mounted as usual ; Macassar.

Body elongate, 0.35-0.48 mm in length, with maximum breadth of 60 - 90 μ at middle of anterior third or at junction of posterior two thirds, more or less narrowed at level of posterior end of cirrus or vagina. Haptor well marked off from body proper, 45 - 60 μ broad, with prominent lateral corners ; dorsal and ventral hooks similar in shape to those of *P. sphincteroporus* ; dorsal hook with a pointed triangular dorsal root and a short truncate ventral root, measuring 30 μ from end of dorsal root to height of curve of blade ; transverse bar 24 - 30 μ long ; ventral hook with a long ventral root and a stumpy dorsal root, measuring 37 - 42 μ from end of ventral root to height of curve of blade ; transverse bar 27 - 33 μ long, with two incisions on anterior margin ; hooklets of 6 pairs, 11 - 14 μ long. Head 30 - 36 μ broad, with two pairs of not very conspicuous lobes, with three swollen ducts of sticky glands on each side. Neck portion usually marked out. Sticky glands in shoulder region. Mouth opening ventrally at base of head. Pharynx globular, 15 - 21 × 15 - 21 μ. Esophagus bifurcating at about middle of anterior third. Ceca without side branches, united at about middle of posterior third.

Testis oval, 40 - 50 × 20 - 30 μ ; situated at posterior end of middle third of body. Vas deferens running forward medial to left cecum, turning backward just in front of genital pore to form an inverted club-shaped vesicula seminalis which is 20 - 25 μ wide, and

lies ventral to the prostatic reservoir, with its attenuated posterior end curved toward the base of the copulatory organ. Cirrus 50 – 60 μ long, widened basally; the thick, well chitinized left wall is tapered anteriorly to a transversely sigmoid filament, whose sharp-pointed tip may project out of the genital pore, while the thinner right wall forms at its anterior end a nodular thickening, which appears to fit into the terminal filament of the left wall. The base of the cirrus is surrounded obliquely by a muscle band. Genital pore midventral, at posterior end of anterior third of body. There is a single inverted claviform prostatic reservoir 36 – 50 μ long by 12 – 20 μ wide immediately dorsal to the vesicula seminalis with its attenuated posterior end directed toward the base of the cirrus; the prostate cells lie in front of the prostatic reservoir.

Ovary elongated oval, 20 – 30×12 – 15 μ, anterolateral to testis. Receptaculum seminis 30×15 – 20 μ, immediately anterior to ovary. Uterus ventromedian, containing no eggs. Vagina opening ventral to right cecum at level of posterior end of cirrus, consisting of a terminal cup with chitinous wall and a saccular, apparently muscular base which is perforated by the vaginal duct. Latter narrow, originating from bottom of terminal cup, running obliquely backward to join receptaculum seminis. Vitellarian follicles small, extending along each side of body from behind pharynx to posterior end of body proper, most abundant in bifurcal and posttesticular regions where they are continuous across the median line; transverse vitelline ducts united together just in front of receptaculum seminis.

This species differs from the genotype in the structure of the copulatory organ and of the genital pore, and in the possession of a single prostatic reservoir.

The differences between the present genus and the related known genera from marine fishes are shown in the following table.

Genera	Ceca	Vas deferens	Bars of haptoral hooks	Vagina
Tetrancistrum	united posteriorly, with numerous out-pocketings	not turning round cecum	2	present
Haliotrema	united posteriorly	turning round cecum	2	present

Pseudo-haliotrema	united posteriorly	not turning round cecum	2	present
Meta-haliotrema	united posteriorly	turning round cecum	2	absent
Ancyro-cephalus	separated posteriorly	not turning round cecum	2	present
Ancyro-cephaloides	united posteriorly	not turning round cecum	lacking	present
Parancyro-cephaloides	united posteriorly	not turning round cecum	ventral bar only	present

Pseudohaliotrema n. g.

Generic diagnosis : Dactylogyridae Bychowsky, 1933. Body small, elongate. Caudal haptor well marked off, with 2 pairs of large hooks and 6 or 7 pairs of marginal hooklets ; each pair of large hooks with a supporting bar. Head with one pair or two of lateral lobes. Neck more or less distinctly marked out. Ceca simple, united posteriorly. Testis postequatorial. Vas deferens not turning round cecum. Vesicula seminalis formed by mere dilatation of vas deferens. Prostatic reservoirs one or two or lacking, lying parallel to copulatory organ. Copulatory organ not simple. Genital pore may be provided with sphincter-like muscular thickening. Ovary anterolateral or anterior to testis. Vagina with chitinized opening ventrally or laterally. Receptaculum seminis present or absent. Vitellaria consisting of small follicles, extending from behind pharynx to posterior end of body proper. Parasitic on gills of marine fishes.

Genotype : *Pseudohaliotrema sphincteroporus.*

Other species : *P. sigani.*

13. *Pseudohaliotrema* (*Pseudohaliotrematoides*) *fusiforme* n. subg., n. sp.

Pl. IV, Figs. 15 – 16.

Habitat. Gill of *Siganus* sp.

Material and locality. 10 mature specimens stained and mounted as usual ; Macassar.

Body approximately fusiform, 0.56 – 0.81 mm in length, with maximum breadth of 0.15 – 0.25 mm in testicular zone, whence it tapers gradually to a conical point anteriorly but rather abruptly to a truncate haptor posteriorly. Haptor about 90 μ broad, with two (a dorsal and a ventral) pairs of hooks and 7 pairs of marginal hooklets ; dorsal hook measuring 84 – 95 μ from end of ventral root to height of curve of blade, with a short dorsal root 6 – 17 μ long and a powerful ventral root which is much longer (38 – 50 μ) and broader

than the blade and longitudinally striated; supporting bar curved a little, 30 – 48 μ long; ventral hook 87 – 97 μ long, with two strong, longitudinally striated roots, of which the dorsal is 30 – 35 μ long and the ventral 30 – 40 μ long; supporting bar 27 – 30 μ long. Head nearly conical, 48 – 75 μ broad at level of mouth aperture, with a rather inconspicuous lateral lobe; its front lobe with a light median incision. Sticky glands massed on either side of pharynx, their ducts swollen distally and opening on submedian and lateral margins of head. Eye-spots lacking. Pharynx spherical, 27 – 57 × 30 – 45 μ. Esophagus short. Ceca simple, comparatively wide, united near posterior end of body proper.

Testis round, postequatorial, 90 – 140 × 75 – 140 μ. Vas deferens running forward medial to left cecum and encircling copulatory organ nearly all round, opening into cirrus at its base. Vesicula seminalis formed by mere dilatation of ascending vas deferens, fusiform, 15 – 38 μ wide. There is no prostatic reservoir, though the prostate cells are massed together in two groups at the base of the cirrus. The copulatory organ consists of a curved, strongly chitinous cylinder 69 – 80 μ long by 24 – 33 μ wide and two, curved, solid, accessory rods of nearly equal length (54 – 72 μ). There are two strong muscle bands, of which the larger anterior encircles the distal portion of the cirrus and of the posterior accessory rod as well as the posterior somewhat swollen part of the anterior accessory rod, and the posterior holds the posterior end of the cirrus. Genital pore elliptical or biscuit-shaped, midventral, at about middle of anterior third of body.

Ovary transversely elongate, 27 – 60 × 33 – 120 μ, almost equatorial, resting on testis; germiduct very short, arising from the anterior end of ovary. No receptaculum seminis. Uterus midventral, tubular, containing no eggs. Vagina opening on right side at level of posterior end of copulatory organ, consisting of an elliptical sac lined with folded cuticle, measuring 27 – 33 μ long by 14 – 24 μ wide; vaginal duct arising from inner end of vaginal sac, irregularly winding, provided with fine circular muscle for greater proximal portion. Vitellaria composed of small follicles, extending along each side of body from behind pharynx to posterior end of body proper, confluent across median line anteriorly and posteriorly; transverse ducts united in front of ovary.

The present new subgenus differs from the type subgenus

Pseudohaliotrema in possessing neither prostatic reservoir nor seminal receptacle.

14. *Hamatopeduncularia arii* n. g., n. sp.
Pl. IV, Fig. 17.

Habitat. Gill of *Arius* sp.

Material and locality. 4 mature specimens fixed in acetic sublimate under a cover slip, stained with Heidenhain's hematoxylin and mounted in balsam; Bandjermasin, Borneo.

Body flattened subcylindrical, 1.35–1.5 mm in length, with maximum width of 0.13–0.19 mm at about junction of posterior two thirds. Haptor usually not distinctly marked off from body proper, 0.18–0.25 mm in diameter, provided on each side with 5 horn-like or claviform peduncles, at the rather pointed tip of which is inserted a larval hooklet 15 μ long. There are 7 pairs of larval hooklets, 5 pairs being attached to the peduncles and the rest to the lobes bearing the haptoral hooks. Dorsal haptoral hooks 48–54 μ from tip of dorsal root to height of curve of blade, ventral root much shorter than dorsal; connecting bar slender, arcuate, with simple ends, 60–80 μ long; ventral hook 40–48 μ from tip of ventral root to height of curve of blade, dorsal root half as long as ventral; connecting bar slender, 60–66 μ long, divided at each end into two nodules fitting into lateral wing-like expansions of the ventral root. To the end of each longer root of the hooks is attached a retractor muscle bundle coming from the body proper, and between the longer roots of each pair is a transverse bundle. The round to oval cement reservoir filled with secretion granules lies close to each hook, with its duct opening alongside the blade of the hook. Cement glands between posterior end of vitellaria and cement reservoirs.

Head trapezoidal, 86–105 μ in diameter, with swollen sticky gland ducts along each lateral margin. Mouth opening at base of head; pharynx subglobular to ellipsoidal, 56–90×42–60 μ. Esophagus short, ceca simple, terminating blindly parallel to each other at about middle of posterior third of body.

Testis elliptical, 0.24 mm long by 60–90 μ wide, situated in postequatorial median field, with its anterior end overlapping ovary. The vas deferens running obliquely forward dorsal to the ovary and left cecum pursues a long course in the left marginal

field and then crossing the cecum ventrally opens into an oval vesicula seminalis which lies in the median field anterior to the cirrus and measures 105 – 120 μ by 60 – 80 μ. The backwardly directed ejaculatory duct runs alongside the ducts of the prostatic reservoirs and opens into the cirrus at its base. The cirrus consists of a straight tube provided with a spiral ornament for its greater distal portion and also with a coat of circular and oblique muscle fibers. It is supported by a solid, somewhat curved, accessary chitinous rod, which rests on a muscle band running from the cirrus and then turning toward the genital pore. To the somewhat enlarged base of the cirrus is attached a small bulb of spiral muscle fibers apparently continuous with the muscular coat of the cirrus mentioned above. There are two claviform prostatic reservoirs dorsal to the vesicula seminalis; their efferent ducts run backward across the dorsal side of the cirrus and uniting together open into the cirrus through the axis of its basal muscle bulb. The prostate cells extend for the most part in the dorsal intercecal field between the copulatory organ and the ovary. Male genital pore opening in front of uterine pore behind seminal vesicle.

Ovary elongated retort-shaped, 0.18 – 0.19 mm long by 50 – 90 μ wide, situated longitudinally at midbody with its posterior end overlapping testis. The germiduct arising from the tapering anterior end of the ovary joins the receptaculum seminis and receives the shell gland cells from the two sides. No uterine eggs observed. Uterus opening midventrally at level of base of cirrus. Vagina cup-shaped, dextral to median line at level of shell gland. There is no distinct vaginal duct. Vitelline follicles extending from pharynx to cecal ends, confluent around esophagus and behind testis.

The present genus is unique in possessing tentacle-like appendages on the posterior haptor, though resembling *Haliotrema* Johnston and Tiegs in other respects. It may be defined as follows.

Hamatopeduncularia n. g.

Generic diagnosis: Dactylogyridae Bychowsky, 1933. Body small, elongate. Haptor not well marked off from body proper, with two pairs of haptoral hooks supported by transverse bars at posterior end and five pairs of marginal hooklets, each of which is inserted at the tip of a more or less long peduncle projecting laterally. The remaining two pairs of hooklets are attached to the lobes bearing the haptoral hooks. Head with swollen sticky gland ducts on each side. Two

pairs of eye spots present. Ceca terminating blindly. Testis postequatorial, elongated. Vas deferens turning round left cecum. Vesicula seminalis large, in front of copulatory organ. Cirrus chitinous, with accessory piece. Prostatic complex well developed. Male and female genital pores separate but close to each other. Ovary pretesticular, elongated. Shell gland, receptaculum seminis, and transverse vitelline ducts joining together in front of ovary. Eggs? Vagina present. Vitellaria follicular, surrounding esophagus and intestine, confluent behind testis. Paraitic on brackish water fishes.

Genotype : *Hamatopeduncularia arii.*

15. *Diplectanum serrani* n. sp.

Pl. V, Fig. 18.

Habitat. Gill of *Serranus* sp.

Material and locality. Several mature specimens stained and mounted; Macassar.

Body elongated lanceolate, with haptor well marked off, 0.45 – 0.66 mm in length, 0.1 – 0.14 mm in maximum width at or near level of genital pore or ovary and testis. Posterior part of body covered with anteriorly directed scales. Haptor 0.14 – 0,15 mm wide; dorsal hook 33 – 42 μ long from end of ventral root to height of curve of blade, dorsal root nodular ; ventral hook 42 – 48 μ long from end of dorsal root to height of curve of blade, ventral root nearly as long as dorsal one, but more attenuated distally; connecting rod 48 – 54 μ long, swollen at inner end ; central bar 75 – 90 μ long by 12 – 20 μ wide, blunt-pointed at both ends. Marginal hooklet 8 – 9 μ long. Squamodisc 39 – 45 μ long by 33 – 42 μ wide, consisting of 9 – 11 concentric rows of scales.

