Facultad de Veterinaria
Departamento de Patología Infecciosa y Parasitología *
León. España.

A COMPARATIVE STUDY OF THE ECOLOGY OF THE PRE-PARASITIC STAGES OF *TRICHOSTRONGYLUS AXEI* AND *T. COLUBRIFORMIS* **

por

ROJO-VAZQUEZ, F. A. ***

SUMMARY

The rate of development of eggs of *T. axei* and *T. colubriformis* and the survival of infective larvae of the above species from material exposed during Spring and Summer 1975 was followed until the end of October of the same year. 24 plots were seeded with faecal pellets and pats during that time. In general as temperatures increased development ocurred more rapidly but larvae appeared on herbage at different times depending on the form of faecal material. There was also a difference in the rate of migration of the two species greater activity being shown by *T. colubriformis* than *T. axei*. The results are compared with those of other authors.

INTRODUCTION

Relatively little attention has been paid to the comparison of the pre-parasitic development of *T. axei* and *T. colubriformis* on pasture herbage. A study of the development and survival of these species in Southern England was therefore carried out during the period March to October 1975.

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*, Director: Prof. M. Cordero del Campillo.
**, trabajo realizado en el Central Veterinary Laboratory, Weybridge, Gran Bretaña.
***, Profesor Adjunto de Parasitología y Enfermedades parasitarias de la Facultad de Veterinaria de León.

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MATERIAL AND METHODS

Twenty four plots each 0,5 metres square were marked out with corner stakes and stout string in order to define the area over which faecal pellets and pats containing eggs of *T. axei* and *T. colubriformis* were to be spread. The herbage on these plots was clipped in order to keep it at a height of about 5 cm. and clippings were allowed to remain on the plot. Faeces in the form of faecal pellets from housed donor lambs carrying pure infection of *T. axei* or *T. colubriformis* were collected during the previous 24 hours by means of a faecal collecting bag. This material was spread evenly over the herbage on the plots daily from Monday to Friday inclusive during the first week of each four week period. Separate plots were used for each species. Plots were seeded in this way every 4 weeks throughout the observations. Plots 1, 3, 5, 7, 9 and 11 being used for *T. axei* and 13, 15, 17, 19, 21 and 23 for *T. colubriformis*. On the first day of the week pellets were spread a second series of plots 2, 4, 6, 8, 10 and 12 for *T. axei* and 14, 16, 18, 20, 22 and 24 for *T. colubriformis* were seeded with nine 2,5 cm dia pultaceous masses of faeces hereafter referred to a "pats". The total number of eggs spread on plots with pellets was 100.000 and on plots with pats the number varied between 30.000 and 326.000, this variation being due to the constant size of pats and reflects a varying eggs count of the faeces. Before the faeces were spread on the plots, the number of pellets comprising 3 g was determined and every 14 days following the date when faeces were first spread on the plots, the same number of pellets were collected and examined for the presence of nematode eggs using a modification of the McMaster egg counting method. The mixture of faeces and salt solution remaining after completion of the McMaster count was used to carry out a salt flotation to study the stage of development of the eggs and to record the percentage which had reached the various stages of development. A second sample of faeces collected at the same time was broken up placed in a small Baermann-Wetzel apparatus to recover any free first, second or third-stage larvae which may have been present in the pellets. Examinations of plots seeded with pats were also made one patbeing remove for examination. Half of it was examined for the presence of eggs as with pellets and the other

half for the recovery of larval stages. These fortnighly examinations continued until eggs could no longer be recovered. Herbage was collected from the plots at the same time. About 20 g being collected by taking small random samples. The herbage collected in this way was examined by the technique described by Parfitt (5) for the presence of infective larvae. These examinations continued until at least three consecutive collections were negative. The observations terminated on 28 October.

Meteorological records were obtained from a small meteorological station situated about 1 km. from the experimental plots. Air temperature was recorded by means of a thermograph housed in a standard Stevenson screen, soil temperature at a depth of 2,10 cm was taken by means of a recording soil thermometer and daily rainfall was recorded using a standard meteorological office gauge.

