TREMATODES FROM INDIAN MARINE FISHES

Part I. On Some New Monogenetic Trematodes of the Sub-orders *Monopisthocotylea* Odhner, 1912 and *Polyopisthocotylea* Odhner, 1912

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CONTENTS

I. Introduction

This paper is one of a series of papers on the trematodes of marine fishes of the Indian coast. Parts II and III of this series dealing with new Gasterostomes and Prosostomes respectively have already been published (Chauhan, 1943). This paper contains description of some ectoparasitic monogenetic trematodes and surprisingly enough is the first record of this group of worms obtained from India with the exception of a form obtained from the gill chambers of two species of fresh water fishes, *Punctius puckelli* and *P. ticto* by Dr. V. N. Moorthy from Chitaldrug and described by Price (1938) under the name *Dactylogyrus moorthyi* Price, 1938. In view of the fact that our knowledge of the Indian forms of this group of trematodes is limited only to one species*, I have ventured to make the present paper more elaborate than is usual for such type of work.

II. Material and Method

In November-December 1939 and December-January 1940–41, I examined at Bombay about two hundred marine fishes for parasites; all possible locations, *e.g.*, intestine, gills, skin, mouth cavity were examined. Parasites were fixed in Bouin's Fluid and preserved in 70% alcohol. Thick forms were slightly pressed between two slides and then immersed in the fixative. The specimens were stained by Delafield's Hæmatoxylin, Borax carmine and Hæmalum and were differentiated, cleared and mounted in the usual manner. Hæmalum gave best results though Borax carmine was a better stain to bring out very prominently skeletal elements which remained absolutely unstained and thus could be easily made out.

The incidence of infestation was very low and usually one or two specimens were found on a fish. Some of the forms were very small and were usually passed over; some were very delicate and broke away in separating them from host tissues. Some forms specially Gyrodætyloids, did not take stain well and little could be made out of their anatomy. The present paper deals only with well fixed, well stained and mature forms.

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* Stewart (*Rec. Ind. Mus.*, 1914, **10**, 195–205) published a description of *Polystomum kachugæ*, n.sp. from the urinary bladder of *Kachuga lineata* from Allahabad; now regarded as *Polystomoides kachugæ* (Stewart, 1914), Ozaki, 1935. Dayal (*Proc. Nat. Acad. Sci. India*, 1941, **11**, 93–98) published an account of *Diplozoon indicum*, n.sp. from the gills of a fresh water fish *Barbus sarana* from Lucknow. But no monogenetic trematodes have been recorded so far from marine fishes of India.

III. Descriptions of New Forms

Class.—Trematoda Rudolphi, 1808.

Order.—Monogenea (Van Beneden, 1858) Carus, 1863.

A. *Sub-Order.*—Monopisthocotylea Odhner, 1912.

Super-Family.—Gyrodactyloidea Johnston and Tiegs, 1922.

Family.—Dactylogyridæ Bychowsky, 1933.

(*a*) *Sub-Family*—Tetraonchinæ Monticelli, 1903.

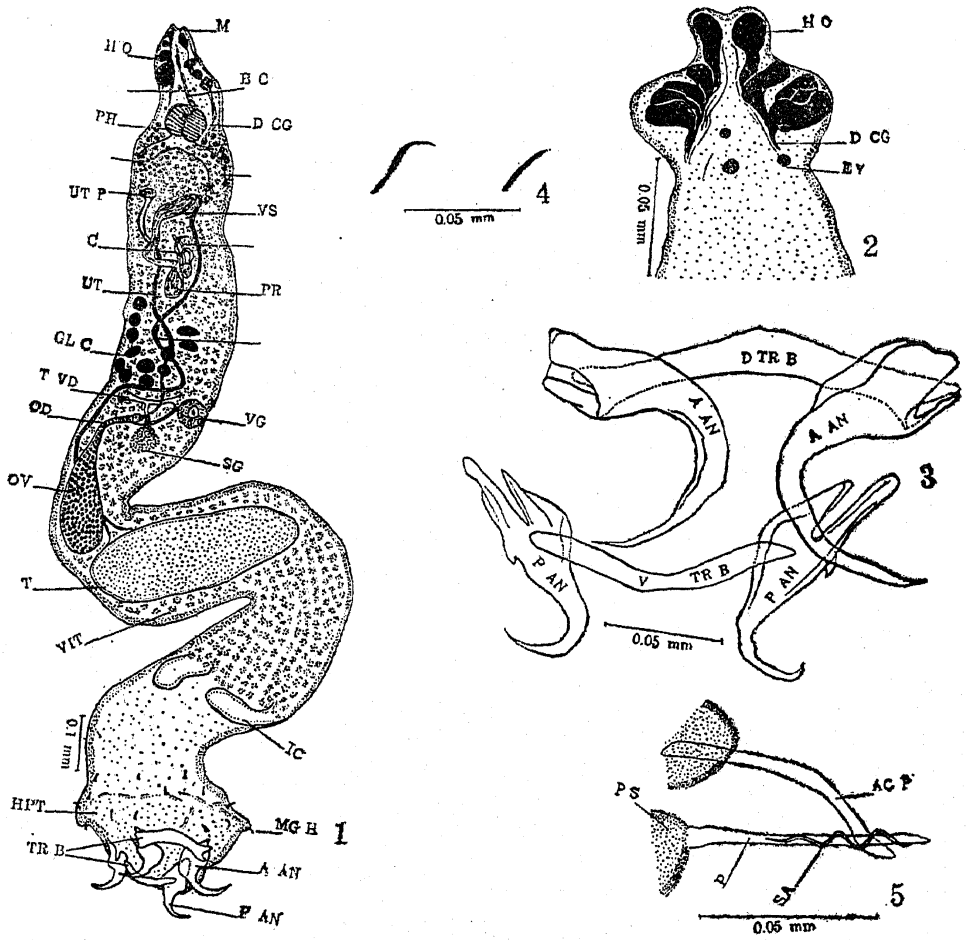
Genus.—Ancyrocephalus Creplin, 1839.

(1) *Ancyrocephalus alatus*, n.sp.

(Figs. 1–5)

Numerous specimens of this parasite were found in the gill washings of marine fishes, *Muræsox talabonoides, Arius fulcarius, Mugil parsia* and *Harpodon neherius* both in November–December 1939 and December-January 1940–41. The incidence of infection was very heavy in *Muræsox talabonoides* where every one of the specimens examined was found to be infected.

Body elongate (Fig. 1), anterior end tapering or wedge shaped, posterior broad and flat, lateral margins almost paralleled for the most part of the body length; very minute, delicate forms covered over with mucous, in the living condition; shape and size vary greatly—length being 0·71–2·43 mm. and width 0·11–0·27 mm.; greatest width in the region of testis; posteriorly the parasite ends in a well-defined adhesive disc, haptor (*HPT*) measuring 0·1–0·33 mm. in width and bearing a dorsal (Fig. 3, *A AN*) and a ventral (*P AN*) pair of biramous laterally curved anchors; each pair of anchors with median dorsal and ventral transverse supporting bars (Fig. 3, *D TRB, V TRB*) to which the anchors are articulated laterally; average length of an anchor of the dorsal pair 0·17 mm. and of its transverse bar 0·16 mm.; an anchor of the ventral pair measures 0·12 mm. in length and its transverse bar 0·12 mm.; transverse bar of the dorsal pair usually curved anteriorly in the middle and that of the ventral pair posteriorly; marginal hooklets (Fig. 1, *MG H*) 12 in number, elongate, pointed or curved (Fig. 4), measuring 0·02–0·043 mm. in length. Cephalic glands (Fig. 1, *CG*) seven to nine, extending laterally on each side, or in a compact mass in a contracted animal, in the region of the pharynx, from which ducts enter the three head organs (Fig. 1, *HO*) on either side. In some cases the middle pair of head organs may be partially subdivided or the middle and the last pair may be even lobular (Fig. 2, *HO*). Two pairs of eyes (Fig. 1, *EY*) situated in the region of pharynx; anterior pair smaller in size and more approximated than the posterior. Pharynx (Fig. 1, *PH*) a small muscular, sub-spherical



FIGS. 1–5. *Ancyrocephalus alatus*, n.sp.—Fig. 1. Entire view. Fig. 2. Anterior end to show head organs and eyes. Fig. 3. Dorsal and ventral pair of anchors with transverse bars. Fig. 4. Two marginal hooklets. Fig. 5. Penis with spiral ala, accessory piece, and a portion of the penis sac.

A AN, Anterior anchor; *AC P*, Accessory piece of penis; *B C*, Buccal cavity; *C*, Cirrus; *CG*, Cephalic glands; *D CG*, Duct of cephalic glands; *D TR B*, Dorsal transverse bar; *EY*, Eye; *GL C*, Gland cells; *H O*, Head organs; *HPT*, Haptor; *IC*, Intestinal cæcum; *M*, Mouth; *MG H*, Marginal hooklet; *OD*, Oviduct; *OV*, Ovary; *P AN*, Posterior anchor; *PH*, Pharynx; *PR*, Prostate reservoir; *P*, Penis; *PS*, Penis sac; *SA*, Spiral ala; *SG*, Shell gland; *T*, Testis; *TR B*, Transverse bar; *T VD*, Transverse vitelline duct; *UT*, Uterus; *UT P*, Uterine pore; *VD*, Vas deferens; *VG*, Vagina; *VIT*, Vitellaria; *VS*, Vesicula seminalis; *V TR B*, Ventral transverse bar.

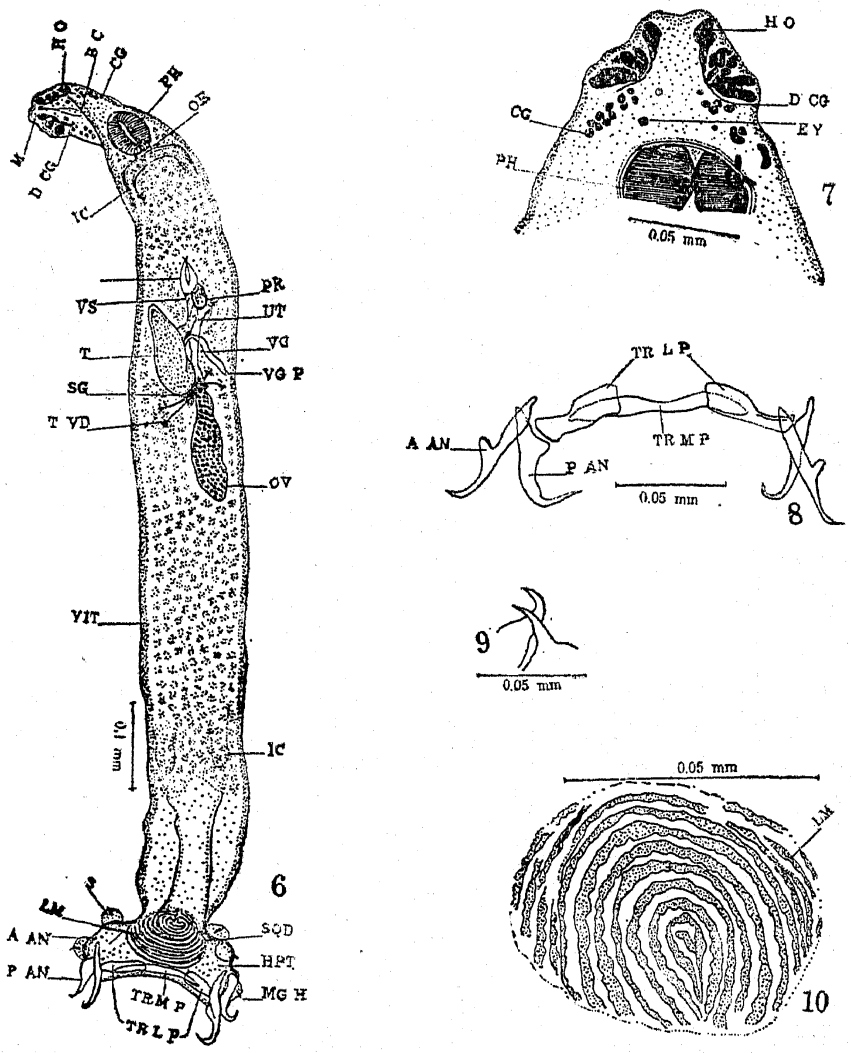
structure measuring 0·07 × 0·09 mm.; mouth (*M*) situated terminally leading into the pharynx through a buccal cavity (Fig. 1, *BC*); œsophagus very short or wanting and bifurcating posteriorly into two simple intestinal cæca (Fig. 1, *IC*), each extending posteriorly up to a short distance anterior to the beginning of the haptor. Testis (Fig. 1, *T*) single, large, oval, post-ovarian measuring 0·15–0·56 mm. in length and 0·06–0·14 mm. in width and situated in the posterior half of the body; vas deferens (*VD*) arising