Head triangular or trapezoidal, 48 – 70 μ wide at base, with three pairs of swollen sticky gland ducts on each side. Two pairs of eye spots in front of pharynx. Sticky glands well developed on either side of eye spots and pharynx. Pharynx 27 – 33×21 – 27 μ. Esophagus very short, ceca extending some distance further back of testis and terminating blindly.

Testis oval, 35 – 63×24 – 42 μ, situated at about midbody. Vas deferens narrow, running forward along uterus on its sinistrodorsal side, forming a small fusiform vesicula seminalis ; ductus ejaculatorius very narrow, looped in front of vesicula seminalis ; muscular bulbus ejaculatorius as observed in *D. epinepheli* Yamaguti, 1938, has not been detected. Copulatory organ 60 – 70 μ long, consisting

of a reniform, chitinous structure, which is divided into four compartments, and whose posterior end is produced into a styliform process, and a fine tubular cirrus proper, whose end is usually more or less winding. The thin-walled muscular sheath enclosing the cirrus proper runs arcuately toward the genital pore and opens along with the uterus. Genital pore ventral to posterior end of prostatic reservoir. Latter elongate saccular, 30 – 40 × 15 – 22 μ, along right side of reniform portion of copulatory organ, into which it opens at the anterior end. Prostate cells extending in dorsal area between copulatory organ and ovary, though not illustrated in the figure.

Ovary 30 – 58 × 24 – 50 μ, turning round right cecum, with the attenuated distal portion ventral to the anterior end of the main part, which lies immediately anterodextral to the testis. The uterus, receiving the shell gland and the seminal receptacle at the very beginning, is provided with fine circular muscle fibers and runs a little obliquely forward. No mature eggs observed. Vagina short cylindrical, opening in left submedian line a little behind genital pore, chitinized at its posterior somewhat swollen part, from which the winding half-chitinized vaginal duct is continued backward. The straight posterior portion of the vaginal duct is however no more chitinous and forms a small receptaculum seminis at its posterior end. Vitelline follicles extending from pharynx to cecal ends.

This species differs from *Diplectanum aequans* Wagener of Maclaren in almost every respect of genital organs, and from *D. americanum* Price, 1937, and *D. epinepheli* Yamaguti, 1938, in the number of the rows of scales of the squamodisc as well as in the ovary turning round the right cecum.

In 1938 I insisted on the generic status of the genus *Squamodiscus* mihi, but a comparison of the present species with *Diplectanum epinepheli* revealed that the presence or absence of the ejaculatory bulb as well as the structure of the squamodisc in terms of hooks, rodlets or scales is of no generic importance.

16. *Pseudolamellodiscus sphyraenae* n. g., n. sp.
Pl. V, Fig. 19.

Habitat. Gill of *Sphyraena* sp.

Material and locality. Several mature specimens; Macassar

Body elongate, 0.8 – 1.4 mm in length, with maximum width of 0.13–0.21 mm at about genital pore, whence it tapers rather rapidly toward the anterior extremity. Haptor 0.2 – 0.26 mm in diameter, flattened dorsoventrally and elongated transversely, provided with a pair of small digitiform posterior appendages tipped with a larval hooklet, 2 pairs of lateral hooks, a pair of connecting rods and a very long slender central bar and two (a dorsal and a ventral) transversely elongated accessory organs (squamodiscs) consisting of 27 concentric rows of hook-like scales placed end to end. Of the lateral hooks the ventral is a little larger than the dorsal, both having a very prominent guard, and measuring respectively 30 – 42 μ long and 24 – 33 μ long. Connecting rod 50 – 60 μ long ; central bar whip-like, strongly curved at each outer end in form of a hook, attenuated and apparently jointed at the middle. Marginal hooklets 7 μ long : their number was unable to determine.

Head truncated conical, 80 – 108 μ wide, with a number of sticky gland ducts arranged one closely behind another along each side : sticky gland cells in shoulder region on either side of posterior end of pharynx. In the neck region there are two pairs of eye spots, and a pair of compact masses of comparatively small prostatic cells. Pharynx elliptical, 51 – 72×33 – 45 μ. Esophagus short ; ceca simple, terminating blindly near posterior end of body.

Testis longitudinally elongated, 0.1 – 0.24 mm long by 30 – 75 μ wide, situated at about junction of posterior with middle third of body. Vas deferens running forward in median field, 13 – 21 μ wide. Vesicula seminalis oval, 27 – 40 × 13 – 27 μ, situated longitudinally in front of copulatory organ. Latter tubular, tapering distally, flexed in form of a V, enclosed in an incomplete chitinous ring at base, with a hook-like backward branch on proximal portion. Male genital aperture at posterior end of anterior third of body, apparently a little separated from female genital pore. Anterodorsal to the seminal vesicle is a comma-shaped prostatic reservoir opening into the cirrus by a short narrow duct produced from its posterior end. The prostate cells are profusely developed in the dorsal part of the terminal genitalia, partly massed together on each side of the eye-spots, the paired ducts from these cervical prostate cells uniting together ventral to the prostatic reservoir to form a ventromedian unpaired duct which joins the other ducts behind the rounded proximal end of the prostatic reservoir.

Ovary tubular, turned back on itself twice immediately in front of testis and then winding in form of an S. Receptaculum seminis oval to elliptical, lying by the left of beginning of uterus. Uterus opening posterosinistral to male aperture ; its dilated anterior portion may be as wide as 30 – 42 μ, posterior portion narrow, tubular. Vagina opening widely on the right of median line at level of male genital aperture, provided on the right with a chitinous rod which is 42 – 51 μ long and has a row of a few minute spiniform teeth at its posterior end and is surrounded by muscular tissue. The vaginal duct arising from near the posterior end of the wide vaginal aperture runs straight backwards and may be widened as much as 12 – 18 μ when it happens to contain vitelline cells. On the left of the vagina is a long (0.15 – 0.2 mm) tubular organ attenuated at the middle and terminating blindly with a diameter of 18 – 30 μ. At the two extremities it appears to be lined with epithelia, the remaining greater part being filled with granular substance ; it extends from the right side of the proximal end of the prostatic reservoir to the level where there are two chitinous structures *sui generis* (marked with an asterisk in the figure), of which the right one, indefinite in shape and 16 – 33 μ long, lies at the bottom of a ventral pit on the right of the vaginal duct, and the other, 13 – 20 μ in diameter, consists of several closely massed spines 9 – 11 μ long and apparently projecting over the ventral surface on the left of the uterus. The function of these three organs is unable to determine. Vitelline follicles extending along each side of body, from level of posterior end of pharynx to cecal ends. Transverse vitelline ducts meeting immediately in front of ovary.

This genus is characterized by the structure of the haptor, especially by the central bar, by the profuse development of the prostatic cells. The problematical structures may be of specific significance in view of their absence in a related member[1] of the same genus from the same host species.

Pseudolamellodiscus n. g.

Generic diagnosis : Dactylogyridae Bychowsky, 1933. Body elongate, small. Haptor with a pair of small digitiform posterior appendages tipped with larval hooklet, two pairs of large lateral hooks, one pair of supporting rods, a

1) The specific determination of this is unable to make owing to scarcity of material.

whip-like central bar, marginal hooklets and two large squamodiscs. Two pairs of eye spots present. Intestinal ceca terminating blindly near posterior extremity. Testis behind midbody. Vas deferens straight, vesicula seminalis near genital pore. Copulatory organ chitinous. Prostatic cells profusely developed, prostatic reservoir conspicuous. Ovary pretesticular, more or less winding but not turning round cecum. Uterus may be distended terminally, opening close to male aperture. Eggs? Vitellaria follicular, extending in lateral fields from pharynx to cecal ends. Vagina provided with a chitinous structure at its wide submedian aperture. Receptaculum seminis present. Parasitic on marine fishes.

Genotype : *Pseudolamellodiscus sphyraenae.*

17. *Lamellodiscus flexuosus* n. sp.
Pl. V, Figs. 20 - 21.

Habitat. Gill of *Synagris taeniopterus* (Valenc.).

Material and locality. About 20 mature specimens stained and mounted ; Macassar.

Body flattened cylindrical, 0.45 - 0.84 mm in length, 54 - 150 μ wide at about middle. Haptor 75 - 120 μ in diameter, with a distinct constriction between itself and body proper ; dorsal hook 20 - 34 μ long, with two short roots ; paired connecting rods arcuate, each bifid at inner end, 33 - 48 μ long ; ventral hook 35 - 42 μ long from tip of longer dorsal root to height of curve of blade ; central bar 36 - 57 μ long, thick at middle portion lying ventral to inner ends of two dorsal connecting rods, but markedly tapered toward both ends ; marginal hooklet about 9 μ long. Accessory adhesive organ flask-shaped, 24 - 36 μ in diameter, consisting of about 10 chitinous lamellae, with a transversly elongated oval adhesive cavity on external surface at its swollen part. To the anterior end of this organ is attached a muscle band coming from the body proper. Cement glands well developed at posterior end of body proper. Head trapezoidal, 36 - 100 μ in diameter at base, with two lobes on each side ; the two anterior lobes may not be distinctly separated one from the other. Sticky glands well developed, extending from shoulder region to neck ; their ducts distended with secretion product are arranged along each lateral margin of the head. Two pairs of eye spots in front of pharynx. Pharynx 15 - 40 × 17 - 42 μ. Esophagus rather short. Ceca terminating blindly near posterior end of body proper.

Testis elongated elliptical, 100 - 210 × 24 - 70 μ, confined to middle third of body. Vesicula seminalis tubular, long, tightly

winding in pretesticular median field. Copulatory organ consisting of a terminal bulb 30 – 50 μ long by 12 – 20 μ wide and supported by three, partly overlapping valves, and a posteriorlv enlarged basal piece. Genital pore midventral, though somewhat displaced in the figure, near posterior end of anterior third of body. There are two prostatic reservoirs; the smaller anterior lies dorsal to the copulatory organ; the posterior is longitudinally elongated claviform, 45 – 100 μ long by 6 – 15 μ wide, and lies dorsal to the vesicula seminalis. The prostate cells are divided into two masses, one of which lies immediately in front of the copulatory organ and the other behind the posterior prostatic reservoir.

Ovary 10 – 35 μ in diameter, situated anterolateral to testis, turning round right cecum with the broader posterior portion dorsally and the tapering anterior portion ventrally. Eggs oval, 70 – 80 μ long, with a short polar filament terminating in a knob. Receptaculum seminis not detected. Vagina forming a thin-walled chitinous sac 18 – 27 μ long by 12 – 24 μ wide, opening ventrally on the left of median line; vaginal duct very narrow, arising from posterodorsal end of vagina, running obliquely backward to join germiduct ventral to vesicula seminalis. Vitellarian follicles surrounding whole length of esophagus and intestine; transverse ducts joining together on ventral side in front of testis, where the shell glands are closely massed.

This species is characterized by the structure of the accessory adhesive disc and of the terminal genitalia. The specific name refers to the winding vesicula seminalis.

18. *Lamellodiscus convolutus* n. sp.
Pl. VI, Fig. 22.

Habitat. Gill of *Synagris taeniopterus* (Valenc.).

Material and locality A number of mature specimens stained and mounted; Macassar.

Body elongate fusiform or slender, 0.27 – 0.46 mm in length, 42 – 78 μ in maximum width at middle or in front of it. Haptor 60 – 75 μ in diameter; dorsal hook 22 – 25 μ long, with two short roots; paired connecting rods curved, each bifid at inner end, 26 – 32 μ long; ventral hook 27 – 30 μ long from tip of longer dorsal root to height of curve of blade; central bar 42 – 60 μ long, only slightly curved, not markedly attenuated toward both ends; marginal

hooklets 8－9 μ long. Accessory adhesive organ (lamellodisc) 21－30 μ in diameter, made up of 7－8 chitinous rib-like lamellae which lie one above another, becoming smaller toward both ends wtih a round adhesive cavity on the external surface. There is a weak muscle band attached to this lamellodisc. Head conical or trapezoidal, without distinct lateral lobes, 30－36 μ broad at base. There are two pairs of eye spots immediately in front of the pharynx which measures 18－29 μ long by 10－24 μ wide. Esophagus short; ceca simple, terminating blindly near posterior end of body proper.

Testis elongate oval to elliptical, 50－80×20－40 μ, situated a little behind middle of body. The vas deferens arising from the anterior end of the testis runs forward along the left cecum on its medial side, and crossing the median line at the level of the vagina turns backward to form a complete loop ; finally it passes behind the posterior portion of the accessory copulatory piece and opens into the posterior end of the cirrus. The vesicula seminalis is replaced by this convoluted vas deferens. The copulatory organ consists of a hollow, arcuate, spicular cirrus 42－50 μ long and two acessory pieces, one of which is a small hook 12－15 μ long with a prominent guard, and the other is a slender solid, arcuate rod 33－36 μ long. These two accessory pieces are articulated end to end, the rod-shaped one supporting the base of the cirrus and the hook being directed forward along with the tip of the cirrus. Genital pore midventral, at posterior end of anterior third of body. There are two elongated saccular prostatic reservoirs alongside the copulatory organ, one on the right of it with base directed forward and the other on the left with the base directed backward ; the light colored prostate cells lying between the genital pore and the intestinal bifurcation open into the right reservoir, while the darker ones lying between the above mentioned loop of the vas deferens and the left reservoir open into this reservoir.