RESULTS

The results are summarized in Figs 1 and 2. Fig 1 shows the results of the observations on plots 1-24 and the corresponding meteorological records are given in Fig 2.

T. axei plots (pellets)

On Plot 1 two weeks after exposure 65% of the eggs were in the gastrula stage and 35% were embryonated. The maximum weekly average temperature was 6,2°C and the minimum 1,1°C. Four weeks after exposure 40% of the eggs were embryonated, 40% in the gastrula stage and 20% dead. The temperature was a little higher than in the former period but remained low. After 8 weeks eggs could no longer be recovered from faeces and no larvae were recovered from faeces or herbage although observations continued for 20 weeks.

On Plot 3 fifty per cent of the eggs contained first-stage larvae two weeks after exposure. By that time average temperature was 17,5°C (max) and 8,8°C (min). Four weeks after exposure, third-stage larvae were observed on the herbage, the weekly average temperature being 12,7°C (max) and 8,4°C (min). The number of larvae recovered from herbage remained high du-

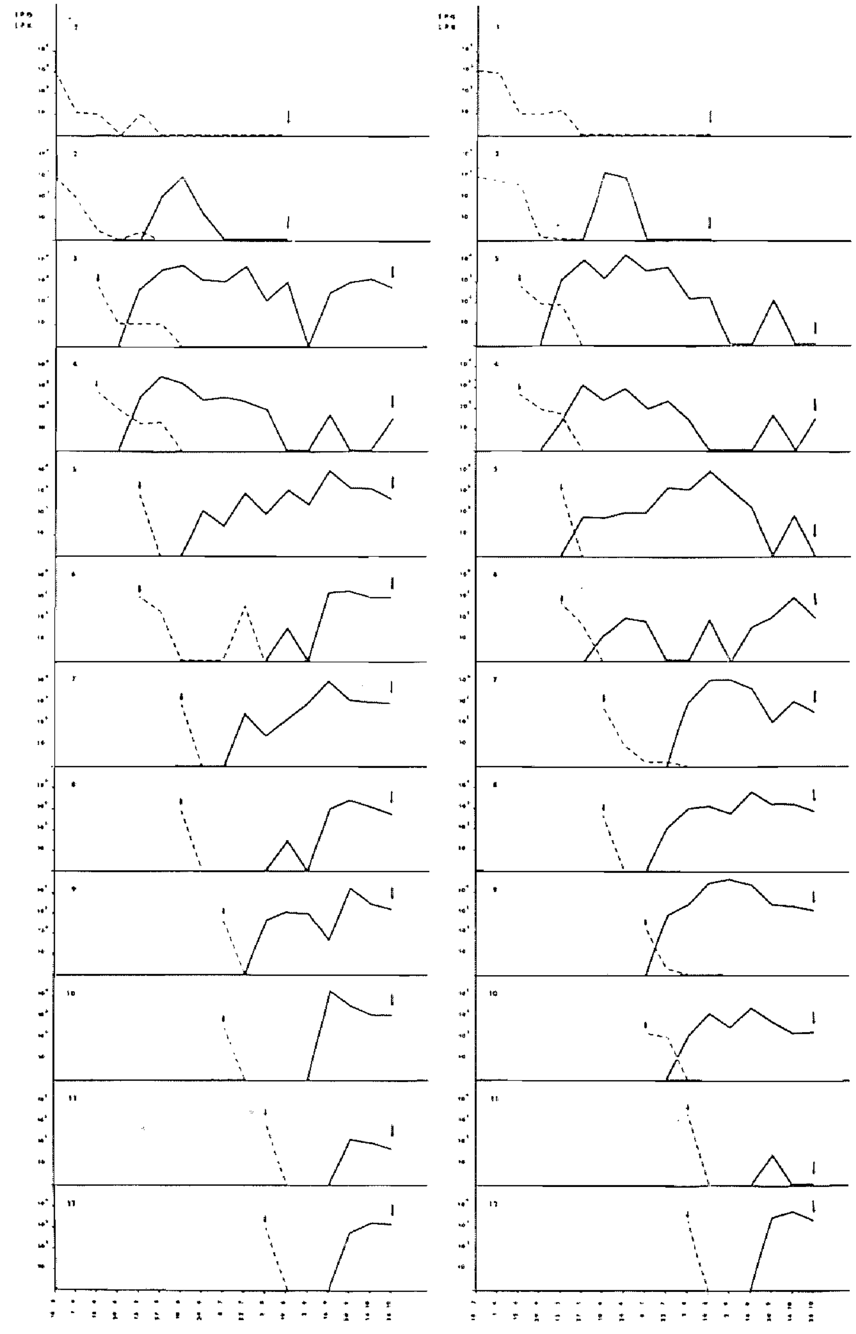

Fig. 1.—The recovery of eggs from faeces and infective larvae from herbage on the plots. 1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21 and 23 seeded with faecal pellets and plots 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22 and 24 with faecal pats. The short arrow indicates the date when faeces were first spread, and the long arrow indicates the date when observations ceased. The broken line indicates eggs present per gram of faeces and the solid line the number of infective larvae per kilogram of herbage.

