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Parasitic Worms mainly from Celebes. Part 7. Cestodes of Reptiles

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Abstract

Anoplocephalidae Kholodk., 1902 1. *Oochoristica celebesensis* n. sp. Dilepididae Fuhrmann, 1907 2. *Ophiovalipora micracantha* n. sp. Proteocephalidae La Rue, 1911 3. *Acanthotaenia shipleyi* von Linstow, 1903

PARASITIC WORMS MAINLY FROM CELEBES
Part 7. Cestodes of Reptiles
With 1 Plate

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ANOPLOCEPHALIDAE Kholodk., 1902

1. *Oochoristica celebesensis* n. sp. (Figs. 1-2)

Habitat and locality. Small intestine of *Mabuja* sp.; Macassar.

Material. Two gravid specimens fixed in acetic sublimate, stained and mounted in toto.

Length 20-40 mm, breadth 0.9-1.6 mm. Scolex 0.65-0.75 mm in transverse diameter, 0.6 mm in dorsoventral diameter, suckers 0.2-0.25 mm in transverse diameter, with their openings directed obliquely outward and not forward. Neck short, corrugated 0.45-0.58 mm in diameter. Strobila composed of 90-140 segments, more or less serrate at intersegments, with distinct incisions at genital pores. Proglottides broader than long throughout strobila; mature ones measuring 0.2-0.25 × 0.8-1.25 mm, gravid ones 0.3-0.85 × 0.9-1.6 mm. Subcuticular longitudinal muscle well developed. Inner longitudinal muscle sheath consisting of two layers; bundles of inner layer about 20 each on dorsal and ventral sides, each with

a few to 10, thick, rather loosely bundled fibers; outer layer made up of fine, uniformly arranged fibers. Dorsal and ventral excretory stems following a more finely sinuous course than usual, making several turns in each proglottis, with cirrus pouch and vagina between. The dorsal stem passes into the ventral between the dorsal and the ventral sucker of its own side, thus forming a single loop on each side of the scolex. These two loops are connected with each other by a dorsal and a ventral transverse commissure, so that a complete transverse ring is formed in the apical central area among the four suckers; dorsal stems 3-7 μ wide, ventral stems 25-45 μ wide in mature and gravid proglottides; transverse anastomosis occurring for ventral stems alone, running immediately posterodorsal to vitelline gland and ventral to testes. An inward branch may be given off from the ventral stem to join the transverse anastomosis in the submedian field.

Testes subglobular to oval, 35-75 μ by 30-50 μ , 22-31 in number, situated mostly in one layer, partly overlapping one another in posterior intervacular medulla behind ovary and vitelline gland. Usually they form a continuous row behind the vitelline gland, and one or two may often be found outside the excretory stems. Vas deferens pursuing a sinuous oblique course from the dorsal side of the vitelline gland, where the vasa efferentia from the two sides join together, toward the proximal end of the cirrus pouch, near which it becomes more strongly convoluted than elsewhere. Cirrus pouch elongated claviform, 0.18-0.22 mm long by 30-70 μ broad, extending almost transversely a little beyond excretory stems with its pointed end directed inwards, containing narrow twisted ductus ejaculatorius and a narrow, straight, unarmed cirrus. Its wall consists of a thin layer of longitudinal muscle fibers. The genital atrium, provided with a dense coat of radiating muscle fibers, may occasionally form an oval or a spherical cavity 40-60 μ long by 39-45 μ wide, usually with its wall more or less crumpled; its external aperture wide, funnel-shaped, irregularly alternating, dividing lateral margin of proglottis in ratio of 1:1.7-3.

Ovary distinctly two-winged, 0.09-0.15 \times 0.24-0.5 mm, situated in anterior median field only a little nearer to the pore side than to the opposite side, with its transverse axis slightly oblique to that of the proglottis; each wing divided into several claviform lobes, which, however, become rather finger-shaped when the egg pro-

