

Tick infestation in soldiers who were bivouacked in the Perth region

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ABSTRACT We report observations on infestations with the tick, *Amblyomma triguttatum*, in soldiers who were bivouacked in two areas near Perth; 34% of 175 persons were infested with varying stages of the ectoparasite. Most persons were infested with only one tick but some troops had multiple infestations. Local skin reactions to tick-bites were frequent; they usually developed 24–48 h after removal of the tick and may indicate delayed hypersensitivity reactions. A small number of persons developed secondary bacterial infections. Management and prevention of these infestations is reviewed briefly.

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Tick-bite is a common problem in eastern Australia, particularly among persons who live in the tropics and subtropics.¹ In most reported instances, infestation has occurred with the Australian scrub-tick, *Ixodes holocyclus*, which is distributed from Normanton in the Gulf of Carpentaria, Queensland to Bairnsdale, Victoria.^{2,3} This ectoparasite has been reported to cause local allergic reactions, secondary skin infections, anaphylaxis, and neuromuscular paralysis, as well as the transmission of organisms such as *Rickettsia australis*, the aetiological agent of Queensland tick typhus.

Ixodes holocyclus is not found in the southern parts of Western Australia, but infestation may occur with other species of ticks. Persons who are particularly at risk are bushwalkers and those who camp in the countryside. This paper reports the incidence of infestation in troops who were encamped at two sites near Perth and describes the clinical manifestations of infestation with the hard-tick, *Amblyomma triguttatum*, which is commonly known as the "kangaroo-tick".

Patients and methods

Seventy-five troops of 7 Field Battery, Royal Australian Artillery camped near Lancelin for two days, and 100 soldiers from 28 Independent Rifle Company, Royal Western Australian Regiment bivouacked at Bindoon for seven days during February and March, 1985. Lancelin is located on

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the coast 120 km north of Perth while Bindoon is further inland, 90 km northeast of Perth. The terrain and vegetation in the two locations varied. At Lancelin, the soil was sandy, the terrain undulating, and the open, stunted scrubland vegetation consisted mostly of Acacia and Banksia species. At Bindoon, the soil was clay, the terrain was elevated and undulating, and the vegetation included taller Eucalyptus species as well as a thick undergrowth of Acacia, Banksia and Eucalyptus species. During the periods of the study, the maximum temperatures in the two locations varied between 35–40 °C.

Tick infestation had been a problem in the past and all troops volunteered to take part in the survey; each subject gave informed consent. Soldiers were dressed in the standard uniform (jungle greens) which consists of long cotton trousers and shirts, general purpose boots, and webbing.

No attempt was made to modify the behaviour of soldiers; most did not use insect repellents. They moved through the bush during the day and slept in the open in sleeping-bags. Any ticks that were noticed incidentally were removed with forceps and preserved. A paramedical non-commissioned officer inspected troops twice a day for evidence of tick infestation. All ticks were collected and stored in plastic vials that contained Kahle's solution (95% ethyl alcohol, 30 mL; 10% formalin, 12 mL; glacial acetic acid, 4 mL; water, 54 mL). Each soldier filled in a questionnaire which recorded the number and site of ticks and the reactions to their bites. Two days after each camp had finished, the soldiers were reviewed at their routine weekly assembly.

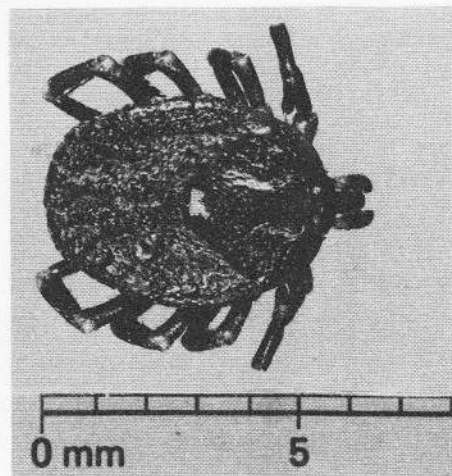


FIGURE 1: The adult tick, *Amblyomma triguttatum*.

Results

Tick infestation occurred in soldiers who were camped at both Lancelin and Bindoon. Twenty (26%) of 75 troops at Lancelin were

infested and 39 (39%) of 100 soldiers at Bindoon were infested. All of the ticks were identified as *A. triguttatum*, and the data from both camp-sites have been combined; 34% of the total of 175 troops were infested. The adult stage of the parasite is illustrated in Figure 1; the nymphs are approximately 2 mm in length and the six-legged larvae are about 0.7 mm long.

