

# Contributed Papers

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## The Influence of Host Age in Parasitism of Wild Rabbits

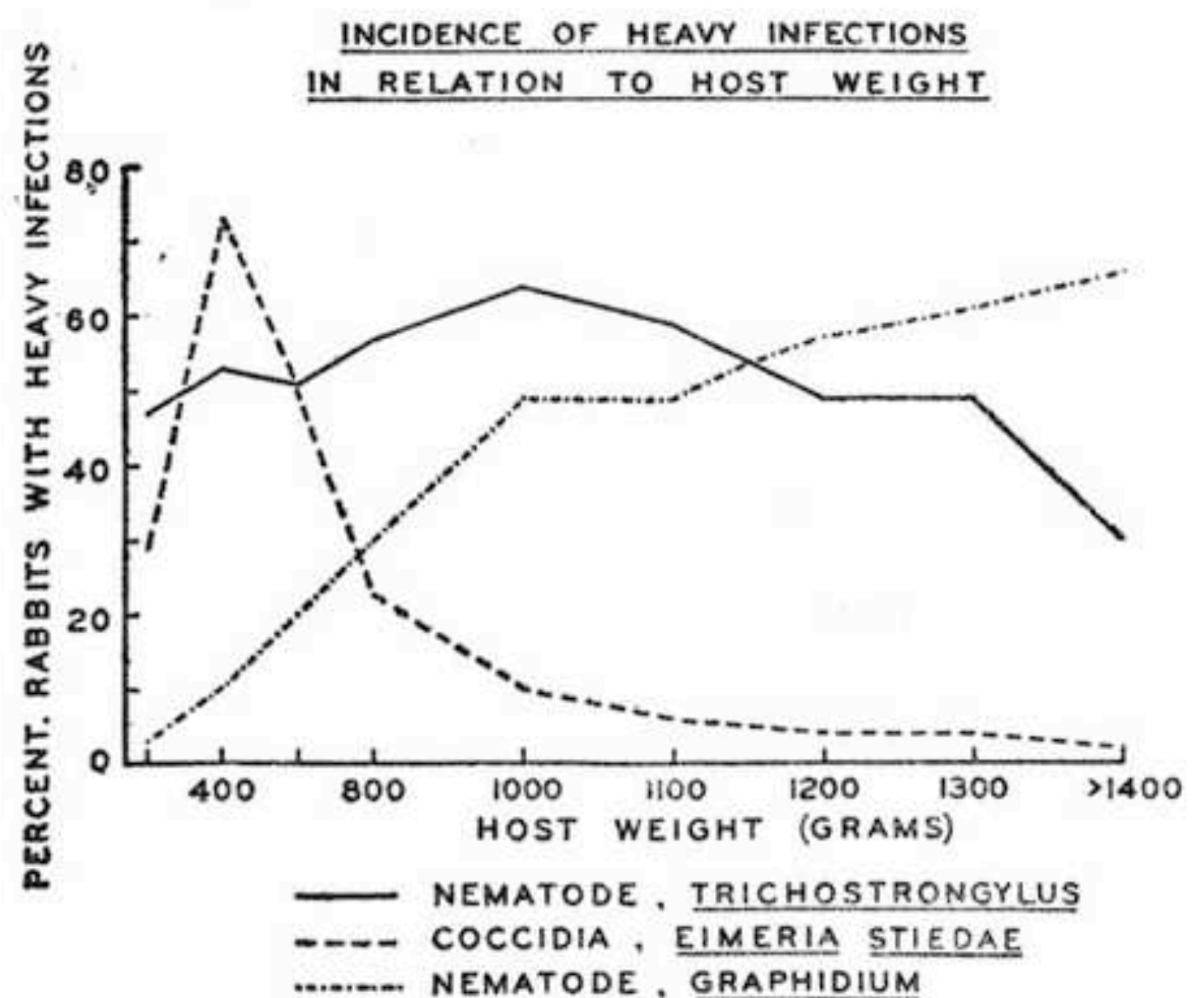
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Host age has an important influence on the incidence of rabbit parasites, but the nature of the relationship is different for each parasite. This is shown in the figure, where the paunched weight is used as an index of host age. Smaller weight groups have been used for full-grown rabbits than for young ones, and two different scales have been employed, that for the young rabbits being the smaller. This has been done in order to make the horizontal scale more representative of time by minimising the effect of the more rapid increment of weight in the young rabbits.