from the anterior end of the testis, passing by the side of the ovary and opening into a laterally placed vesicula seminalis (*VS*), which is very elongate, sigmoid, tubular structure swollen at both ends and situated in the middle of the anterior half of the animal in between the two intestinal cæca; single narrow ductus ejaculatorius (*DE*), originating from the anterior end of the vesicula seminalis and running forwards at the anterior end of the prostatic reservoir (*PR*), where it turns backwards and inwards to form the cirrus (Fig. 1, *C*) at its base; a well-differentiated prostate gland (*PR*) divided into two lobes; the terminal end of ductus ejaculatorius (penis) (Fig. 5, *P*) elongated, cuticularised tubular structure, pointed at its extremity and measuring 0·06 mm. in length, and posteriorly with a muscular small rounded penis sac (Fig. 5, *PS*); a fine spiral ala (Fig. 5, *SA*) with pointed ends running spirally round the organ present on the anterior two-thirds of the penis; usually the penis is sickle-shaped; accessory chitinous, probably hollow, spicule (Fig. 5, *AC P*) measuring 0·07 mm. slightly thicker than the penis, and also a curved body is present, its terminal end slightly spatulate in shape; male genital pore at a distance of 0·4 mm. from the anterior end. Ovary (Fig. 1, *OV*) simple, much smaller than the testis, pear-shaped and situated in the middle of the body, anterior to testis, measuring 0·1–0·30 mm. in length and 0·04–0·07 mm. in width; oviduct (*OD*) continuous anteriorly with the ovary and continued into the uterus (*UT*) which opens to the exterior (*UT P*) in the region of the anterior end of vesicula seminalis, at a distance of about 0·3 mm. from anterior end; a single vagina (*VG*) probably chitinous and opening to the outside, in the region of the transverse vitelline duct, at a distance of 0·7 mm. from anterior end; narrow vaginal duct passes from the vagina to the oviduct; the duct functions as receptaculum seminis; transverse vitelline duct (*T VD*) just in front of the conical oviduct; small shell gland (*SG*) opens into the uterus in the region of oviduct. Vitellaria (*VIT*) small but well developed extending in the region from pharynx to a distance midway between the testis and the haptor; two rows of about 6–7 pairs of gland cells (*GL C*) in the region between the receptaculum seminis and vagina. They have been termed by Yamaguti (1934) as gland cells (*GL C*). Egg was not present in any of the specimens.

(*b*) *Sub-Family*.—Diplectaninæ Monticelli, 1903.
(Syn. Lepidotreminæ Johnston and Tiegs, 1922.
Genus.—Lamellodiscus Johnston and Tiegs, 1922.

(2) *Lamellodiscus belengiri*, n.sp.
(Figs. 6–10)

Many specimens of this parasite were obtained on the gills of the marine fishes, *Sciæna belengeri*, *Muræsox talabonoides* and *Sciæna carulta* in



FIGS. 6–10. *Lamellodiscus belengeri*, n.sp.—Fig. 6. Entire view. Fig. 7. Anterior end to show head organs, cephalic glands, their ducts and eyes. Fig. 8. Dorsal and ventral pairs of anchors with transverse bars. Fig. 9. Penis hooks. Fig. 10. Squamodisc, showing concentric lamellæ.

LM, Lamellæ; *OE*, Oesophagus; *S*, Outgrowth on haptor; *SQD*, Squamodisc; *TR LP*, Lateral piece of transverse bar; *TR MP*, Median piece of transverse bar; *VG P*, Vaginal pore; other lettering as in previous figures.

November-December 1939 and also in December-January 1940–41. Infection was not so heavy as in the case of the previous specimen.

Shape of the body varies from elongate (Fig. 6) to oval; measuring 0·52–1·17 mm. in length and 0·11–0·225 mm. in width. Cephalic glands (Figs. 6 and 7, *CG*) 8–9 in number, situated in the region of the pharynx and their ducts opening through three pairs of head organs (*HO*); eyes (Fig. 7,

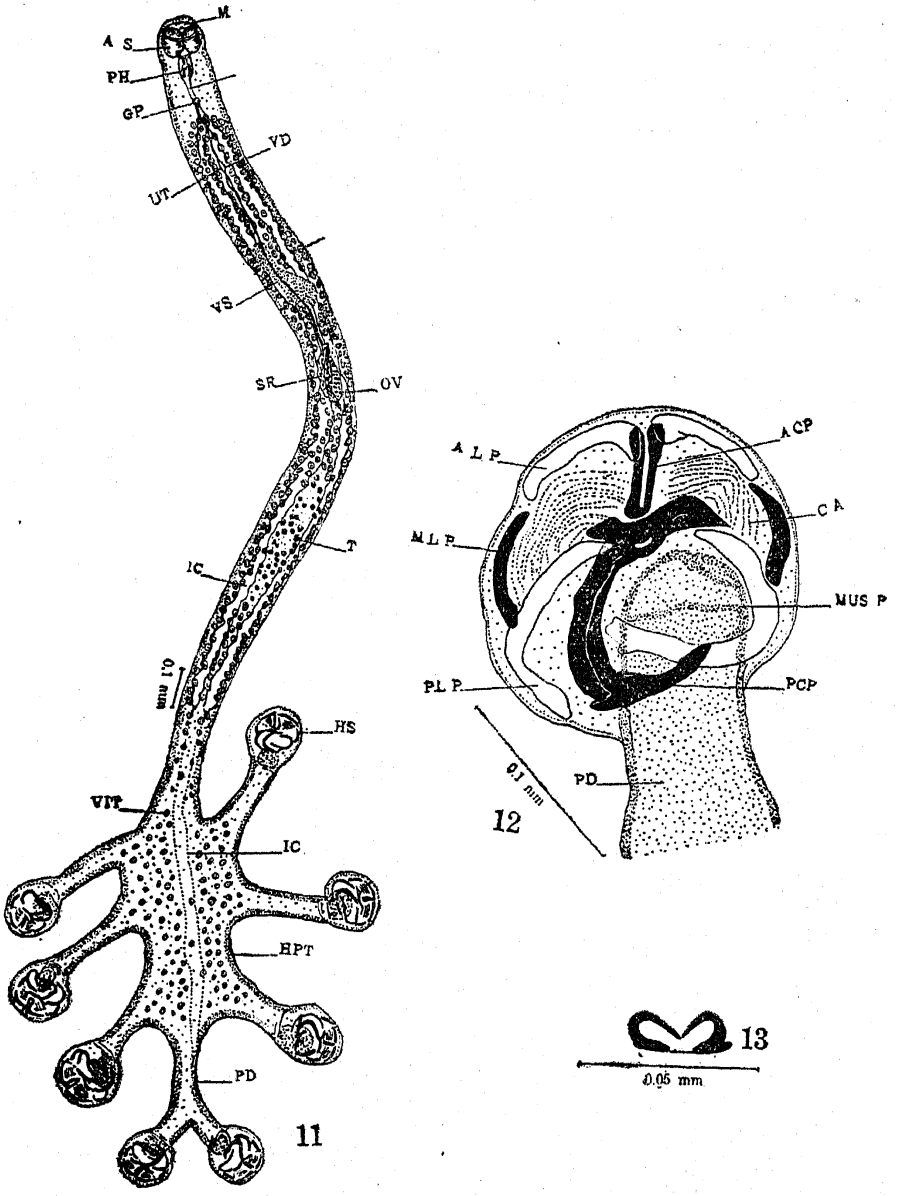
EY) two pairs, the anterior pair smaller; posteriorly, the body terminates in a distinct haptor (Fig. 1, *HPT*) measuring 0·11–0·27 mm. in diameter, the diameter of the haptor much greater than the width of the animal; haptor with two pairs of hooks (Fig. 8), curved distally, one dorsal (Fig. 8, *A AN*) and one ventral (Fig. 8, *P AN*); average length of an anchor about 0·066 mm.; dorsal pair of anchors biramous and the ventral only slightly so; anchors articulated laterally by means of a single transverse bar, consisting of a central piece (Fig. 8, *TR MP*) measuring 0·08 mm. and two right and left lateral ones (Fig. 8, *TR LP*) measuring about 0·04 mm. each; haptor carries three pairs of foliate, round, cutaneous outgrowths (Fig. 6, *S*) on each side anteriorly, each outgrowth bearing a marginal hooklet (*MGH*); haptor bears a special adhesive disc, squamodisc, consisting of concentric rows of lamellæ (Fig. 10, *LM*) made up of continuous chitinous matter, both on dorsal and ventral sides; number of lamellæ varying from 5–16 on each side. Mouth (Fig. 6, *M*) terminal or subterminal mid-ventral, situated in front of the eyes (*EY*) leading into pharynx (*PH*) through the buccal cavity (*BC*); pharynx muscular, oval, measuring 0·045–0·05 mm.; œsophagus practically wanting; two intestinal cæca (Fig. 6, *IC*) simple and posteriorly not uniting, terminating much anterior to the haptor. Gonads situated in the posterior part of the anterior half of the body; testis (Fig. 6, *T*) elongately oval in shape, usually preovarian, situated on the left side; size and shape variable, being 0·045–0·11 mm. in length and 0·03–0·04 mm. in width; vas deferens arises from the anterior end of the testis leading into a comparatively short vesicula seminalis (*VS*) and opening into the cirrus (*C*); prostate gland (*PR*) posterior to penis; penis enclosed into a sac, a simple structure consisting of two hook-like structures (Fig. 8) measuring about 0·026 mm., pointed anteriorly, rather broad and flat posteriorly, arranged like a pair of jaws (Fig. 6, *C*); male genital pore situated posteriorly in the anterior third of body. Ovary (*OV*) elongately oval, rather tapering anteriorly, lying in the middle of the body, posterior to testis or in the neighbourhood of its posterior portion to the right side of the body, measuring 0·10–0·13 mm. in length and 0·03–0·04 mm. in width ; uterus (*UT*) short and opening just beside the penis; vagina (*VG*) opens about midway between the cirrus and the ovary to the right side (*VG P*); shell gland (*SG*) small and situated near the transverse vitelline duct; vitellaria (*VIT*) extending from the region of pharynx to a distance slightly posterior to the termination of intestinal cæca; transverse vitelline duct (*T VD*) just in front of the ovary. No eggs were found.

(B) *Sub-Order.*—Polyopisthocotylea Odhner, 1912.
Super-Family.—Diclidophoroidea Price, 1936.
(i) *Family.*—Diclidophoridæ Fuhrmann, 1928.
(Syn. Choricotylidæ Rees and Llewellyn, 1941.)
Sub-Falimy.—Cyclocotylinæ Price, 1943.
Genus.—Cyclocotyla Otto, 1823.

