SHORT COMMUNICATIONS

THE ROLE OF MAMMALS IN NATURAL FOCI OF TICK-BORNE ENCEPHALITIS IN CENTRAL EUROPE*)

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Abstract. The role of mammals as hosts of immature stages and adults of the main vector of tick-borne encephalitis in Central Europe—the tick *Ixodes ricinus* (L.)—is analyzed.

While evaluating the role of mammals in natural foci of different diseases we can consider either their importance for the existence of the pathoerogont itself or their role as hosts of vectors of such diseases. In my paper I shall focus attention on the latter aspect, bearing in mind the fact that *Ixodes ricinus* (L.) is the most important vector of tick-borne encephalitis in Central Europe.

a) Role of mammals as hosts of immature stages of *I. ricinus*

A total of 52 mammal species have been established in Central Europe as hosts of larvae and nymphs of *I. ricinus*. Apart from some exceptions (otter, mink and bats) all species inhabiting this region are being infested with these ticks. The decisive role as hosts however is played by small rodents and insectivores. While on birds and lizards, other important groups of *I. ricinus* hosts, both immature stages occur regularly, the small terrestrial mammals are important primarily as hosts of larvae and to a far lesser degree as hosts of nymphs. Out of the total number of specimens collected only 1—2% of nymphs occur on them, if compared to larvae (Rosický and Černý 1954). *Apodemus flavicollis*, *Clethrionomys glareolus*, *A. sylvaticus* and *Talpa europaea* are the most frequent hosts of larvae. In the period of maximum tick occurrence the mean infestation per host varies according to host species, locality and biotope and generally does not exceed 20, although some animals have been found to be heavily infested. E. g. 327 larvae and 2 nymphs and 330 larvae and nymphs have been collected from *T. europaea* and *M. arvalis* respectively (Grulich 1960, Rosický and Černý 1954). Single larvae and primarily nymphs also occur on large mammals, wild ruminants and carnivores. The total numbers of these animals, however, are so low that in the absolute number of immature stages engorged per area unit these hosts are of minor importance. The absolutely highest number of larvae feed on *A. flavicollis* and *C. glareolus*. In years of low numbers of mouse-like rodents Soricidae are much more involved as blood donors of larvae. Nymphs feeding on small mammals are found most frequently.

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again on *A. flavicollis* and *O. glareolus*. From larger mammal species *Sciurus vulgaris*, *Lepus europaeus*, *Erinaceus europaeus* and *E. concolor* (syn. *E. roumanicus*) are important as their hosts. A substantial role as hosts of this tick stage is played by some bird species which are ecologically associated with the herb layer.

Larvae and nymphs of *I. ricinus* occur on small mammals between end of March and November, particularly they are found between the second half of April and October. Nymphs appear on hosts sooner than larvae, this fact being in accordance with the results of tick collecting from vegetation. The spring maximum of tick infestation on small mammals is reached in May, and relatively high values are observed depending on biotope and character of weather even in April or June; then, there is a decline and in August or September another rise of tick infestation occurs.

b) Role of mammals as hosts of *I. ricinus* adults

The hosts of *I. ricinus* adults may be divided into two groups. The first group includes wild mammals, the second—domestic animals which get in contact with nature i.e., the biotopes inhabited by ticks, when they are kept in pastures. The most heavily infested species from the first group are *Cervus elaphus*, *Capreolus capreolus* and *Dama dama*, of minor importance as hosts are *Sus scrofa*, *Lepus europaeus*, *Sciurus vulgaris*, *Oryctolagus cuniculus*, both species of the genus *Erinaceus* and carnivores. In some regions of Central Europe, due to long-lasting tradition of game-keeping, the population levels of game animals are high. E.g. animal yield of *Cervus elaphus* in some places of Czechoslovakia constitutes over 8 animals, of *Capreolus capreolus* over 20 animals and of *Lepus europaeus* over 250 animals per 1,000 ha (Čermák et al. 1955). The game animals contribute considerably to the maintenance of high numbers of *I. ricinus*, because on many game species the infestation in the period of maximum tick occurrence amounts to several scores of adults. It should be emphasized that the importance of particular species of free-living vertebrates varies according to regions, various biotopes even in single years depending on their population densities.

The importance of domestic animals, primarily of cattle and goats, as hosts of *I. ricinus* adults in pasture lands is quite considerable. Due to their high numbers and regular occurrence in tick infested biotopes they constitute blood source of primary importance. The cattle become infested in some cases by several hundreds of *I. ricinus* females during the season (Černý 1960). However, the significance of domestic animals in the maintenance of high tick population is only regional, depending on the manner of their breeding. In regions, where they are kept indoor, they are of no significance as hosts of ticks.

The adults of *I. ricinus* usually occur on large mammals from March till November, in warmer regions even in the mild winter. Domestic animals are highly infested shortly after they have been driven to pastures and this high infestation is maintained for about two months, before the whole stockpile of active tick adults has been collected from vegetation.

c) Role of mammals in relation to other vectors of tick-borne encephalitis

Under conditions of Central Europe the tick *Ixodes ricinus* is the most important and epidemiologically highly significant vector of the tick-borne encephalitis virus. Other tick species living in this region have been also proved to take part in the circulation of the virus in nature. They are: *Ixodes hexagonus*, *I. trianguliceps*, *Dermacentor marginatus*, *D. reticulatus*, *Haemaphysalis concinna*, *H. punctata* and *H. inermis* (Blašković and Nosek 1972). Some of them may also attack man. All mentioned species parasitize mammals which are the only hosts of monotropic species of the genus *Ixodes* and of ditropic species of the genus *Dermacentor*; in case of hemitropic species of the
genus *Haemaphysalis* they are the main hosts of adults and together with birds and lizards important hosts of immature stages.

To make the picture complete it should be added that there are close trophic relations between mammals, particularly small mammals, and gamasoid mites and fleas whose role in the circulation of tick-borne encephalitis virus in natural foci has been lately demonstrated. These mutual relations, however, are so complicated that they exceed the limits of this short paper.

**REFERENCES**


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