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Mémoire.

SITES OF ATTACHMENT IN *AMBLYOMMA TRIGUTTATUM TRIGUTTATUM* KOCH (ACARI: IXODIDAE) ON NATURAL HOSTS

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SUMMARY

The sites of attachment of *Amblyomma triguttatum truguttatum* were studied from June to September 1981 on 146 feral pigs *(Sus scrofa)* and from March to August 1982 and January 1983 on 68 grey kangaroos *(Macropus giganteus),* naturally infested. Two hundred fifty hour (81 %) of 314 nymphs wete detected on the ears of the pigs; neither adults nor larvae of *A. t. triguttatum* were found on *S. scrofa.* Six hundred ninety four (97 %) of 715 larvae; 283 (96 %) od 295 nymphs and 11 (79 %) of 14 adults of *A. t. triguttatum* were found on the ears of the kangaroos. The proportion of the larvae and nymphs on the ears of kangaroos and pigs respectively, decreased with the increase of tick load.

RÉSUMÉ : **Sites de fixation de *Amblyomma triguttatum triguttatum* Koch (Acari : Ixodidae) sur des hôtes naturels.**

Les sites de fixation de *Amblyomma triguttatum triguttatum* ont été étudiés de mars à août 1982 et janvier 1983 sur 68 kangourous gris *(Macropus giganteus)* et de juin à septembre 1981 sur 146 porcs marsouins *(Sus scrofa)* naturellement infestés. Six cent quatre-vingt-quatorze larves (97 %) sur 715, 283 nymphes (96 %) sur 295 et 11 tiques adultes (79 %) sur 14 ont été trouvées sur les oreilles des kangourous. Deux cent cinquante-quatre nymphes (81 %) sur 314 ont été détectées sur les oreilles des porcs; ni larves ni adultes de *A. t. triguttatum* n'ont été trouvés sur *S. scrofa.* La proportion des larves et des nymphes sur les oreilles des kangourous et des porcs, respectivement, a diminué avec l'accroissement du parasitisme par tiques.

INTRODUCTION

Amblyomma triguttatum triguttatum Koch is a three host tick peculiar to Australia. Its natural hosts are the larger macropods, although it also attacks domesticated animals and man (Roberts, 1970). It is involved in the epidemiology of Q fever (Pope, Scott and Dwyer, 1960) and the larvae cause an allergic dermatitis in man (Moorhouse, 1981). In southeast Queensland, larvae of *A. t. triguttatum* are found from March-April to September, nymphs from March-April to December and adults from November to March (Guglielmone, 1984).

Site selection by ticks appears to be the result of long association between tick and host (Nelson, Keirans, Bell and Clifford, 1975). The knowledge of attachment sites of ticks can help to understand the host-tick relationship and be exploited to reduce the sampling areas of the host (Kaiser, Sutherst and Bourne, 1982; Rechav, 1982) or the application of acaricides (Barnard, 1981), thereby facilitating the studies on population dynamics and tick control. Adults of *A. t. triguttatum* (sub-specific status not given) prefer to attach on the ears of kangaroos (McCarthy, 1960) but no information is available about the nymphs and larvae. This paper reports the feeding sites of pre-adult stages and, to a lesser extent, adults of *A. t. triguttatum* on the grey kangoroo *(Macropus giganteus)* and nymphs on the feral pig *(Sus scrofa).*

MATERIALS AND METHODS

The kangoroos and feral pigs inspected were adults shot with government permission for commercial purposes in an area ranging from 26° 39 ′ to 28° 35 ′ S and from 148° 14′ to 150° 18′ E in southeast Queensland.

Twenty seven male (M) and 28 females (F) pigs were studied in June 1981, 30 M 28 F, 8 M 7 F and 9 M 9 F in July, August and September 1981, respectively. The number of kangaroos inspected were as follow: 9 M 9 F, 4 M 4 F, 8 M 8 F, 6 M 5 F, 8 M 8 F, 5 M 6 F and 6 M 2 F in March, April, May, June, July, August 1982 and January 1983 respectively.

The left side of the hosts wer inspected for ticks. The attachment sites were categorized as follows: 1) ear, 2) head, 3) neck, 4) fore leg, including the axillae and scapular regions, 5) side, comprising the lateral area of the body from the posterior border of the scapular region in an imaginary line drawn from the patella to the spine, 6) ventral region, from the xiphoid process of the sternum to an imaginary line drawn from the anterior border of the left leg to the middle ventral line, 7) hind leg, including genitalia, anal and tail areas plus external part of the leg to the back.

