Echinostomum garzettae n. sp.

(Voyage of Dr. W. Volz.)

By

W. G. MacCallum,

Assoc. Prof. of Pathology Johns Hopkins Univ. Baltimore.

With 1 figure in text.

While in Benakat (Lematangilir) Residenz Palembang in November 1900 Dr. W. Volz collected two specimens of a trematode worm from the intestine of *Garzetta nigripes* Temm. which he preserved in formalin and on his return trip to Europe kindly presented to me for study. After comparing them carefully one was cut into serial sagittal sections and from the study of the whole worm and of the serial sections the following details as to the anatomical structure have been made out.

The worm is elongated measuring 10 mm in length and 3 to 3.5 mm in width at its widest point a short distance behind the ventral sucker. In the hardened condition it is quite tightly curved ventrally on itself the dorsal surface being convex in both directions while the ventral is concave and groovelike. This is largely due to the fact that the central portion of the body is much thicker than the marginal portions which also curve ventrally in the con-

tracted condition. The anterior extremity is converted into a spreading somewhat reniform structure which is flat ventrally and in the center of which on the flat side there is a small sucker which is perforated and constitutes the mouth. This expanded disc measures 1.4 mm transversely and .8 mm to 1.04 mm antero-posteriorly while the mouth sucker measures only .2 mm the actual orifice being .16 mm in diameter. The margin of the disc is set with a single row of chitinous spicules 47 in number as seen in the drawing. Those at the posterior angles of the disc are slightly inclined to double up as regards the line of insertion but in general they maintain one straight line. The spicules are straight and conical but although they present but one form they are not all of the same size — the largest lateral ones measure .08 × .05 mm while anteriorly there are four or five which are smaller measuring .03 × .015 mm. Otherwise the skin surface is entirely smooth and unarmed.

As shown in the drawing there is a depression behind the head disc bounded at the sides by folds which run backward from its posterior angles and between which quite close to the anterior extremity lies the large ventral sucker. In the hardened worm this is quite deeply sunken between the neck-folds but doubtless the living worm can protrude it to a certain extent. It is very much larger than the mouth sucker and its cavity extends in a backward direction. The orifice which is practically round measures .5—.8 mm in diameter while the outer diameter of the sucker is 1.25—1.38 mm and its depth is 1.2 mm.

In the receding space between the acetabulum and the reniform head disc there opens the genital cloaca, the orifice being situated just anterior to the acetabulum in the median line.

The greater portion of the body lies behind the acetabulum which reaches only 2 mm from the anterior extremity. In the median line dorsally quite far back there may be found the minute orifice of Laurer's canal while at a point just in front of the posterior end of the body and also dorsally there is the orifice of the excretory system.

The worm is greyish-white in color, in the hardened section at least, and the vitellarium shows through as a blackish margin which extends from the region of the acetabulum almost to the posterior end although it is not continuous with that of the opposite side at the posterior extremity. In the median line behind the

ventral sucker a quite large yellow area indicates the position of the uterus filled with eggs.

The skin as seen in section exhibits a very dense highly refractive superficial layer of homogeneous appearance while in the thicker underlying layer there is a vertical striation which with some granules and vacuoles gives the cuticle a considerable opacity. The parenchyma which supports the organs is composed largely of stellate or branching cells with vesicular nuclei. The body musculature has the usual arrangement, specially powerful dorsoventral and oblique bands being found in the anterior expansion where some fibrils run to each marginal spicule.

The anterior or mouth sucker is a very weak structure, but it is composed of all the muscular layers usually found there — it communicates directly with the short prepharynx which is lined with cuticle and which enters the elliptical muscular pharynx. This structure which measures .24 × .34 mm gives directly into the relatively short oesophagus which is surrounded by numerous glandlike cells possibly serving to secrete some digestive material. This in turn divides near the front of the acetabulum to give off the simple lateral intestinal coeca which run to the posterior extremity of the body. The coeca appear to possess a circular muscular coat only, with a smooth lining of rather high epithelial cells. In this instance they are entirely empty.

The ventral sucker shows microscopically the usual cuticular lining, radial and circular muscle fibres and the large deeply staining cells among these fibres which have been so frequently described. The sucker seems to be almost surrounded by a curious space or sac in the body parenchyma which evidently constitutes part of the excretory system and will be referred to later.

