CHAPTER VIII
MORPHOLOGY AND LIFE HISTORY OF
ECHINOPARYPHIUM MACRORCHIS N.SP.
CHAPTER VIII

MORPHOLOGY AND LIFE HISTORY OF

ECHINOPARYPHIUM MACORCHIS N.SP.

115 Lymnaea luteola f. australis (Lamarck) collected from Polsapara Tank of Durg were isolated individually in the laboratory and tested for infection. Five snails were found to be naturally infected with redia and cercaria of a new species of an echinostome.

MATERIALS AND METHODS

Cercariae and rediae from natural infection were studied in fresh and living conditions, unstained or stained with neutral red; and fixed in 10% hot formalin and 70% alcohol for permanent preparations and measurements. Metacercariae were obtained experimentally by exposing naturally shed cercariae to encyst in laboratory raised uninfected snails of the species Lymnaea luteola and Indoplanorbis existus. In absence of second intermediate hosts (snails of the above mentioned species in this case), the cercariae encyst in the same snail host from which they have been shed. These metacercariae were the starting point for the study. Two to fourteen days old metacercarial cysts were fed to the experiment definitive hosts, two 10 days old clean ducklings in this case. Twenty days postinfection the ducklings were dissected and 96 echinostome worms were recovered from the proximal part of the small intestine. Adults were fixed in Bouin's fluid.
Diagrams were made with the aid of camera lucida. All measurements are given in millimeters.

DESCRIPTION OF STAGES IN THE LIFE CYCLE

Rediae (Plate XXII Fig. 2 and Plate XXIII, Fig. 1)

Rediae of the second generation or daughter rediae are lodged in thousands in the hepatopancreas of the snail in different stages of development. Mature rediae dirty yellow, 1.363 to 1.975 long by 0.046 to 0.080 wide. Collar well marked, 0.015 to 0.020 long by 0.052 to 0.080 wide. Pharynx sub spherical 0.034 to 0.046 long by 0.029 to 0.045 wide. Gut 0.170 to 0.226 long by 0.015 to 0.028 wide, length of gut is variable in relation with the length of redia. Birth pore situated immediately behind the collar at 0.080 to 0.111 from anterior end. Locomotor organs in the form of two procorusculae, situated at 0.384 from posterior extremity. Besides full grown cercariae, young cercariae and germ balls are often seen in the body of mature redia.

Cercaria (Plate XXII, Fig. 1)

Measurements based on 15 living and 10 fixed (in 10% hot formalin) specimens. Body 0.438 to 0.450 long by 0.144 to 0.156 wide. Maximum body width at level of acetabulum. Body
spines distributed from posterior margin of collar up to level of acetabulum, becoming sparse in the post equatorial region of the body. Collar distinct 0.021 long by 0.115 wide, with 39 spines, arranged in double dorsally uninterrupted rows; four corner spines in ventral lappets; 5 ventro-lateral spines on each side, which do not differ much from corner spines. Dorsal spines of unequal size; oral 10 smaller; aboral 11 larger, equal in size to the lateral and ventral spines, 0.009 long. Oral sucker subterminal 0.050 to 0.054 long by 0.060 wide. Propharynx 0.014 long. Pharynx spherical 0.030 to 0.036 in diameter. Oesophagus solid 0.144 long by 0.024 wide, made up of 10 rectangular cells. Caeca extend posteriad unto the posterior end of body. Four pairs of penetration glands in lateral oesophageal fields; with granular contents. First pair lies close to pharynx, while the other three pairs lie close together at a distance from the first pair. Acetabulum postequatorial, 0.068 to 0.082 long by 0.066 to 0.079 wide. Genital primordium in the form of a single oval mass, situated between acetabulum and excretory bladder, 0.023 to 0.030 long by 0.027 to 0.036 wide. Body of cercaria filled up with cystogenous cells which have granular contents. Aspinose tail slightly longer than body 0.452 to 0.461 long by 0.060 wide at proximal end and 0.021 wide at distal end.
Excretory bladder bipartite 0.038 to 0.042 long by 0.040 to 0.048 broad, contractile, opens to the exterior through an excretory pore situated at the junction of body and tail. Two main collecting excretory ducts extend anteriad from the upper chamber of excretory bladder, along the lateral regions of the body, becoming distended in the oesophageal region due to the presence of densely packed minute refractile excretory granules. In the prepharyngeal region, both the ducts turn back forming a triangular loop on each side of prepharynx and extend posteriad upto the level of acetabulum to bifurcate into the anterior and posterior collecting tubules. Altogether 18 pairs of flame cells were observed in the body, which could be represented by the following formula:

$$2 \left[ (3+3) + (3+3+3+3) \right] = 36$$

Caudal excretory duct originates posteriorly from the excretory bladder, and proceeds into the tail upto one fourth of its length to bifurcate into two lateral branches.

*Related species*:

The above described cercariae does not resemble any known echinostome cercaria. Its collar spine number, however,
comes close to *Cercaria rebstocki* McCoy, 1929 and *Cercaria complexa* Faust, 1919 which have 37 and 38 collar spines and 4 and 3 penetration glands respectively. The number of flame cells also differs.

The present form differs from cercaria of *Echinocaryphium serratum* Novell, 1968 with 37 collar spines in the structure of the ventral sucker. The inner margin of the ventral sucker of the present form is simple whereas that of the former species is serrated.

The other known echinostome cercaria with 37 to 38 collar spines have been bred out into adults which are different from the adult of the present form *Echinocaryphium macrorchis* n.sp.

Ahmed (1959) raised *Cercaria spinifera* (LaVal) into adult *Echinocaryphium spiniferum*. The above mentioned cercaria possesses a fin fold on the tail, whereas such a structure is absent in the present form.

**Metacercaria** (Plate XXIII, Fig. 2 and 3)

Cercarias encyst mainly in mantle and foot of snail host, however, cysts were recovered from pericardial sac as well. Cysts spherical 0.226 to 0.260 in diameter; cyst wall double layered of moderate thickness being 0.006 thick, outer
layer transparent, inner layer opaque. Head spines, digestive tract and excretory granules well marked. Metacercarial cysts become infective 48 hours postencystment and remain so till 30 to 35 days.

**Adult (Plate XXIV Fig.1)**

Measurements based on 20 specimens fixed in warm Bouin's fluid.

*Diagnosis:* Echinostomatidae, *Echinoparyphium* Dietz, 1909 am. Mendheim, 1943. Small size worms 2.398 to 2.470 long by 0.304 to 0.455 wide. Body spines extend up to acetabular level. Head collar well developed (Plate XXV, Fig.1) 0.228 to 0.234 wide, with 32 spines. Arrangement of spines same as cercaria. Four corner spines 0.073 long by 0.018 wide. Lateral spines 5 on each side measure 0.072 long by 0.018 wide. Dorsal spines arranged in double uninterrupted rows; 10 oral, 0.066 long by 0.012 wide; 11 aboral 0.036 long by 0.018 wide. Oral sucker subterminal 0.098 to 0.104 long by 0.103 to 0.117 wide, Prepharynx 0.020 to 0.026 long by 0.019 wide. Pharynx oval 0.037 to 0.091 long by 0.047 to 0.052 wide. Oesophagus 0.400 to 0.429 long, bifurcates in front of acetabulum; caeca run posteriorly and end blindly a little away from the posterior end of body. Acetabulum pre-equatorial,
situated somewhat in the middle of the anterior half of body, 0.326 to 0.331 long by 0.338 to 0.343 wide. Genital pore pretesticular, Cirrus sac (Plate XXIV Figs. 2 and 3) comparatively large, 0.320 to 0.332 long by 0.117 to 0.120 wide, containing undivided vesicula seminalis, 0.376 long by 0.065 wide, cirrus unarmed, long and protrusible. Pars prostatica could not be located. Testes tandem roughly rectangular in shape, post-equatorial, postovarian; anterior testis 0.195 to 0.198 long by 0.129 to 0.132 wide, posterior testis 0.230 to 0.235 long by 0.115 to 0.119 wide. Ovary (Plate XXV, Fig. 2) spherical, submedian, post-equatorial, pretesticular, 0.128 to 0.130 in diameter. Mehlis' gland complex 0.065 long by 0.117 to 0.120 wide, Receptaculum seminis is lacking, instead is found a receptaculum seminis uterinus, serving its purpose. Laurer's canal could not be traced. Uterus extends from level of ovary upto the acetabular level in the intercaecal field. Uterus of a mature worm at a time lodges about 4/5 eggs, comparatively large in size. Vitellaria present in the form of large follicles, having an average diameter of 0.039, vitellaria present in the post equatorial region only, commencing from a level just anterior to ovary, extending upto the end of intestinal caeca. Some follicles occupy the intercaecal zone near the excretory bladder.
Excretory bladder cylindrical 0.416 to 0.421 long by 0.036 to 0.040 wide opens out through the excretory pore, which is postero-terminal in position.