Most persons were infested with only one tick, although one soldier was infested with eight nymphs, and almost 100 larvae were recovered from another individual. The numbers of the various stages of ticks on different persons are indicated in Figure 2. The distribution of adult and nymphal ticks on the body is shown in Figure 3. Although ticks could be found over the whole body,

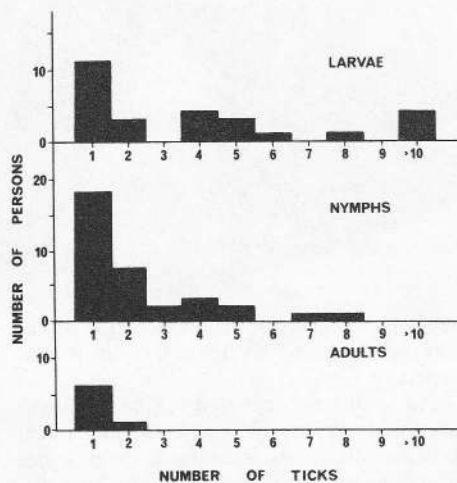


FIGURE 2: Number of ticks and stages of ectoparasitic infestation of soldiers.

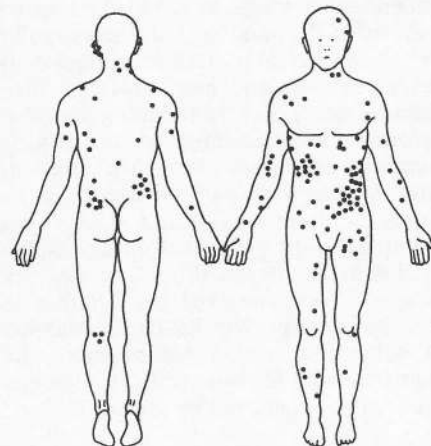


FIGURE 3: Distribution of nymphal and adult ticks on the body.

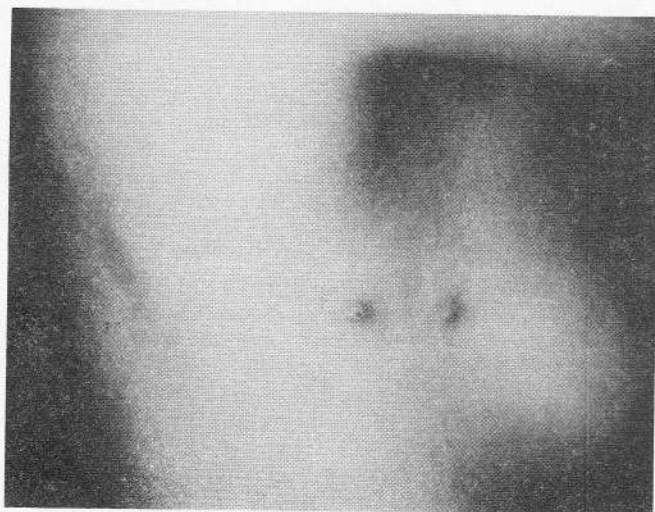


FIGURE 4: Papulopustular lesions on the chest wall that developed 48 h after the removal of ticks.

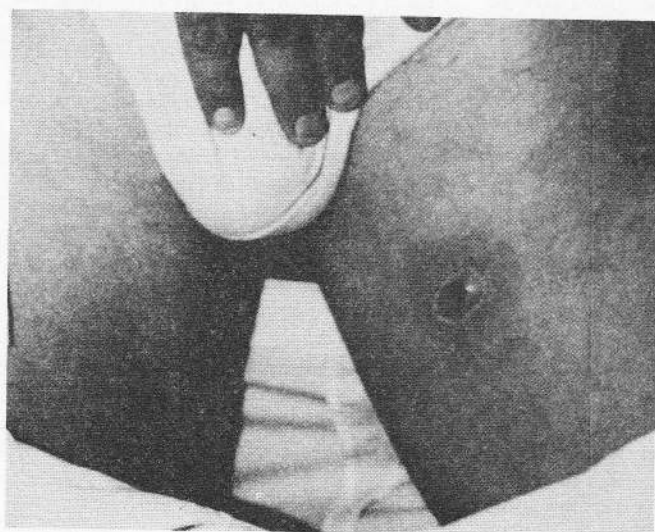


FIGURE 5: Abscess on anterior thigh that occurred several days after a tick-bite.

the highest density of them was on the trunk, especially around the waist and on the frontal aspect.