(3) *Cyclocotyla multaetesticulae*, n.sp.
(Figs. 11–13)

Only two specimens of this parasite were found in November 1939, on the gills of a marine fish *Pellona* sp.

Body elongate (Fig. 11), 2·83 mm. long, 0·13 mm. wide, anterior end broad and flat, the sides of the body nearly parallel; posterior haptor (*HPT*) palmate, about 0·42 mm. in length and 0·25 mm. in maximum width, carrying four pairs of pedunculated haptoral suckers (*HS*). Peduncles (*PD*) of suckers long and thick, their length decreasing from before backwards; suckers are " cuplike " (Price, 1943), almost equal in size, average diameter of each 0·12 mm, general structure of the suckers quite typical of the genus; the skeletal elements of each sucker made up of eight chitinised pieces (Fig. 12)—two unpaired central pieces situated one behind the other and three lateral ones on each side, anterior central (*AC P*) U-shaped carrying anteriorly two radiating pieces termed right and left (*A LP*) anterior lateral pieces; posterior unpaired central piece (*P CP*) large and curved central axis of this piece hollow; laterally this piece articulates with right posterior lateral piece (*P LP*) and left posterior lateral piece (*P LP*) right and left (*M LP*) median lateral pieces attached to the middle of the posterior lateral piece, running anteriorly on each side. Further the surface of inner walls of the posterior central piece (Fig. 12, *P CP*) heavily corrugated on the right side; anterior dorsal space in between the lateral pieces and the anterior and middle piece further supported by two systems of very small chitinous thin rodlets (Fig. 12, *CA*) lying inside the muscular walls; each system consisting of 7–9 concentric arcs; the number of rodlets varies in each case, each sucker with a highly muscular pad (*MUS P*) in the depth of the sucker cavity, languette absent. Mouth (Fig. 11, *M*) subterminal transversely oval; anterior suckers (*AS*) in the form of two muscular and oval openings into the buccal cavity measuring about 0·045 in width and 0·065 mm. in length; pharynx (*PH*) muscular, spherical, measuring 0·03 × 0·045 mm. and followed by a narrow Oesophagus (*OE*) bifurcating posteriorly to form two main intestinal limbs branched laterally specially on the outside; intestinal cæca uniting posteriorly and running practically to the end of the haptor. Testes (Fig. 1, *T*) about

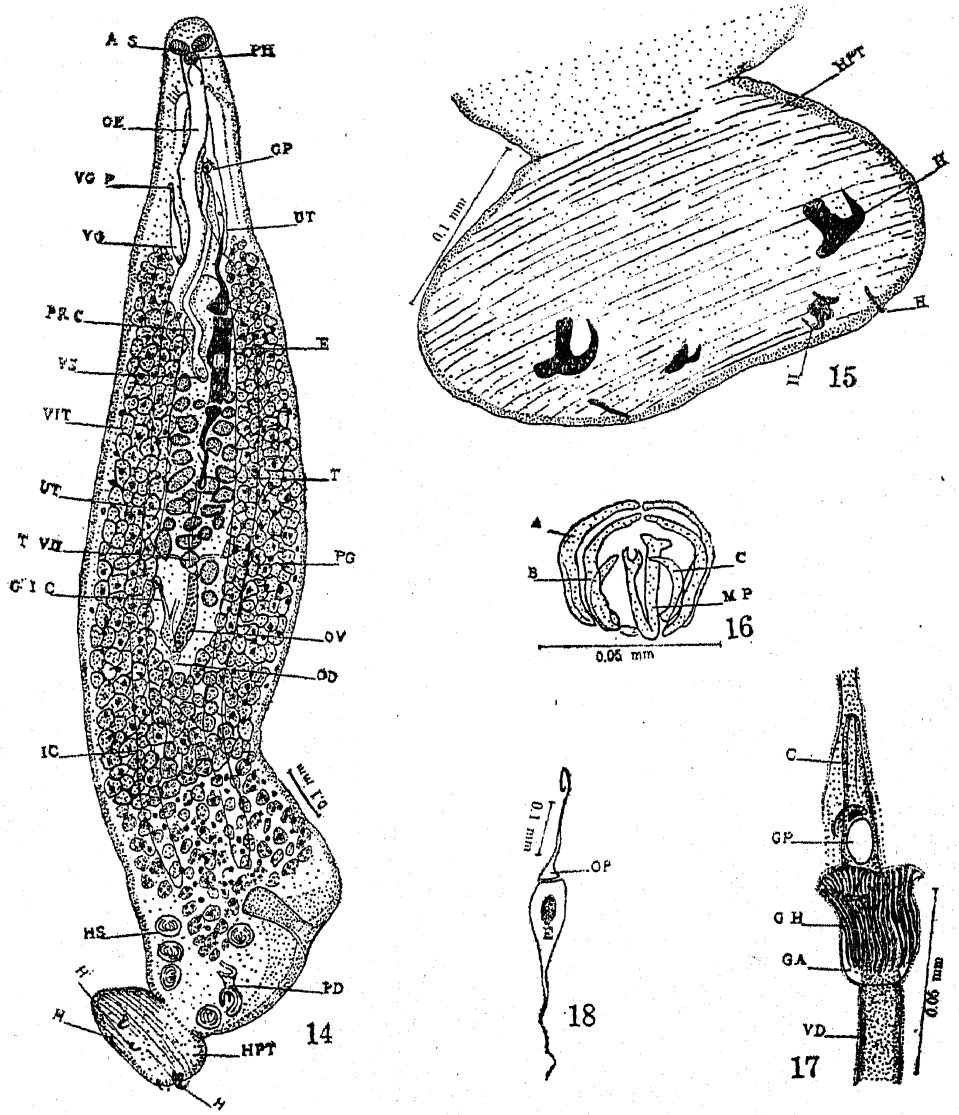


FIGS. 11–13. *Cyclocotyla multætesticulæ*, n.sp.—Fig. 11. Entire view. Fig. 12. Haptoral sucker, showing arrangement of the cuticular pieces of its framework. Fig. 13. Two of the cirrus hooks.

A C'P, Anterior central piece; *A LP*, Anterior lateral piece; *AS*, Anterior sucker; *CA*, Rodlets of concentric arcs; *GP*, Genital pore; *HS*, Haptoral sucker; *M LP*, Median lateral piece; *MUS P*, Muscle pad; *P CP*, Posterior central piece; *PD*, Peduncle; *P LP*, Posterior lateral piece; *SR*, Receptaculum seminis; other lettering as in previous figures.

150, small, follicular, situated between the intestinal limbs in the post-ovarian region; vas deferens running anteriorly, ventral to the receptaculum seminis (*SR*) forms anteriorly a vesicula seminalis (*VS*) at the base of the cirrus; cirrus provided anteriorly with a crown of eight inwardly curved

hooks (Fig. 13), the height of the each hook being 0·01 mm., genital pore (*GP*) situated halfway between the pharynx and the intestinal bifurcation, on the œsophagus, at a distance of 0·18 mm. from the anterior end. Ovary (*OV*), small, median, preequatorial, measuring 0·13 mm. in length; receptaculum seminis (*SR*) massive, preovarian; vitellarian follicles (*VIT*), numerous relatively large, extending from the level slightly below the genital pore to



FIGS. 14–18. *Bilateracotyle chirocentrosus*, n.g. *et* n.sp.—Fig. 14. Entire view. Fig. 15. Haptor showing three pairs of haptoral hooks Fig. 16. Framework of chitinous pieces of haptoral sucker. Fig. 17. Genital atrium, showing genital spines. Fig. 18. Egg.

A, Outermost; *B*, Middle; *C'*, Innermost; and *MP*, Median pieces of the chitinous ramework of the haptoral sucker; *C"*, Cirrus protruded out; *E*, Egg; *GA*, Genital atrium; *GH*, Genital hooks; *GIC*, Genito-intestinal canal; *H*, *H'*, *H"*, Haptoral hooks of the first, second, and third pair respectively; *OP*, Operculum; *PG*, Pigment granules; *PR C*, Prostate gland cells; other lettering as in previous figures.

posterior end of the body and extending into the haptor. No egg was observed.

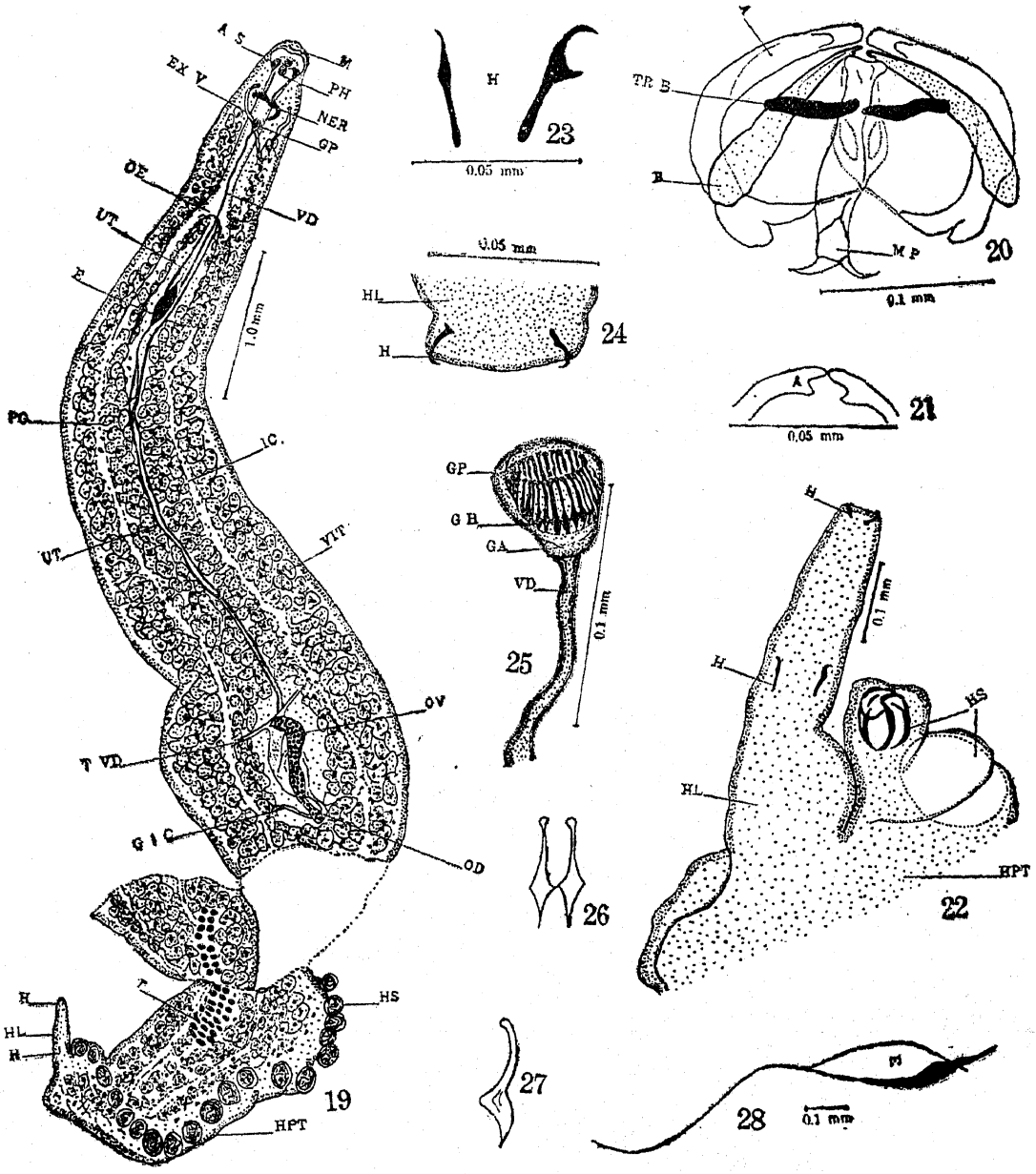
(ii) *Family*.—Microcotylidæ Taschenberg, 1879.

