

TAENIASIS IN THE BANTU

PROF. R. ELSDON-DEW, *Director Amoebiasis Research Unit* and Institute for Parasitology, Durban*

Tape is one of the most costly items to this country affecting all levels of the population from the highest to the lowest. The *Taenia rubra* of our government departments is a well-known form, with a Parkinsonian type of life cycle. Though this problem affects the medical profession, like so many others confronting them, it is not in their hands to solve and I do not propose to discuss this form of parasitism further.

Why is it that the tapeworm is considered a joke and the unfortunate sufferer becomes a butt of ribald remarks? Is this *schädenfreude* based on the attitude—'it couldn't happen to me?' Though infection with the adult worm is not serious it is, as I will show, not to be taken lightly.

Life Cycle

Though the life cycle is simple, I will draw attention to certain points. With most tapeworms, and there are thousands upon thousands of species, the adult lives in a predator host, and the eggs passed by that adult find their way as larvae into that predator's food supply. Thus the tapeworms of the lion have their larval forms in our antelopes, those of the whale in minute crustacea and those of man in his pigs and cattle.

Though the adult tapeworm in man causes little if any disturbance beyond mild colic and food-loss, there is a very real aesthetic objection to being inhabited by such an unsavoury lodger. The mental distress of a carrier is very real and is in no way mitigated by the ribaldry referred to. Thus it is that precautions are taken to ensure that contaminated meat does not reach the consumer. Meat inspection at our abattoirs is thorough enough to protect some part of our population. This admirable measure, however, is twin-edged and lopsided.

Affected carcasses. The condemnation or retention of affected carcasses is a costly feature. Just how costly we do not know, but estimates indicate that the figure runs into

millions of rands every year. Were you in receipt of the number of complaints from farmers arriving in my office alone, you would realize that this loss is no book-entry. Each year this loss becomes bigger and though the impact on the individual farmer has been lessened by insurance, this has merely spread the load over the whole meat industry.

Meat inspection. I said that meat inspection was lopsided. It is carried out in the towns where efficient sewage disposal should break the cycle anyway. In the country, where the cycle can continue, what little inspection is done is perfunctory in the extreme. To be logical, the restricted force of meat-inspectors should be concentrated in the country areas and we should let the townsmen have the tapeworms.

This not entirely facetious comment merely serves to emphasize that the tapeworm cycle must be broken. It is obvious that our Bantu in country areas are the most affected. In some places the incidence is 50% and more. Small wonder that the animals are being contaminated more and more, forming a vicious cycle bordering on a chain reaction—a chain reaction which is already reaching the explosive level.

The farmer loses most. It is true that the greatest sufferer in this situation is the farmer, whose pecuniary loss may well be serious. It is also true that a remedy lies within his own hands. But here, too, we have a vicious cycle. The more cattle a farmer loses, the less money he has to put in train the necessary protective measures. We must not however forget the loss of meat. The human population explosion is happening here too, and though for the moment we have space, our supply of meat is bordering on the precarious and it will not be long before it is inadequate. If meat producers are put out of business by the tapeworms the process will be accelerated, and we in town and country alike will be the sufferers. So the farmer's problem is our problem.

The Remedy

What can the farmer do? The cycle is man-pasture-stock-

*The Amoebiasis Research Unit is sponsored by the following bodies: South African Council for Scientific and Industrial Research, Natal Provincial Administration, University of Natal, and US Public Health Service (Grant A1-01592).

man, and theoretically it can be broken at any point. The man to pasture link could be severed by adequate hygiene—easily said, but not so easily done. Farmers should provide latrines for their staff but can they induce the primitive Bantu to use them; particularly since, without constant supervision, such erections rapidly become repellent?

Educate the Bantu—once again easily said but again not so easily done. It must be recalled that the Bantu diet usually implies two defaecations a day, and while one may be within range of a latrine the herd-boy may well be out in the bush when the second becomes due. Is he likely to bury it as he should? Even education would not induce him to undertake such a task when he is out of sight.

Breaking the cycle. The cycle can be broken at the man-level. An efficient taeniocide could well reduce the tapeworm population. Many farmers are already treating their staff—at the no mean cost of about 50 cents a time—and no doubt this will lessen the infection of pasture, but it will take a long time to affect incidence since there is a reservoir in the cattle. Re-infection will be the rule, unless a second break is made at the stock-man link. So the break at the man level will need to be repeated over and over till the cattle and the pasture have been maintained parasite-free. This is all very well, but what of the contamination of pasture by casual passers-by. Just how important this can be is exemplified by the recrudescence of measles in pigs and cattle in a highly sanitated area like Europe. This has been attributed to the increase in camping, touring and caravanning. How can a farmer prevent this? It is true that pasture is a crop to be protected by fencing—but such fencing would need to be man-proof, would be expensive, and would need constant supervision. Can one envisage adequate protection for the Zoutpansberg farms? Talking of the Zoutpansberg—one could write a thesis entitled 'The Mopani worm as an aetiological factor in taeniasis in man and cysticercosis in cattle'. Here the farmers risk contamination of their pasture for the sake of the fees they get from collectors of this African delicacy.