Ovary club-shaped, 10－15 μ wide at base, turning round right cecum with its transverse proximal portion immediately anterodorsal to testis. Shell gland ventral, at midbody. Uterus midventral; eggs oval, 70－90 μ long, with a rigid polar filament, whose end is provided with an elliptical knob. Vagina cup-shaped, not very strongly chitinized, opening on left of median line just behind copulatory organ; vaginal duct very narrow,

running obliquely backward, chitinized at its distal portion 15–20 μ long. There is no receptaculum seminis. Vitellarian follicles extending along esophagus and ceca, occupying entire shoulder regions, confluent behind testis; transverse vitelline ducts at level of shell gland or a little further behind.

This species is characterized by the convoluted vas deferens, hence the specific name.

19. *Lamellodiscus difficilis* n. sp.
Pl. VI, Figs. 23–24.

Habitat. Gill of *Lethrinus* sp.

Material and locality. 4 mature specimens; Macassar.

Body very slender, 0.47–0.95 mm in length, with maximum breadth of 80–90 μ in region between copulatory organ and shell gland. From this region the body tapers markedly toward the head as well as toward the posterior end of the body proper which forms a very long and narrow peduncle for the haptor. Haptor nearly triangular, 0.15–0.18 mm in transverse diameter. Dorsal hook 48–57 μ long from tip of ventral root to that of blade, with rudimentary dorsal root; ventral hook 57–63 μ long from tip of ventral root to height of curve of blade, its dorsal root is distinctly shorter than the ventral; paired connecting rods widely divergent, each bifid at inner end, 69–75 μ long; central bar incurved at both ends, 102–114 μ lineally from end to end. Accessory lamellodisc 50–60 μ in diameter, flask-shaped, consisting of 10 circular chitinous lamellae, with round adhesive cavity on external surface of posterior swollen part, anterior smaller lamellae being telescoped one into another. To the anteriormost lamella is attached a muscle band coming down from the body proper. Marginal hooklets 9 μ long.

Head about 30 μ wide, blunt-pointed, with 4 swollen ducts of sticky glands on each side. Two pairs of eye spots present. Pharynx 18–30×14–18 μ. Ceca terminating close together in the attenuated posterior part of body proper.

Testis elliptical, 40–75×15–33 μ. Vas deferens arising from anterolateral end of testis, forming elongate saccular vesicula seminalis behind vagina. Copulatory organ (Fig. 24) consisting of two large chitinous bodies of very complex structure, bulging out laterally. Genital pore apparently opening ventrally between these two bodies at posterior end of anterior third of body. There

are two prostatic reservoirs ; one is directed forward from the copulatory organ, being surrounded at its anterior end by prostate cells ; the other extends backwards as far as the vesicula seminalis.

Ovary 15 – 24 μ wide, situated immediately anterolateral to testis, apparently turning round right cecum. Uterine eggs elliptical, without filament, probably owing to incomplete development. Vagina cup-shaped, chitinous, 40 – 45 μ long, opening on the right behind copulatory organ ; vaginal duct chitinous, curved, arising from vagina on its posterodorsal side. Vitelline follicles extending along esophagus and ceca for their entire length.

This species can easily be distinguished from any of the other members of the genus by the body shape and the structure of the copulatory organ. The specific name refers to the complicated structure of this organ.

20. *Lamellodiscus duplicostatus* n. sp.
Pl. VI, Fig. 25.

Habitat. Gill of *Lethrinus* sp.

Material and locality. 4 mature specimens stained and mounted as usual ; Macassar.

Body slender, subcylindrical, 0.42 – 0.86 mm long, 50 – 70 μ wide. Haptor 70 – 85 μ wide. Dorsal hook 35 – 40 μ long, with rudimentary dorsal root ; ventral hook 48 – 54 μ long, with ventral root longer than dorsal ; connecting rod 33 – 40 μ long, slightly curved near its bifid inner end ; central bar 45 – 48 μ long, attenuated toward both ends marginal hooklets 9 μ long. Lamellodisc flask-shaped, 24 – 27 μ in diameter, consisting of ten ring-shaped lamellae, of which the complete smaller anterior are telescoped one into another, with a muscle band attached to the anteriormost one, and the larger posterior are divided into symmetrical ribs on the inner side and show a circular adhesive cavity on the outer side.

Head blunt-pointed, 26 – 33 μ in diameter, with a longitudinal row of swollen sticky gland ducts. Two pairs of eye spots anterodorsal to pharynx. Pharynx 20 – 30×9 – 15 μ. Ceca simple, terminating blindly at anterior part of posterior third of body.

Testis oval or elliptical, 45 – 51×27 μ. Vas deferens swollen (about 10 μ) in form of vesicula seminalis behind vagina, then winding its way forward by left side of vagina. Copulatory organ consisting of slender curved cirrus, a transverse basal piece and a

loop-like accessory piece, whose anterior end is produced anteriorly as well as ventrally into a claw-like process. Genital pore at posterior end of anterior third of body. There are two prostatic reservoirs; the anterior is fusiform, 30×12 μ, and lies dorsal to the cirrus; the posterior is very much elongated, 8–9 μ wide, and extends on the dorsal side of the vas deferens as far back as the ovary. Prostate cells massed together at proximal end of each prostatic reservoir.

Ovary turning round right cecum in front of testis. Shell gland well developed between testis and posterior prostatic reservoir. Eggs not observed. Vagina round, 18–24 μ in diameter, provided inside with three valves; vaginal duct arising from posterodorsal part of vagina, not traceable to its junction with germiduct. Vitelline follicles extending along esophagus and ceca for their entire length.

This species is characterized by the structure of the lamellodisc and the copulatory organ. The specific name refers to the double-ribbed lamellodisc.

21. *Diplectanocotyla gracilis* n. g., n. sp.
Pl. VII, Fig. 27.

Habitat. Gill of *Megalops cyprinoides* Broussonet.

Material and locality. Several mature specimens stained and mounted; Macassar.

Body very narrow and slender, 0.7–0.02 mm in length with nearly uniform width of 45–66 μ at anterior half; posterior half attenuated, especially in front of haptor. Latter 90–140 μ wide, flattened dorsoventrally and widened laterally, provided anteriorly with a dorsal and a ventral squamodisc and posteriorly with two pairs of hooks supported by two pairs of rods and a central sucker with two (a dorsal and a ventral) backwardly directed cavities. Squamodisc consisting of about 16 concentric rows of scales, of which the anterior are semicircular but the others V-shaped or arched. The sucker, 30–60 μ in transverse diameter, is sharply demarcated from the surrounding tissue and made up of radial muscle fibers. The dorsal and ventral hooks are nearly equal in length (33–50 μ), and have a well curved blade and a bifid root. The ventral supporting rod, 34–48 μ long and slightly curved, is articulated with the longer ventral root of the ventral hook by its

enlarged outer end, with the similarly widened inner end dorsal to the blunt-pointed simple inner end of the dorsal supporting rod in the space between the dorsal and the ventral part of the sucker. The dorsal supporting rod, 36–48 μ long, is articulated with the bifid root of the dorsal hook by its simple outer ramus, from the base of which a plump ramus is given off toward the dorsal cavity of the sucker. The simple inner end of this rod crosses the corresponding part of the ventral rod as mentioned above. The marginal hooklets are 5 μ long, but their number is unable to determine.

Head blunt-pointed in front, with a pair of prominent lateral lobes, where it measures 42–60 μ in width. There are three pairs of swollen sticky gland ducts, two opening on the side of the front lobe, another on the lateral lobe. The sticky gland cells are seen on either side behind the pharynx. Two pairs of eye spots are present between the mouth opening and the pharynx, those of the anterior pair being smaller and wider apart from each other than those of the posterior pair. Pharynx oval, 24–33×15–20 μ. Esophagus fairly long (70 μ in the type); ceca narrow, terminating blindly at about middle of posterior third of body.

Testis elliptical, 33–60 μ long by 17–21 μ wide, situated about midbody. Vas deferens strongly winding between shell gland and receptaculum seminis, then straight. The copulatory organ consists of two almost symmetrical chitinous structures whose complex anterior portions are fused together, the left one with a claw-like point representing the cirrus proper. Genital pore apparently at anterior end of this copulatory organ immediately behind intestinal bifurcation. There is a club-shaped prostatic reservoir extending in the dorsal area from the cirrus to the level of the receptaculum seminis or a little more posteriorly, the prostate cells extend from the genital pore to the posterior end of the reservoir, mostly on the right side of the median line.

Ovary elliptical, pretesticular, 40–70×13–24 μ. Shell gland well developed between ovary and vas deferens coils. Uterus extending straight in midventral area between shell gland and genital pore. No eggs observed. Vitelline gland consisting of minute follicles, extending along esophagus and intestinal ceca throughout their length. Vagina opening on left margin of body a little behind genital pore, made up of a narrow chitinous tubule, whose pos-

terior portion with a thicker well chitinized wall projects into the receptaculum seminis 14–21 μ wide.

The present new genus is distinguished from the allied genera with squamodiscs by the possession of two pairs of supporting rods for the two pairs of haptoral hooks and by the possession of a central sucker instead of the central bar. It is defined as follows.

Diplectanocotyla n. g.

Generic diagnosis: Dactylogyridae Bychowsky, 1933. Body very small and slender. Haptor with two pairs of large hooks, two pairs of supporting rods, a central sucker with two (a dorsal and a ventral) cavities, marginal hooklets, and two rather poorly developed accessory adhesive organs (squamodiscs). Two pairs of eye spots present. Intestinal ceca terminating blindly near posterior end of body. Testis at or near midbody. Vas deferens winding. Copulatory organ consisting of complex chitinous structures. Prostatic reservoir present. Ovary pretesticular, not turning round cecum. Shell gland conspicuous. Uterus mid-ventral. Eggs? Vitellaria follicular, extending along esophagus and ceca. Vagina chitinous, with lateral opening. Receptaculum seminis present. Parasitic on marine fishes.

Genotype: *Diplectanocotyla gracilis*.

II. CAPSALIDAE Baird, 1853

22. *Benedenia synagris* n. sp.

Pl. VII, Fig. 28.

Habitat. Gill of *Synagris* sp.

Material and locality. Three mature specimens, fixed in acetic sublimate, stained and mounted; Macassar.

Body 1.0–1.9 mm in whole length, body proper flattened elliptical, 0.4–0.6 mm wide at middle; haptor circular, 0.17–0.33 mm in diameter, with frilled marginal membrane 15 μ wide; haptoral hooks of three pairs; anterior hook 50–63×10–14 μ, pointed anteriorly, terminating posteriorly into two points of different size; middle hook stout, not laminate, well curved, measuring 40–50 μ long from its blunt anterior end to height of curve, 9–17 μ wide; posterior hook consisting of a long powerful root and a minute curved point, 42–57 μ from anterior end of root to height of curve of blade, 10–12 μ wide at its root. Marginal hooklets 9 μ long, of 7 pairs. Anterior adhesive organs saucer-shaped, 0.1–0.18×0.06–0.11 mm, with median incision between them. Two pairs of eye spots anterodorsal to pharynx. Mouth opening just behind posterior pair

of eye spots. Pharynx 0.12 – 0.23 mm in diameter. Ceca narrow, with inconspicuous side branches, terminating blindly a little in front of posterior end of body proper. In the frontal area there are numerous rounded gland cells, part of which intrudes into the base of each anterior adhesive organ.

Testes subglobular, 63 – 100 × 75 – 110 μ, juxtaposed between two ceca at about middle of body. Vas deferens winding, crossing vagina and uterus dorsally, opening into ductus ejaculatorius behind pharynx. Prostatic reservoir elliptical, 60 μ long by 25 μ wide in the type, lying obliquely at base of cirrus pouch which is elongated claviform, 0.18 – 0.21 mm long by 30 – 40 μ wide and extends from the right of the ootype to the left of the pharynx. Cirrus opening on left margin of body at level of pharynx.

Ovary subglobular, 45 – 110 × 72 – 130 μ, median, in front of testes from which it is separated by vitelline follicles, giving rise to germiduct at its anterodextral end. Ootype oval, large, containing a round, filamented shell filled with yolk, and a number of vitelline droplets of varying size. Uterus running alongside cirrus pouch and opening immediately behind the male aperture at the left marginal notch. Vitellaria occupying all available space of body proper except for its two extremities ; vitelline reservoir 20 – 90 μ wide, lying transversely between ovary and seminal receptacle. Vagina opening on dorsal surface posterolateral to uterine pore, running obliquely inward, somewhat widened and then narrowed, continued into flask-shaped receptaculum seminis which is 30 – 40 μ wide and lies just in front of the vitelline reservoir.

This species is characterized by the shape of the haptoral hooks and by the absence of the genital sinus.

III. MAZOCRAEIDAE Price, 1936

23. *Kuhnia scombri* (Kuhn, 1829) Sproston, 1945
Syn. *Octocotyle major* Goto, 1894

Habitat. Gill of *Scomber kanagunta* (Russel).

Material and locality. A single whole mount ; Macassar.

As compared with the original description by Goto the present worm agrees *Kuhnia* (= *Octocotyle*) *major* more closely than *O. minor* though different markedly in the number and size of the

caudal hooks. In the following is given a table of comparison of the species concerned.