Sub-Family:—Protomicrocotylinæ Johnston and Tiegs, 1922.
Genus.—*Bilateracotyle* n.g.

(4) *Bilateracotyle chirocentrosus*, n.g. *et* n.sp. (Figs. 14–18)

Seven specimens of this parasite were obtained in November 1939 on the gills of a marine fish *Sciæna belengeri* and only one in December 1939 from the gills of *Chirocentrus dorab*. Forms obtained from both the hosts are identical except in unessential respects.

Body elongate (Fig. 14), flat, tapering anteriorly, broadest in the middle and tapering into a distinctly marked off disc, haptor (*HPT*) bearing usually three pairs of hooks (*H*, *H'*, *H''*); posterior end of the body proper bears three pairs of retractile pedunculated (Fig. 14, *PD*) chininous suckers in two longitudinal rows immediately before the commencement of the disc; body length of the worm 2·05 mm. maximum width 0·41 mm.; structure of the frame work of the chitinous pieces of the sucker (Fig. 14 *HS*, Fig. 16) typically microcotylid; each sucker supported by a framework of three pairs of lateral pieces (*A*, *B*, *C'*) on each side and one bent median piece (*MP*); two of the outer lateral pieces long and strongly recurved almost meeting distally; the long and median piece bent upon itself and presenting somewhat the appearance of the letter U; average diameter of a sucker is 0·04 mm.; the orientation of these pieces, with reference to the axis of the body, in various suckers variable; posterior haptoral disc, oval in shape, measuring 0·24 × 0·13 mm. with transverse muscular striations; outer pair of disc hooks (Fig. 15, *H*) largest and anchor-shaped, measuring 0·05 mm. in length; the second pair (*H'*) more posterior, rather towards the margin, long and thin, situated laterally in between the space of the outer and inner pair, measuring 0·02 mm. in length; inner pair of hooks (*H''*) more or less similar in shape to the outer, though smaller, measuring 0·026 mm. in length. Anterior suckers (Fig. 14, *AS*) two, elongately oval with membranous septa, measuring 0·04 × 0·02 mm.; pharynx (*PH*) bulb-shaped; Oesophagus (*OE*) very long, slightly sinuous, bifurcating into two intestinal cæca (*IC*) with ramifying branches laterally and terminating just anterior to the beginning of the posterior suckers. Testes (Fig. 14, *T*), follicular, 20–28 in number and situated in the middle third of the body, in between the cæca, preovarian, the very much coiled vas deferens opening into vesicula seminalis (*VS*) which is very long, sinuous tubular running anteriorly in midline and surrounded on all sides



FIGS. 19–28. *Pseudaxine indicana*, n.sp.—Fig. 19. Entire view. Fig. 20. Framework supporting the haptoral sucker. Fig. 21. Outermost piece of Fig. 20, lateral view. Fig. 22. Haptoral languette ("Proboscis"), showing the arrangement of two pairs of hooks. Fig. 23. Second pair of haptoral hooks, situated in the middle length of the proboscis. Fig. 24. Terminal portion of proboscis showing the first pair of haptoral hooks. Fig. 25. Genital atrium, showing the genital hooks and the genital pore. Fig. 26. Genital hooks, enlarged. Fig. 27. Genital hook lateral view. Fig. 28. Egg.

EX V, Excretory vessel; *HL*, Haptoral languette; *NER*, Part of nervous system; other lettering as in previous figures.

by well-developed prostatic cells (*PR C*), opening in the genital pore (*GP*) through a long tubular unarmed cirrus (Fig. 17, *C''*); it begins just anterior

to the anterior testis and has a slightly swollen base filled with sperms; genital pore to the right side, midway between the pharynx and the intestinal bifurcation, at a distance of 0·26 mm. from the anterior end; genital atrium (Fig. 17, *GA*) elliptical, large and armed by a coronet of long chitinous 24–38 spines (Fig. 17, *GH*) average length of spines being 0·02 mm. Ovary (Fig. 14, *OV*) 0·17 × 0·03 mm., median elongated, situated in the anterior portion of the posterior half of the body, genito-intestinal canal (Fig. 14, *GIC*) opens into the left cæcum of the intestine; transverse vitelline ducts (*T VD*) just anterior to the ovary; vitellaria (*VIT*) large, follicular, extending from the point of intestinal bifurcation upto the haptoral suckers, usually following the course of intestinal cæca specially in the region, anterior to the ovary; pigment granules (*PG*) scattered amongst vitelline follicles; uterus (*UT*), median visible up to the genital atrium; vagina (*VG*) a simple tube, opening laterally to the left side, the opening (*VG P*) situated at a level slightly lower than the genital pore. Only one operculate egg (Fig. 18) in the uterus, spindle-shaped with polar filaments, measuring 0·23 mm. (without filaments) in length and 0·04 mm. in width.

(iii) *Family.*—Gastrocotylidæ Price, 1943.

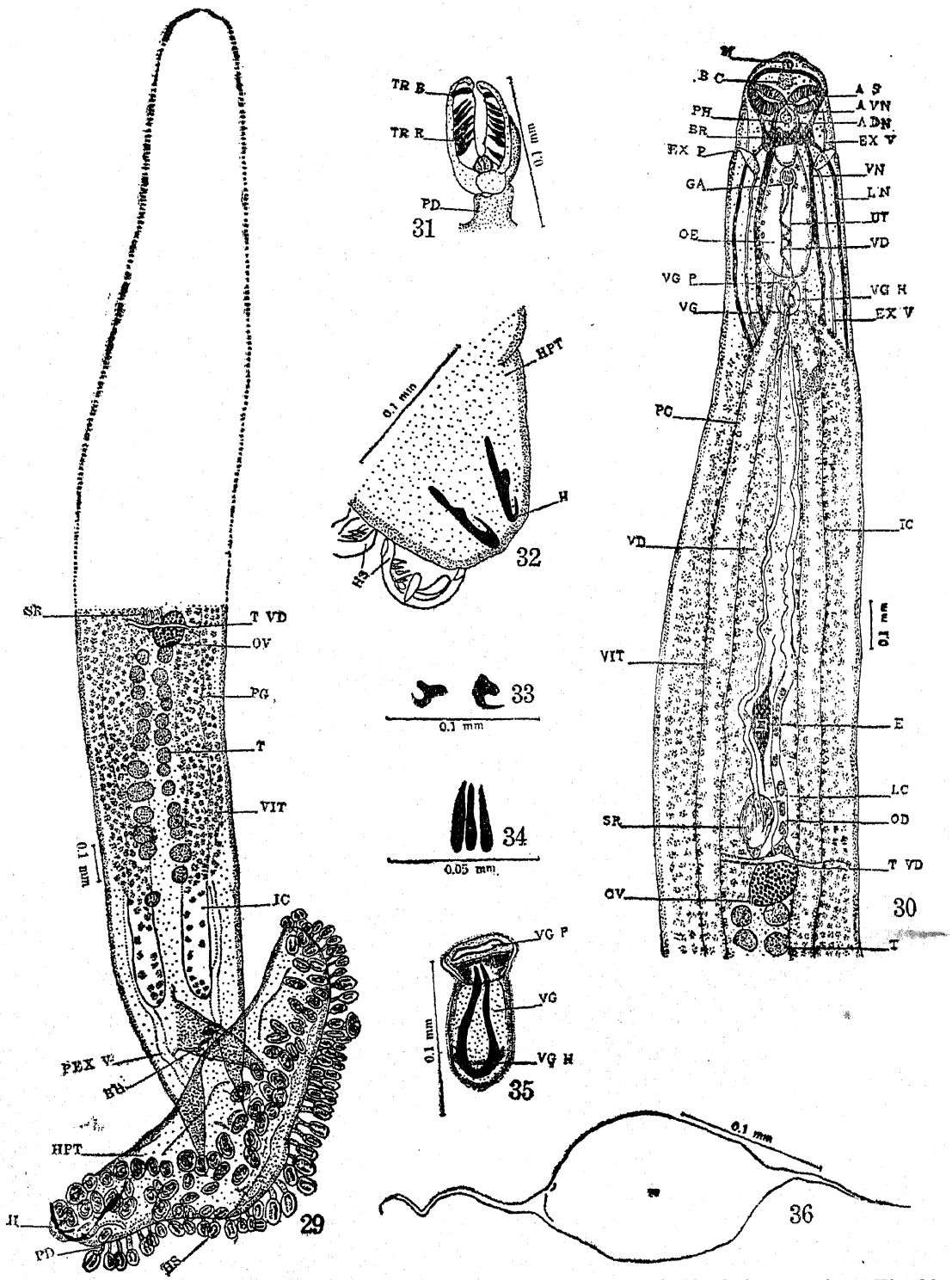
(*a*) *Genus.*—Pseudaxine Parona and Perugia, 1890.

(5) *Pseudoxine indicana*, n.sp.

(Figs. 19–28)

A single good specimen of this very interesting form was obtained in January 1941 on the gills of marine fish *Chrysophrys berda.*

Body elongate (Fig. 19) tapering anteriorly, broad posteriorly measuring 9·16 mm. in length and 1·6 mm. in maximum width at the level of the ovary; posteriorly fan-shaped cotylophore (= haptor) (*HPT*) inclined to the body and separated from it by a notch, carrying 19 suckers, in a single row, on its lower margin; average diameter of a sucker 0·16 mm.; framework of cuticular pieces (Fig. 20) consisting of two pairs of lateral pieces (*AB*); the outer of which bifid at both ends, a median piece (*MP*) and a pair of transverse pieces (*TR B*); the median piece complex in shape; the extreme of the cotylophore carries an elongated proboscis-like process (Figs. 19 and 22, *HL*) measuring 0·5 mm. in length and 0·1 mm. in width, bearing in the middle of its length a pair of hooks (Figs. 22 and 23, *H'*), 0·04 mm. in length and another pair (Figs. 22 and 24, *H*) of smaller hooks measuring 0·01 mm. in length at its tip. Mouth (Fig. 19, *M*) opening at the anterior end of the body, in which lie two paired egg-shaped anterior suckers (*AS*); mouth leading into the oval pharynx (*PH*) lying between the suckers; Oesophagus (*OE*) about 1·0 mm. in length and bifurcating into two



FIGS. 29–36. *Pricea multæ*, n.g. *et* n.sp.—Fig. 29. Posterior half of the parasite. Fig. 30. Only anterior half of the parasite; Fig. 31. Haptoral sucker, lateral view. Fig. 32. Extreme lateral side of the haptor, showing haptoral hooks. Fig. 33. Body hooks. Fig. 34. Three cirrus hooks. Fig. 35. Terminal portion of vagina, showing the vaginal hook and the vaginal opening. Fig. 36. Egg.

