XVIII STUDIES IN INDIAN HELMINTHOLOGY

No. III.

On an unsuccessful attempt to infect *Mus decumanus* with *Hymenolepis nana*, Siebold, and on the Sectional Anatomy of that Parasite.

By F. H. Stewart, *D.Sc., Capt., I.M.S., Hon. Assistant, Indian Museum.*

(Plates XXXIV—XXXV).

The question of the specific identity or distinctness of *Hymenolepis nana*, Siebold, and *H. murina*, Duj., is a matter of practical as well as of scientific interest. Grassi, Calandruccio, and Rovelli (1, 2 and 3) consider that the two species are identical and that *H. nana* is only a dwarfed variety of *H. murina*. Moniez (7) and Linstow (5) have maintained on anatomical grounds that they are two valid species. Grassi and Rovelli (3) state that on feeding rats aged between one and three months with ripe proglottides of *H. murina* the contained onchospheres developed to cysticercoids in the intestinal villi of the rat, and further that the cysticercoids ultimately rupture into the lumen of the intestine and there become adult. They apparently did not attempt to infect man with the tapeworm from the rat or to perform the reverse experiment. Grassi (1) had previously administered to a boy ripe proglottides of *H. nana* and had found proof of the subsequent existence of the parasite in the bowel. He did not, however, consider this to be conclusive proof of direct transmission from man to man as *Hymenolepis nana* is very frequent in the district where the experiment took place.

If the two species are identical and if the development in the rat is direct as described by Grassi and Rovelli, it is clear that infection in man will as a rule be due to contamination of food by rats. To prove or disprove the transmissibility of *H. murina* to man or of *H. nana* to the rat would therefore be of considerable practical importance. It is also clear that when such eminent zoologists differ on anatomical grounds as to whether the species are one or two, the scientific question can only be decided by feeding experiments.

The experiment which the present paper records could unfortunately be conducted on a small scale only and as it proved negative would require to be repeated on a larger scale to be

conclusive. It is, however, of considerable value in consideration of the statement of Grassi and Rovelli that they obtained infection in every rat employed which was between the ages of one and three months.

On the 19th of January two young white rats (*Mus decumanus albino*) were obtained which were stated to be twenty days old and which appeared to be about that age. Their faeces were examined and no eggs of parasites found. On the 10th of February they were presumably 42 days old. Five specimens of *H. nana* were obtained on that day from an Indian soldier after the administration of Ol. Chenopodii. One specimen was stained and mounted and proved to contain onchospheres. The remaining four were given, two each, to the two young rats and were actually swallowed by them. On the 10th of March and 5th of April the faeces of these animals were examined and found not to contain any ova. One rat died on the 12th of April, the second was killed on the 17th. No tapeworms were found in their intestines.

The experiment[1] therefore tends to prove that *Hymenolepis nana* and *H. murina* are two distinct species and that the rat is not the source of infection of man.

ON THE SECTIONAL ANATOMY OF *HYMENOLEPIS NANA*, SIEB.

The anatomy of *Hymenolepis nana*, Sieb., has been described by Leuckart (4, pp. 832, 995), Linstow (5), Miura and Yamasaki (6), Railliet (9), and other authors. A full account of the literature is given by Ransom (10). None of the authors mentioned above have illustrated their papers with figures of sections except diagrammatic figures. The present writer therefore considers it desirable to publish drawings of the actual sections together with some pictures of the undissected animal and a short account of the anatomy of the reproductive system.

The female reproductive organs are fully developed from the 50th segment; fertilisation takes place between the 62nd and 66th (fig. 12). It takes place abruptly; thus in the 61st segment all the eggs are unsegmented; in the 62nd, if this is the first fertilised segment, the left lateral and ventral half of the egg-mass is segmented, the right lateral and dorsal half unsegmented; in the 63rd segment all the eggs with the exception of one or two near the yolk-gland are segmented. Fig. 12 shows this transition between the 62nd and 63rd segments, it also shows the commencing atrophy of the yolk-gland in the fertilised segments and the testes, seminal vesicle and cirrus sac.

Figs. 1-5 are drawn from sections of the 60th segment. They show the yolk-gland, the bilobed ovary, the receptaculo-ovarian duct, the receptaculum seminis and vagina. The receptaculo-ovarian duct has not been described previously in this species. It leads from the receptaculum in the direction of the ovary, but its

[1] I understand that the experiment was carried out at Hong Kong.—Ed.]

exact lower connection cannot be determined. A uterus is not recognisable apart from the cavity of the ovary. The tissues of the animal are, however, so loose that it is impossible either to prove or to disprove the homology of some of the spaces with the uterus of larger forms. On passing from the unfertilised to the fertilised segments (fig. 12) the egg-mass broadens out. This may be due to a change of situation of the eggs or merely to an increase in size.

The present writer has not been able to recognise a shell-gland.

The yolk-gland atrophies at the 65th segment, having decreased in size from the 63rd.

Development of the ova.—The ova in the 50th segment have no cell outlines, the nuclei being embedded in a syncytium (fig. 6). At the 53rd segment irregular cell outlines appear (fig. 7). In the 54th segment yolk granules occur in the protoplasm (fig. 8), which increase markedly in size up to the 60th segment (fig. 9). Fig. 10 shows the segmented egg of the 62nd segment. The embryos develop double-contoured shells in the 90th segment and embryonic hooks in the 91st.

Male reproductive organs in the 60th segment.—The three testes lie near the posterior margin of the segment close to the dorsal surface (fig. 1). The vas deferens (figs. 2 and 3) leads forward to the base of the seminal vesicle. The seminal vesicle (fig. 4), a sausage-shaped thin-walled structure, runs from the midline toward the left side to become continuous with the cirrus pouch. The walls of the latter (fig. 5) are markedly thicker than those of the former and contain muscle fibres. A definite cirrus has not been recognised by the present writer.

The seminal vesicle can first be observed to contain spermatozoa in the 44th segment. The testes are progressively compressed behind the 63rd segment and disappear about the 67th or 68th.

Fig. 11 represents the 57th segment of an undissected preparation seen from the ventral surface. It shows the three testes, the vas deferens and seminal vesicle, the ovary, yolk-gland and receptaculum seminis.

LITERATURE REFERRED TO IN THE TEXT.

1. Grassi.—Die Taenia nana und ihre medecinische Bedeutung. *Centralbl. f. Bakt. und Parasitol.*, 1887, p. 97.
2. Grassi and Calandruccio.—Weitere Nachrichten ueber Taenia nana. *Ibid.*, 1887, p. 282.
3. Grassi and Rovelli.—Embryologische Forschungen an Cestoden. *Ibid.*, 1889, p. 370.
4. Leuckart.—Menschliche Parasiten.
5. Linstow.—Ueber Taenia nana, Sieb. und T. murina, Duj. *Jenaische Zeit. f. Naturwiss.*, 1896, p. 570.
6. Miura and Yamasaki.—Ueber Taenia nana. *Mitth. a. d. med. Fac. d. kais. Jap. Univ. Tokio*, 1897, p. 239.

7. Moniez.—Sur le Taenia nana, parasite de l'homme. *C. R. Ac. Sci. Paris*, 1888, p. 368.
8. Meniez.—Traite de Parasitologie, Paris (1896).
9. Railliet.—Traite de Zoolog. Med. et Agricole, Paris (1895).
10. Ransom, B. H.—An account of the tapeworms of the genus Hymenolepis parasitic in man. *U.S.A. Hyg. Lab. Bull.*, No. 18, 1904, Washington, D. C.