	K. major	*K. minor*	Present worm
Body length	ca 4.0	ca 2.0	4.35
Posterior sucker	45×38 μ	30×37 μ	33–45×39–48 μ
Caudal hooks	1 pair[1]	2 pairs	2 pairs[2]
Outer pair	0.1 mm	37 μ	30 μ
Genital pore	at posterior end of esophagus	at middle of esophagus	at posterior end of esophagus
Cirrus spines	5 pairs	6 pairs	5 pairs
Diameter of cirrus bulb .	35 μ	35 – 50 μ	27 μ

24. *Kuhnia otolithis* n. sp.
Pl. VII, Figs. 29 – 30.

Habitat. Gill of *Otolithes* sp.

Material and locality. A single whole mount; Macassar.

Body lanceolate, 2.35 mm long, 0.5 mm wide at about middle. Head truncate, 0.2 mm in diameter, followed by short neck. Cotylophore lightly constricted off, with 4 pairs of short-stalked suckers and a rudimentary caudal lobe bearing a pair of minute hooks[3]. The posterior sucker consists of two valves of different structure; the inner valve is divided into asymmetrical halves, one of which is placoid and 54 – 60 μ long by 36 – 39 μ wide, and the other is smaller and shows a wide, oblique cleft near the base, both having a common trabecular base inside the valve; the outer valve consists of two nearly symmetrical parts, each of which is bordered by an arcuate lateral and a straight medial, chitinous frame, and has a number of transverse or oblique ribs which are simple or branched, straight or arcuate, long or short. The medial frames of the two halves are closely parallel to each other and has a common laterally elongated base articulated with the trabecular base of the inner valve. Mouth terminal, very wide. Anterior suckers round, 75×70 μ, Pharynx 45×50 μ. Esophagus short, bifurcating about

1) It seems probable that there is more than one pair.

2) Between the outer and the inner hook there is another rudimentary hook on each side.

3) The larger anchors may have been lost.

0.2 mm behind head end. Ceca with numerous short side branches, terminating close to each other at posterior end of body proper.

Testes round, 11 in number, arranged in two longitudinal rows, occupying greater median field of middle third of body. Vas deferens strongly twisted in front of ovary, extending from the right side of the unpaired vitelline duct to the left transverse vitelline duct. There is neither distinct pars prostatica nor armed cirrus bulb. No reniform bulbs. Genital pore ventral to intestinal bifurcation, about 0.2 mm from anterior extremity, provided with a circle of six minute strongly incurved hooks.

Ovary vermiform, 0.24×0.25 mm, extending obliquely across the median line in front of testes, with its attenuated proximal portion describing an S-shaped curve immediately in front of right anteriormost testis, and the swollen recurved distal portion just medial to left cecum at junction of anterior with middle third of body. The germiduct runs backward and crossing the unpaired vitelline duct dorsally gives off the genito-intestinal duct and then unites with the vitelline duct. Shell gland extending between left anteriormost testis and distal portion of ovary. Uterine eggs not observed. Vitelline follicles extending along whole length of intestine. The transverse vitelline ducts from the two sides unite with each other at the level of the anterior end of the convoluted vas deferens to form the longitudinal unpaired vitelline duct, which crosses the middle portion of the ovary ventrally. There is no definite vagina, though a large apparently circular fold is seen middorsally in front of the transverse vitelline ducts.

This species is characterized by the rudimentary caudal lobe, the structure of the posterior sucker, the simple terminal genital ducts, the shape of the ovary, etc.

IV. DISCOCOTYLIDAE Price, 1936

25. *Allodiscocotyla chorinemi* n. g., n. sp.

Pl. VII, Figs. 31 – 32.

Habitat. Gill of *Chorinemus moadetta* (Cuv. et Valenc.).

Material and locality. Three mature specimens, of which two had been macerated when fixed in acetic sublimate, and gave somewhat exaggerated measurements; Macassar.

Body elongate, 1.5 – 2.6 mm long by 0.2 – 0.25 mm broad, taper-

ing anteriorly to a conical point. Posteriorly it tapers gradually and then becomes enlarged laterally to form a cotylophore which has 4 pairs of oval, bivalved marginal suckers 63 – 72 μ long by 45 – 57 μ wide and is produced backward to a small trapezoid, medially incised caudal lobe bearing 3 pairs of hooks. The central chitinous piece of the suctorial valve is anchor-shaped at each end, and flanked on each side with a row of 13 ribs extending from one valve to the other. On the valve which has a pair of rod-shaped chitin pieces between the base of the lateral arms and the central piece there are three or four oblique ribs, and on each side a half-X-shaped chitin piece near the top just inside the lateral arms. The caudal hook of the outer pair is 42 – 45 μ long from the free end of the root to the height of the curve of the blade; the root is 15 μ long and shorter than the blade, whose sharp point is nearly parallel to the very prominent stumpy guard. The hook of the inner pair is about 15 μ long, and that of the intermediate pair is rudimentary, measuring only 9 μ.

Mouth opening on ventral side at base of head cone; anterior paired suckers oval, 30 – 36×18 – 24 μ, with a partition at middle. Pharynx rounded, 20 – 30×18 – 21 μ. Esophagus with inconspicuous outgrowths at intervals, bifurcating at level of posterior end of vagina. Intestinal limbs with numerous prominent outgrowths on outer side and some less prominent ones on inner side, terminating close together at base of cotylophore.

Testes round, 18 – 21 in number, arranged in front of ovary in two longitudinal rows in intercecal field of the middle third of body, 8 – 10 on the right, 10 – 11 on the left; 2 or 3 of the left posteriormost testes may lie on the left of the anterior portion of the ovary. Vas deferens winding irregularly between two rows of testes, at the anterior end of which it passes into the pars prostatica. Latter long, up to 24 – 33 μ wide, provided with a thick layer of circular muscle fibers, surrounded throughout by prostate cells, running sinuously in median field between testes and cirrus pouch. Upon entering the cirrus pouch it becomes a little narrower ductus ejaculatorius which is about 70 μ long in the type, devoid of the outer layer of circular muscle fibers, and opens into the unarmed basal portion of the cirrus from the right side. The cirrus is elongate saccular, 70 – 95 μ long by 30 – 33 μ wide, and beset densely on the inner surface of its thin wall with acicular spines which are

about 4–5 μ long and have a discoid base 2.5 μ in diameter. The ductus ejaculatorius and the cirrus are surrounded by a thick layer of longitudinal muscle fibers which forms an elliptical outline 0.12–0.16 mm by 45–80 μ. Genital pore midventral, 0.15–0.33 mm, about one tenth of body length, from anterior extremity.

Ovary very much elongated longitudinally, immediately posttesticular, 0.28–0.48 mm in length, with maximum width of 30–45 μ at its anterior swelling, from which the distal end giving rise to the germiduct is directed backward. The germiduct turns forward at its point where the genito-intestinal duct is given off, and then backward forming a tubular receptaculum seminis 12 μ wide; upon receiving the vitelline duct on the left of the attenuated posterior portion of the ovary it passes into the ascending uterus, which runs forward alongside the vitelline duct and then ventral to the entire course of the male genital ducts. There is no mature egg in the uterus, though an abortive filamented one may be found. The extent of the vitelline follicles coincides with the intestine and its branches; the paired vitelline ducts run obliquely backward and join together ventromedial to the anterior end of the ovary; the unpaired duct is somewhat tapered posteriorly, about 0.15 mm long by 30 μ wide in the type, and lies in the midventral field. The retort-shaped vagina with its posterior end constricted off in form of a bulb, is 0.1–0.13 mm long by 40–60 μ wide and lies obliquely on the right or the left at about the middle of the anterior third of the body. It is lined with folded cuticle and surrounded by fine, circular muscle fibers, and opens ventrally close to the lateral margin of the body; the vaginal duct arising from the anterior portion of the vagina at its posteromedial end divides between the posterior bulb of the vagina and the pars prostatica into two symmetrical ducts; both ducts contain abundant sperm and run backward ventral to the intestinal limbs, and apparently open into the paired vitelline ducts; each of them gives off at the anterior end of the vitellaria a short anterior branch which appears to open outside on the lateral margin of the body at a level a little posterior to the vaginal aperture. Excretory system not made out.

The present genus bears a superficial resemblance to *Discocotyle* Dies., 1850, but differs fundamentally in the posttesticular position of the ovary, and in the structure of the vagina and of the male terminal genitalia.

Allodiscocotyla n. g.

Generic diagnosis: Discocotylidae Price, 1936. Body elongate, tapering anteriorly, Cotylophore with 4 pairs of lateral suctorial valves and a caudal lobe bearing three pairs of hooks. Ceca with side branches, not continuous posteriorly. Testes not very numerous, arranged in two intercecal longitudinal rows in middle portion of body. Pars prostatica strongly muscular, surrounded by well developed prostate cells. Cirrus armed, enclosed with ductus ejaculatorius in muscular sac. Genital pore ventral to esophagus. Ovary strongly elongated longitudinally, post-testicular. Receptaculum seminis and ductus genito-intestinalis present. Vitellaria follicular, extending along entire length of intestinal limbs. Vagina muscular; vaginal duct divided into long symmetrical descending ducts, each of which gives off a short anterior branch opening outside on the lateral margin of the body. Eggs filamented. Parasitic on gills of marine fishes.

Genotype: *Allodiscocotyla chorinemi.*

26. *Vallisia chorinemi* n. sp.
Pl. IX, Figs. 40 – 42.

Habitat. Gill of *Chorinemus moadetta* (Cuv. et Valenc.).

Material and locality. A single whole mount; Macassar.

Body bent at right angles in front of its middle; forebody slender, about 2.0 mm long, 0.138 mm wide at head, attenuated between head and genital pore, somewhat enlarged at level of vagina (0.25 mm in diameter) as well as at its junction with hindbody; hindbody subcylindrical, 2.5×0.5 mm, its anterior end truncate, projecting a little beyond base of forebody; posterior cotylophore with four pairs of pedunculate sucking valves, whose framework is shown in Pl. IX, Fig. 41, produced backward into a trapezoid lobe bearing two pairs of hooks, of which the outer are 42 – 45 μ long with a prominent guard and a curved blade longer than the root, and the inner are rudimentary. Mouth ventroterminal, wide, 90 μ in transverse diameter; paired anterior sucker 42 μ in diameter; pharynx 33×36 μ; esophagus very long (1.1 mm), sending off on each side at irregular intervals several diverticles reaching to lateral margins of body, bifurcating 0.75 mm behind genital pore. Ceca with numerous lateral outgrowths, running along each side of body, apparently united posteriorly in cotylophore, the posteriormost cecal branches intruding into base of caudal hook-bearing lobe; dark pigment dots indicating the extent of the esophagus, ceca and their branches. The anus as observed

by the Italian authors in *Vallisia striata* has not been detected with certainty.

Testes round, about 10, situated in a longitudinal series at middle third of hindbody. Vas deferens winding in median field, surrounded by prostate cells for a considerable length, dilated at about level of vaginal aperture into a tubular terminal organ which is 0.37 mm long, up to 50 μ wide and covered inside except at its posterior end with acicular spines 10 – 15 μ long. Genital pore midventral, 0.435 mm from anterior extremity.

Ovary about 0.4 mm long, may be divided into two portions; anterior portion attenuated, on the right of posterior testes; posterior portion ovoid, about 0.1 mm in diameter, immediately behind posteriormost testis. Shell gland complex just behind ovary. Uterus running by the left side of testes in hindbody; ventral to vas deferens in forebody. Eggs single, fusiform, 66 μ wide with a stiff filament about 0.21 mm long at each pole. Vagina double, wide, tubular, opening laterally at a level 0.34 mm posterior to genital pore. In the vagina there are two groups of denticulate combs on each side, one at the vaginal aperture, and the other about 0.2 mm further behind. The anterior combs, 10 in number, are arranged one behind another in an oblique row : teeth of each comb pointed, directed ventrally or laterally, increasing in number from 2 to 6 from end toward middle. The posterior combs, 5 in number, are massed rather irregularly though showing a tendency toward serial arrangement, and the number of teeth on each comb is fewer, some are pointed, others blunt or rudimentary. The sinuous vaginal ducts arising each from the posterior end of the vagina run backward convergently to unite with each other behind the intestinal bifurcation where the paired vitelline ducts filled with spermatozoa come from the two sides, all joining together to form a long, wide, unpaired vitelline duct which passes ventrosinistral to the testes and by the left side of the posterior oval portion of the ovary just behind which it opens into the germiduct coming from the posterior end of the ovary. Vitelline follicles very small, commencing along lateral edge of body a little behind vaginal aperture, profusely developed among cecal branches, reaching to base of caudal lobe.

This species differs from *Vallisia striata* Parona et Perugia, 1890, in the size of the body, the very long esophagus bifurcating

far posterior to the genital pore, the anterior and posterior extent of the vitellaria, etc.

27. *Protomicrocotyle celebesensis* n. sp.
Pl. IX, Figs. 45–46.

Habitat. Gill of *Caranx* sp.

Material and locality. 6 mature specimens fixed in acetic sublimate under cover glass pressure, stained and mounted; Macassar.