A DN, Anterior dorsal nerve; *A VN*, Anterior ventral nerve; *BH*, Body hook; *BR* Brain; *EX P*, Extretory pore; *LC*, Laurer's canal; *LN*, Lateral nerve; *P EX V*, Posterior excretory vessel; *TR R*, Transverse rib of the framework of the haptoral sucker; *VG H*, Vaginal hook; *VN*, Ventral nerve; other lettering as in previous figures.

intestinal canals (*IC*) sending many lateral branches ramifying specially on the outer side, into the vitellaria; cæca not contiguous posteriorly and running upto near the posterior end of the cotylophore. Testes (Fig. 19, *T*) small, follicular, about 40 in number lying irregularly in the inter-cæcal field anteriorly in two rows and posteriorly in three rows, post-ovarian, a few extending into the haptor; vas deferens (*VD*) running anteriorly to the genital opening (*GP*); genital pore on the œsophagus halfway between the pharynx and the intestinal bifurcation, 0·58 mm. from the anterior end of the body armed with a coronet of 24 hooks (Fig. 25, *GH*) each of which about 0·022 mm. in length; each hook having a curved anterior extremity, a broad body in contact with its neighbour (Figs. 26 and 27). Ovary (Fig. 19, *OV*), elongate, cylindrical, situated in the median line, in the posterior half of the body measuring 0·77 mm. in length and 0·13 mm. in width; oviduct (OD) arising posteriorly from ovary, receiving the genito-intestinal canal (*GIC*) and the yolk duct (*YD*) and passing on as ootype; uterus (*UT*) running forward to the genital pore; transverse vitelline ducts (*T VD*) just anterior to the ovary; vitellaria (*VIT*) on both sides of the body from the level of the genital pore to the end of the cotylophore; black pigment granules (Fig. 19, *PG*) few, scattered in vitellaria; single uterine egg with polar filaments, 0·3 mm. long (length without polar filaments) and 0·08 mm. wide.

(*b*) *Genus.—Pricea*, n.g.

(6) ***Pricea multae*, n.g. *et* n.sp.**

(Figs. 29–36)

Only one good matured specimen of this species was collected from the gills of *Cybium lanceolatus* in December 1939.

Body elongately cylindrical (Figs. 29 and 30) slightly tapering anteriorly and bearing comparatively a very broad haptor (Fig. 29, *HPT*) posteriorly, sides running almost paralleled for most part of the body length, 3·22 mm. (with haptor) long and 0·4 mm. broad, posterior haptor very broad measuring 1·02 mm. in length and 0·33 mm. in width, very distinctly set off from the body proper and carrying a pair of recurved haptoral hooks (Figs. 29 and 32, *H*) with double roots, at one of its extreme side end. Each measuring 0·08 mm. in length; the haptor is an elongately oval structure whose long axis is at right angles to the long axis of the body, and usually folded upon itself giving Napoleon's helmet-like appearance, carrying 122 retractile, pedunculated suckers (Figs. 29 and 31, *HS*) arranged in two rows, at both margins of its sides, each measuring about 0·07 mm. in diameter, frame work of cuticular structural pieces forming the supporting skeleton of the

haptoral sucker very interesting consisting of a pair of two (Fig. 38 *A, B*) thin, long bars, recurved upon themselves and almost meeting in the middle, a three pronged central piece (*MP*) on a basal piece (*BP*), a pair of transverse bars (*TR B*) contained within the bent extremity of the inner lateral piece, followed by five to seven thinner transverse ribs (*T RR*) and in addition, a pair of lateral pieces each outside the three pronged median one, giving support to the thin transverse ribs (Fig. 38, *D*); a pair of recurved hooks (Fig. 29 and 33, *BH*) with double roots, situated in the posterior end of the body, just above the haptor, measuring about 0·03 mm. in length. Mouth (Fig. 30, *M*) sub-terminal leading to a very small globular pharynx (*PH*) through a buccal cavity (*BC*), anterior suckers (*AS*) bilocular, egg-shaped highly muscular organs, with membranous septa, measuring 0·09 × 0·05 mm., œsophagus (*OE*) elongate, club-shaped and bifurcating into intestinal crura (Fig. 29, *IC*) terminating just a little before the origin of haptor, with ramifying branches, laterally, into the vitellaria, which are more numerous on the outer side. Testes (Fig. 29, *T*) numerous, 26 in number, post-ovarian, follicular, situated in two lateral rows, in between the intestinal crura, size variable, 0·03–06 mm. in diameter; vas deferens (*VD*) runs anteriorly, in the middle, its course more sinuous in the anterior region, opening into an unarmed genital atrium (*GA*) situated in the midline, on the œsophagus, at a distance of 0·23 mm. from the anterior end—through a long muscular armed cylindrical cirrus, with 12 small club-shaped chitinous spines (Fig. 34, CH) broad at the base and tapering anteriorly. Ovary (Fig. 30, *OV*) spherical, situated in the middle of the body, measuring 0·11 mm. in length and 0·08 mm. in width; genito-intestinal canal (Fig. 30, *GIC*) present, transverse vitelline yolk ducts (*TV D*) anteror to the ovary; receptaculum seminis (*SR*) big, oval and situated slightly anterior to ovary, on the left side; uterus (*UT*) with a single uterine spindle-shaped egg (Fig. 30 and 36, *E*) with polar filaments; oviduct (*OD*) very elongated, leading into the vagina (Fig. 30 and 35, *VG*) situated just on the point of bifurcation of the œsophagus into intestinal limbs, at a distance of 0·44 mm. from the anterior end; its terminal end dilating to form oval vaginal pouch (*VG P*), containing a doubly curved chitinised U-shaped hook (Fig. 35, *VG H*) one of its arms measuring 0·035 mm. in length, vaginal opening with fleshy, muscular flaps, presenting the appearance of a rudimentary pseudo-genital sucker (Fig. 35); vitellaria (*VIT*) follicular, extending from the level of the genital pore upto the extent of the testes, though a few follicles extending posteriorly, on the intestinal cæca, upto the point of their termination; pigment granules (Fig. 29, *PG*) few.

The nervous system (Fig. 30) consists of a brain (*BR*) arched over the œsophagus, posterior to pharynx; from its lower end arise the ventral nerve

chords (*VN*) running posteriorly along the sides of the digestive system. Dorsal and lateral to the ventral trunks are the lateral nerve trunks (*L N*) running along the margins of the body. Antero-ventral nerves (*A VN*) supporting the ventral and lateral walls of the oral suckers originating at the junction of the lateral nerves with the brain, run anteriorly on the outer sides of the suckers and complete the ring anteriorly. Near the top of the brain is a pair of antero-dorsal nerves (*A DN*), running along side the œsophagus and pharynx and supplying the dorsal walls of the suckers.

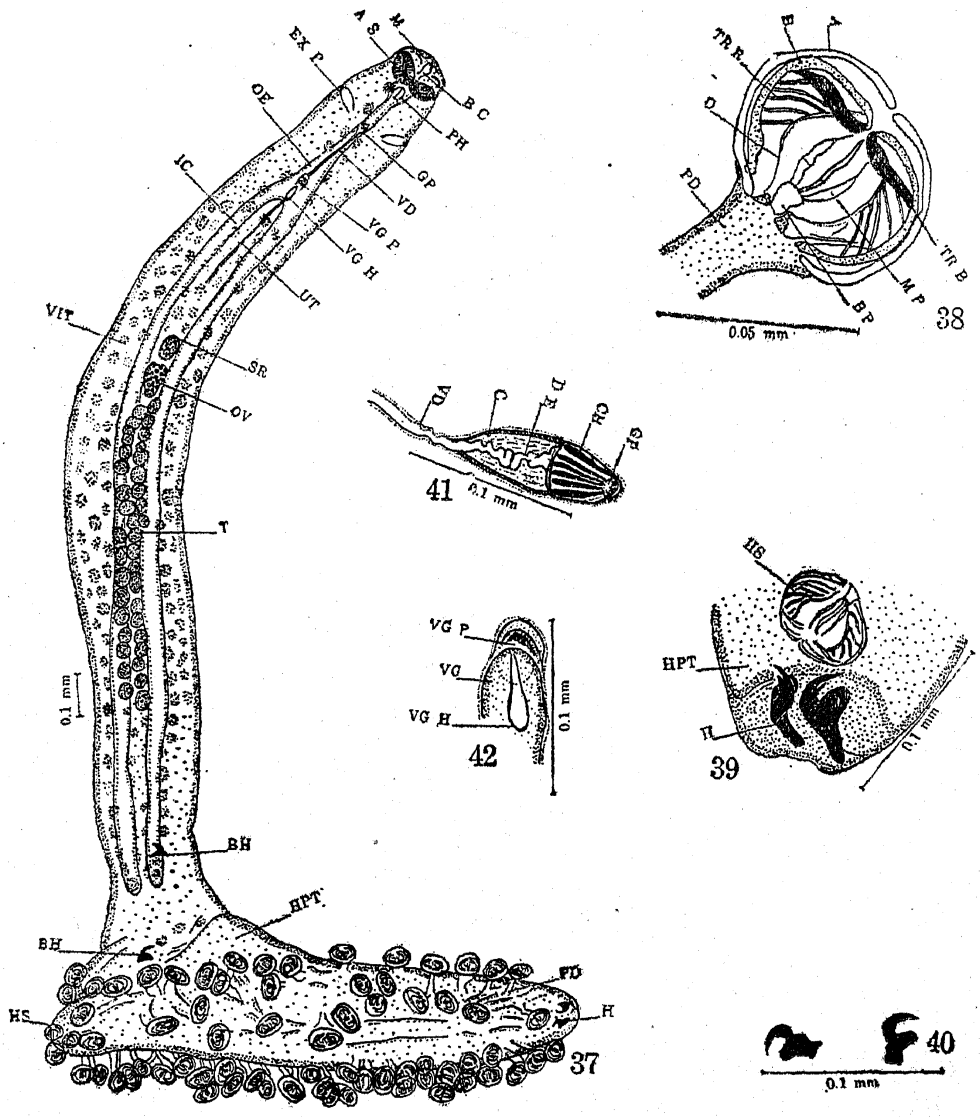
The excretory system (Fig. 30) opens to the exterior through two dorsal and laterally placed spindle-shaped pores (*EX P*) situated laterally at the level of genital pore. An excretory vessel (*EX V*) is seen to run anteriorly and one posteriorly (*EX V*) from both pores, on both sides. The posterior excretory vessels (Fig. 29, *P EX V*) are visible in stained preparation on the outer sides of the intestinal limbs, after the termination of the vitellaria into the posterior region, upto the haptor.

(7) *Pricea minimae*, n.sp.

(Figs. 37–48)

Six specimens of this fluke were found on the gills of *Thynus pelamys*.

Body elongately cylindrical (Fig. 37) with sides almost parallel, anterior end truncated, posterior ending in a foot-like haptor (*HPT*), the entire haptor has the same relation to the body as a foot has to the leg; body length 3·46 mm. and maximum width, in the region of gonads, 0·27 mm.; two hooks (Figs. 37 and 41, *BH*), one behind the other on the posterior end of the body proper, one hook situated on the right intestinal cæcum, near its posterior end and the other just anterior to the haptor slightly to the left; average length of a hook being 0·04 mm.; one more pair of recurved hooks (Figs. 37 and 39, *H*) situated at one side extremity of the haptor, measuring 0·06 mm.; haptor bears, 70 retractile, pedunculated suckers (*HS*) in two rows, along its both sides, with the structure (Fig. 38) of the chitinous framework as described for the genus except the number of ribs which is 5–7 ; oval in shape with an average diameter of 0·03–0·07 mm.; haptor itself measures 0·12 × 0·033 mm. Mouth (Fig. 37, *M*), subterminal leading into the pharynx (*PH*) through a buccal cavity; two anterior suckers (*AS*) elongately oval measuring 0·04–0·07 mm.; pharynx small, spherical and muscular organ; œsophagus (*OE*) thin and long, bifurcating into two intestinal cæca (*IC*) extending posteriorly upto just anterior to the haptor. Testes (Fig. 37, *T*) follicular, 28 in number, post-ovarian, and intercæcal; with an average diameter of each 0·02–0·04 mm.; male genital duct (Fig. 41, *DE*) opens as usual into the genital atrium (*GA*) through a cirrus



FIGS. 37–42. *P. minimæ*, n.sp.—Fig. 37. Entire view. Fig. 38. Haptoral sucker, showing the arrangement of the cuticular pieces of the framework supporting it. Fig. 39. Extreme lateral side of the haptor, showing haptoral hooks. Fig. 40. Body hook. Fig. 41. Cirrus showing the genital pore, arrangement and shape of cirrus hooks, and ductus ejaculatorius. Fig. 42. Terminal part of vagina, showing its opening and the vaginal hook.