ducing maturity is reached. The germiduct, arising from the ovarian isthmus on its posteroventral side, describes a U-shaped curve, at the end of which it joins the vagina just dorsal to its own origin; the sinuous fertilization canal thus formed turns back on itself anterodorsal to the vitelline gland, where it receives the vitelline duct, and then passes into the uterine duct, which runs forward sinuously dorsal to the ovarian isthmus and opens into the uterus. Shell gland rather poorly developed between vitelline gland and ovarian isthmus. Vitelline gland transversely elongated, with irregular outline, 50-100 μ by 0.12-0.26 mm, lying between and behind two ovarian wings, giving rise to vitelline duct anterodorsally. The uterus develops at the beginning on the ventral side of the ovary as a ramifying organ with slender branches directed outwards, but as eggs are produced these branches break down, and the eggs come to lie freely in the parenchyma and are pressed one against another, filling up the entire medullary parenchyma; the genital organs except the male and female terminal ducts disappear completely, and the fibrous meshwork of the parenchyma among the eggs degenerate without forming egg capsules in the true sense of the word. As dissected out in tap water and examined in the fresh state the outer shell of the egg is round, 69-81 μ in diameter, and appears transparent and gelatinous; the inner embryonic shell is 36-51 μ by 31-41 μ , and the transparent oncosphere 27-36 μ by 24-30 μ , with three pairs of hooks 12-14 μ long. Between the outer and the inner shell is a considerable space filled with some clear substance, and between the inner shell and the oncosphere is a much narrower space containing fine granules.

The vagina, narrow and simple throughout its length and opening into the genital atrium immediately behind the male aperture, runs inwards, at first transversely, behind the cirrus pouch and then obliquely backwards along with the vas deferens dorsal to the pore side wing of the ovary, and finally joins the germiduct posterodorsal to the ovarian isthmus. There is no receptaculum seminis. The swollen duct that lies at the inner end of the vagina and looks like a seminal receptacle under a low power microscope is the fertilization canal.

According to the descriptive key to the species of *Oochoristica* given by Hughes the present species is most closely related to *O. excelsa* Tubangui et Masiluñgan, 1936, but differs from it in the

much larger size of the scolex and of the suckers, in one or two testes often lying outside the excretory stems, in the greater length of the cirrus pouch, in the two wings of the ovary being divided into lobules, in the absence of a receptaculum seminis, and in the smaller size of the eggs, oncospheres and embryonic hooks respectively.

DILEPIDIDAE Fuhrmann, 1907

2. *Ophiovalipora micracantha* n. sp. (Figs. 3 to 5 and 8)

Habitat and locality. Small intestine of *Varanus salvator*; Celebes.

Material. Two gravid specimens fixed in acetic sublimate, stained and mounted in toto.

Length about 40 mm, breadth 1.45 mm. Scolex conical, 0.21 mm in diameter, suckers transversely elongated oval, 84–90 μ in transverse diameter; rostellum inverted club-shaped, 110 μ long, 40 μ in diameter at its anterior swelling; its wall consisting of a thin outer layer of longitudinal muscle and a thicker inner layer of circular muscle. Rostellar hooks 20, in two alternate rows; those of anterior row 9.5 μ long, of posterior row 14.5 μ long, both similar in shape, with a long root, a short blade and an inconspicuous guard. Rostellar sac elliptical or fusiform, 0.2 mm long by 0.1 mm broad, containing abundant cellular element. Neck short, nearly as broad as scolex. Proglottides imbricated, increasing in length and breadth posteriorly, last gravid ones a little longer than broad, mature ones measuring 0.25–0.58 \times 0.65–1.1 mm, gravid ones 0.55–1.2 \times 1.0–1.45 mm.

Inner longitudinal muscle sheath consisting of two layers; inner bundles not very strong and comparatively numerous, each made up of 1 to 6 fibers, outer bundles more numerous than inner ones, each composed of 1 to 3 much finer fibers. The outer circular and inner longitudinal subcuticular muscles are well recognizable, but the inner transverse muscles delimiting the medulla from the inner longitudinal muscle sheath are unable to observe; the intersegmental transverse muscles are conspicuous. The dorsoventral fibers are present, though comparatively scanty. Dorsal and ventral excretory stems pursuing a regular serpentine course, with the vas deferens and vagina between; dorsal stem 3–9 μ wide, ventral

stem 15–45 μ wide, in mature and gravid proglottides; transverse anastomosis for ventral stems alone.

On the antiporal side the ventral stem lies ventral to the dorsal stem as on the pore side, and such a crossing of the dorsal and ventral excretory stems as observed by Hsü in *Ophiovalipora houdemeri* does not occur in either of my two specimens.