Body flattened fusiform, 4.0–5.1 mm in length, 0.6–0.83 mm in maximum width at or near middle. Anterior extremity pointed; posterior extremity curved to the right or left, with a longitudinal row of 4 chitinous suctorial valves on the right or left margin which is expanded and folded owing to excessive asymmetrical development, terminating in a laterally enlarged lobe bearing 3 pairs of hooks along the posterior margin. Each suctorial valve may have a shelf-like basal lobe of its own, except for the last two valves, for which any definite lobe may not be developed. The caudal lobe is distinctly striated transversely like the posterior end of the body proper, giving a serrate appearance in profile. Of the marginal hooks the two lateral are larger than the medial and have a ventral root with two nodular tips, measuring 30–35 μ from the base to the height of the curve of the blade, and 20–27 μ broad at the base, to which are attached subcuticular longitudinal muscle fibers coming from the lateral part of the body proper. The medial hooks are definitely smaller, 15–20 μ from the bifid dorsal root to the height of the curve of the blade; their retractor muscle fibers are more poorly developed than those of the outer hooks. All the points of the four hooks are directed ventrally. On the outer side of each medial hook is seen a very minute hook resembling the marginal hooklet of the Dactylogyridae. The chitinous framework of the suctorial valve consists of two pairs of lateral arms, a pair of curved apical pieces, a pair of plump basal rods, and an unpaired central piece. The longer prong of the central piece with a dozen transverse ribs on each side terminates in a single point, but is expanded on the inner side of this point to a T-shaped structure; the shorter prong is broader and divides into two truncate lobes.

Mouth subterminal, wide. In the buccal cavity there is on each side a round sucker 30–48 μ by 27–45 μ, and at the base is a

subglobular pharynx 39–60 μ long by 37–50 μ wide. Esophagus simple or with few side branches, bifurcating at about level of genital pore. Ceca with numerous side branches, extending to near caudal lobe.

Testes subglobular to oval, 50–100×90–150 μ, 40–55 in number, extending in two longitudinal rows one on each side of median line from posterior end of anterior third of body to ovary; each row may be double at some places. Vas deferens tightly coiled in pretesticular median field for a distance of 0.25–0.4 mm, then straightened out to a simple tube; cirrus forming a weakly muscular bulb provided with a crown of 16–22 acicular spines which are 6–12 μ long, and to the somewhat thickened bases of which are attached short muscle fibers enclosing the bulbus cirri. Common genital pore opening just in front of cirrus, 0.375–0.63 mm from anterior extremity.

Ovary longitudinally elongated, turned back on itself at both ends, 0.65–0.85×0.2–0.35 mm, situated in posttesticular median field with the swollen distal end on the right. Before joining the vitelline duct the germiduct may be widened and thrown into convolutions, probably serving as a receptaculum seminis. Genitointestinal duct present. Shell gland compact, rosette-shaped. Uterus midventral, containing few eggs. Eggs fusiform to elliptical, 165–210×60–80 μ, with a rigid filament 0.24–0.3 mm long at each pole. Vitellaria follicular, surrounding intestine and its branches, commencing at level of anterior end of coiled vas deferens, terminating at posterior end of body proper without intruding into caudal lobe. Vitelline duct Y-shaped, ventral to ovary; the two arms uniting usually at anterior end of ovary; the stem a little to right or left of median line. Vagina oblique, opening ventrally near the lateral (right or left) margin of body, 0.5–0.83 mm from anterior extremity, provided with numerous short and long spines. Near the vaginal aperture some spines are curved at the tip, while all the others are covered with minute spiniform hairs at their blunt tip. Vaginal duct atrophied. A very narrow short passage lined with cuticle is seen at the posteromedially directed inner end of the vagina, probably representing the rudiment of the vaginal duct.

This species differs from *Protomicrocotyle mirabilis* (MacCallum, 1918) in the shape of the body and the characters of the egg,

and from *P. pacifica* Meserve, 1938, in structure of the terminal genitalia as well as in the number of the testes, etc.

V. MICROCOTYLIDAE Taschenberg, 1879

28. *Metamicrocotyla bora* n. g., n. sp.[1]

Pl. VIII, Figs. 33-34.

Habitat. Gill of *Mugil cephalus*.

Material and locality. Two mature specimens stained and mounted; Macassar.

Body 10.5-13 mm long, 1.23-1.26 mm wide at about junction of anterior with middle third, whence it tapers anteriorly to a blunt point, but rather slowly toward the posterior extremity bearing 27 pairs of suctorial valves. The framework of this valve, 45-90 μ in diameter, consists of two pairs of chitinous arms, a pair of basal bars and an unpaired central piece, whose anterior prong reaching to the ends of the anterior arms terminates in a small triangle with a slight median notch, while the shorter posterior prong bifurcates near its base with a dagger-shaped supplementary piece resting on its forked end. The muscle fibers attached to the valves are continued into the body proper without forming definite bundles. Caudal anchors lacking. Anterior sucker elliptical, muscular, 72-81×45-60 μ, with a row of denticles along its margin. Pharynx oval, 45×33 μ. Esophagus 0.65-1.3 mm long, with uneven outline, bifurcating 0.82-1.4 mm from anterior extremity. Ceca with numerous, comparatively wide diverticles on each side; the left cecum extends as a simple tube to near the posterior end of the cotylophore.

Testes over a dozen in number, situated in intercecal field at middle third of body, not reaching to base of cotylophore. Vas deferens simple, running in median field dorsal to uterus. Neither cirrus nor cirrus pouch. Genital atrium provided on each side with 3 paired groups of chitinous spines or hooks; the anterior group consists on either side of 5 or 6 simple spines which are 95-110 μ long and whose slightly incurved distal portion projects freely toward the genital pore; the middle and posterior groups consist on either side of 6 and 7 hooks (65-70 μ long) respectively, the

1) The specific name is the Japanese name for the host.

claw-like distal portion projects into the base of the genital atrium beside the uterine pore with the points of the two groups directed opposite to each other, and the longer gently arcuate proximal portion is imbedded in the dense bolster of fine muscle fibers. Genital pore comparatively wide, surrounded by circular muscle, opening 0.45 – 0.73 mm from anterior extremity.

Ovary roughly in form of an interrogation mark; attenuated posterior end turned back on itself, situated at posterior end of anterior third of body. The somewhat winding germiduct arising from the distal end of the ovary runs backward along the right side of the longitudinal portion of the ovary and forms an inconspicuous fusiform swelling just before giving off the genito-intestinal duct. The latter duct crosses this swelling ventrally and opens into the right cecum. Shell gland cells are massed around the beginning of the uterus lying sinistral to the longitudinal portion of the ovary. No eggs were observed, though a long, convoluted polar filament with a claviform point was seen at the distal end of the uterus. Vitellaria commencing at level of genital atrium or immediately behind it, terminating a short distance posterior to midbody, leaving a considerable posterior portion of ceca free. Vitelline ducts Y-shaped, ventral to ovary; the posterior end of the unpaired stem curves toward the right to join the germiduct ventral to the ovary. Vagina lacking.

This genus is distinguished from *Microcotyle* by the complete absence of the vagina. The abrupt evanescence of the vitellaria in the posterior part of the body may be of specific significance in view of the posterior extent of the gland in another species of the same genus described below.

29. *Metamicrocotyla filiformis* n. sp.
Pl. VIII, Figs. 35 – 36.

Habitat. Gill of *Mugil cephalus*.

Material and locality. A single mature specimen stained and mounted as usual; Macassar.

Body slender, rather filiform, 12 mm long, 0.36 mm in maximum width at level of ovary. Cotylophore 1.3 mm long, bearing 48 suctorial valves on the right and 53 on the left: the chitinous framework of the valve, up to 75 μ in diameter, consists of two pairs of slender lateral arms, one pair of basal rods and an unpaired

central piece, whose longer ramus terminates in a small triangular knob, but whose shorter broader ramus terminates in a furca, to which a dagger-shaped accessory piece is appended. The fine muscle fibers attached to the suctorial valves are massed into a powerful bundle which runs up forward in the intercecal field to be dispersed in the body parenchyma in the testicular region.

Anterior extremity is nearly as wide as the blunt-pointed head end which is 0.12 mm in diameter. Anterior sucker oval, 60×45 μ, with a row of minute teeth along its free margin. Pharynx 33×30 μ. Esophagus 0.36 mm long, with several inconspicuous outgrowths on each side, bifurcating just behind genital pore. Ceca with side branches on each side as far back as posterior extent of testes, and then turn into narrow, simple tubes, of which the left reaches to the middle of the cotylophore, but the right terminates in front of it.

Testes very much elongated longitudinally, about 70 in number, placed in one row or two in postovarian intercecal field for a distance of about 4.5 mm. Vas deferens simple, median, opening directly into genital atrium. Neither cirrus nor cirrus pouch. Genital atrium opening at a distance of 0.43 mm from anterior extremity, provided on each side with 12 spines which are divided into three groups of four each; the anterior spines are about 50 μ long with their simple points directed forward and inward, while the middle and posterior spines are about 40 μ long, and the claw-like points of the two groups are directed opposite to each other; the posterior spines are imbedded for the most part in a muscle bolster.

Ovary long, tubular, winding, measuring as a whole 1.0 mm long by 0.21 mm wide, situated behind middle of anterior third of body. Germiduct arising from backwardly directed distal end of ovary, running somewhat sinuously between right cecum and ovary, widened and turned back on itself just before giving off very short genito-intestinal duct. Shell gland compact, situated at the point where the germiduct receives the vitelline duct. Eggs not observed. Vitellaria rather poorly developed along intestine and its branches; vitelline duct Y-shaped, ventral to ovary, with the posterior end of its stem curved to the right to join the germiduct. Vagina lacking.

This species is distinguished from the genotype by the more slender body shape, the number of the suctorial valves and of the

testes, the size and number of the atrial spines, the posterior extent of the vitellaria, etc.

Metamicrocotyla n. g.

Generic diagnosis: Microcotylidae Taschenberg, 1879. Body elongate. Cotylophore with symmetrical rows of suctorial valves of uniform structure, without caudal anchors. Anterior suckers with marginal denticles. Intestinal limbs extending into cotylophore on one side. Testes variable in number, postovarian. Neither cirrus nor cirrus pouch. Genital atrium provided with paired groups of spines or hooks. Ovary winding, in anterior half of body. Eggs filamented. Ductus genito-intestinalis present. Vitellaria lacking or poorly developed in posterior part of body. Vitelline duct Y-shaped, ventral to ovary. Vagina lacking. Parasitic on gills of marine fishes.

Genotype: *Metamicrocotyla bora.*

Other species: *M. filiformis.*

30. *Heteromicrocotyla carangis* n. g., n. sp.
Pl. VIII, Figs. 37-39.

Habitat. Gill of *Caranx* sp.

Material and locality. 4 gravid examples stained and mounted; Macassar.

Body elongated fusiform, 5.5-6.7 mm in length, 0.5-0.7 mm in maximum width at about middle, whence it tapers anteriorly to a blunt point. Cotylophore 1.75-2.0 mm long, tapering posteriorly, with asymmetrical sides, bearing 25-26 sessile suctorial valves on the right and 13 or 14 pedunculate suctorial valves on the left. The chitinous framework of the sessile valve, measuring 40-70 μ by 65-130 μ and smaller toward both ends of the row, consists of 3 pairs of slender, marginal pieces and an X-shaped central piece; of the marginal pieces the anterior is U-shaped, the lateral C-shaped, and the smallest posterior simply arcuate. The two anterior arms of the central piece reach to the U-shaped marginal pieces, and the widely divergent posterior arms extend into the open area of the C-shaped marginal piece. The pedunculate valve is mushroom-shaped, 80-100 μ long, 60-70 μ wide at the distal part, and consists of 4 pairs of lateral pieces and an unpaired central piece, whose longer arm terminates in a small pickaxe and whose shorter arm terminates in a cross. The smaller apical piece of the lateral frame is simple and apparently articulated with the curved portion of the larger lateral frame. Between the halves of

the valve at the base is a pair of minute slightly curved spiniform pieces.

Head 0.13 – 0.15 mm wide, truncate in front, may or may not have a knob-like protuberance at the middle of the front end. In the buccal cavity there are two small discoid symmetrical suckers 35 – 40 μ by 45 – 50 μ. Pharynx oval, 30 – 45×27 – 30 μ. Esophagus about 0.25 mm long in the type, with few side branches, bifurcating at a distance of 0.3 – 0.5 mm from anterior extremity. Intestinal limbs with branches on each side, terminating in cotylophore at different levels, reaching to near its posterior end on the side bearing pedunculate valves; the inner branches in the testicular region as well as the outer ones at the base of the cotylophore on the side bearing the sessile valves are considerably long.

Testes oval to elliptical, 45 – 50 in number, 60 – 120 × 30 – 90 μ, arranged in one layer in postovarian intercecal field, partly intruding into basal portion of cotylophore. Vas deferens running forward on the left of median line as far as vagina, in front of which it comes to the median field and is surrounded for its entire terminal portion by comparatively small, round to oval prostate cells which extend further over the cirrus pouch. There is a larger elliptical cirrus pouch 0.12 – 0.15 mm long by 60 – 70 μ wide and consisting of three layers of very fine muscle fibers; an outer and an inner layer of longitudinal fibers and a thick middle layer of circular fibers, the whole thickness amounting to 20 μ in the type. The cylindrical cirrus, covered with slightly curved spines about 6 μ long, is 60 – 75 μ long by 21 – 24 μ wide, and projects into the genital atrium. The latter is cylindrical, 0.1 – 0.27 mm long, and provided with a circle of minute spines at the level of the anterior end of the cirrus. At the ventral opening which lies 0.18 – 0.28 mm from the anterior extremity, it is surrounded by circular muscle fibers and armed inside with over a dozen simple spines 15 – 20 μ long. On each side of this genital pore there is an oval mass of granular structure inclosed in a capsule of lameller muscle fibers.