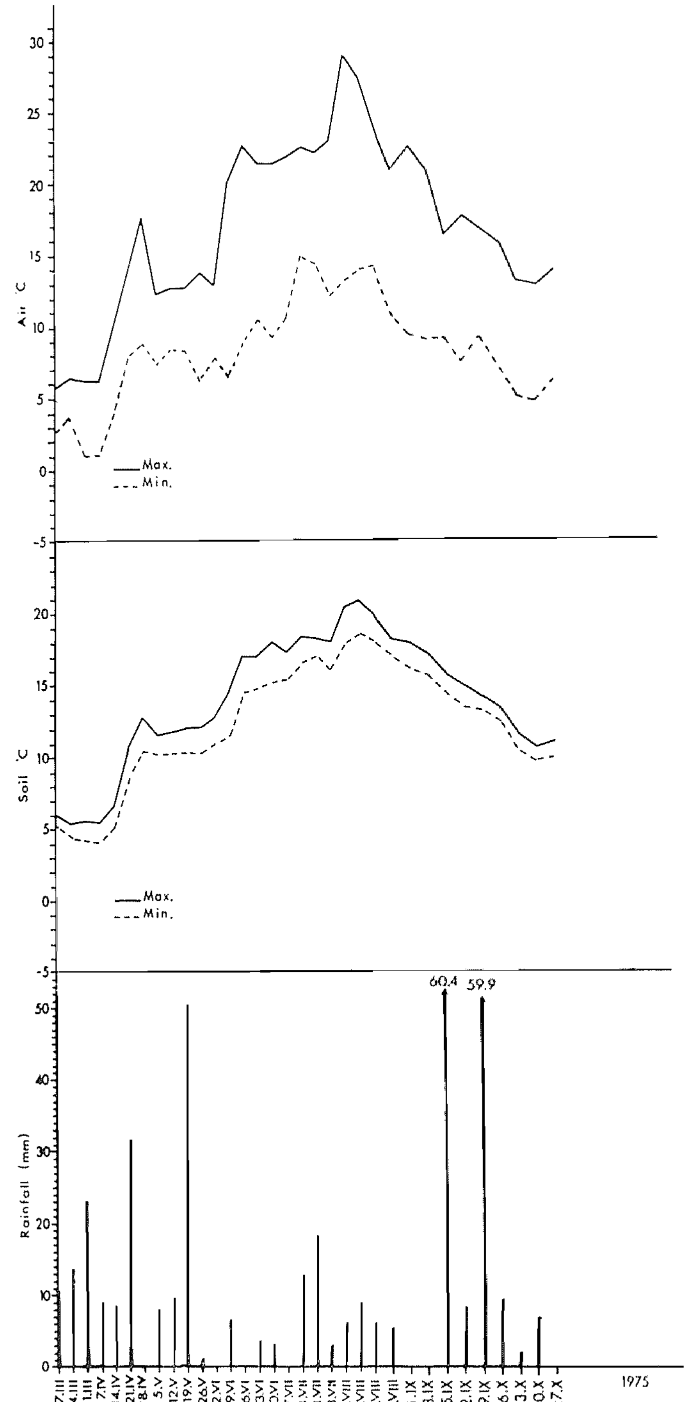

Fig. 2.—Meteorological records for the period 17th March 1975 to 27th October 1975, showing weekly average for air and soil temperatures and total weekly rainfall

ring the period of observations except for a dry spell when the weekly average temperature rose to 23,3°C and no larvae could be recovered.

On Plot 5 the eggs disappeared very quickly from faeces but larvae did not appear on the herbage until 6 weeks after faeces were first spread. By that time the weekly average temperature was 21,4°C (max) and 10,4°C (min). The number of infective larvae was gradually increasing but fell during the dry period observed at the end of August following this it rose again and remained high until observations ceased.

On Plot 7 initial development was similar to plot 5 eggs disappeared rapidly from faeces and larvae were recovered after 6 weeks. Highest recoveries were made on 16.9 when heavy rainfall followed a long dry period.

On Plot 9 the eggs disappeared from faeces after 15 days and two weeks later infective larvae could be recovered from herbage. The number of infective larvae was fairly high for one month; then fell during a dry spell and then again reached a higher level. When observations ceased the number of third-stage larvae was gradually decreasing.

Due to high temperature and lack of rain when faeces were spread on plot 11, infective larvae did not appear on the herbage until a period of two months had elapsed. Numbers did not reach as high a level as other plots.

T. axei plots (pats)

On Plot 2 after two weeks about 90% of the eggs were embryonated and by the 8th week after faeces were first spread these had hatched. Larvae were recovered from herbage 10 weeks after exposure reaching the highest point two weeks later when weekly average tenperature was 19,8°C (max) and 6,5°C (min). The number gradually declined and no larvae could be recovered 16 weeks after faeces were exposed on the plot.

