

**Preliminary Note on the Life-History of
Gaigeria pachyscelis (Raill. and Henry, 1910),
a Hookworm of Sheep.**

By

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DURING the last few years investigations have been carried out on the mode of infection, development and methods of prevention and cure of *Gaigeria pachyscelis*, a nematode parasite of sheep which is very prevalent in the drier areas of South Africa. The most important results so far obtained are briefly referred to in this preliminary note; a fuller account of these investigations will be given at a later date.

The material used was obtained in the first place from infected sheep from the Vryburg area of the Union. The sheep were brought to Onderstepoort, and the mature larvae were cultured from their faeces. Ordinary jam bottles were used in which the broken up faeces were placed; they were then incubated at about 26° C., and the mature larvae were collected from the walls of the jars in from 6 to 8 days. This was a relatively simple process as these larvae possess characteristics by which they may easily be distinguished from the larvae of *Strongyloides*, Wireworms, *Trichostrongyles* and *Oesophagostomes*.

INFECTION.

For the purpose of infection sheep were used which had been reared at Onderstepoort where these Hookworms do not occur; they consisted for the most part of lambs less than a year old. Several attempts were made on 18 sheep to bring about oral infection, but in all cases the results were negative. The infective larvae were introduced into the mouths of sheep either in the form of a drench, or in a little water squirted into the sides of the mouth or in a little mash. Meanwhile it had been observed that the infective larvae were not able to withstand drying, and also that they were attracted towards the source of heat, the gentle warmth at the same time being responsible for a very increased activity. Now these responses are very characteristic of those larvae which bring about infection by penetrating intact skin, and attempts at this mode of infection were now made. In the first series of experiments the active larvae, in a little water, were placed between the hoofs of 23 sheep and this

application of larvae was repeated several times during the course of the following weeks. The faeces of all the sheep were regularly examined once a week from the 4th week onwards after the first application of larvae. Positive results, shown by the appearance of the characteristic eggs in the faeces of the sheep, were obtained in practically all the sheep. (20 sheep gave positive results, 1 remained negative, and 2 died shortly after the 1st application of larvae.) The time which lapsed from the time of the 1st cutaneous infection to the first appearance of the eggs in the faeces varied from 10 weeks to 21 weeks and 5 days, the more frequent period, however, being about 10 weeks.

In order to exclude the possibility of the sheep becoming infected through the licking up of active larvae from their hoofs, the hoofs of the exposed sheep in the next series of experiments were enclosed in thick canvas bags, and these bags were kept on the hoofs for at least one day after application of the larvae. Five sheep were used, and these all gave positive results. Unfortunately four sheep died during the 10th week of infection and before any eggs had been seen in the faeces. However, adult *Gaigeria* were found on post-mortem in the small intestines of all four. The 5th sheep showed *Gaigeria* eggs in its faeces 11 weeks and 3 days after its first exposure.

Having established that cutaneous infection was possible, the larvae, suspended in a little water, were in the next series of experiments applied to the skin behind the ears. So far this mode of infection has been applied to 34 sheep, and of these 31 have given positive results, either by the finding of the eggs in the faeces or of adolescent or larval stages on post-mortem. One sheep failed to become infected, and of the remaining 2, one died while the writer was away and the other died soon after infection.

Summarising the above-mentioned results we find that of 18 sheep exposed to oral infection none gave positive results, whereas of 62 sheep which had been exposed to cutaneous infection, either between the hoofs or behind the ears, 56 became infected, 2 remained negative, and in the case of 4 no definite results can be given. From these results it appears legitimate to conclude that the normal mode in which sheep become infected is through the skin and not through the mouth.

DEVELOPMENT.

The eggs when passed out in the faeces are in the morula stage. With suitable moisture, air and warmth they develop and hatch out in about 24 hours. The larvae feed and grow and undergo their first moult about 24 hours later. These 2nd stage larvae are very similar to those of the preceding stage, and in from 4 to 6 days from the commencement of incubation, depending on the temperature, they reach the 3rd or infective stage. These larvae are ensheathed in the cuticle of the previous stage, which is provided with a long slender tail; they are active but do not feed. They are climbers, are attracted towards the source of gentle heat, cannot withstand drying and can penetrate the intact skin. They vary in length from 0.605 mm. to 0.713 mm. On coming in contact with living skin they become very active, and boring through the skin they

soon reach the lungs presumably via the blood and lymph streams. They remain in the lungs until the 13th or 14th day after entering the skin, and during this period they grow in the lungs and pass into the 4th stage. This stage is characterised by the presence of a globular larval mouth capsule provided with a dorsal tooth and two subventral lancets at its base; sex differentiation has not yet taken place, the genital primordium being still lens-shaped and composed of a few cells; they have increased in length to about 1.4 mm. On the 13th and 14th days after infection the first larvae make their appearance in the small intestine; these are all still in the same stage of development as the 4th stage larvae found in the lungs and show very little if any increase in size. Their course from the lungs to the intestine is probably via the trachea and oesophagus. In the intestine the larvae attach themselves to the villi by drawing the villi into their buccal capsules and lacerating them by means of their teeth. They are reddish in colour and appear to feed on the liberated blood. Growth continues, and sex differentiation is very soon apparent. During the 5th or 6th week after infection they pass into the 5th or final stage; the larval buccal capsule is replaced by the adult buccal capsule and the final ecdysis takes place soon after. From this time onwards the adolescent 5th stage worms gradually grow and become sexually mature in about 10 weeks from the time of their exposure to infection.

No investigations have as yet been carried out in the field, but from the above-mentioned results it is probable that the sheep acquire their infection, in the more arid areas, through their feet from larvae present in the moist earth round about drinking troughs, and in the moister areas by the larvae, which have crept up blades of grass, coming into contact with the skin round the mouth during grazing. Infection in the former case can be considerably reduced by the liberal application of common salt round the drinking troughs as it has been found that the infective larvae are easily killed by a strong salt solution. Unfortunately no satisfactory drugs have been found which will expel the worms from the intestine, Carbon tetrachloride or Tetrachlorethylene, the commonly used drugs for the treatment of other hookworms, having so far given very disappointing results. However, better results may perhaps be obtained with these drugs when a more satisfactory method has been devised for introducing these drugs direct into the abomasum.