Ovary irregular in shape, situated just in front of midbody with the right swollen distal end turned back on the attenuated proximal portion and the left folded middle portion reaching as far back as the posterior end of the unpaired vitelline duct. The germiduct provided with circular muscle fibers arises from the distal end of the ovary and runs backward ventral to the proximal portion of the

ovary and gives off the genito-intestinal duct similar in structure. From this point the wall of the germiduct becomes membranous like that of the vitelline duct with which it unites at the anterior end of the testicular area. Uterus distended with numerous eggs, which are oval to elliptical, comparatively thin-walled, 170 – 190 μ long by 80 – 100 μ wide, and produced at each end into a very long entangled filament. Vitellaria follicular, extending throughout the length of intestine and its branches; the Y-shaped vitelline duct lies ventral to the ovary. The wide simple vagina, surrounded by fine muscle fibers, opens dorsally on the right of the median line about midway between the intestinal bifurcation and the ovary (1.25 mm from the anterior extremity in the type); the vaginal duct arising from the posterior end of the vagina runs backward along the inner margin of right vitellaria and empties into the right vitelline duct at its base.

The present genus resembles *Microcotyle* van Beneden et Hesse, 1863, in general anatomy, but is distinguished from it by the posterior suctorial valves of one side being quite different in structure from those of the other side. It may be defined as follows.

Heteromicrocotyla n. g.

Generic diagnosis: Microcotylidae Taschenberg, 1879. Body elongate. Cotylophore with asymmetrical rows of suctorial valves of different structure; on one side the valves are sessile, and consist of three pairs of arched marginal chitinous pieces and an X-shaped central piece, while on the other side they have a moderately long stalk and consists of four pairs of lateral chitinous pieces, U-shaped central piece and a pair of basal spiniform pieces. No caudal anchors. Head with two small paired suckers and a pharynx. Intestinal limbs with side branches, extending into cotylophore. Testes numerous, postovarian. Vas deferens simple. Muscular cirrus pouch present; cirrus armed with spines, projecting into genital atrium, which opens midventrally at level of esophagus. Ovary crooked, in middle third of body. Eggs numerous, filamented at each pole. Vitellaria extending whole length of intestine, paired vitelline duct uniting together ventral to ovary. Vagina opening dorsally in submedian line some distance posterior to intestinal bifurcation; vaginal duct opening into right vitelline duct. Parasitic on gills of marine fishes.

Genotype: *Heteromicrocotyla carangis.*

31. *Gotocotyla meservei* n. sp.[1]
Pl. IX, Figs. 43 – 44.

1) Named in honor of the American parasitologist, F. G. Meserve.

Habitat. Gill of *Elagatis* sp.

Material and locality. Several mature specimens stained and mounted; Macassar.

Body elongate, pointed anteriorly, 2.8–3.7 mm long by 0.18–0.38 mm wide. Cotylophore tapering posteriorly, 0.65–1.1 mm long, with 25–44 suctorial valves on each side; caudal lobe shield-like, 45×30 μ, notched between two terminal hooks which are about 40–45 μ long, with a prominent guard and a strongly curved point. The suctorial valve consists of two pairs of asymmetrical lateral arms, a λ-shaped apical piece, and a U-shaped central piece which is widely bifurcated at one end near the base of the valve but produced into a long slender rod at the other end. Besides these chitinous frames there are on the side with strong lateral arms two solid chitinous pieces, one at the base of the valve, and the other intercalated between this and the stouter arm of the λ, with its sleeve-like inner margin modified into a slender rod reaching to the base of the short spiniform process of the basal vesicular structure on the opposite side. Between this basal vesicle and the weaker arm of the λ is a hollow chitinous tube serving as a support for the latter. Just inside the weak lateral arms there is a pleural membrane supported by a row of 7 transverse chitinous ribs.

Head rather pointed. Mouth subterminal. Anterior sucker 30×24–27 μ, pharynx 30×24 μ. Esophagus short, bifurcating at a level 0.125–0.32 mm from anterior extremity. Ceca with narrow side branches, may extend a short distance into cotylophore. Testes round, 100–120 in number, massed together in one layer between ovary and cotylophore, occupying almost whole of this region, where the intestinal limbs are greatly atrophied and their branches are seen among the testes as mere septa indicated by pigment cells. Vas deferens slightly widened distally. There is a subelliptical cirrus pouch of longitudinal and circular muscle fibers. It measures 0.12–0.16 mm long by 35–60 μ wide and contains a simple ductus ejaculatorius and a cylindrical cirrus which is 40–60 μ long by 24–30 μ wide and densely beset with spines. Genital pore immediately behind intestinal bifurcation, 0.13–0.18 mm from anterior extremity.

Ovary very long and slender, doubled up, situated in median field just in front of midbody. Genito-intestinal duct provided with circular muscle fibers, opening into right cecum at level of paired

vitelline ducts. Eggs about 0.2 mm long, with rigid filament at each pole. There is neither vagina nor adhesive organ as described by Ishii for the genotype. Vitellaria commencing at a distance of 0.4–0.6 mm from anterior extremity and terminating at about middle of testicular region; vitelline duct Y-shaped, ventral to ovary.

This species differs from *G. sawara* Ishii, 1936, in body size, in the absence of the dorsal "adhesive organ" and of the vagina, in the number of suctorial valves, etc., and from *G. elagatis* Meserve, 1938, in the number and structure of the suctorial valves, and the number of the testes, as well as in the structure of the terminal genitalia, though resembling very closely in general appearance.

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Explanation of Plates[1)]

Plate I

Fig. 1. *Ancyrocephalus macrogaster* n. sp.
Fig. 2. *Ancyrocephalus bilobatus* n. sp., dorsal view.
Fig. 3. *Ancyrocephalus spinicirrus* n. sp.
Fig. 4. *Ancyrocephalus platycephali* n. sp.

Plate II

Fig. 5. *Haliotrema upenei* n. sp., dorsal view.
Fig. 6. *Metahaliotrema scatophagi* n. g., n. sp.
Fig. 7. *Haliotrema lutiani* n. sp.

Plate III

Fig. 8. *Haliotrema caesionis* n. sp., dorsal view.
Fig. 9. *Metahaliotrema arii* n. sp.
Fig. 10. *Pseudohaliotrema* (*Pseudohaliotrema*) *sphincteroporus* n. g., n. sp.
Fig. 11. Terminal genitalia of *Pseudohaliotrema* (*P.*) *sphincteroporus*.
Fig. 12. Terminal genitalia of *Pseudohaliotrema* (*P.*) *sigani*.

Plate IV

Fig. 13. *Pseudohaliotrema* (*Pseudohaliotrema*) *sigani* n. sp., dorsal view.
Fig. 14. Posterior extremity of *Pseudohaliotrema* (*P.*) *sigani*.
Fig. 15. *Pseudohaliotrema* (*Pseudohaliotrematoides*) *fusiforme* n. subg., n. sp., dorsal view.
Fig. 16. Terminal genitalia of *Pseudohaliotrema* (*Pseudohaliotrematoides*) *fusiforme*.
Fig. 17. *Hamatopeduncularia arii* n. g., n. sp.

Plate V

Fig. 18. *Diplectanum serrani* n. sp.
Fig. 19 *Pseudolamellodiscus sphyraenae* n. g., n. sp.
Fig. 20. *Lamellodiscus flexuosus* n. sp., dorsal view.
Fig. 21. Genital complex of *Lamellodiscus flexuosus*, dorsal view.

Plate VI

Fig. 22. *Lamellodiscus convolutus* n. sp.
Fig. 23. *Lamellodiscus difficilis* n. sp. dorsal view.
Fig. 24. Copulatory organ of *Lamellodiscus difficilis*, dorsal view.
Fig. 25. *Lamellodiscus duplicostatus* n. sp., dorsal view.
Fig. 26. Atrial spines of *Metamicrocotyla filiformis*.

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1) Unless otherwise indicated all the figures are in ventral view,

Plate VII

Fig. 27. *Diplectanocotyla gracilis* n. g., n. sp.
Fig. 28. *Benedenia synagris* n. sp.
Fig. 29. *Kuhnia otolithis* n. sp.
Fig. 30. Framework of posterior sucker of *Kuhnia otolithis.*
Fig. 31. *Allodiscocotyla chorinemi* n. g., n. sp.
Fig. 32. Framework of posterior sucker of *Allodiscocotyla chorinemi.*

Plate VIII

Fig. 33. *Metamicrocotyla bora* n. g., n. sp.
Fig. 34. Framework of posterior sucker of *Metamicrocotyla bora.*
Fig. 35. *Metamicrocotyla filiformis* n. sp. in three parts.
Fig. 36. Framework of posterior sucker of *Metamicrocotyla filiformis.*
Fig. 37. *Heteromicrocotyla carangis* n. g., n. sp.
Fig. 38. Framework of pedunculate posterior sucker of *Heteromicrocotyla carangis.*
Fig. 39. Framework of sessile posterior sucker of *Heteromicrocotyla carangis.*

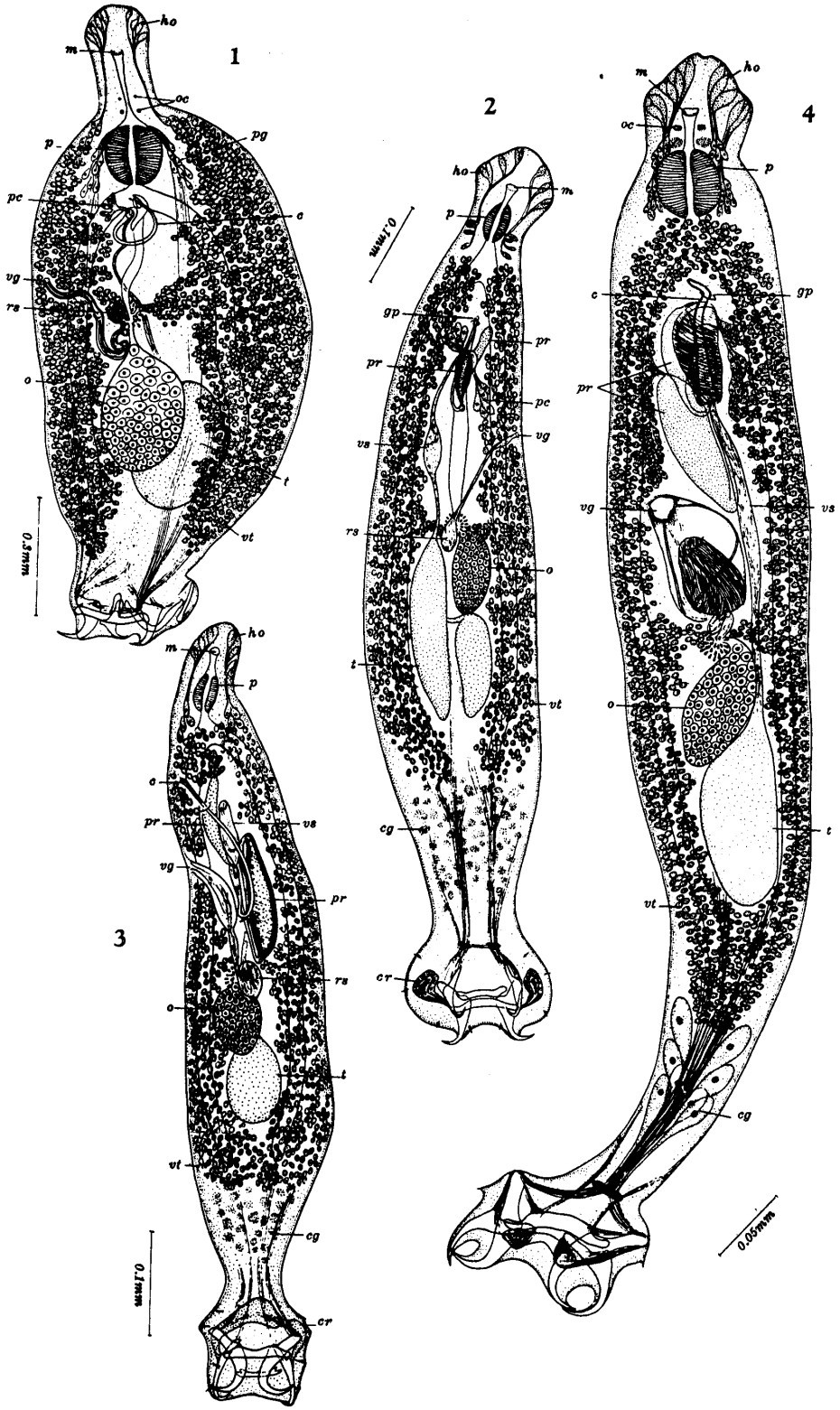
Plate IX

Fig. 40. *Vallisia chorinemi* n. sp., forebody in ventral view, hindbody in dorsal view.
Fig. 41. Framework of posterior sucker of *Vallisia chorinemi.*
Fig. 42. Anchors of *Vallisia chorinemi.*
Fig. 43. *Gotocotyla meservei* n. sp.
Fig. 44. Framework of posterior sucker of *Gotocotyla meservei.*
Fig. 45. *Protomicrocotyle celebesensis* n. sp.
Fig. 46. Framework of posterior sucker of *Protomicrocotyle celebesensis.*