Paunched weight provides a reliable indication of age in young rabbits up to a limit of approximately four months, but recent work by the Animal Ecology Section on the sequence of fusion of the epiphyses of the bones allows age determination to be extended beyond this limit. These techniques were not available when the present material was collected, but the recent work is relevant in that it suggests that paunched weight may be used as a means of dividing a sample of full-grown rabbits into groups of increasing mean age, although it is of no value in assessing the age of an individual rabbit.

The figure shows that the incidence of heavy infections\* of the protozoan parasite *Eimeria stiedae* is virtually confined to rabbits of less than 1000g. The nematode *Trichostrongylus retortaeformis*, on the other hand,

shows a high incidence of heavy infestations in rabbits of widely different ages. Already high in the youngest animals, the incidence reaches its peak in rabbits of 1000g. and then declines, the decline being most rapid in the heaviest weight group. A third type of relationship is shown by the stomach-worm *Graphidium strigosum* in which incidence of heavy infestations increases progressively with host weight (age). This last type of relationship also occurs with the larval cestode *Cysticercus pisiformis*, and in this instance the relationship can be checked by two methods of age determination. Using unpublished data supplied by Mr. C. H. Tyndale-Biscoe on the sequence of epiphyseal fusion in the lumbar vertebrae, a sam-



\*Heavy infections means for *E. stiedae* more than half the liver affected by lesions, for *G. strigosum* more than 50 worms and for *T. retortaeformis* more than 1000 worms.

ple of 245 full-grown rabbits was divided into four groups of increasing age, and the incidence of the parasite in each group was 14%, 28%, 41% and 55% respectively. Re-



grouping the rabbits according to weight in four 100g.-groups starting from 1100g., the comparable figures for incidence were 22%, 21%, 34% and 43%.

In rabbits which live long enough, there is thus a kind of succession as one parasite after another reaches its maximum incidence, and the phenomenon is probably to be explained in terms of the life-history of the parasite and the nature of the host-parasite inter-relationships. These are different for each of the four parasites under discussion.

At one extreme is *E. stiedae* with its high incidence in young rabbits and low incidence in adults. There is a high availability of infective bodies (oocysts) because, unlike the other parasites, *E. stiedae* multiplies asexually within the host, and, further, by analogy with other species of *Eimeria* the oocysts are relatively resistant to environmental conditions other than drought (Landers, 1)). These facts account for the high incidence in young rabbits. The multiplication of the parasite within the liver of the host causes considerable tissue damage and, if death does not occur, the rabbit develops an immunity to further infection (Bachman, (2)) and this would account for the low incidence of the parasite in adult rabbits. At the other extreme is *C. pisiformis* which is a two-host parasite, the adult tapeworm occurring in dogs. By law, dogs have to be given regular anthelmintic treatment, and this together with the fact that dogs may visit rabbit areas at rather infrequent intervals, would suggest a low availability of tapeworm eggs. Since at low levels of infestation there is little host reaction against this parasite, incidence becomes a function of the length of the period of exposure to risk of infection, that is of the age of the rabbit. The availability of *T. retortaeformis* larvae is

adequate to ensure a high incidence in young rabbits and there is also a host resistance mechanism which limits the size of infestations by the occasional elimination of the worm population (Michel, (3)), but the "immunity" is less permanent than in *E. stiedae*. The availability of *G. strigosum* larvae is probably relatively low since the parasite is less common in the rabbit population than is *T. retortaeformis* and the larvae are more susceptible to desiccation (Wetzel and Enigk, (4)). Host resistance is limited to a stunting of worm growth and reproduction (Bull, (5)) and incidence therefore increases progressively with host age. The important factors in determining the age-incidence relationship seem to be firstly the availability of the infective bodies which controls the age at which substantial infections can occur, and secondly the severity of the host-parasite reaction which determines whether or not there is an immunity effect and thus a lowered incidence in adult rabbits.

In conclusion, two implications of these findings may be briefly mentioned. The first is of practical importance when comparing the incidence of a parasite in samples of rabbits collected at different times or places. Unless the age structure of the host samples is first standardized, any variations in incidence might represent the effects of differences in host age rather than in the seasons or localities of collection. Secondly the age-incidence relationship has an epidemiological significance. There is a reduction in the mean age of a host population which is increasing rapidly by reproduction, and therefore any parasite which could be significant in checking the increase must be one which reaches a high incidence in young animals. *E. stiedae* and *T. retortaeformis* fulfil this condition and the former is of additional significance in that it is known as a cause of substantial mortality in young rabbits.

#### REFERENCES.

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