On Plot 4 two weeks after faeces were placed on the plot 40% of the eggs were embryonated and infective larvae were present in the faeces. The weekly average temperature was 17,5°C (max) and 8,8°C (min). Third-stage larvae appeared on herbage two weeks later. The number of larvae was high for 12 weeks and then fell to zero when the temperature was very

high and rainfall minimal. A small number of infective larvae appeared on the herbage again but 2 weeks later had disappeared.

By the time faecea were placed on Plot 6 the weekly average temperature was 12,7°C (max) and 8,4°C (min). Two weeks after that date about 30% of the eggs contained first-stage larvae. The temperature rose to above 20°C (max) and rainfall was again minimal. During this period infective larvae were present in the faeces but could not be recovered from herbage. 14 weeks after exposure the infective larvae were recovered from herbage. The count then fell to zero but quickly returned to a high level were it remained until the end of the observations.

On Plot 8 eggs disappeared rapidly from faeces, but larvae were recovered only after 10 weeks had elapsed. At this time temperature was high and rainfall minimal. Larvae disappeared from the herbage, but were recovered in larga numbers following moderately heavy rainfall.

On Plot 10 there was a marked interval between the disappearance of the eggs in faeces and the presence of infective larvae on herbage. During this time the temperature was very high (28,7°C) and the amount of rain as low as 6,1 mm. After a period of very heavy rainfall and a weekly average temperature of 16,8°C a great number of infective larvae apeared on the herbage but it was decreasing slowly by the time observations ceased.

On Plot 12 which was also seeded under hot dry conditions a two month period elapsed before larvae were recovered. Moderately high numbers of larvae were recovered from this plot.

T. colubriformis plots (pellets)

Broadly speaking the same pattern was observed on plots seeded with faeces containing eggs of either *T. axei* or *T. colubriformis*.

On Plot 13 larvae could not be recovered from herbage.