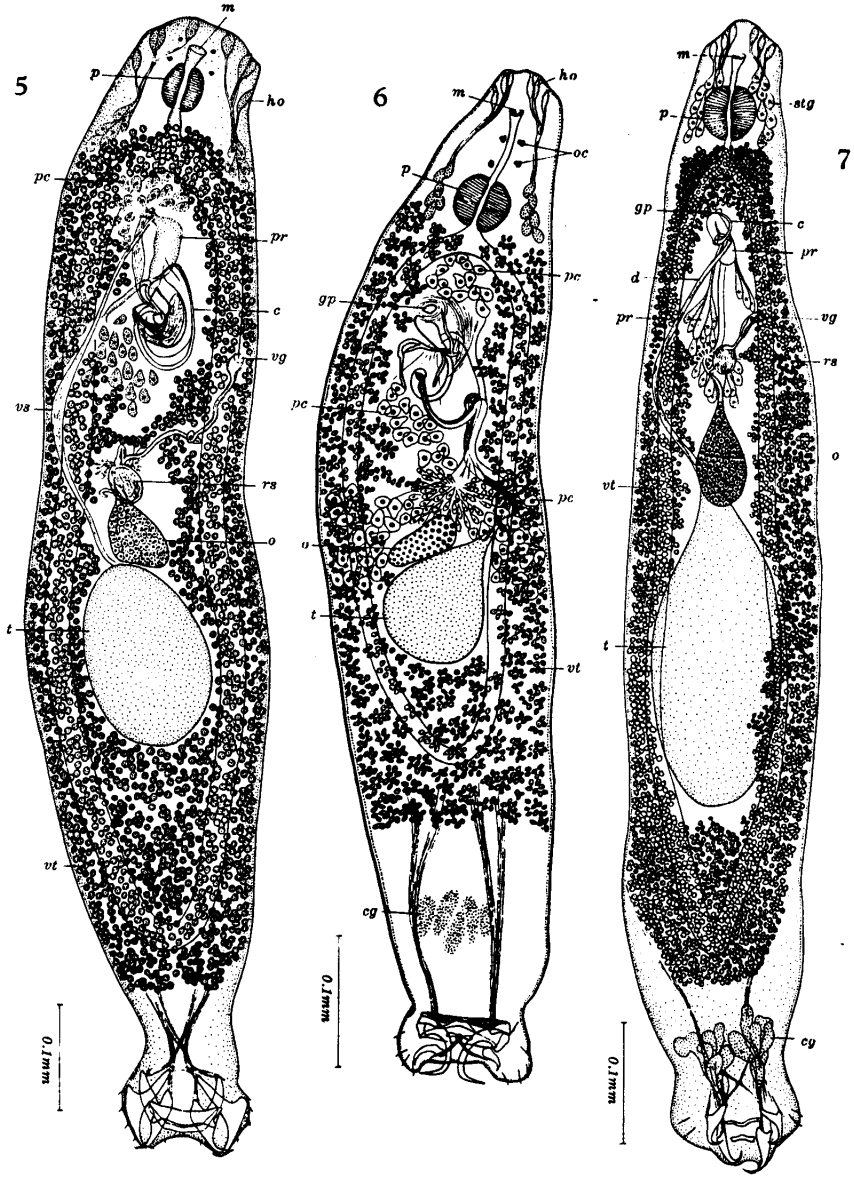
Abbreviations used in Figures

ap = accessory piece, as = anterior sucker, at = genital atrium, avg = accessory vagina, c = cirrus, cg = cement gland, cr = cement reservoir, d = vas deferens, de = ductus ejaculatorius, e = esophagus, eg = egg, gi = genito-intestinal duct, gp = genital pore, ho = head organ, i = intestine, m = mouth, o = ovary, oc = eye spot, ot = ootype, p = pharynx, pc = prostate cell, pg = pharyngeal gland, pp = pars prostatica, pr = prostatic reservoir, ps = posterior sucker, rs = receptaculum seminis, sg = shell gland, sq = squamodisc, stg = sticky gland, t = testis, u = uterus, vd = vitelline duct, vg = vagine, vr = vitelline reservoir, vs = vesicula seminalis, vt = vitellaria, * = structure *sui generis.*

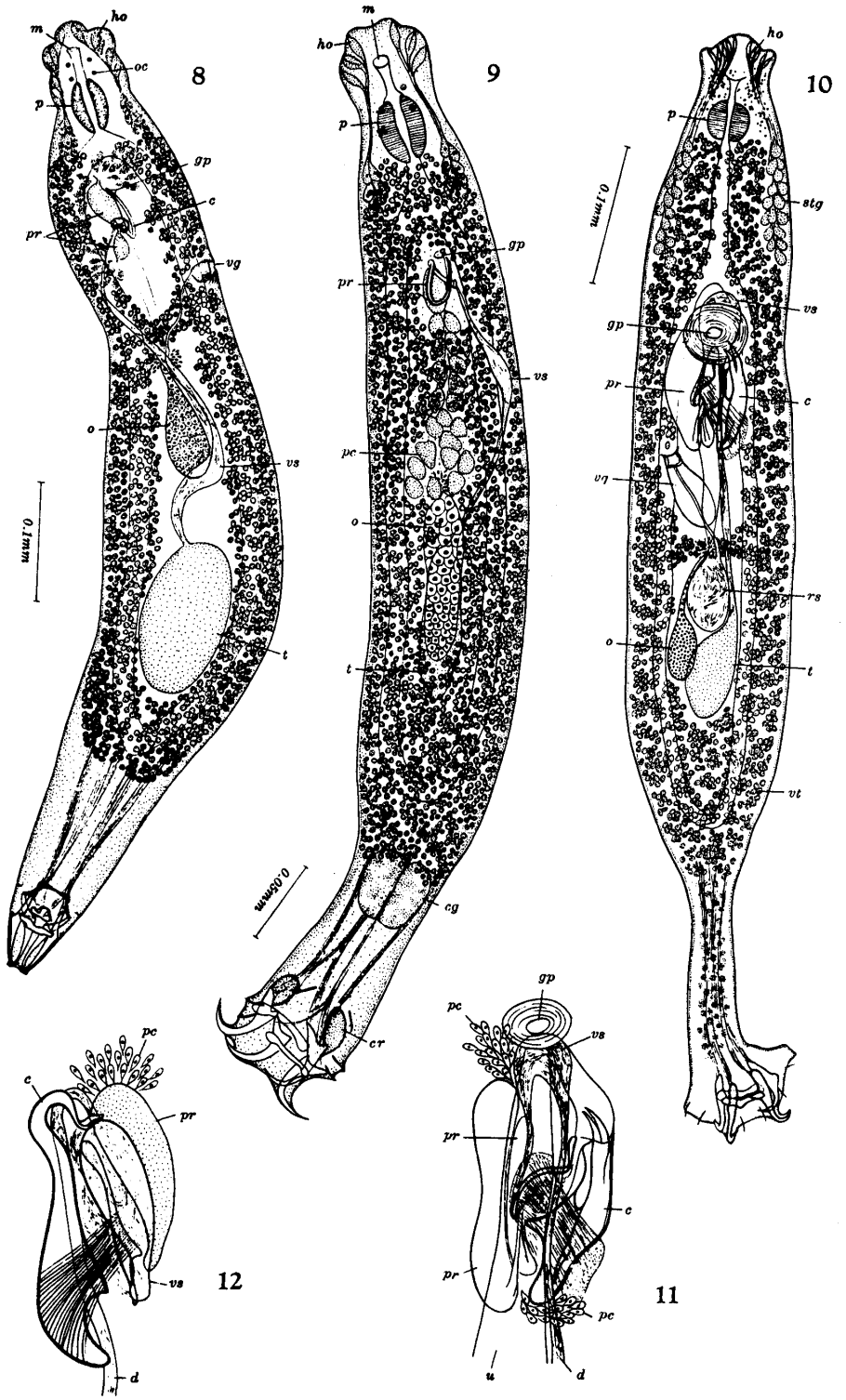
YAMAGUTI: MONOGENETIC TREMATODES OF FISHES Pl. I



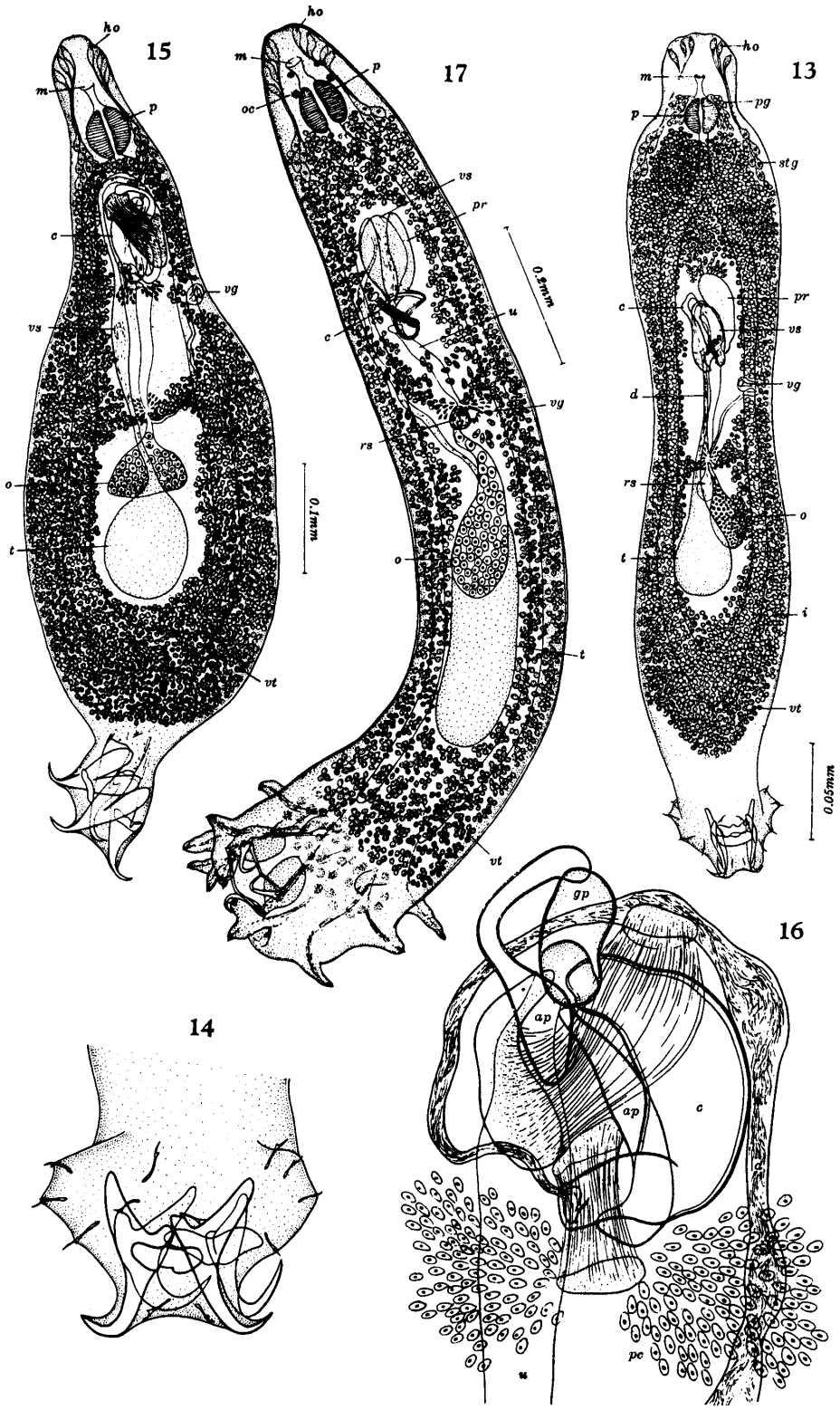
YAMAGUTI: MONOGENETIC TREMATODES OF FISHES Pl. II



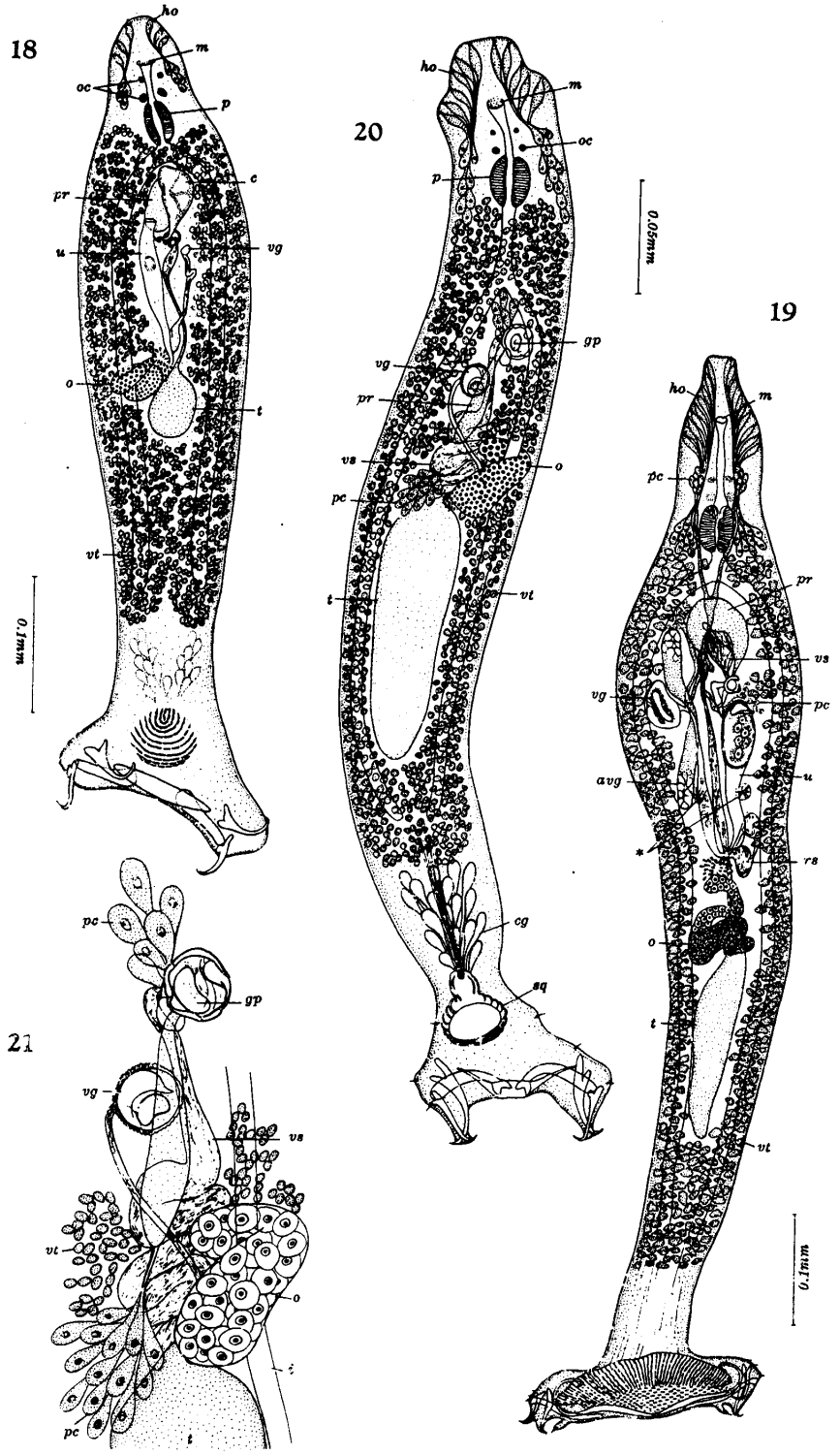
YAMAGUTI: MONOGENETIC TREMATODES OF FISHES Pl. III