B P, Basal piece, supporting the three pronged middle piece of the cuticular framework supporting the haptoral sucker; *CH*, Cirrus hook; *D*, Innermost thin and lamellar lateral piece of the framework of the haptoral sucker; *DE*, Ductus ejaculatorius; other lettering as in previous figures.

(Fig. 41, *C*) very much coiled; cirrus elongated, cylindrical and muscular organ, armed with 10 spines, each measuring 0·03 mm.; genital pore (*GP*) situated, in the midline, on the œsophagus at a distance of 0·21 mm. from the anterior end. Ovary (*OV*) pear-shaped, pretesticular,

situated in the middle of the body measuring 0·05 × 0·08 mm.; receptaculum seminis (*SR*) smaller than the ovary and preovarian; vagina (*VG*) with the characteristic-U shaped hook (Fig. 42, *VG H*) one of its arm measuring 0·045 mm., situated on the œsophagus, at the point of its bifurcation at a distance of 0·4 mm. from the anterior end; vitellaria (*VIT*) very few, follicular, extending mostly from the level immediately below the vagina to the end of the intestinal limbs; few scattered follicles anterior to vagina. Uterus and egg could not be observed. Two excretory pores (Fig. 37, *EX P*) each placed laterally at the level of the genital pore, along the margins of the body.

Host.—Thynus pelamys.

Location.—Gills.

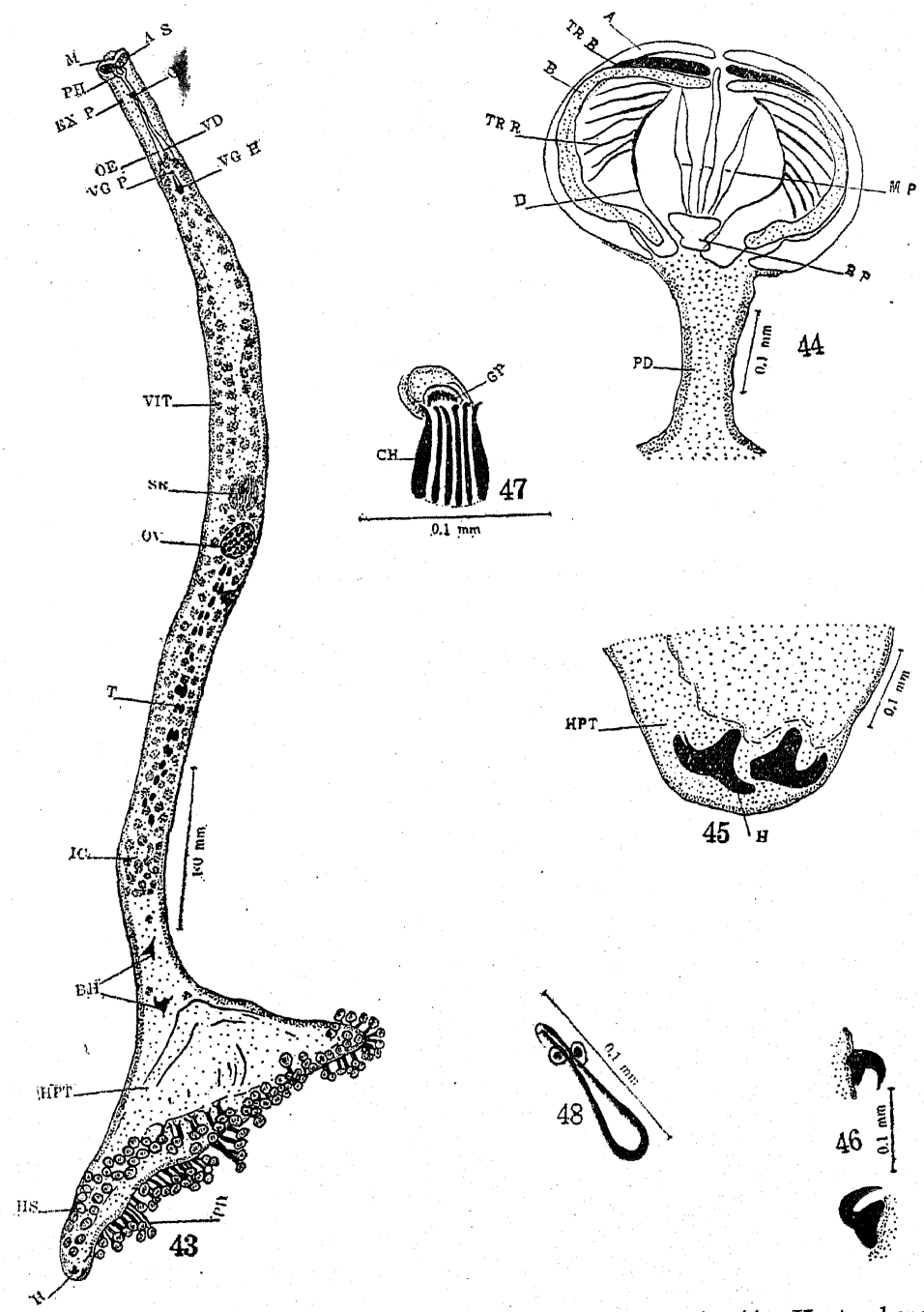
Locality.—West coast of India (Bombay).

(8) *Pricea microcotylae*, n.sp.

(Figs. 43–48)

About a dozen specimens of this fluke were found on the gills of *Scomber microlepidotus.*

Body very narrow (Fig. 43), thin and elongate, measuring 7·0 mm. in length and 0·37 mm. in maximum width (in the region of gonads), posteriorly ending in an asymmetrically situated haptor (*HPT*) carrying 113 suckers, with retractile peduncles (*PD*); suckers (*HS*) comparatively smaller in size and arranged in two rows on both sides, average measurement being 0·026 × 0·078 mm.; four hooks, one pair (Figs. 43 and 45, *BH*) situated at one end of the haptor, measuring 0·11 mm. in length (average); the two others (Figs. 43 and 46, *BH*) situated one behind the other at the posterior end of the body proper, one not on the right intestinal cæcum as in the last species, average length is 0·08 mm.; framework of the suckers (Fig. 44) characteristic of the genus, except for the number of the ribs which is 5–6. Mouth (*M*) subterminal leading into a small bulbose pharynx (*PH*), two anterior suckers (*AS*) oval, measuring 0·05 × 0·10 mm.; œsophagus (*OE*) long and very thin, two limbs of the intestine (*IC*) terminating anterior to the body hook and vitellaria. Testes (Fig. 43, *T*) very small, follicular, arranged into two irregular rows, posterior to the ovary, about 25 in number; vas deferens (*VD*) opening into the genital pore (*GP*) situated on the œsophagus at a distance of 0·26 mm. from the anterior end; number of cirrus hooks (Fig. 47) 12 each slightly recurved on its outer side in this species and measuring 0·05 mm. in length (average). Ovary (*OV*) median, spherical, measuring 0·156 × 0·234 mm. and pretesticular; receptaculum seminis



FIGS. 43–48. *P. microcotylæ*, n.sp.—Fig. 43. Entire view. Fig. 44. Haptoral sucker showing the arrangement of the cuticular pieces of its framework. Fig. 45. Extreme side of the haptor showing the two haptoral hooks. Fig. 46. Body hook. Fig. 47. Cirrus hook, showing their arrangement in the cirrus. Fig. 48. Vaginal hook.

Lettering as in previous figures.

(*SR*) slightly bigger than ovary, situated anterior to it; uterus (*UT*) seen only in the region anterior to the vagina; vaginal pore situated on the intestinal

bifurcation, at a distance of 0·8 mm. from the anterior end; vaginal hook (Fig. *VG H*) comparatively larger, thin, its one arm measuring 0·08 mm., vitellaria (*VIT*) extending from the region anterior to the vaginal pore up to a distance a little posterior to the end of the intestinal crura. No egg was observed. Two lateral, excretory pores along the margin, at the level of the genital opening.

Host.—Scomber microlepidotus.

Location.—Gills.

Locality.—West coast of India (Bombay).

IV. Discussion

Odhner (1912) subdivided the group *Monogenea* into two sub-orders, *Monopisthocotylea* and *Polyopisthocotylea* on the basis of the presence of a genito-intestinal canal in the former and its absence in the latter. Monopisthocotylids have a single posterior organ of attachment and Polyopisthocotylids have many. Fuhrmann (1928) divided the sub-order Monopisthocotylea into two sub-orders *Monopisthodiscinea* and *Monopisthocotylinea*. Price (1936) retained Odhner's classification but divided Odhner's sub-order Monopisthocotylea into two super-families, *Gyrodactyloidea* and *Capsaloidea*, and the sub-order Polyopisthocotylea into two super-families, *Polystomatoidea* and *Diclidophoroidea*.

The superfamily Gyrodactyloidea was created by Johnston and Teigs in 1922 and can be distinguished from the super-family Capsaloidea Price, 1936 by the possession of transverse supporting bars to the hooks in the haptor; the haptor of forms belonging to the super-family Capsaloidea being either unarmed or if armed lack the supporting bars.

The super-family Gyrodactyloidea contains four families which can be distinguished one from the other by the key given by Price (1937). I have described in this paper two new species belonging to one of the four families only, *viz., Dactylogyridæ* Bychowsky, 1933. This family contains four sub-families, *viz., Bothitrematinæ* Price, 1936; *Dactylogyrinæ* Bychowsky, 1933; *Diplectaninæ* Monticelli, 1903 and *Tetraonchinæ* Monticelli, 1903. A useful key to these sub-families is also given by Price (1937).

The new species *Ancyrocephalus alatus*, belongs to the sub-family Tetraonchinæ because its haptor is without accessory structures or squamodiscs. Price (1937) gives a key to the genera of this sub-family. He includes twenty genera in his key and puts *Dactylodiscus* Olsson, 1893 as a genus inquirenda. He included all the nine new genera of Mueller in his key only provisionally. Subsequent to Price's monograph following additional genera

have been added to the family:—*Ancylodiscoides* Yamaguti, 1937; *Ancyrocephaloides* Yamaguti, 1938; *Parancyrocephaloides* Yamaguti, 1938 and *Anchoradiscus* Mizelle, 1941. Of the nine genera of Mueller only three, *viz.*, *Cleidodiscus*, *Urocleidus* and *Actinocleidus*, have been retained in this sub-family by Mizelle and Hughes (1938) and Seamster (1938) who have given very acceptable reasons for regarding the others as synonyms of some of these three genera. In view of these additions and alterations, I give below a new key to the genera of this sub-family.