Host: Natural host unknown.
Experimental host: Duckling

Location: Proximal part of small intestine

Locality: Durg (M.P.) India.

DISCUSSION

The genus Echinoparyphium (Dietz, 1909) includes the following species, which have been hitherto recognised.

*E. baculus*, Diesing, 1850; *E. recurvatum* Linstow, 1873; *E. flexum* Linton, 1892; *E. elegans* Looss, 1899; *E. aconiatum* Dietz, 1909; *E. agnatum* Dietz, 1909; *E. parahum* Dietz, 1909 *E. australis* Nicoll, 1914; *E. emollitum* Nicoll, 1914; *E. clerici* Skrjabin, 1915; *E. politum* Skrjabin, 1915; *E. mordwiloi* Skrjabin, 1915; *E. japonicus* Ando and Osaki, 1923; *E. westsibiricum* Issaitschikov, 1924; *E. golezi* Tsuchinochi, 1924; *E. sisjakovi* Skwortzov, 1934; *E. recurvatum* Verma, 1936 *E. syrdariense* Burudelev, 1937; *E. jubilarum* Elperin, 1937; *E. schulzi* Mathevossian, 1938; *E. nordiana* Baschkirova, 1939; *E. recurvatum* vanelli Yamaguti, 1939 *E. ichtyochilum* Mendheim, 1940; *E. syrdariense* aquaticum Baschkirova, 1941; *E. nordiana* Baschkirova, 1941; *E. ellisi* Jonston and Simpson, 1944; *E. microvitellatum* Oschmarin, 1947; *E. baculoides* Dollfus, 1951; *E. bioccaleruxi* Dollfus 1951; *E. paracintum* Bychowskaya-Pavolovskaya, 1953; *E. petrowi.*
Besides the above mentioned species, *E. volvulus* Odhner, 1911; *E. niloticum* (Odhner, 1911) *E. contiguum* Barker and Bastron, 1915; *E. harveyanum* Johnston, 1916; *E. oxyrum* Johnston, 1916; *E. brevicauda* Ishii, 1935; *E. gizzardai* Verma, 1936; and *E. splendens* (Verma, 1936), were formerly also included under the genus *Echinoparyphium*. Hendheim (1940) and Dollfus (1951), however, excluded them from the genus *Echinoparyphium* on the basis of the relative size of the collar spines. The spines of the two rows which are dorsally uninterrupted in the above species are of uniform length.

