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observations on the tapeworms of man known as Taenia nana and Taenia flavopunctata

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In this preliminary communication, I would like to add to the relatively restricted number of case-histories of the tapeworms formerly known as *Taenia flavopunctata* and *T. nana*, with a few observations, which are also the first from my field of endeavor, Brazil. Since there may easily be considerable delay before the opportunity for further observations occurs, it seems better not to hesitate any longer in publishing these. I intend, however, to return later to several points in the biology of these cestodes.

The group of tapeworms to which these two species belong was separated off by Weinland, under the name of *Hymenolepis* and have recently been studied in a rather thorough manner by Raphael Blanchard.¹ As he includes a bibliography and the pertinent case-histories, and I do not know of any more recent papers on the subject, I will refer exclusively to his monograph.

Blanchard quotes only 4 cases of *Taenia flavopunctata*, which are:

1) A case of Ezra Palmer, 1842. There were 6 worms, without scolex, 20-30 cm. In length. These were described and named by Weinland. Leuckart also saw fragments of them.

2) Case of Leidy. Fragments of 3 worms collected by W. Pepper and eliminated by a child of 3, in Philadelphia, after the use of santonin.

3) Case of Parona, 4 worms with scolex, eliminated by a child of 3, in Varese (Italy), after the eggs had been found in the stools.

4) Case of Grassi. After taking a remedy against cestodes, a girl of 12 eliminated besides one *Taenia solium*, 2 *Hymenolepis*, 20-30 cm. long, one of them with scolex.

Finally there is a helminthological experiment of Grassi, which led to the development of a large number of tapeworms belonging in here.²

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² However, in only one of the two subjects of the experiment. [A.N.]
To this short list I will now add the following case:

In May 1893, soon after I became Director of the Bacteriological Institute, a local physician, Dr. Rocha Faria, brought me a *Taenia* for examination, which had been eliminated by the child of a Portuguese settled here, in its second year, after the use of santonin. The specimen which was preserved in alcohol was rather friable and proved to be the scolex and strobila of a small species of tapeworm. The scolex showed four rather large suckers; the hook less rostellum which was poorly developed and lay between them, was less distinct. There were about 960 proglottis, among them some sterile ones which immediately called attention. The last segments, which had separated as a small chain, were completely filled with eggs.

It could be either a new species or an already known but rare one. Of the latter *Taenia flavopunctata* Weinland was the only probable one. Careful examination showed that it was undoubtedly a *Hymenolepis* which in general agreed quite well with the one described by Weinland. The divergences were evidently due to different methods of conservation and different conditions of examination.

After being able to include the specimen among the known human parasites there remained another point to be considered. Grassi, realizing that a parasite so seldom found in man could hardly belong to him, had looked for another host. He had found that a species described as *T. leptocephala* by Creplin, in 1825, from rodents, especially rats, was identical with *T. flavopunctata* and that therefore the same name ought to be used for both. According to R. Blanchard, however, this species had already been described in 1819, by Rudolphi, who called it *T. diminuta*, and this name must be accepted, in accordance with the rules of priority. 3

Although Grassi’s data were perfectly trustworthy; it seemed advisable to test them once more. I especially wished to find out if a tapeworm corresponding to the one seen by me was common in the rats of São Paulo.

In fact, I soon found that *S. Paulo Mus decumanus* often contains a tapeworm which, on the one hand, concurs with the descriptions of *T. diminuta* (*T. leptocephala*) and, on the other, with the specimens from man, except for differences due to preservation. Consequently I agree with Grassi in considering the rat as the common host of the human *T. flavopunctata*.

The material obtained form rats permitted me to study the worm further, especially in the fresh state. The results gained will be presented later.

While I was still occupied with this subject, I had the opportunity, during a stool examination, to see the eggs of another tapeworm which I suspected of belonging to *H. nana*. Comparison with the descriptions available to me made this even more probable, especially as the manifestations observed in the bearer also favored this supposition.