To test dependance of infestation sites against the factor of type of host, sex of the hosts and month, the statistical package

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GLIM-3 (Baker and Nelder, 1978) was used. To test whether the tick load affected the proportion found on the different parts of the host surfaces, the tick infestation were divised into three levels independent of sex of the hosts and month and evaluated using chi-square.

RESULTS

Fifty three of the 146 feral pigs were infested with *A. t. triguttatum* nymphs. Forty five percent, 33 %, 27 % and 28 % of the pigs inspected in June, July, August and September 1981 respectively, carried nymphs. This was the only stage of *A. t. triguttatum* detected on the pigs.

Seventy four at the 88 kangaroos were parasitized with *A. t. triguttatum,* 13 carried larvae, 28 nymphs, 27 larvae and nymphs and 6 were infested with adult ticks. The percentage of kangoroos infested with larvae was 44, 100, 69, 45, 31, 27 in March, April, May, June, July and August 1982 respectively. No larvae were found on the kangoroos inspected in January 1983. Nymphs were found on 37 % of the kangoroos caught in April and in 100 % of those inspected from May to August 1982; kangaroos shot in March 1982 and January 1983 were free of nymphs. Adult ticks were found only in January 1983, 75 % of the kangaroos were infested.

The only ticks different to *A. t. triguttatum* found in this study were one female and one nymph of *Haemaphysalis* spp. found on a female pig caught in August 1981.

The great majority of the larvae and nymphs were found on the ears of the host *(table I).* Eleven (79 %) of the 14 adults of *A. t. triguttatum* (10 females and 4 males) were also found on the ears of kangoroos, 2 (14 %) and 1 (7 %) were detected on the hind leg and neck respectively.

The data analyzed with GLIM-3 were in the form « ear from total » due to the obvious predilection of *A. t. triguttatum* for the ears of the hosts. Differences due to type of hosts in respect to nymphal infestation, sex of the host (larval and nymphal infestations) and month (larval and nymphal infestations) were not statistically significant ($P > 0.05$). On the other hand the propotion of larvae on the ears of kangaroos and nymphs on the ears of pigs decreased with the increase of tick load *(table II).*

DISCUSSION

All parasitic stages of one host ticks as *Otobius megnini* and *Anocentor nitens* select the ears of their hosts to attach. Specificity of attachment sites is also common in two and three host ticks of mammals. However the general trend

TABLE I. — *Sites of attachment of* A. t. triguttatum *larvae and nymphs on grey kangaroos and nymphs on feral pigs.*

	Head	*Ear*	*Neck*	*Fore leg*	*Side*	*Ventral*	*Hind leg*	*Total*
				Grey kangaroos				
Larvae on males	0	406 (96) *	0	0	0	0	17 (4)	423
Larvae on females	0	288 (99)	0	0	0	0	4 (1)	292
Nymphs on males	0	131 (98)	0	0	0	2 (1)	2 (1)	135
Nymphs on females	0	152 (95)	2 (1)	0	0	0	6 (4)	160
				Feral pigs				
Nymphs on males	3 (1)	166 (79)	1 (< 1)	4 (2)	0	5 (2)	32 (15)	211
Nymphs on females	0	88 (85)	0	2 (2)	0	1 (1)	12 (12)	103

* Percentage of the total in parenthesis.

TABLE II. — *Number of larvae and nymphs of* Amblyoma triguttatum triguttatum *on and outside the ears of the hosts at different levels of infestation.*

	Grey kangaroos						*Feral pigs*		
	Larvae			*Nymphs*			*Nymphs*		
Infestation level	⩽ 15	16-30	> 30	⩽ 5	6-10	> 10	⩽ 5	6-10	> 10
N° of hosts per level	24	10	6	39	9	7	35	9	9
Total n° on the ears	137	199	358	91	68	124	67	71	116
Total n° outside the ears	1^{a} *	0^{b}	20^{b}	3^{a}	3^{a}	6^{a}	10^{a}	6^{a}	44^{b}

* Numbers not sharing superscripts indicate differences in the proportion of ticks outside the ears.

is that no all parasitic stages select the same site of a host to feed.

