The Role of Ticks in the Epidemiology of Crimean-Congo Hemorrhagic Fever in Southern Africa

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Summary

The widespread distribution of *Hyalomma marginatum rufipes*, *Hyalomma truncatum* and *Rhipicephalus evertsi evertsi* and the presence of antibodies of CCHF in so many animals suggest that CCHF should be far more common than it really is. However, the low rate of viraemia in large mammals, the fact that the virus is present in the blood for only a few days, and that people are not often bitten by adults of *H. m. rufipes*, *H. truncatum* and *R. e. evertsi* indicates that the disease is not as prevalent as might be expected. The immature stages of the ticks acquire the virus from their hosts *Lepus saxatilis* and *L. capensis*. The virus survives moulting to persist in unfed adult ticks and can infect humans or other large mammals if bitten by infected adult ticks.

1 Introduction

Crimean-Congo hemorrhagic fever (CCHF) virus was first isolated in 1944 when approximately 200 people sleeping outdoors in the Crimean Peninsula developed hemorrhagic symptoms. Subsequent periodic epidemics of the disease have occurred in eastern Europe, USSR, Bulgaria, Pakistan, Iraq and Egypt (Hoogstraal 1979; Tantawi et al. 1980). Later, the CCHF virus was isolated in the Congo from a child suffering from hemorrhagic fever, and in African countries such as Kenya, Ethiopia and Nigeria (Hoogstraal 1979). The virus was first isolated in South Africa during February 1981 from the blood of a 13-year-old boy who died after camping in a nature reserve (Gear et al. 1982).

Although the virus has been associated with 28 species of ixodid ticks, it is believed that the principal vectors of the virus are ticks of the genus *Hyalomma* (Hoogstraal 1979). In addition to sympatric distribution between CCHF virus and *Hyalomma* ticks, there is evidence that CCHF virus and *Hyalomma* ticks evolved together (Hoogstraal 1979). There are also indications that ticks from the genus *Rhipicephalus* may be a supplemental reservoir and should not to be disregarded as a vector (Swanepeol et al. 1983; Rechav et al. 1987). The objectives of this review are to consider the ecology of the vectors of CCHF in South Africa and to discuss the role of the various tick species in the epidemiology of CCHF.

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2 Geographical Distribution of Vectors of CCHF

The distribution of various *Hyalomma* species in Europe, Asia, Middle East, North and Central Africa was reviewed in detail by Hoogstraal (1979). Furthermore, one can expect to find CCHF virus in the presence of *Hyalomma* ticks. These ticks are common in Eurasia and Africa and are usually found in similar habitats to that of hares or hedgehogs (Causey et al. 1970). Sufficient documentation on the distribution of *Hyalomma* species (Theiler 1956; Rechav et al. 1987) and *Rhipicephalus evertsi evertsi* (Theiler 1962) is available for South Africa. These species all prefer semi-arid habitats, while avoiding the coastal belt and higher mountain ranges of Natal and Lesotho. *H. truncatum* is, however, more sparsely distributed in the higher rainfall areas than the other species. Not only does *H. m. rufipes* have a similar distribution to that of *H. truncatum* (Theiler 1962), but their two-host life cycles are also similar.

The geographical distribution of species serving as vectors in laboratory experiments has not been included. Uncertainty as to their role in transmitting the virus under natural conditions still prevails (Hoogstraal 1979).

3 Hosts and Seasonal Activity

The seasonal activity of the three two-host tick species serving as potential vectors for CCHF virus was monitored during various surveys conducted in different parts of South Africa. The results dealing with the immature stages of *H. truncatum*, *H. m. rufipes*, and *R. e. evertsi* are presented separately to those of the adult ticks, and associated hosts.

3.1 Immature Stages

Two methods were used for monitoring the immature stages:

1. Collection of questing larval ticks from vegetation by a dragging technique (Rechav 1982, 1986; Rechav et al. 1987) – dragging a 1-m square cloth over a random path of 100 m.

2. Removal of feeding ticks from their hosts.

Free-living larvae of *H. m. rufipes* and *H. truncatum* were collected from vegetation for 36 consecutive months with two peaks of abundance in mid-winter (July) and mid-summer (November) being observed (Fig. 1). Similar peaks of abundance were observed for larvae and nymphs of the two *Hyalomma* species which were removed from two species of hares (*Lepus saxatilis* and *Lepus capensis*) over the same period (Figs. 2, 3). Hares appear to be the preferred hosts for the immature stages of *H. truncatum* and *H. m. rufipes*. However, of the two *Hyalomma* species more *H. truncatum* larvae and nymphs were removed. Similar patterns of seasonal abundance were demonstrated by larvae and nymphs of *H. truncatum* found on two species of rodents and the highveld gerbil *Tatera brantsii* and the four striped mouse *Rhabdomys pumilio*. No immature stages of *H. m. rufipes* were found on these rodents. Larvae and nymphs of *H. m. rufipes*