The patient was a child of 2½ years, born of foreign parents but raised in São Paulo, which a year ago had been treated for a long time for symptoms of an intestinal illness and had also exhibited all sorts of nervous symptoms. There had been several bouts of irregular fever, besides other symptoms which generally occur during teething, but which did not seem connected with this period (ascarides had

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3 Other synonyms are *T. varesina*, *E. parona* and *T. minima* Grassi. [A.N.]
also been eliminated a few times). I saw the child during one of the attacks of fever and examined the feces. Besides many cysts of flagellates and eggs of *Trichocephalus*, the tapeworm eggs were present in a very small number. A cure with *Extractum aethereum filicis maris* was begun after the fever had come to a stand-still. Although *Taenia nana* was especially looked for no fragments were found; on the other hand, it was possible to exclude with certainty any large species of tapeworm. Since *Extractum filicis* is mostly found rather ineffective here, I had a sample sent out by Carlo Erba from Milan. A second attempt was made with this. Before using it, the stool was again examined. The eggs of *Hymenolepis* were so scarce that they could only be found by the method of sedimentation. After the first dose, which was rather small (0.3 *Extract. Fil.*) there followed a movement which contained 5 strobilas of a small *Taenia*; two more doses, after 2 hours each, did not produce any results. Though there were no scolecis and the neck was near the head, I was able to ascertain that they belonged to *T. nana*. The average number of proglottis was 190, and the maximum, 200; the eggs were oval in shape and somewhat variable in size and had distinct papillae on the poles or the inner egg-membrane; they concurred entirely with those, eliminated previously.

*Taenia nana* was also considered by Grassi as identical with a species of *Hymenolepis* of the rat and mouse, *H. murina* Dujardin. He proved that this species undergoes the cysticercoid stage also in the mucous membrane of the definitive host. In consequence of this, the infection of man would also have to be due to swallowing eggs which must have come before from another human being, or an animal, whereas later the host can reinfect himself with the eggs of his own tapeworms. If the human and the rat *Taenia* are really the same, man can infect himself with the eggs of the latter; if, however, *T. nana* were a separate species adapted to man and only related to *T. murina*, one would have to postulate also for the former a development without a change of host. Transmission through an intermediate host belonging to the class of insects could hardly explain infection, often by thousands of specimens, even if multiplication by budding of the cysticercoids were postulated.

It is known that *Hymenolepis nana* is relatively common only in Italy; it was once seen in Egypt by Bilharz, 1851, and found again, in 1885, by Walter Innes. Eggs of this species were repeatedly found by Ransone in Nottingham in the stool of a girl of nine years. In Belgrad Dr. Holes caused the elimination 5 times, each time of about 50 specimens, by a girl of 7. Besides this, the worm was observed by Spooner in 1887, at Philadelphia, and Wernicke, in Buenos Ayres (1890?) found 30-40 specimens in the postmortem of an Argentinian sailor. In Sicily the worm is rather frequent according to Grassi and Calandruccio. In Italy also, it has been seen relatively often.\(^4\)

As there is considerable emigration from Italy to South America, it seems very likely that the parasite was brought to Brazil and the Argentine from there. On the

\(^4\) This hypothesis was put forward by Moniez and accepted by Blanchard. The reasons given by the latter for so doing are not at all germane to the subject. [A.N.]

\(^5\) For more details, see R. Blanchard, from whom the data presented herein were obtained. [A.N.]
other hand it is possible it is frequent in rodents in these countries and that they are
the source of human infections. I searched for this worm also in the wandering rat
and did find it after several negative results.

With a view to studying *H. diminuta*, I had several times obtained rats from the
same locality and they almost always contained the same parasites. Often the
worms were not, however, developed to the point of containing ripe eggs and
mostly only juvenile, animals wandered into the traps, so that I was obliged to
keep the rats alive for sometime and to examine their excrements now and then.
One of these rats was found dead in a cage in which it had been for several weeks
and had also served for a bacteriological experiment. Dissection showed that the
stomach was filled with masses which were clearly of a fecal nature. Microscopic
examination thereof revealed tightly packed eggs of *H. diminuta* and between
them somewhat rarer eggs which agreed with those of *H. nana*, and demonstrated
clearly that this was a case of ileus. In the small intestine two adult specimens of
*H. diminuta* were present and a large number of small tapeworms, which were
entirely like *H. nana*; there was also a male of what is probably a new species of
*Strongylus*. The liver contained great many eggs of *Trichosoma*, a constant find in
the local rats. As no other lesions were discovered, I attribute the death of this
animal to helminthiasis and consider the ileus as due to obstruction of the intestine
by *H. diminuta*.