All soldiers reported skin reactions eventually after tick infestation. Local pruritus often drew attention to the presence of a tick, but parasites were sometimes discovered incidentally on routine inspection. However, generally, no significant skin inflammation was observed at the time of removal of the parasite. Localized papular or papulopustular lesions (Figure 4) developed over the next 24–48 h, then subsided slowly over the following few days. Secondary bacterial infection with abscess formation (Figure 5) supervened occasionally. At least two patients developed an abscess with regional lymphadenitis and required therapy with antibiotic agents. No local or systemic toxic effects, such as tick paralysis, were observed. In addition to reactions after proven tick-bites, a number of subjects had skin lesions that were consistent with the bites of ticks, although other causes could not be excluded.

Discussion

The several subspecies of *A. triguttatum* are

among the most common and widespread of the many species of hard scutate ticks that are found in Australia.⁴ In Western Australia, *A. triguttatum* is abundant throughout the southwestern coastal region of the State.⁴ Limitation of the distribution of ticks to particular areas is considered to be related to the microhabitat, with particular reference to such factors as climate, vegetation, soil type and the prevalence of natural hosts. The incidence of tick infestation was slightly higher in troops in the more inland region. This may be related to variations in the microhabitat between the two regions, but could equally well have been a chance finding.

In keeping with other "three-host ticks", the life-cycle of *A. triguttatum* involves parasitization of a different host for each of the larval, nymphal, and adult stages. After engorgement, the larvae drop off the host then moult to produce nymphs. The nymphs reattach themselves to another host for a second blood meal, then the same sequence of events occurs. Adult ticks infest a third host, and it is then that mating occurs usually. These ticks have little host specificity; they may be found on a wide variety

of small marsupials in the wild, and humans may be infested as incidental hosts.⁵

As indicated earlier, tick-bites in humans may produce localized skin irritations that are similar to insect bites. Many of these lesions are produced by direct toxic effects and others may be allergic reactions to tick saliva. The lesions usually resolve spontaneously and pathological studies have shown that they are characterized by local oedema and an eosinophilic infiltrate.⁶ Occasionally, a nodular, granulomatous reaction may develop around retained and embedded mouthparts. Reactions to bites may also be complicated by secondary bacterial infections that may result in the formation of an abscess and sometimes by more distal sequelae.

A variety of human pathogens may be transmitted by ticks; these include a number of viruses that cause encephalitis or haemorrhagic syndromes, rickettsiae such as the agents of Queensland tick typhus (*R. australis*) and Q-fever (*Coxiella burnetii*), bacteria such as *Borrelia duttoni* (relapsing fever), *Leptospira burgdorferi* (Lyme disease) and *Francisella tularensis* (tularemia) and protozoa (species of *Babesia*). Only *R. australis*, *Cox. burnetii*, *Babesia* (which has not yet been reported in infections in humans in Australia) and possibly *L. burgdorferi* occur in Australia. Moreover, of particular interest is the isolation by Pope et al. of 13 strains of *Cox. burnetii* from *A. triguttatum* that were removed from kangaroos.⁷ Finally, some ticks may produce systemic manifestations that include fever, headache, nausea, vomiting and paralysis which may culminate in respiratory failure.

In this study, we observed that local reactions occurred frequently and a small number of subjects developed secondary bacterial infections. These soldiers had encamped in the same areas on a number of occasions; this provided an opportunity for them to develop hypersensitivity reactions to the tick-bites. We found no evidence to incriminate these ticks as vectors of disease.

Ticks were found all over the body, but were more prevalent on the trunk. Presumably, they had crawled under the collar and cuffs of the sleeves and trousers or through any other apertures in the clothing, then migrated over the surface of the body. Removal of the ticks entailed retracting the tick from the host's skin gently, preferably with forceps. In contrast to *Ixodes* species which may be difficult to remove without detaching tick mouthparts, which remain in the skin, *A. triguttatum* usually is removed with ease. Indeed, many of the ticks separate spontaneously after feeding.

In endemic areas, ticks should be searched for on the body and removed daily. Long trousers and sleeves are said to reduce exposure to ticks,⁶ but clearly such measures

cannot be relied upon. Further protection may be provided by insect repellents such as diethyltoluamide or insecticide agents such as permethrin that are either sprayed onto the skin, or used to treat clothes.⁸⁻¹¹ In preference, both techniques should be employed; clothes should be rinsed in a solution that contains repellent, and repellent should be applied to the skin at the neck, wrists, ankles and waistline.

Acknowledgements

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