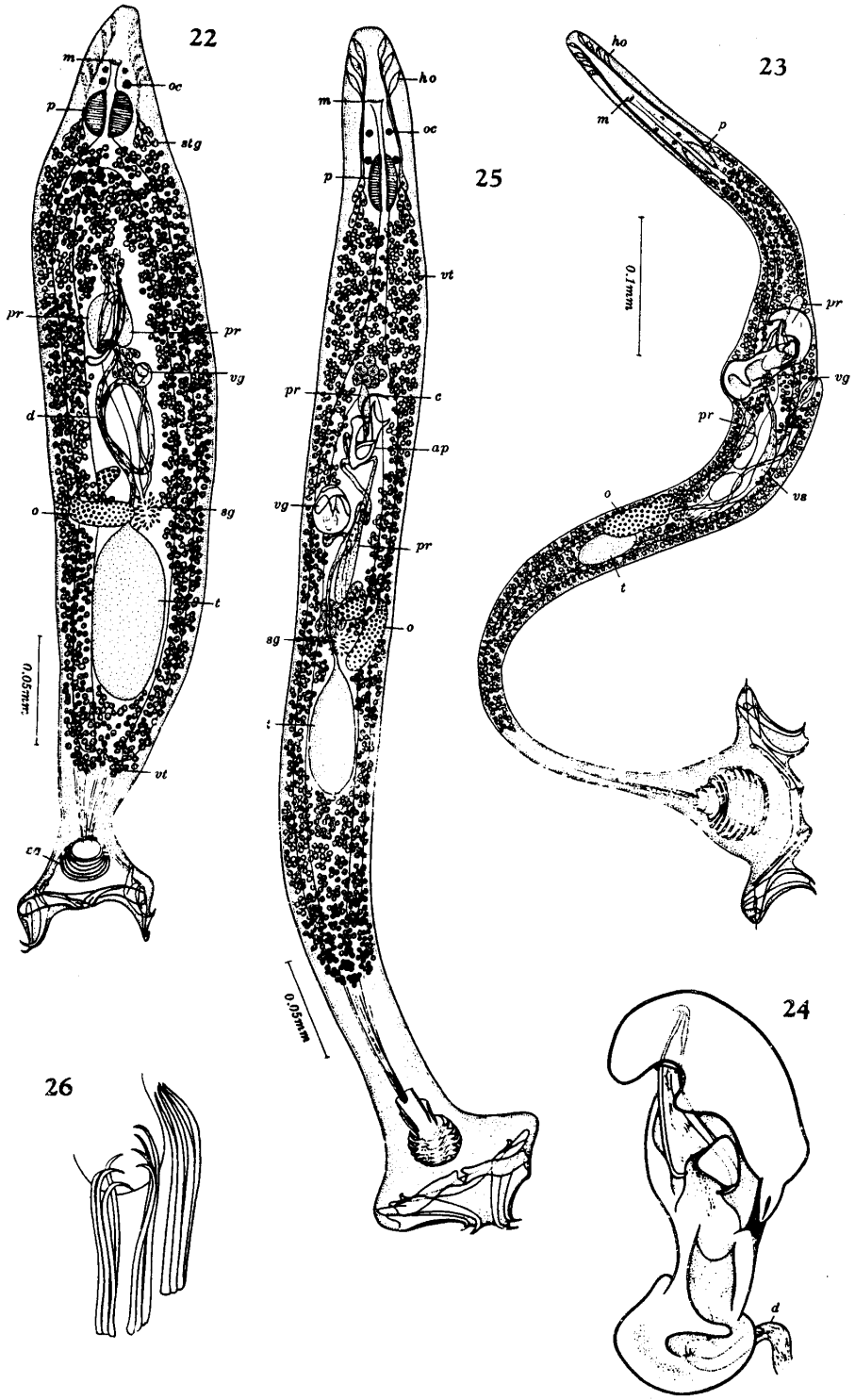
YAMAGUTI: MONOGENETIC TREMATODES OF FISHES Pl. IV



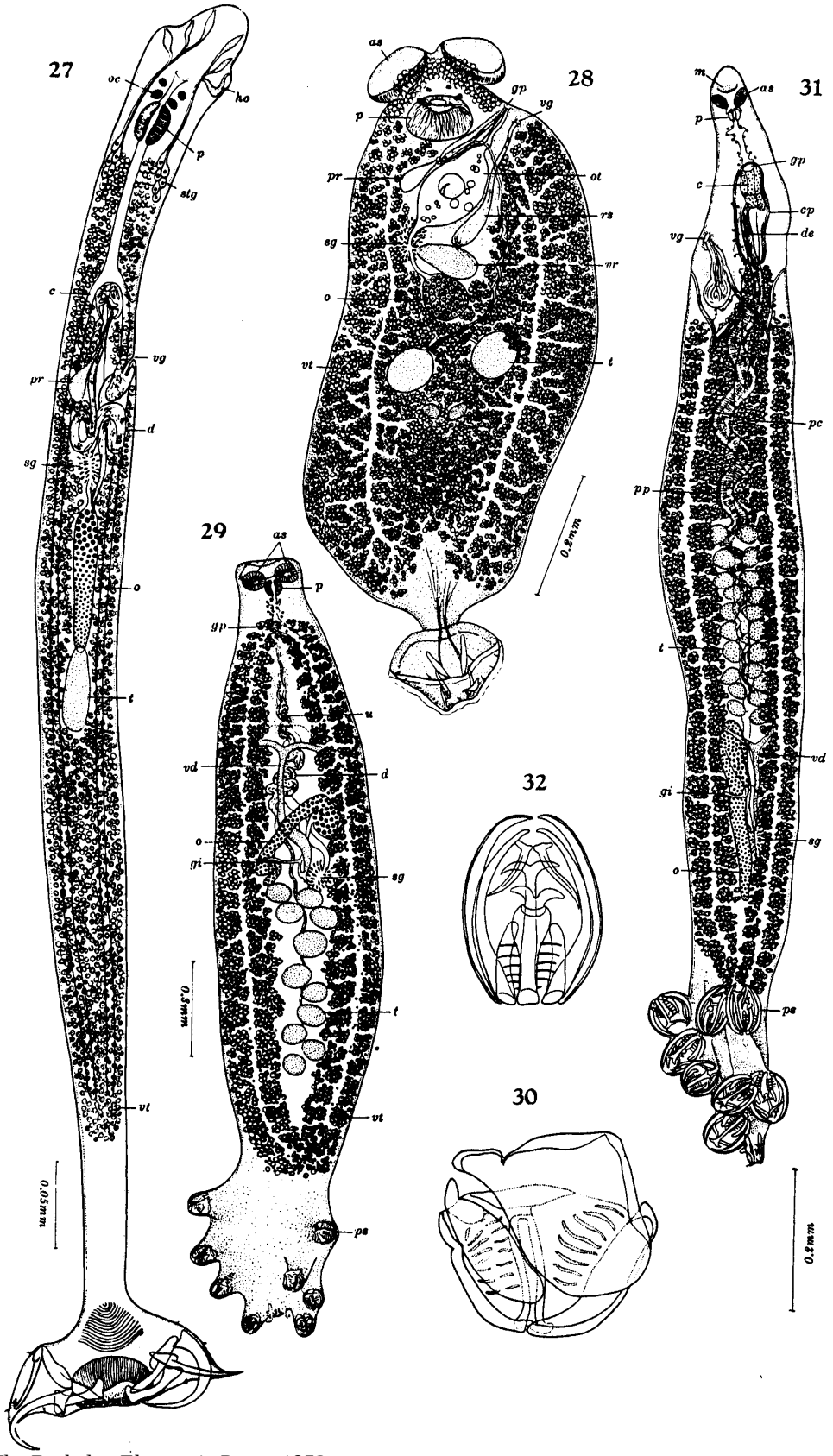
YAMAGUTI: MONOGENETIC TREMATODES OF FISHES Pl. V



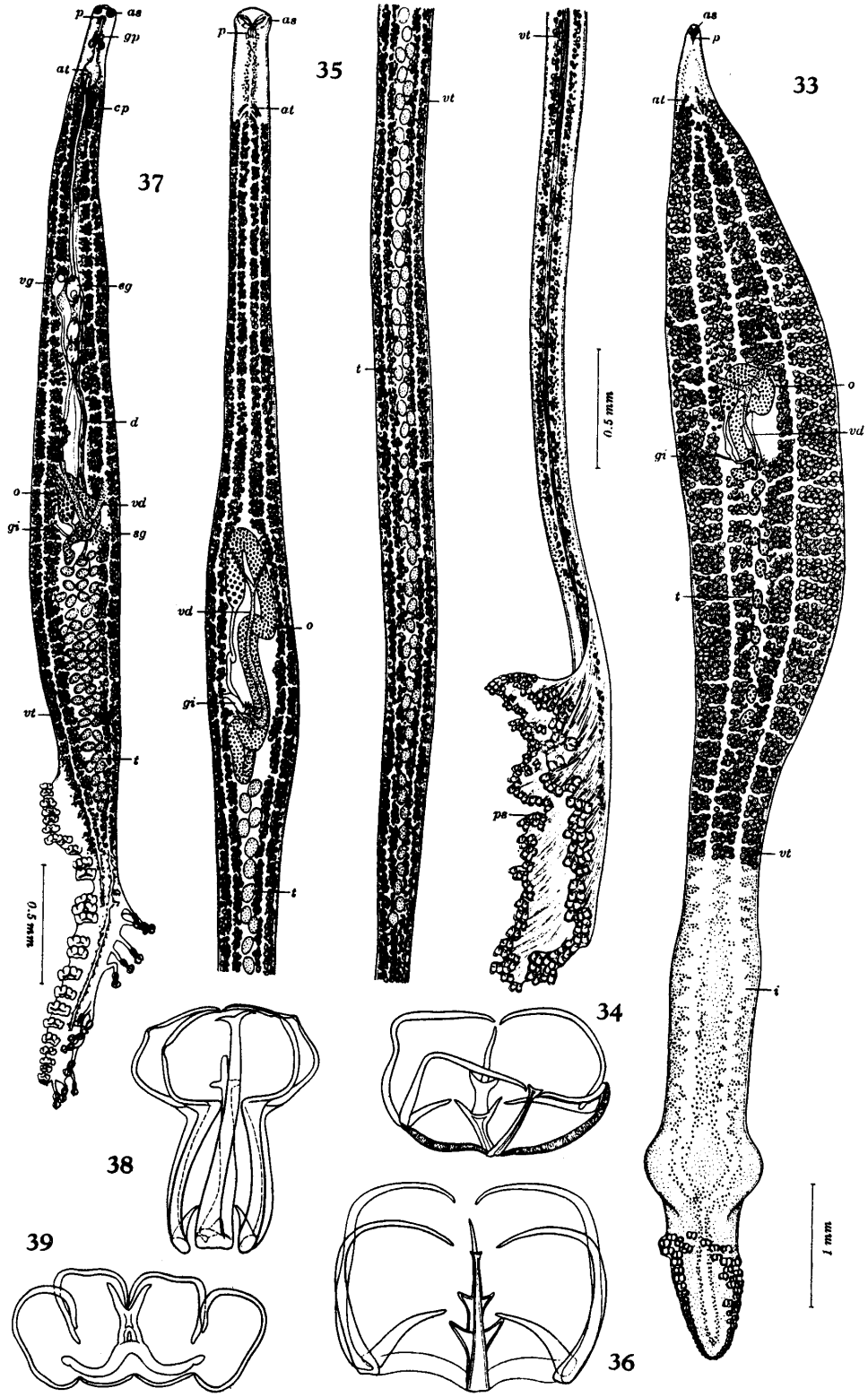
YAMAGUTI: MONOGENETIC TREMATODES OF FISHES Pl. VI



YAMAGUTI: MONOGENETIC TREMATODES OF FISHES Pl. VII



YAMAGUTI: MONOGENETIC TREMATODES OF FISHES Pl. VIII



YAMAGUTI: MONOGENETIC TREMATODES OF FISHES Pl. IX