Until now I have been unable to find any difference between the small species
of *Hymenolepis* of man and of the rat so that I agree with Grassi. The occurrence of
a new case of *H. murina* in man enabled me to extend the comparison to the
scolecites also.

This time the patient was a little girl of four, also born of foreign parents, but
reared in São Paulo, who for the last two years, at least, had been suffering from
constant diarrhea and occasional attacks of fever. Neither a carefully chosen diet
nor treatment in Europe had led to improvement. As in the first case also, the child
showed symptoms of a perverted appetite, such as eating the white wash off the
walls, but the nervous symptoms were not pronounced. Nutrition had not suffered
as much as one would have expected, which must be ascribed to very good care.
The similarity of the symptoms to those of the first case led the parents to bring the
child for consultation, and in the quite fluid stools I found numerous eggs with the
shape of those of *H. nana*; 4.0 extract *Filicis maris aether*. emulsion, from Carlo
Erba, were administered. They were followed by two movements which brought
forth an incredible amount of small *Taenia*. I isolated 850 and counted over, 2000
but was unable to finish the count for extraneous reasons. Most of the strobiles
were devoid of the scolex, only 10% of which were recovered. Macroscopically
they were already characterized by their relatively great thickness as compared to
the thin neck. Microscopic examination demonstrated that often the head was
almost free, so that one may assume that sometimes the separation supervened
only after elimination. There were also many small fragments composed exclusively
of ripe proglottis.

Whereas in the *Taenia* of the rat which had died slowly the rostellum was
mostly stretched out, in the human ones it was invariably withdrawn. Warming to
blood-temperature did not produce any signs of life.
This second case makes it probable that observation of similar states of illness would lead to finding further cases of *T. nana* here. Nevertheless, I cannot consider this parasite very frequent because I only once found a similar tapeworm egg, in about 500 earlier stool examinations carried out because of symptoms of helminthiasis or intestinal disease.

In regard to the further clinical course of my cases of *Taenia nana* I may add the following remarks:

The second child, who had eliminated about 2000 worms on the 22nd of March, was submitted to a new treatment on the 10th of April, 1894. This time only 25 strobiles were passed of which about half retained the scolex. The small patient can be considered as more or less cured as all the manifestations are gone. The stools were always diarrheic before, in spite of all care; they have become consistent though the child is allowed to eat every kind of food.

The first case did not evolve in so satisfactory a way. Although there was considerable improvement after the second treatment, which only brought forth 6 strobiles, there was no definitive cure. By the beginning of May all the old symptoms had returned, in pains in the abdomen, diarrhea, restless sleep and a facies of pain. Another cure was undertaken with 3 g of Erba’s extract given in one dose. This resulted in the passing of about 100 strobiles, of which 10-20 with scolex and of two female *Trichocephalus*. Now, after two weeks, the symptoms have abated somewhat but have not disappeared entirely.

I would like to state that the same extract used in two case of *T. saginata*, which had withstood 4-5 cures, gave excellent results, the scolex being eliminated in all of them. (One of the patients was the mother of the first child).

We thus see that even with a good preparation the worm is often eliminated without its scolex. The ripe proglottis have also been generally separated from the rest of the strobila and form one or more fragments. This small species thus behaves just like the larger kinds of *Taenia*. It is therefore rather surprising the other authors convey the impression that in their cases the worms were always passed with the head. In my cases evidently not only were all the strobilas eliminated but the effect must have been definitive even when the scoleces were not attached to the strobila; in the first patient, for instance, only 10% of the worms were able to regenerate. The paradox that in this first case the second cure produced only 6, whereas the third cure produced 100 specimens with the same substance is explained by reinfection which is easy for reasons which will be explained subsequently.

On this account the second cure was followed by a long period during which there was a remission of all the symptoms. Therefore in cases of this kind it is advisable to go on repeating the cure until all the strobilas have been eliminated; intervals of about two weeks seem the most adequate. The totality of the worms passed only can be found, easily and rapidly, against a black background, such as is found in some photographic dishes. In a white container it is almost impossible to do so. This factor must be taken into special account while controlling the result, an operation which should preferably be carried out personally by the physician.