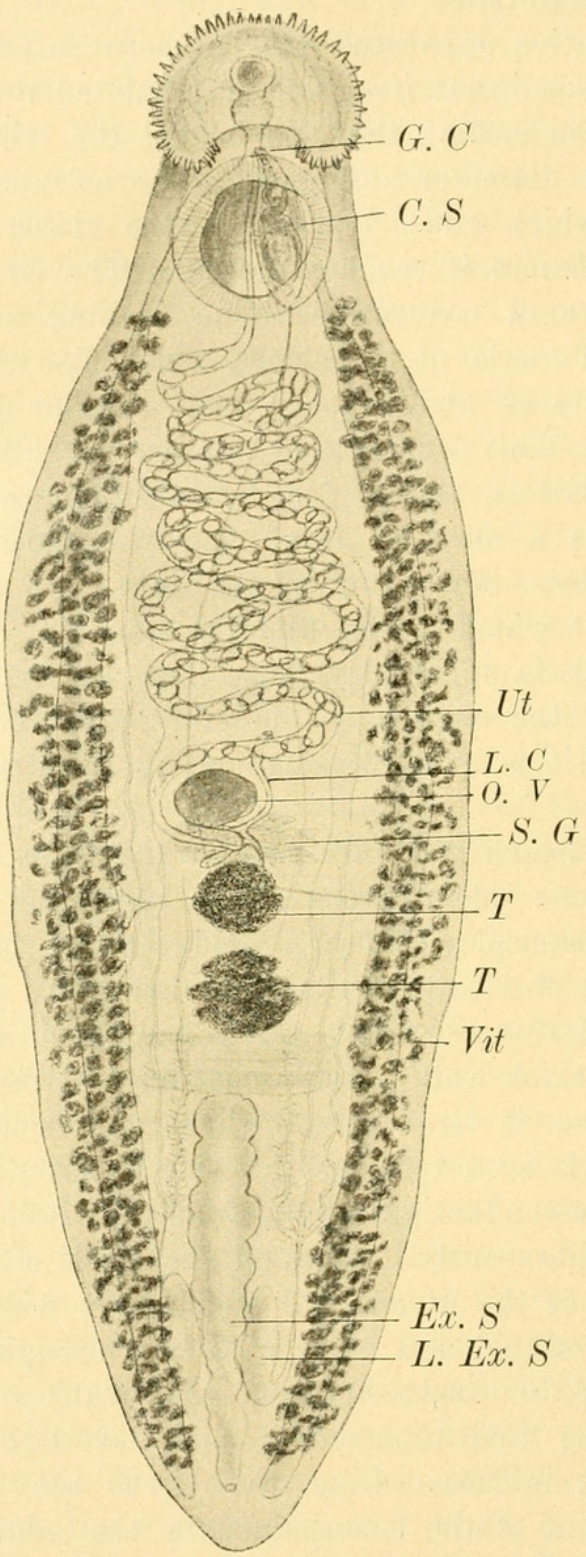
This excretory system is complicated and peculiar. At the posterior extremity in the median line there is a large thin walled sac lined by a flattened epithelium which opens as stated above by means of a cuticle lined canal at a point on the dorsal surface just in front of the posterior end of the body. Anteriorly it is continuous with widely ramifying sacs which penetrate every part of the body even pushing into the thin lateral portions between the lobules of the vitellarium and the muscle bundles to approach the skin. They are also seen in the most anterior part of the body, in the head disc intercalated in the meshes of the tissue, so that the whole body appears as a sponge-like mass. They are lined by a transparent

thin layer of epithelial cells whose outline can be made out only with difficulty and whose nuclei are very small and irregular in form and size and in fact look like chromatin granules. Usually these cavities are empty but they may contain a coagulated fluid. It is one of these sacs that practically surrounds the large ventral sucker which appears almost to be suspended in it. Although this is obviously the excretory apparatus it is difficult to make it appear analogous in detail with that system in other trematodes for a search for ciliated funnels etc. in this connection has been unsuccessful. There exists however in the body a pair of structures which may explain this lack and which otherwise would themselves be difficult to explain. On each side of the large median excretory sac there is a pear-shaped thin-walled sac lined with epithelium like that of the central sac, the bulbous end of which is directed forward; turning on itself posteriorly it gives off on its outer side a tube which runs directly forward and soon divides into three branches each of which continues to run forward. In the sections at my disposal I cannot trace a communication between these lateral sacs and the median one — they lie almost directly in contact with it so that in passing from one section to the next, one sac disappears and the other begins, but the walls seem to be complete. No communication exists between the lateral structures on the two sides — there are many sections through the median portion of the body which contain no trace of either and no external opening can be found. It seems therefore most probable that other sections (perhaps transverse) might show a communication between the lateral sacs and the median one and thus constitute one excretory system. The canals which run forward on each side from the point of branching are tortuous thick-walled tubes with cuticle-like lining and surrounded by a mantle of cells which look like secreting cells — one of the tubes especially on each side is thickly surrounded by these large pink-staining cells. These tubes run forward toward the anterior end of the body where they become very thin-walled and finally disappear in the parenchyma. They are very little if at all branched but they are continuous with delicate thin-walled tubules which run backward through the parenchyma and which it is exceedingly difficult to trace. The limited amount of material is perhaps the only excuse for so imperfect a study of these structures in which I have nowhere been successful in tracing out and describing the

terminals of the finer tubules nor in deciding as to the outlet of the lateral reservoirs.