Key to the genera of the sub-family Tetraonchinæ :—

1.	One pair of head organs	*Diplectanotrema* Johnston and Tiegs, 1922
	More than one pair of head organs ..	2
2.	Intestine single	*Tetraonchus* Diesing, 1858
	Intestine double	3
3.	Intestine uniting posteriorly	4
	Intestine not uniting posteriorly	13
4.	Eyes absent	*Tetraoncistrum* Goto and Kikuchi, 1917
	Eyes present	5
5.	Vitellaria not extending into posterior third of body	6
	Vitellaria extending into posterior third of body	7
6.	Vagina present	*Daitreosoma* Johnston and Tiegs, 1922
	Vagina absent	*Empleurosoma* Johnston and Tiegs, 1922
7.	Haptor not disc-like	8
	Haptor disc-like	10
8.	Anchors with 2 pairs of non-articulating haptoral bars	12
	Anchors without or with only one pair of supporting bars	9
9.	Anchors totally without supporting bars, one pair of eyes, testis oval without incision	*Ancyrocephaloides* Yamaguti, 1938
	Anchors with saddle-shaped supporting bar only between the ventral pair of anchors, two pairs of eye-spots, testis deeply incised appearing as if folded upon itself	*Parancyrocephaloides* Yamaguti, 1938

10.	Enormously developed, ovate, anchor bases, anchor shafts vestigial or wanting	*Anchoradiscus* Mizelle, 1941
	Very small anchor bases, anchor shafts present	11
11.	Marginal hooklets 14, posterior disc four, lobed, anchors without an accessory piece	*Actinocleidus* Mueller, 1937
	Marginal hooklets reduced, posterior disc four lobed ; all anchors with an accessory piece	*Ancylodiscoides* Yamaguti, 1937
12.	Vagina absent	*Urocleidus* Mueller, 1934
	Vagina present	*Cleidodiscus* Mueller, 1934
13.	Eyes present	14
	Eyes absent	16
14.	Vagina absent	*Anchyodiscus* Johnston and Tiegs, 1922
	Vagina present	15
15.	Vaginal aperture median, haptor with three bars	*Murraytrema* Price, 1937
	Vaginal aperture lateral, haptor with two bars	*Ancyrocephalus* Creplin, 1839
16.	Haptor without bars	*Amphibdella* Chatin, 1874
	Haptor with 1 or 2 bars	17
17.	Haptor with one bar	*Amphibdelloides* Price, 1937
	Haptor with two bars	*Haliotrema* Johnston and Tiegs, 1922

The species, *Ancyrocephalus alatus*, n.sp. possesses three pairs of head organs, large hooks supported by cuticular bars, only twelve marginal hooklets, intestinal cæca not uniting posteriorly, two pairs of eyes and the vitellaria extending into the posterior third of the body. In view of these characters, the form belongs to the genus *Ancyrocephalus* Creplin, 1939. Creplin created this genus in 1939 and named *A. paradoxus* as the type species. Johnston and Tiegs (1922) recognised twelve species belonging to this genus. Price (1937) reviews the species and considers that the following ten belong to this genus:—*A. paradoxus* Creplin, 1839 (type species); *A. atherinæ* Price, 1934; *A. bassensis* Hughes, 1928; *A. lactophrys* (MacCallum, 1915), Johnston and Tiegs, 1922; *A. manilensis* Tubangui, 1931; *A. similis* Price, 1937; *A. teuthis* (MacCallum, 1915) Johnston and Tiegs, 1922; *A. tylosuri* (MacCallum, 1917), Johnston and Tiegs, 1922; *A. vanbenedenii* (Parona and Perugia, 1890) and *A. vesiculosus* Marray, 1931.

Since then the following additional new species have been added to the genus:—*A. thysanophrydis* Yamaguti, 1937; *A. lethrini* Yamaguti, 1937 and *A. parvus* Linton, 1940.

The species *Ancyrocephalus alatus*, n.sp. differs from all the known species of the genus in the general shape of the body, the number of marginal hooklets which is only twelve, the structure of vesicula seminalis and penis possessing a spiral ala and the shape of the accessory piece.

Lamellodiscus belengeri, n.sp. belongs to the sub-family *Diplectaninæ* Monticelli, 1903. The characteristic feature of this sub-family is the presence of a pair of dorsal and ventral accessory structures known as squamodises on the haptor. The sub-family contains three genera: *Lamellodiscus* Johnston and Tiegs, 1922; *Lepidotrema* Johnston and Tiegs, 1922 and *Dilectanum* Diesing, 1858. Price (1937) has given key to the three genera. The squamodiscs of the genus *Lamellodiscus* show concentric rows of paired lamellæ and have three cuticular bars supporting the anchors. The genus was created by Johnston and Tiegs, 1922 with *L. typicus* as the type species. Since then only two species *L. pagrosomi* Murray, 1931 and *L. major* Murray, 1931 have been added to this genus. The new species differs from all the known species of the genus in the possession of the peculiar six outgrowths on the haptor, in the number of marginal hooks being only six, in the peculiar but simple structure of the penis which has only two simple hooks and in the pre-ovarian position of the testis. The vagina is also without chitin; also the lamellæ of the squamodisc are continuous.

Included in the sub-order Polyopisthocotylea are the two super-families: Polystomatoidea Price, 1936 and Diclidophoroidea Price, 1936. I have described in this paper six forms all of which belong to the super-family Diclidophoroidea. This super-family is distinguished from Polystomatoidea, the other super-family of this sub-order, by the presence of a pair of small suckers on the anterior end of the body. The super-family contains six families: *Diclidophoridæ* Fuhrmann, 1928; *Discocotylidæ* Price, 1936, *Mazocræidæ* Price, 1936; *Hexostomatidæ* Price, 1936; *Gastrocotylidæ* Price, 1943 and *Microcotylidæ* Taschenberg, 1879; Price (1943) gives a provisional key to distinguish the families. His classification is based mainly on the number and shape of the cuticular pieces composing the framework of the haptoral suckers. Price himself is not satisfied with this basis. The difficulty is further aggravated by the fact that no suitable descriptive terms have been proposed for these structures. Price (1943) has given diagrams to show the types of frameworks of the haptoral suckers in these six families. I have used Price's key and his diagrams to distinguish the new forms.

The family Diclidophoridæ Fuhrmann, 1928 has eight principal cuticular pieces in the framework of the haptoral sucker (see Price: Fig. 1; page 45: 1943). The family contains two sub-families: *Diclidophorinæ* Cerfontaine, 1895 and *Cyclocotylinæ* Price, 1943. The former has "clamp-like" or "pincer-like" sucker and in the latter, the sucker is "cup-like". Price (1943) has given a key to the seven genera comprised within the sub-family *Cyclocotylinæ*.

Cyclocotyla multætesticulæ n. sp. described in this paper belongs to the genus *Cyclocotyla* Otto, 1823 because the haptor is distinctly set off from the body, vitellaria extend into the haptor, vagina is absent, testes are post-ovarial and cirrus is armed. A complete list of species of this genus is given by Price (1943) but not a key.

I give below a key to the species of this genus including *C. multætesticulæ*, n.sp.

Key to the species of the genus Cyclocotyla:—

1.	Vaginæ two, opening in the neighbourhood of the genital atrium	*C. taschebnergii* (Parona and Perugia, 1889) Price, 1943
	Vaginæ absent	2
2.	Body proper (not including the haptor) clearly divisible into two regions	3
	Body proper not divisible into two regions	4
3.	Anterior part of body demarcated from posterior by distinct shoulders	*C. bellones* Otto, 1823 (Type species) · *C. charcoti* (Dollfus, 1922) Price, 1943
	Two regions of the body merge imperceptibly into one another	*C. smaris* (Ijima, in Goto, 1894) Price, 1943
4.	Peduncles of unequal length	5
	Peduncles of equal length	7
5.	Penis with 10 or 13 hooks	*C. prionti* (MacCallum, 1917) Price, 1943
	Penis with eight hooks	6
6.	Body proper oval, anterior end obtuse, peduncles comparatively short and robust	*C. labracis* (Cerfontaine, 1895) Price, 1943
	Body proper lanceolate, anterior end rather narrow, peduncles comparatively longer and slender	*C. elongata* (Goto, 1894) Price, 1943
7.	Three anterior pairs of peduncles of equal size and relatively large, posterior pair relatively small, with smaller suckers	8

	Peduncles progressively shorter in antero-posterior succession	9
8.	Larger, with 25 testes and 12 cirrus hooks ..	*C. neomænis* (MacCallum, 1917) Price, 1943
	Smaller, with 56 to 65 testes and 13 cirrus hooks	*C. caulolatali* (Meserve, 1938) Price, 1943
9.	Origin of the anterior-most peduncles contiguous	*C. pagelli* (Gallien, 1937) Price, 1943
	Origin of the anterior-most pair of peduncles separated by the width of the body, *i.e.*, haptor not distinctly set off from body proper	10
10.	Body ovate, peduncles of the posterior-most pair of haptoral suckers reach the haptoral disc separately, languette present, number of testes about 30	*C. chrysophryi* (Beneden and Hesse, 1863) Price, 1943
	Body elongate, posterior-most pair of haptoral suckers pedunculated but the two peduncles unite posteriorly into a single median stem, joining the haptor, languette absent, number of testes more than 30	*C. multætesticulæ*, n.sp.

The family *Microcotylidæ* Taschenberg, 1879 is characterised by the possession of a variable number of haptoral suckers, the framework of the sucker consisting of seven pieces of which three are paired and one median. The family contains only one sub-family, *Protomicrocotylinæ* Johnston and Tiegs, 1922 which contains only a single genus, *Protomicrocotyle* Johnston and Tiegs, 1922. Probably the genus *Microcotyle* van Beneden and Hesse, 1863, *Axine* Abildgard, 1794, *Bicotylophora* Price, 1936 and *Centracolpa* Meserve, 1938 which at present are not assigned to any sub-family will have to be grouped in a new sub-family *Microcotylinæ*, n. sub-fam. The genus, Protomicrocotyle is characterised by the possession of four suckers in one row on the posterior end of the body, a dumbell-shaped haptor; numerous (150–200) testes and the position of the ovary in the posterior portion of the body. The form *Bilateracotyle chirocentrosus*, n.g. *et* n.sp. evidently belongs to a new genus of this sub-family because, it has three suckers in two rows on the posterior end of the body an oval haptor, only 20–28 testes, unarmed, long and tubular cirrus and more numerous spines of the genital atrium. The following is the genus diagnosis:—

Bilateracotyle, n.g.

Genus Diagnosis.—Sub-family: *Protomicrocotylinæ* Johnston and Tiegs, 1922; with sub-family characters; body elongate, with two elliptical anterior

suckers. Intestinal crura not uniting posteriorly, with lateral ramifying branches specially on the outer side; posterior haptoral disc oval in shape, bearing three pairs of hooks; two rows each of three typical microcotylid retractile, pedunculated suckers with variations in the orientation of the chitinous framework present at the posterior end of the body proper; genital atrium with 24-38 long spines; ovary situated in the middle of the body; vitellaria extending from the level of the intestinal bifurcation upto the suckers; testes 20–28; vesicula seminalis long and with well-developed prostatic gland cells. Egg single, spindle-shaped with polar filaments parasitic on the gills of marine fishes. Type Species *B. chirocentrosus*, n.sp

A new family *Gastrocotylidæ* is recently created by Price (1943) and is characterised by the possession of numerous haptoral suckers and in having a skeletal framework, the arrangement of which is figured by him (Price, 1943, Fig. 1 *D*, p. 45). A detailed paper by him on the subject is not yet published. I have no hesitation in including the genus *Pseudaxine* Parona and Perugia, 1890, in this family because of the resemblance of its skeletal framework with the type described and figured by Price. Probably the genera, *Gastrocotyle* van Beneden and Hesse, 1863, *Gotocotyle* Ishii, 1936 and *Thoracocotyle* MacCallum, 1913 will also be included in this family.

The form *Pseudaxine indicana*, n.sp. belongs to the genus *Pseudaxine* because its haptor is separated from the body by a notch, and because it has a single row of suckers on the margin of the haptor and because the haptor has a haptoral outgrowth "Proboscis" with two pairs of hooks.