On Plot 15 the pattern initially was similar to plot 3 the comparable *T. axei* plot, but subsequently larvae disappeared from plot 15.

Larvae appeared more quickly on Plot 17 than on *T. axei* plot 5 but again had disappeared by the end of the observations.

On Plots 19 and 21 the numbers of larvae recovered were similar, but they appeared much earlier on plot 21.

On Plot 23 the pattern was similar to the corresponding *T. axei* plot 11 very few larvae being recovered from either plot. At the end of the observations plot 23 was negative.

T. colubriformis plots (pats)

Plot 14 showed a similar pattern to *T. axei* plot 2. Larvae appeared on the herbage after 10 weeks, but could not be recovered 6 weeks later.

On Plot 16 the pattern was again almost identical to the corresponding *T. axei* plot 4.

Larvae appeared much more quickly on Plot 18 than *T. axei* larvae on plot 6. Recoveries on both plots subsequently fell to zero due to the lack of rain, but rose again when rain fell.

On Plot 20 larvae appeared more quickly than on *T. axei* plot 8 and this aerlier appearance of larvae is seen againwhen plot 22 is compared with plot 10.

Development and recovery of larvae from Plot 24 is very similar to *T. axei* plot 12.

DISCUSSION

It is interesting to compare the results of the current work with the findings of other authors despite the unusual weather conditions prevailing during the summer 1975 in Southern England. Gibson and Everett (1) state that the development and survival of the free living stages could be modified by many factors but mainly temperature and rainfall. The importance of temperature is illustrated by the lack of development on plot 1 and 13 and that of rainfall by observations on plots 3, 4, 15 and 16 on which during the very hot dry spell in August larvae disappeared from the herbage on a number of occasions although low levels were subsequently recovered. Similar results are recorded by Onar (2) with *T. axei* and Rose (6) with *C. oncophora*. A further important factor which influences the behaviour of the free-living stages is the form in which the faeces pass to herbage. On Plots 1 and 13 eggs of both species spread in pelleted faeces failed to develop to infective larvae. Eggs in faecal pats spread on Plots 2 and 14 at the same time resulted in small numbers of larvae which appeared after 10 weeks. Presumably the larger masses of faeces afforded protection until conditions allowed development to proceed. During dry spells larvae on plots seeded with faecal pats appeared later than on plots with pellets. Thus pats act as a store for larvae during unsuitable conditions. This appears to have ocurred on plot 6. Rose (5) has found similar results for *O. ostertagi*. In general the observations reported in this paper agree with those of Gibson and Everett (1). The minimum temperature for development to take place is aproximately 10°C. In late spring and summer development becomes more rapid but when temperature is high many eggs are destroyed and larval. populations are low. Broadly speaking temperature requirements for the development of the infective larvae from the eggs appear to be similar for both species. Onar and Everett (3) point out that the survival times of *T. axei* are greater than that of *T. colubriformis*. This may be related to the greater ability of the eggs of *T. axei* to withstand adverse conditions as seen in some laboratory experiments (unpublished data). However there is a difference in the behaviour of these two species recorded by Onar and Everett (3) that is the more active migration of the infective larvae of *T. colubriformis* than those of *T. axei*. In the present study this resulted in a significantly aerlier appearance of infective larvae on the herbage. It could also be an important factor affecting survival times.

RESUMEN

Se estudia el desarrollo de los huevos de *T. axei* y *T. colubriformis* y la supervivencia de las larvas infestantes de ambas especies, a partir de material expuesto durante la primavera y verano de 1975, hasta octubre del mismo año. Durante ese tiempo, se sembraron 24 parcelas con cagarrutas y masas fecales. En general, a medida que la temperatura aumenta, el desarrollo es más rápido; las larvas aparecieron en las heces dependiendo de la forma fecal. También existe una diferencia en la capacidad migratoria de las larvas, que es mayor en *T. colubriformis* que en *T. axei*. Los resultados obtenidos se comparan con los de otros autores.

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