Testes subglobular to oval, 45–80 \times 35–60 μ , 18–23 in number, extending in two layers in postovarian intervacular medulla; vasa efferentia meeting together dorsal to vitelline gland, the vas deferens thus formed is very narrow and runs obliquely forward across the ovarial isthmus dorsally and then is thrown into coils, which extend to near the median anterior end of the proglottis where they abruptly turn toward the cirrus pouch. This coiled vas deferens has an almost uniform diameter of 6–9 μ throughout its course. There is neither external nor internal seminal vesicle. Cirrus pouch fusiform to subcylindrical, thin-walled, 0.14–0.2 mm long by 30–50 μ wide, may or may not reach to the excretory stems. Ductus ejaculatorius narrow, forming an 8- or U-shaped loop in proximal half of cirrus pouch, passing imperceptibly into cirrus. Latter 6–9 μ wide, covered inside with minute acicular spines about 3 μ long, 14–17 μ wide when protruded into vagina. Genital atrium small, practically absent; genital pore irregularly alternating, dividing lateral margin of proglottis in ratio of 1:1.3–4.0 in mature and gravid proglottides. Around the genital pore or the genital atrium there are developed neither the circular nor the radiating muscles as described by Hsü for *O. houdemeri*.

Ovary two-winged, 0.06–0.2 \times 0.27–0.45 mm, only slightly displaced to the pore side from the central area; each wing divided into ramifying lobes; the branches turn from their original club-shape to digitiform when fully developed and may well reach the excretory stems. Vitelline gland irregularly lobed or indented, 45–90 μ long by 80–180 μ wide, situated transversely behind ovarial isthmus. The germiduct arises from the ventral side of the ovarial isthmus and after describing a U- or V-shaped curve joins the seminal duct dorsal to the isthmus, where it turns abruptly backward to receive the vitelline duct anterodorsal to the vitelline gland. Shell gland compact, 36 μ in diameter, placed directly anterodorsal to the vitelline gland or halfway between this gland and the ovarial isthmus. The uterine duct running forwards in a sinu-

ous course passes between the vas deferens and the fertilization canal and then dorsal to the ovarian isthmus. The uterus develops at first anteroventral to the ovary as a transversely elongated organ and is confined between the excretory stems of the two sides, but as development proceeds it is split up into numerous compartments communicating with one another and extends outwards across the ventral side of the ventral excretory stems not only into the extravascular medulla but also into the posterior lateral cortical parenchyma; as the uterine wall degenerates the eggs are freed into the parenchyma and ultimately enclosed in egg capsules with polar thickenings of $3\ \mu$, each of which contains a single egg. Measurements of some eggs on the whole mounts gave the following results.

Egg capsule $45-51 \times 37-45\ \mu$, outer egg shell $42-45 \times 36-39\ \mu$, inner egg shell $37-39 \times 34-36\ \mu$, oncosphere $21-24 \times 18-32\ \mu$, embryonic hook $12\ \mu$.

The simple narrow vagina, surrounded throughout its course by accompanying cells, $0.21-0.33\ \text{mm}$ long by $6-12\ \mu$ wide, and opening immediately behind the male aperture, runs inwards transversely posterior or posteroventral to the cirrus pouch, and as it passes or after passing between the dorsal and the ventral excretory stem narrows markedly to lead into the receptaculum seminis. It may be distended with spermatozoa or by the cirrus thrust into it to a width of $18-24\ \mu$. Receptaculum seminis elliptical, fusiform or retort-shaped, $75-180\ \mu$ long by $30-60\ \mu$ wide in mature and gravid proglottides, lying obliquely dorsal to anterior portion of pore side wing of ovary, giving rise to a short seminal duct at its attenuated inner end.

This species differs from *Ophiovalipora houdemeri* Hsü, 1935, the only known species of the genus, in the size of the mature and gravid proglottides, in the shape and size of the rostellar hooks, in the more numerous inner bundles of the longitudinal muscle sheath, in the ventral stem not lying dorsal to the dorsal stem on the antiporal side, in the genital atrium being very poorly developed, in the larger size of the cirrus pouch, in the number of the testes, in the vagina opening behind cirrus, in the transverse diameters of the ovary and vitelline gland, in the size of the eggs, etc.

PROTEOCEPHALIDAE La Rue, 19113. *Acanthotaenia shipleyi* von Linstow, 1903. (Figs. 6-7)

Habitat and locality. Small intestine of *Varanus salvator*; Celebes.

Material. A number of gravid specimens, fixed in 70% alcohol, stained with hematoxylin, and mounted whole in balsam.