The genus includes the following four species: *P. trachuri* Parona and Perugia, 1890 (Type species); *P. katsuwœnis* Ishii, 1936; *P. vagans* Ishii, 1936 and *P. mexicana* Meserve, 1938. *P. indicana*, n.sp. differs from the above in the general shape of the body, in the number of testes and suckers, in the number and shape of hooks in the genital atrium and in the position of the ovary and particularly in the structure of the framework of the haptoral sucker.

I also propose to include the three forms *Pricea multæ*, *P. minimæ* and *P. microcotylæ*, n.sp., in a new genus of the family Gastrocotylidæ, which I have named after Dr. Emmett W. Price in recognition of his work in this group of trematodes. In fact the structure of the framework of the haptoral sucker is widely different from the type one described for this family by Price (1943) and differs from all known genera. If Price's criterion for basing the classification of these forms on the structure and arrangement of the cuticular pieces of the framework of the haptoral sucker is valid, probably a new

family will have to be created for these three forms. There are a large number of other differences as well. But since this family is in a process of revision by Price himself I content myself with creating the new genus without at present proposing a new family for it. The genus *Pricea*, n.g. has the following generic diagnosis:—

Genus *Pricea*, n.g.

Genus Diagnosis.—Family: *Gastrocotylidæ* Price, 1943. Body elongate, with two elliptical oral suckers, intestinal cæca discontinuous, with ramifying lateral branches into the vitellaria specially on the outer sides, terminating before the beginning of the haptor; a pair of hooks present at one end of the haptor and one pair above it in the posterior portion of the body proper. Testes post-ovarian 25–38, follicular, not extending beyond the ends of the intestinal crura. Vitellaria follicular, extending from the level of genital pore anteriorly to the termination of the intestinal cæca posteriorly. Vaginal opening situated at the point of bifurcation of œsophagus into intestinal limbs, having a pouch and a U-shaped cuticular hook. Genital pouch situated on the œsophagus halfway the distance between the pharynx and œsophageal end. It has twelve cirrus hooks. Ovary situated in the mid-region. Haptoral suckers with a characteristic structure (Fig. 38), situated on both sides of the haptor in double row, the number varying from 70–122 (Figs. 29, 37 and 43). They may be pedunculated. Excretory pores two, lateral, situated in the region slightly below the brain. Parasites of marine fishes. Type species *Pricea multæ*, n.sp.

The three forms included in this genus differ from each other in the shape and size of the body and haptor, number of suckers, extent of vitellaria, number of testes and position and size of body hooks.

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VI. REFERENCES

Chauhan, B. S. .. Trematodes from Indian Marine Fishes, Part II. On some Trematodes of the Gasterostome Family *Bucephalidae* (Braun, 1883) Poche, 1907, with description of four New Species, *Proc. Ind. Acad. Sci.*, B, 1943, **17**, No. 4: 98–117.

———— .. *Idem.*, Part III. Description of a New Species of the genus *Mehratrema* (Family *Monodhelminthidæ*) Dollfus, 1937, *ibid.*, 1943, **18**, No. 5: 133–37.

Fischthal, Jacob H., and Allison, Leonard N. *Parasit.*, 1940, **26** (6 suppl.): 34–35.

———— .. *Ibid.*, 1941, **27** (6): 517–24.

Fuhrmann, Otto .. *Zweite Klasse des Cladus Platyhelminthes:* Trematoda, *Handbuch der Zoologie* (*Krumbach*), 1928, **2**: 1–128.

Guberlet, John E. .. *Publicazioni della stazione di Napoii*, 1932, **12**, 3: 323–36.

Hess, Walter N. .. *Parasit.*, 1928, **15**: 138–39.

Ishii and Sawada, Toshisada .. Studies on the Ectoparasitic Trematodes, *Livro jubilar Prof. Travassos*, Brasil, 1938: 231–44.

Johnston, T. H., and Tiegs, O. W. New Gyrodactylid trematodes from Australian fishes together with a classification of the super-family *Gyrodactyloidea*, *Proc. Linn. Soc. N. Southwales*, Sydney, 1922 (186), **47** (2): 83–131.

Lebour, Marie W. .. Fish trematodes of the Northumberland coast, *Northumberland Sea Fisheries Report* for 1907: 39–47.

Linton, Edwin .. Trematodes from fishes mainly from the Woods Hole Region, Massachusetts, *Proc. U.S. Nat. Mus.*, 1940, **88**: 1–172.

Llewellyn, J. .. A description of the anatomy of the monogenitic trematode *Choricotyle chrysophryi* van Beneden and Hesse, *Parasit.*, 1941, **33** (4): 397–405.

———— .. A review of the Monogenean family *Diclidophoridæ* Fuhrmann, 1928, *ibid.*, 1941, **33** (4): 416–30.

Lühe, Max .. Parasitiche Plattwürmer, I. Trematodes, *Süsswasserfauna Deutschlands* (*Braur*), *Jena*, 1909, **17**: 1–217.

Manter, Harold W. .. Some North American fish trematodes, *Illinois Biol. Monogr.*, 1926, **10**, 2: 1–138.

———— .. *Livro Jubilar Prof., Travassos*, Brasil, 1938: 293–98.

Meserve, Frank G. .. Some Monogenetic trematodes from the Galapagos Islands and the neighbouring Pacific, *Allan Hancock Pacific Expeditions*, 1938, **2**: 29–88.

Mizelle, John D. .. New species of trematodes from the gills of Illinois Fishes, *Am. Midland Naturalist*, 1936, **17**: 785–806.

——— and Hughes, R. C. .. The North American Fresh-Water *Tetraonchinæ*, *ibid.*, 1938, **20**: 341–63.

——— and Seamster, A. .. Studies on Monogenetic trematodes, I. New species from the Warmouth bass, *J. Parasit.*, 1939, **25**: 501–07.

———— .. *Idem*, III. Redescription and variations in known species, *ibid.*, 1940, No. **3**: 165–78.

Mizelle, John D. .. *Idem*, VI. *Anchoradiscus*, A new Dactylogyrid genus from the Blue gill and the Stump-knocker Sunfish, *ibid.*, 1941, No. **2**: 159–63.

Mueller, Justus F. .. Parasites of Oneida Lake Fishes, Part IV. Additional notes on parasites of Oneida Lake Fishes, including description of new species, *Roosevelt Wild Life Annals*, 1934, **3**, Nos. 3 and 4: 360–70.

_____ .. Studies on the North American Gyrodactyloidea, *Trans. Amer. Mic. Soc.*, 1936, **55**, (1): 55–72.

_____ .. New Gyrodactyloid Trematodes from North American Fishes, *ibid.*, 1936, **55** (4): 457–64.

_____ .. Further studies on North American Gyrodactyloidea, *Amer. Midl. Nat.*, 1937, **18**, 2: 207–19.

_____ .. Additional species of North American Gyrodactyloidea (Trematoda), *ibid.*, 1938, **19**, 1: 220–35.

Murray, Florence .. Gill Trematodes from some Australian fishes, *Parasit.*, 1931, **23**: 492–506.

Odhner, T. .. Die Homologien der weiblichen Genitalwege bei den Trematoden und Cestoden, *Zool. Anz.*, 1912, **39**: 327–51.

Price, Emmett W. .. New Monogenetic Trematodes from Marine Fishes, *Smith. Misc. Coll.* (3286), 1934, **91** (18): 1–3.

_____ .. New term for the adhesive organs of the trematodes, *Proc. Helminth. Soc. Wash.*, 1934, **1** (2): 34.

_____ .. North American Monogenetic Trematodes, *George Wash. Univ. Bull.* (summaries of Doctoral theses, 1934–36), 1936: 10–13.

_____ .. A New Monogenetic Trematode from Alaskan Salmoid fishes, *Proc. Helminth. Soc. Wash.*, 1937, **4** (1): 27–29.

_____ .. The Monogenetic Trematodes of Latin America, *Livro Jubilar Prof. Travassos*, Brasil, 1938: 407–13.

_____ .. A New species of *Dactylogyrus* (Monogena : *Dactylogyridæ*) with the proposal of a new genus, *Proc. Helminth. Soc. Washington*, 1938, **5**: 48–49.

_____ .. North American Monogenetic Trematodes, I. The superfamily *Gyrodactlyloidea*, *Jour. Wash. Acad. Sci.*, 1937, **27** (3): 114–30 and **27** (4): 146–64.

_____ .. *Idem*, II. The families *Monocotylidæ*, *Microbothriidæ*, *Acanthocotylidæ*, and *Udonellidæ* (Capsaloidea), *ibid.*, 1938, **28** (3): 109–26 ; **28** (4): 183–98.

_____ .. *Idem*, III. The family *Capsalidæ* (Capsaloidea), *ibid.*, 1939, **29**: 63–92.

_____ .. *Idem*, IV. The family *Polystomatidæ* (Polystomatoidea), *Proc. Helminth. Soc. Washington*, 1939, **6**: 80–92.

_____ .. *Idem*, V. The family *Hexabothriidæ*, n.n. (Polystomatoidea), .. *Ibid.*, 1942, **9**: 39–56.

_____ .. *Idem*, VI. The family *Diclidophoridæ* (Diclidophoroidea), *Jour. Wash. Acad. Sci.*, 1943, **33**, No. 2: 44–54.

_____ .. *Idem*, VII. The family *Discocotylidæ* (Diclidophoroidea). *Proc. Helminth. Soc. Washington*, 1943, **10**, No. 1: 10–15.

Poche, G. .. .. Das system der Platodaria, *Archiv. Naturgesch*, 1925, Bd. **91**, S.: 1–158.

Rees, G., and Llewellyn, J. .. A Record of the Trematode and Cestode Parasites of Fishes from the Porcupine Bank, *Parasitology*, 1941, **33**, (4): 390–96.

Scamster, Aron .. Studies on Gill Trematodes from Oklahoma Fishes, *Amer. Midl. Nat.*, 1938, **20** (3): 603–12.

Southwell, T., and Kirshner, A. Parasitic Infections in a swan and a Brown Trout. *Ann. Trop. Med. and Parasitol.*, 1937, **31**: 427–33.

Stiles, C., and Hassall, Albert .. Index Catalogue of Medical and Veterinary Zoology, *Hyg. Lab. Bull.* 37 *U.S. Pub. Health and Marine Hospital Service*, 1908: 196.

Stunkard, Horace W., and Dunihue, F. W. *Gyrodactylus* as a parasite of the tadpoles of *Rana castesbiana*, *J. Parasit.*, 1933, **20** (2): 137.

Summers, W. A. .. A New species of *Tetraonchinæ* from *Lepomis symmetricus*, *ibid.*, 1937, **23**: 432–34.

Van Cleave, Harley J., and Mueller, Justus F. Parasites of the Oneida Lake fishes, Part I. Descriptions of new genera and new species, *Roosevelt Wild Life Annals*, 1932, **3** (1): 25–28.

———— .. *Idem*, Part III. A Biological and Ecological Survey of the Worm Parasites, *ibid.*, 1934, **3** (3 and 4): 161–85.

Ward, H. B. .. Parasitic Flatworms in Ward and Whipples, *Fresh Water Biology*, Wiley and Sons, New York, 1918: 365–453.

Yamaguti, Satyu .. Studies on the Helminth Fauna of Japan, Part 2. Trematodes of Fishes I, *Japanese J. Zool.*, 1934, **5** (3): 249–541.

———— .. *Idem*, Part 19, *Fourteen New Ectoparasitic Trematodes of Fishes*, 1937, Published by the author: 1–28.

———— .. *Idem*, Part 24. Trematodes of Fishes, V. *Japanese J. Zool.*, 1938, **8**: 15–74.