For instance the larvae and nymphs of the two host tick *Rhipicephalus evertsi* are mostly found in the ear passage of cattle but adults prefer the upper perineum (Baker and Ducasse, 1967). The larvae, nymphs and adults of three-host tick as *Ixodes ricinus, Amblyomma hebraeum* and *Rhipicephalus sanguineus* attach on different areas of the bodies of sheep, cattle and dog respectively (Lees, 1948; Londt, Horak and De Villiers,1979 ; Koch, 1982). The larvae and nymphs of *Ixodes trianguliceps* feed on the ears of voles while the female ticks prefer the head and neck (Hussein, 1980). The adults and nymphs of *Amblyomma variegatum* select the abdomen of cattle and the larvae the back (Kaiser *et al.,* 1982). The adults and nymphs of *Amblyomma americanum* are more abundant on the foreleg and foreflank of cattle but the larvae prefer the ears (Barnard, Morrison and Ervin, 1989).

The information about the feeding sites of the brown ear tick, *Rhipicephalus appendiculatus* is confuse. According to Londt *et al.* (1979) the larvae and nymphs favour the ear pinnae of cattle to attach. However Baker and Ducasse (1967) found 10 % of the larvae on the ear pinnae, and 11.5 %, 12 %, 12 % and 17.5 % on the nuzzle, head, dewlap and legs respectively. Kaiser *et al.* (1982) found that the dewlap of cattle was the preferred site of attachment for the larvae and nymphs of *R. appendiculatus.* All authors agree that the adults of this tick species attach mostly to the ears of cattle.

The infestation of grey kangaroos with *A. t. triguttatum* was restricted to a small area of this host, the ears, which can be exploited in studies of population dynamics of this tick. The selection of attachment sites of the nymphs of *A. t. triguttatum* appeared to be more dependant on tick rather than host factors since anatomical, physiological and behavioural differences between kangaroos and pigs did not induce a significant change in the selection of feeding sites. This is in line with the findings of Nilsson and Lundquist (1978) in respect to *I. ricinus* and Hayashi and Hasegawa (1984) dealing with *Ixodes assanumai.*

Kaiser *et al.* (1982) regarded the specificity of attachment sites in plurispecific infestation of cattle as an evolutionary adaptation to reduce competition amongst tick species on the same host. It is uncertain if this played a role in the preferance of *A. t. triguttatum* for the ear of kangaroos; no other tick species were found on them in the present study. Seasonality (Galuzzo, 1943) and differences in the size of the mouth parts (Hussein, 1980; Yousfi-Monod and Aeschlimann, 1986) that apparently affected the selection of feeding sites of other ixodids exerted no influence on *A. t. triguttatum.*

The male of *A. t. triguttatum* produces spermatozoa without feeding (Guglielmone and Moorhouse, 1983), however the reproduction strategy of this tick species seems to be copulation on the hosts (Guglielmone and Moorhouse, 1986). Therefore a highly specific site of attachment can increase the chances to find mates. This is coincidental with Rohde (1979) who states that parasites aggregate in specific areas of the hosts to favour the encounter of males and females in low density infestations. Nevertheless this does not explain the concentration of larvae and nymphs of *A. t. triguttatum* on the ears. The colonization of only a small area of the surface of the hosts may be aimed to avoid unnecessary harmful effects on them to preserve this host-parasite system.

Although the number of *A. t. triguttatum* on the hosts was not high, the proportion of the larvae and nymphs on the ears of kangaroos and pigs, respectively, decreased with the increase of tick load *(table II).* A similar phenomenon has been described by Nilsson (1981) dealing with *I. ricinus.*

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Analyse.

Yves J. GOLVAN, avec la collaboration technique de Francine BRETON. **Atlas de Parasitologie.** Schémas explicatifs d'épidémiologie. 24 × 16 cm, 323 p. *Le Léopard d'Or*, 8, rue du Couédic, F 75014 Paris, 1990.

Les cycles biologiques constituent la substance même de la parasitologie fondamentale. On ne peut imaginer une meilleure façon de condenser nos connaissances que de faire un schéma de ces cycles. Un coup d'œil indique toutes les particularités de l'espèce et l'essentiel de ce que l'on doit savoir.

Malheureusement, la confection de ces schémas est un travail difficile. Il est aisé dans le texte d'un gros traité de laisser un certain flou sur les sujets mal connus ou litigieux, mais dans un schéma, chaque détail doit être rigoureusement exact et précis et cela explique pourquoi de bons atlas riches en schémas sont rares.

Yves Golvan est un des très rares spécialistes aptes à réaliser ce travail. Ses connaissances en pathologie tropicale et en sciences naturelles sont encyclopédiques; ses dessins précis, clairs, agréables à voir, souvent teintés d'humour, sont de parfaites réussites.

Tout parasitologiste, débutant ou chevronné, se doit d'avoir ce petit livre à portée de la main.

Alain G. CHABAUD