Length 28-60 mm, breadth 0.4-0.6 mm. Scolex 0.12-0.24 mm long, 0.15-0.23 mm in diameter at level of suckers, covered all over with hair-like spinelets; suckers very prominent, sessile or pedunculate according to their state of contraction or extension, 60-80 μ in diameter, directed outward and a little forward, with their cavity covered with spinelets. Rostellum conical or cylindrical, 90-120 μ long, 60-100 μ in diameter at base, covered all over with extremely fine spinelets arranged in quincunx, may or may not present a depression at the apex, occupied by a muscle plug shaped like the cocoon of a silk-worm. This plug is divided into two parts of different shape and structure; the anterior portion is spherical or lens-shaped, 45-60 μ long by 45-65 μ broad, and chiefly made up of rather coarse stiff-looking meridional muscle fibers, while the posterior portion consists of fine arcuate, lamellar muscle fibers which are closely set together with their convexity directed backward, and apparently serves for protrusion and retraction of the anterior portion. In the posterior portion of the scolex there are numerous, fine, black pigment granules which are most abundant in the area behind the suckers, but may be distributed as far forward as the base of the rostellum. Neck very variable in length, may be as long as 1.5 mm when extended, 80-110 μ wide, densely beset with spinelets which are the longest of all that cover the whole body, well marked off from scolex but imperceptibly passing into segmented portion of strobila. The anterior proglottides may be recognized one from the other only by the clear segmentation line which makes its appearance earlier than the genital primordia. They are broader than long but become square or even longer than broad when the testicular anlagen have scarcely formed symmetrical strips inside the excretory stems. Mature proglottides with parallel sides, definitely longer than broad, distinctly marked off from each other by a clear transverse line. On the lateral margin the point of junction may be only

slightly prominent, but does not show any sign of constriction or imbrication. Gravid proglottides 1.1–3.8 mm long by 0.4–0.6 mm broad, nearly parallel-sided, covered with spinelets which are now reduced in length but are well recognizable under a high power microscope. Inner longitudinal muscle sheath lacking. Nerve trunk running near lateral margin of proglottis, crossing cirrus pouch and vagina dorsally. Dorsal and ventral excretory stems following an undulating course between the vitellarian and the testicular field and along the outskirts of the ovary, with cirrus pouch and vagina between; the dorsal stem is a little narrower than the ventral stem in the mature proglottides, but the difference in diameter of the two stems becomes marked in gravid proglottides, in which the ventral stem is 12–18 μ wide, and the dorsal is 3–9 μ wide and gives off at irregular intervals ventral branches apparently opening on the ventral surface. There is neither foramen secundum on the lateral margin nor transverse anastomosis at the posterior end.

Testes subglobular to oval, 45–90 μ by 40–75 μ , situated in two submedian fields between anterior end of proglottis and ovary, 18–23 on the pore side (4–10 on the pore side of the median vagina), 20–37 on the opposite side in mature and gravid proglottides, total number for each proglottis being 40–65; in the immature proglottides they are distinctly separated into two fields and are arranged on either side in one row or two alternating rows, and their number varies from 32 to 53, but in the mature and gravid proglottides some testes may lie in the median field dorsal to the uterus. Vas deferens up to 20–60 μ wide, tightly convoluted between the excretory stem of the pore side and the testes of the other side in front of the cirrus pouch dorsal to the uterus. Cirrus pouch elliptical, claviform or pyriform, comparatively thin-walled, 0.12–0.19 mm long ($1/2.5$ – $1/3.4$ of proglottis breadth at the same level) by 45–72 μ wide, may be curved and somewhat constricted at about the middle, lying transversely or a little obliquely with the inner end reaching to the uterus. Ductus ejaculatorius convoluted at base of cirrus pouch. Cirrus very long, narrow (5–10 μ) and convoluted proximally, wider and straight distally, covered throughout with spinelets, 80–110 μ long and 42–45 μ wide at base when everted, but may possibly attain a much greater length when fully protruded, opening anterior or posterior to vagina (with just equal

frequency of alternation in 32 gravid proglottides, *i.e.* 16 times anterior, 16 times posterior). Genital pores irregularly alternating, usually a little behind middle of lateral margin of proglottis, sometimes in front of it or just at the middle in immature, mature, and gravid proglottides.

