

NOTES ON THE OCCURRENCE OF MONILIFORMIS SP. IN RATS IN TEXAS

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During the summer of 1920, following the discovery of bubonic plague in a number of Gulf Coast cities, including Galveston and Beaumont, the writer was engaged in an examination of rats caught in the city of Houston, Texas, to determine the presence or absence of plague in that city.

The rat population of Houston is different from that of any other American city, as far as known to the writer, in that from 35 to 40 per cent. of the city rats belong to the species *Epimys alexandrinus*, the roof rat. In other American cities, including the neighboring cities of Galveston, Beaumont and New Orleans, the roof rat constitutes less than 5 per cent. of the total rat population. The wharf or Norwegian rat, *Epimys norvegicus*, constitutes about 60 per cent. of the total number in Houston, whereas the true black rat, *Epimys rattus*, is rare, probably less than 1 per cent. of the total. This rat is commonly confused with melanistic examples of the wharf rat, which are rather common, so that the statistics usually give a higher percentage of *Epimys rattus* than is actually true. A considerable number of rats, probably between 1 and 2 per cent., though resembling roof rats in their graceful form, showed the coloration of wharf rats, and had a tail and ears which were intermediate between the two species. Whether these rats should be looked upon as a distinct species, or, as seems more probable, as intergrades between *norvegicus* and *alexandrinus*, has not been determined.

The most interesting parasitological fact brought out by the examination of these rats is the common occurrence of *Acanthocephala* of the genus *Moniliformis* (Travassos 1915). Up to the present time these worms have been reported from the United States only in three instances. Ward in 1917 described these worms from a squirrel in Illinois. He considered his specimens as belonging to a species distinct from the Old World form and named it *Hormorhynchus* (= *Moniliformis*) *clarki*; a full description of this form has not yet been published. Worms of the same genus were previously reported by H. C. Chapman (1874) and by Stiles and Hassall (1884) from *Sciurus vulpinus* and *Sciurus niger*, respectively. Dr. Van Cleave has informed the writer that he has specimens of *Moniliformis* from Oklahoma also.

Although the full statistics are not yet available, the percentage of adult Houston rats which are infected is approximately 10%, the percentage of infected *E. alexandrinus* being higher than that of

E. norvegicus. The number of worms found in a single rat varies from two or three up to between one and two hundred. Not infrequently the entire small intestine from just behind the stomach to the ileocecal valve is crammed full of the worms, and distended to several times its normal diameter. The intestinal walls become thin and flabby from the distention, and the circumference of the small intestine may exceed three centimeters. With a few exceptions the female worms which are mature, i. e., bear eggs with developed embryos, vary from a minimum

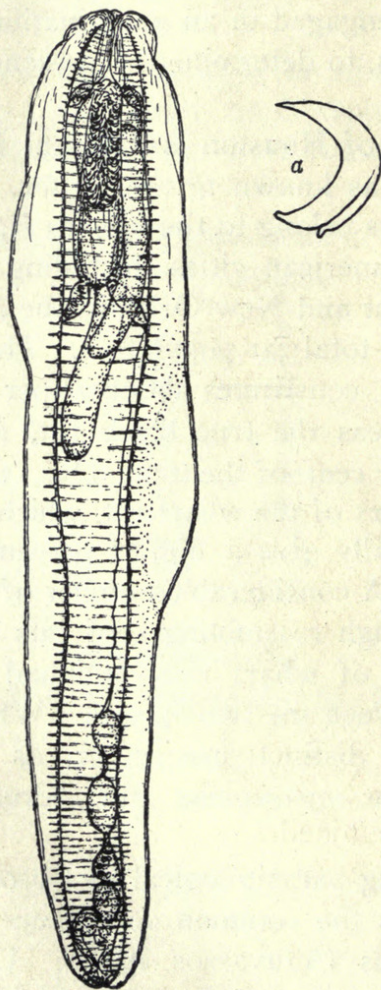


Fig. 1.—Immature acanthocephalan from Norway rat, *Epimys norvegicus*, showing retracted proboscis and immature male reproductive organs. $\times 30$.
a, Hook from proboscis of same worm. $\times 385$.

of 140 mm. to a maximum of 270 mm. in length. The body is very heavily annulated throughout most of its length. The annulations begin very fine, a few millimeters behind the cephalic extremity, become coarse over the anterior two-thirds of the body, and then become gradually less pronounced, the terminal ten to twenty millimeters being practically smooth. The diameter of the enlarged portions of the pseudo-segments reaches a maximum of 3.2 mm., the adjoining constricted portion being from 2 mm. to 2.5 mm. in diameter. When freshly extracted from the

intestine the worms are flabby and flattened and resemble taeniae. The proboscis measures from 0.55 mm. to 0.6 mm. in length, with a maximum diameter of 0.15 mm., about one-fourth the distance from tip to base. The hooks are irregularly arranged; their quincunxial disposition is not as apparent as in many *Acanthocephala*. There are in all from 17 to 20 hooks in a longitudinal series, if the more or less alternating ones in two adjacent rows be counted. There are six hooks in a transverse row, counting only those in alternate longitudinal rows. The lemnisci, even in the largest specimens, do not exceed 5 mm. in length, and are usually little over 4 mm. The male worms measure from 30 to 45 mm. in length, the annulations being close together and much less conspicuous than in the female. The testes are less than 2 mm. in length and either touch each other or are separated from each other by a very short interval. The prostate glands are crowded together into an oval mass about 1.25 mm. long; the individual glands are almost indistinguishable. The eggs measure from 112 to 120 μ by 56 to 60 μ , thus conforming more closely with the measurements given by Travassos in Brazil (124 to 127 μ by 71 to 74 μ) than with those usually given by European writers. The embryos inside the eggs measure from 80 to 84 μ in length.