Differentiation of the two genera *Echinostoma* and *Echinoparyphium* which belong to the same subfamily, is based mainly on the character of their collar spines. The other character that forms an identification standard according to Agarwal (1962) is the commencement of the vitelline follicles. On the basis of the observations made on various species of *Echinoparyphium*, it could be pointed out, that the distribution of the vitelline follicles is not of generic value. As a matter of fact, it ceases to be of any importance in the specific diagnosis in some cases where the intraspecific variation is marked, or studied with accuracy. Therefore, the most important difference between the genera *Echinostoma* and *Echinoparyphium* is that the collar spines of the two rows are equal in size in *Echinostoma* and unequal in *Echinoparyphium*. 
The above fact rules out the existence of the genus *Neoechinonarayphium* Yasaguti, 1958 because the above mentioned genus was erected to include *Echinonarayphium petrovii* Nevostrueva, 1953 distinguishing it from the genus *Echinonarayphium* Dietz, 1909 on account of the vitelline follicles commencing from the level of the anterior margin of anterior testis in the former and commencing from the level of the posterior margin of the acetabulum in the genus *Echinonarayphium*.

The genus *Echinonarayphium* is characterised by the presence of the following features: two dorsally uninterrupted rows of unequal collar spines; a small cirrus sac which is antero-dorsal to the acetabulum and possesses an undivided vesicula seminalis. The cirrus is without any spination and is greatly protrusible, Ovary is spherical, and submedian. Ovoid, rectangular to lobed testes; vitelline follicles commencing from a little beneath the level of the posterior end of the acetabulum, the follicles of the two sides are often confluent in the post testicular region.

In this respect the worms collected from the small intestine of the experimentally infected ducklings were indentified as a species of the genus *Echinonarayphium*.

Dollfus (1953) listed the known species of the genus *Echinonarayphium*, along with the number of their collar spines.
No species was stated to be possessing 39 collar spines like the present species.

Besides, being differentiated on the basis of collar spines _Lechithonaryphium macrorchis_ n. sp., has other distinguishing features. The body is rounded posteriorly and not attenuated, as other forms of _Lechithonaryphium_ Dietz, 1909. The acetabulum is shifted away from the anterior position, characteristic of the group and it comes to lie in the posterior half of the anterior part of the body. The oesophagus becomes much elongated, and the caeca terminate blindly a little away from the posterior extremity of the body. The ovary is large, when compared to other forms studied by me, it is submedian and post equatorial. The Mehlis' gland complex is comparatively small. The eggs are very few, 2½ in a mature specimen. The testes are rectangular in shape and lie close together. The distance between the posterior testis and the posterior end of the body is very short. The excretory bladder is comparatively short. The vitelline follicles are very few, but unusually large. The circus sac occupies an antero-lateral position and is unusually large containing a winding seminal vesicle, and a long contractile unarmed cirrus.

The form has been compared with forms possessing
the number of collar spines nearest its number of 39 collar spines.

E. acornatum Dietz, 1909 and E. contiguum Barker and Dastron, 1915, with 37 collar spines each are differentiated on the relative arrangement of cephalic spines and the position of the gonads. The extension and distribution of the vitelline follicles also differ, which are comparatively smaller in the above two forms, and as stated above unusually large in the present form.

The present form differs from Echinonaryphiun indicum Rai, 1962, a 38 spined form, in the number of collar spines, and the general morphology of the adult worm. The prepharynx is of considerable length in E. indicum, so that the pharynx occupies a position immediately posterior to the ventral lamnents of the collar. The end group collar spines in E. indicum are directed towards the midline of the body; while they point postero-lat-eally in E. acronychis n.sp. The number of end group spines in both the species is, however, the same. E. indicum possesses a receptaculum seminis, while this structure is absent in the present species. Echinonaryphiun serratum Howell, 1968, a 37 collar spined form, differs from the present form, in having smaller eggs, fewer cuticular spines, vitellaria confluent in the post testicular region and a serrated inner margin of the
ventral sucker. The cercariae of both the forms differ considerably.

The study of the larval and adult characteristics of the species under study establishes it as a new form which has been named *Echinobaryphium macrorchis* n.sp.