Ovary situated near posterior end of proglottis between excretory stems of two sides, 0.15–0.68 mm long by 0.2–0.4 mm broad in mature and gravid proglottides, consisting of two symmetrical fan-shaped wings and a median isthmus; the two wings are distinctly separated from each other anteriorly but may be in direct contact posteriorly; each wing is divided on the outer side into ramifying lobules, the number of the terminal branches being 20–35 in gravid proglottides. The oocapt, from which the germiduct arises, lies on the ventroposterior margin of the ovarian isthmus in the median line or more frequently a little to one side of it. The germiduct is very narrow at the beginning but widens out as it turns back on itself behind the ovarian isthmus to form an O- or U-shaped loop, at the distal end of which it joins the vagina close to its own origin; the fertilization canal also describes an 8-shaped loop beside or dorsal to that of the germiduct, receiving the vitelline duct at a point of the posterior curvature, and leads into the sinuous uterine duct, which ascends in the dorsal median line along with the vagina across the ovarian isthmus dorsally and opens into the uterus 0.06–0.2 mm in front of the ovary. The shell gland does not form a compact mass, but extends around the whole length of the uterine duct. The uterus extends in the median field from the posterior end of the proglottis to its anterior end ventral to the ovarian isthmus, vagina, uterine duct, vas deferens coils and also median testes. As eggs are produced it develops numerous lateral outgrowths of irregular outline which are pressed one against another and may intrude into the space among the testes, but in the posterior part of the proglottis it forms a simple elongated sac when distended with eggs. Even in the fully mature proglottides it may sometimes terminate short of the anterior end of the proglottis, but posteriorly it reaches well beyond the ovary in every instance. The eggs are not aggregated, but lie freely in the cavity of the uterus, and are discharged to the outside through rupture of the ventral wall of the uterus and of the body, as a result of which an empty longitudinal median cavity is visible in almost all the

fully gravid proglottides. As measured in life the outer egg shell is $81-91\ \mu$ by $75-93\ \mu$, the inner shell $27-30\ \mu$ by $27-29\ \mu$, the oncosphere $18\ \mu$ by $15-18\ \mu$ and the embryonic hooks are $6-7\ \mu$ long. Between the outer and the inner shell is a wide clear space, but between the inner shell and the oncosphere is a much narrower space filled with granules. Vitelline follicles small, extending whole length of proglottis in a simple or a somewhat finely zigzag row along inside of nerve trunk, $70-100$ on the pore side, $70-105$ on the opposite, the total number for each gravid proglottis varying from 140 to 200 . The vagina, opening anterior or posterior to the cirrus with a wide funnel-shaped aperture, passes transversely and after crossing the distal end of the vas deferens or the proximal end of the cirrus pouch ventrally when it opens anterior to the cirrus, turns backwards at a right or a wider angle to take a median course dorsal to the uterus, and immediately after crossing the ovarian isthmus dorsally joins the germiduct. Throughout its course it is surrounded by accompanying cells though much more sparsely at the longitudinal portion than at the transverse portion, and lined with cuticle which shows numerous, fine, close-set, annular folds at the curve, and a few longitudinal folds at the funnel-shaped portion. In the gravid proglottides it is narrowest ($5-6\ \mu$) at the longitudinal portion, and widest ($40-65\ \mu$) at the external aperture, and moderately wide ($24-45\ \mu$) at the curve. There is no true receptaculum seminis.

The present species differs from any of the other known members of the genus in the gravid proglottides being definitely longer than broad and parallel-sided. Linstow's type specimen from *Varanus salvator* of Ceylon is immature and evidently contracted, so that the testes appear more crowded than they are in my well extended specimens. There is no doubt that von Linstow mistook the undifferentiated complex of the genital ducts at the ovarian isthmus for the vitelline gland.

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Explanation of Plate

- Fig. 1. Scolex of *Oochoristica celebesensis*, end-on view.
 Fig. 2. Mature proglottis of *Oochoristica celebesensis*, dorsal view.
 Fig. 3. Scolex of *Ophiovalipora micracantha* n. sp.
 Fig. 4. Rostellar hook of *Ophiovalipora micracantha* n. sp.
 Fig. 5. Mature proglottis of *Ophiovalipora micracantha*, dorsal view.
 Fig. 6. Scolex of *Acanthotaenia shipleyi* von Linstow, 1903.
 Fig. 7. Gravid proglottis of *Acanthotaenia shipleyi* von Linstow, dorsal view.
 Fig. 8. Ovarian complex of *Ophiovalipora micracantha* n. sp., dorsal view.

Abbreviations used in Figures

c = cirrus, cp = cirrus pouch, d = vas deferens, dv = dorsal vessel, gp = genital pore, o = ovary, oc = oocapt, rs = receptaculum seminis, sg = shell gland, t = testis, u = uterus, ud = uterine duct, vg = vagina, vt = vitellarium, vv = ventral vessel.

YAMAGUTI: PARASITIC WORMS MAINLY FROM CELEBES—CESTODES OF REPTILIA