In two or three Norway rats specimens of *Moniliformis* were found which were uniformly smaller than the worms usually seen. In these rats egg-bearing females measured from 55 to 90 mm. in length. One Norway rat contains numbers of these small mature female worms, measuring from 55 to 70 mm. in length and less than one mm. in diameter, and other larger specimens measuring from 90 to 270 mm. in length of which only those females which measure 150 mm. or more bear eggs. Some of the males from this rat measure only about 25 mm. in length. That the small worms, the dimensions of egg-bearing specimens of which average less than one-third that of the large egg-bearing specimens, especially when occurring in the same host, represent a single species seems to the writer highly improbable. Dr. Van Cleave suggests that the difference may be explained on the basis of periodicity, the smaller worms representing a more recent infection. This, however, does not explain the fact that the smaller representatives of the large worms, up to nearly three times the length of the smallest egg-bearing specimens, are immature, if lack of development of eggs can be accepted as a sign of immaturity.

Without specimens from other places for comparison, it is impossible to draw conclusions as to the status of the species of *Moniliformis*, three of which have been described up to the present time. The type species, *M. moniliformis* Bremser is described very differently by different authors, and it is possible, as suggested by Lühe (1911), that as usually accepted it is a composite of more than one species. The specimens described by various writers from rats in Southern Europe, mea-

suring from 6 to 8 or 10 cm. in length, may not be identical with the specimens from *Arvicola* and *Cricetus*, measuring from 12 to 27 cm. in length. What the relation of either of these is to the forms found in Houston, or to those described by Ward from a squirrel in Illinois as *M. clarki*, or to the South American forms from rats described by Travassos, or to *M. cestodiformis* described by von Linstow from a hedgehog in West Africa, can only be determined by careful comparison of specimens from all these places and hosts. Inasmuch as his work has already been undertaken by Dr. Van Cleave at the University of Illinois, who is collecting material from various parts of the world, the specimens from Texas will be submitted to him for comparison with other forms.

In a single specimen of *Epimys norvegicus* twelve specimens of a small Acanthocephalan worm were found in the lower portion of the small intestine. These worms were at first thought to constitute an entirely new species, but more careful examination makes it appear probable that they are immature specimens of *Moniliformis*. The specimens are all of approximately the same size, and could very possibly have all been acquired from the ingestion of a single intermediate host. None of the females show any signs of developing eggs, and the males, though showing all of the male reproductive organs present, possess them in an evidently immature state. The worms are flattened and show no signs of external annulation; they taper gradually from just back of the proboscis sheath to the posterior end. Their length is from 3.2 mm. to 4 mm., the greatest width about 0.5 mm. The proboscis is retracted in all but one of the specimens, thus making it difficult to count the hooks, but there are evidently about 14 in a longitudinal row, and approximately six or seven in a transverse series. The hooks are all practically alike in size and form. Their characteristic shape is shown in figure 1a. The proboscis sheath is relatively large and measures about 0.75 mm. in length; it is retracted some distance within the anterior end of the body. There is a pair of powerful and conspicuous retractor muscles attached to its posterior end and a second pair at its anterior end. The lemnisci are relatively large, about twice as long as the proboscis sheath. The condition and arrangement of the male reproductive organs is shown in figure 1. The ladder-like lacunar system is very conspicuous, as shown in the figure.

Until further information can be obtained it is impossible to say whether these young worms represent a *Moniliformis* or whether they represent an entirely new genus, but the presumption is strongly in favor of their being *Moniliformis*.

A number of infection experiments with both the large and small forms of adult *Moniliformis* were carried out on cockroaches of two species, namely, *Periplaneta americana* and *Blatella germanica*, by feeding both adult and young roaches on the feces of infected rats and on the egg-filled bodies of the worms, but without any successful results in any case. The fact that a rather high percent of rats from rice and grain mills and storage houses were infested seems to indicate that some grain insect, possibly the rice beetle, *Calandra oryzae*, may act as intermediate host. It is hoped that this point may be cleared up in the near future.

LITERATURE CITED

- Chapman, H. C. 1874.—On *Echinorhynchus Moniliformis*. Proc. Acad. Nat. Sci. Phila., pp. 76.
- Linstow, O. von. 1904.—Neue Helminthen aus Westafrika. Centralbl. Bakt. Paras., I Orig., 36: 379-383, 1 pl.
- Lühe, M. 1911.—Acanthocephalen Süßwasserfauna Deutschlands, Heft 16.
- Stiles, C. W., and Hassall, A. 1894.—A Preliminary Catalogue of the Parasites Contained in the Collections of the U. S. Bur. An. Ind., U. S. Army Med. Mus., Biol. Dept. U. Penn. (Coll. Leidy) and in Coll. Stiles and Coll. Hassall. Vet. Mag., 1: 245-253, 331-354.
- Travassos, L. 1915.—Revisão dos acantocefalos brasileiros. I Fam. Gigantorhynchidae Hamann 1892. Brazil-Medico, 29, no. 12, p. 89.
- 1917.—Contribuições para o conhecimento da fauna helmintologica brasileira. VI. Revisão dos acantocefalos brasileiros, Parte I, Fam. Gigantorhynchidae Hamann 1892.
- Ward, H. B. 1917.—"*Echinorhynchus moniliformis*" in North America. Jour. Parasit., 3: 141, 182.



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