Are we to repeatedly treat all human carriers of the tapeworms? This would indeed be a major project, for there must be a million or more such carriers in the Republic. This would work, but at what cost? Either we would have to detect all carriers or treat the whole population of affected areas. Either process would be a major undertaking implying, apart altogether from the cost of the drugs, an enormous personnel with plenary power.

Such a *blitzkrieg* may well prove necessary particularly in the Bantustans, where as yet hygiene is at a low level, and meat inspection inadequate, unless some other approach can be devised. Obviously research is necessary, and I am glad to say it has been started, albeit with meagre resources.

My remarks so far have been more particularly aimed at the beef tapeworm, but there is an aspect of the pork tapeworm about which we cannot afford to be complacent. The pig is not the only intermediate host for *Taenia solium*; man can also get cysticercosis.

Antigen reactions. In view of the difficulty of obtaining an adequate quantity of material for the fractionation of

antigens in the amoeba, we applied some of the techniques already learned to the tapeworms. This is not the place to discuss the involved procedures of molecular sieving, immunoelectrophoresis and the other modern techniques we are trying—suffice it to say we are studying immune reactions to parasites, including the tapeworms, and have at the moment a test for cysticercosis under trial.

This we have been trying in pigs, with encouraging results. This led us to try the tests on human sera and we find that there are, even among blood donors, a number of positive reactors. As would be expected, the proportion of such positive reactions varies from area to area and from people to people. When we tested a group of Bantu with the clinical diagnosis of epilepsy we obtained a higher figure. The inference is obvious. This work will be published in more detail elsewhere, and as epilepsy is by no means uncommon in the Bantu, further work must be done.

The position as regards *Taenia solium* is confused by an anomaly. There is a discrepancy which must be explained. Where, in Durban, a high proportion of pigs are condemned for the cysticercus phase, the incidence of the adult in man is so low that at one time it was thought not to exist. There are a number of possible causes for the discrepancy, and we are working our way through these. First, is the routine method of species differentiation adequate, or were some *T. saginata* being mislabelled?

Labelling the species. As you know, the usual technique is to squeeze a gravid segment between 2 slides and to count the branches of the uterus. The presence of many branches indicates *T. saginata*, relatively few—*T. solium*. To check this we collected a mile or two of worms. So as to get whole worms, and have head and tail connected, we used autopsy material, and examined this by various techniques. Several lessons emerged. The ratio of case incidence was 156 with *T. saginata* to 4 with *T. solium*, thus confirming the anomaly. Multiple infections were not uncommon, the average number of worms per patient being 2, thus disposing of the common concept that such infections are usually single. Where gravid segments are available, the number of uterine branches is an adequate distinction between the species. In view of the importance of recognizing *T. solium*, less ripe segments were examined and a method of differentiating the species at this level established.

A second possible cause of the discrepancy might lie in the fact that the observations on incidence have been made in the cities, where meat inspection protects the human. To this end a survey of pigs condemned at Natal abattoirs was made to discover the source of these animals. As might be expected most infected pigs come from Bantu owners. White owners of such pigs were either speculators or claimed that the animals concerned belonged to their Bantu staff. However, we were able to pinpoint areas in Southern Natal and the Eastern Free State. Bear in mind our studies were at Natal abattoirs. We are at the moment studying Southern Natal not only for the incidence of the 2 species, but also for the presence of antibodies in humans and pigs.

A third possibility is being followed at the same time. It is conceivable that the cysticerci we see in pork are not

those of *T. solium* but are the larval phase of some other tapeworm with the adult in another predator of pigs. As the Bantu in these areas also run sheep and goats, *Taenia ovis* of the dog is under suspicion: such a parasite *might* be a source of human cysticercosis. We may have to attempt a serological distinction.

A fourth possibility is that the cysticerci found in pigs originate from *T. saginata* in the human. Though the cysticercus in the bovine does not have hooklets, the eggs of *T. saginata* show rudimentary hooklets. Our Onderstepoort collaborators have fed piglets with viable *saginata* eggs without success. Paratenesis must also be considered and experiments are under way.

Our attempts to establish adults in *Cercopithecus* failed. *Taenia solium*, as an adult seems to be host specific—perhaps baboons might be susceptible. You will appreciate that shortage of *Taenia solium* adults is a restricting feature of our work. While one might have but little reluctance to use human volunteers for *T. saginata*, the danger of cysticercosis precludes such a process for *T. solium*.

From the foregoing readers will appreciate just why we have not as yet been able to come to the assistance of farmers in the Pietersburg area. Time, staff and, above all, money are the restraining features. Readers will further understand why we have not investigated that other scourge *Taenia rubra*.