The generative apparatus can be more satisfactorily described. There are two somewhat irregular or lobulated rounded testes lying posteriorly in the median line one behind the other. They measure about .6 mm in diameter and each gives off anteriorly a delicate vas deferens which runs forward to the cirrus sac uniting with its fellow just before it reaches the sac. The cirrus sac is a pear-shaped structure of connective tissue opening anteriorly into the posterior dorsal angle of the cloaca which also receives the uterus and which as stated above opens just anterior to and above the ventral sucker. This sac encloses another sac filled with spermatozoa and immediately surrounded by smooth muscle-fibres. Outside of this there is a mass of large cells with large vesicular nuclei — anteriorly this inner sac passes into the thick cuticle-lined ejaculatory duct which opens directly into the cloaca. This is so tortuous that it is apparently quite long and roughened internally by fissures in the cuticle — possibly the roughening is more apparent when it is everted: surrounding the duct are many small secretory cells.

The ovary which is rather smaller than the lobes of the testis lies a little to one side in front of the testes and gives off from the middle of its posterior surface an oviduct with folded and ciliated wall which runs obliquely upward and backward to meet the somewhat tortuous Laurer's canal which has been already mentioned. The resulting thick-walled tube continues dorsalwards embedded deeply in a mass of large cells with large vesicular nuclei — the shell gland. — It soon receives the wide anterior prolongation from the union of the conducting trunks from the vitellarium — one from each side. Simultaneously it gives off the thick muscular tube which is the begining of the uterus and which soon widens and becoming abundantly convoluted and filled with eggs occupies a large portion of the middle of the body between the ovary and ventral sucker. Near its begining this tube has a muscular diverticulum which is filled with spermatozoa. Like the cirrus sac the uterus opens anteriorly in front of the acetabulum in the genital cloaca. It is wide and thin-walled up to the region of the acetabulum where it becomes a narrow thick-walled tube lined with cuticle. The eggs are elliptical in form with a fairly thick shell and measure about .1—.11 mm in length by .05—.064 mm in breadth.



The figure was drawn wity the camera lucida and is magnified 15 times.

G. C Genital Cloaca. *C. S* Cirrus Sac. *Ut* Uterus. *L. C* Laurer's Canal. *O. V* Ovary. *S. G* Shell Gland. *T. T* Testes. *Vit* Vitellarium. *Ex. S* Excretory Sac. *L. Ex. S* Lateral Excretory Sac.

The vitellarium is disposed in abundant lobules along the sides of the body, the lateral collecting ducts uniting at the level of the ovary to form transverse ducts which unite and pass forward in the median line to meet the uterus.

The central nervous system consists of ganglia lateral to the pharynx with a heavy supra-pharyngeal commissure. Nerve trunks pass as usual anteriorly and posteriorly from these ganglia running back laterally throughout the body.

With regard to the systematic position of this form I have been at some pains to investigate all the described species of the genus *Echinostomum* into which, from the form of the head disc and the general arrangement of its organs, it undoubtedly falls. Many of these are found in birds and even in the intestine of birds closely related to the host of our form but of the sixty-three species reviewed only a few are found to resemble it closely enough to afford any possibility of identity with it. Several species *E. dujardini*, *gadorum*, *labracis*, *pungeus*, *cloacinum*, *ramosum* and *tabulatum* could not be compared as the literature was not at hand but since these are chiefly forms parasitic in fishes and amphibians it is probable that the risk of error is slight. Of the others the type form *E. echinatum* Zeder and its related forms seem to resemble it most closely. *E. echinatum* is found in various species of wild and domestic birds but it as well as *E. dilatatum* (which Stossich considers identical or synonymous) is found to be easily distinguishable in that it possesses only 37 spines in its cephalic disc arranged in part at least in a double row while this worm has 45—47 spicules arranged practically in a single row.

The general conformation and arrangement of the organs as well as the size and habitat are very similar indeed and we must consider these forms very closely related. *Echinostomum recurvatum* Linst. of which I have had the opportunity of examining a specimen determined by Stossich agrees well also in its general structure and in the number and arrangement of its spines, but it cannot be confused with this form on account of its minute size 3 × .7 mm. The accessible descriptions of *E. cinctum* and *E. uncinatum* suggest a resemblance but *E. cinctum* differs in being very much smaller and in being possessed of a general covering of spines together with a head disc which is described as suborbicular by Diesing. *E. uncinatum* is also possibly similar but from the vague description of Diesing it is seen to differ in possessing a flattened linear body

about 1.5 mm in width. All the other described forms seemed to differ very decidedly from the one under consideration which apparently falls readily into the smaller group of those closely related to *E. echinatum*. While closely allied with this form however it seems necessary to consider it distinct and to propose for it the name *Echinostomum garzettae*.

Lippert & Co. (G. Pätz'sche Buchdr.), Naumburg a. S.