Short Communication

Sexual dimorphism in nymphal size of the Karoo paralysis tick, *Ixodes rubicundus*

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INTRODUCTION

Sexual dimorphism in body size is characteristic for many Ixodid ticks, but it is especially expressed in the genus *Ixodes*. Adult females belonging to this genus are usually larger than males of the same species. The body length in the taiga tick, *I. persulcatus* Schulze, 1930 for instance, is 3.52 ± 0.19 mm (females) and 2.66 ± 0.12 mm (males) respectively (Filippova, 1985). Similar relationships are found in *I. ricinus* Linnaeus, 1758 (Belozerov, unpublished) and in some other representatives of the subgenus *Ixodes s. str (I. apronophorus* Schulze, 1924; *I. pavlovskyi* Pomerantsev, 1946; *I. redikorzevi* Olenev, 1927). In some species no sexual dimorphism in body size is evident (*e.g. I. hipponensis,* Kitaoka and Saito, 1967; *I. laguri* Olenev, 1931) or males may even be larger than females (*e.g. I. kazakstani* Olenev, 1934; *I. kaschmiricus* (Pomerantsev, 1948) (*cf.* Filippova, 1977; 1985). In the subgenus *Afrixodes* the adult females are usually also larger than conspecific males, but the expression varies in different species (Clifford *et al.*, 1977; Keirans *et al.*, 1982). The difference in body length of male (2.3–2.5 mm) and female (3.0–3.2 mm) *I. rubicundus* Neumann, 1904 is similar to that of *I. persulcatus,* but in other species the difference may be either less (*I. pilosus* Koch, 1844) or more (*I. ugandanus* Neumann, 1906) pronounced (Arthur, 1965).

In preimaginal stages of *Ixodes* ticks the body size also displays sexual differences (Filippova, 1977, 1985). Voltzit (1986, 1987, 1988, 1989) confirmed these observations not only for *Ixodes,* but for ticks of some other ixodid genera and thereby attracted attention to this phenomenon.

In the course of extensive investigations on the biology of the Karoo paralysis

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tick, *Ixodes rubicundus*, information has been obtained indicating pronounced sexual dimorphism in size at the nymphal stage.

EXPERIMENTAL METHODS AND RESULTS

The ticks under investigation were from F_1 laboratory colonies of *Ixodes rubicundus*, established from native adult females collected on farms in the Orange Free State province of South Africa. Nymphs, engorged during two experiments at the beginning and the end of March 1990, were divided into three groups according to their mass (2.5–3.4, 3.5–4.4 and 4.5–5.5 mg). After moulting (from the end of April to the beginning of July of the same year), the number of adult males and females in each mass category were counted (Table 1). The majority of males originated from nymphs in the 2.5–3.4 mg category, while the majority of females originated from the nymphs in the 4.5–5.5 mg category. These differences were highly significant ($P<0.0001$). Nymphs belonging to the 3.5-4.4 mg category either moulted to males (41%) or females (59%). The difference was not statistically significant.

At the end of January of 1992 a number of freshly engorged *I. rubicundus* nymphs were divided visually into two groups, namely large and small nymphs.

TABLE 1.

Distribution of male and female *I. rubicundus* ticks moulted from nymphs of different mass categories

	Number of males per mass category (mg)			Number of females per mass category (mg)		
	A 2.5–3.4	B 3.5–4.4	C 4.5–5.5	A 2.5–3.4	B 3.5–4.4	C 4.5–5.5
Exp.1 (Beginning of March 1990)	27	2	3	–	7	28
Exp. 2 (End of March 1990)	51	16	–	–	19	33
Total	78	18	3	0	26	61

TABLE 2.

Statistics on mass differences (mg) of *I. rubicundus* nymphs which were separated visually into large and small nymphs.

	$\bar{X}$	SD	MIN.	MAX.	*N*
LARGE NYMPHS	4.70	0.28	4.35	5.36	17
SMALL NYMPHS	3.09	0.22	2.68	3.43	16

Nymphs belonging to the two groups were weighed individually. There was no mass overlap between the two groups (Table 2) and the means differed significantly ($t=18.7$; $df=31$; $P<0.0001$). All small nymphs moulted into males and large nymphs into females.

The level of sexual dimorphism in body mass of *I. rubicundus* nymphs is similar to that demonstrated recently for *I. ricinus* (Kahl *et al.*, 1990) where female nymphs are also significantly heavier (5.50 ± 72 mg) than male nymphs (3.22 ± 0.37 mg). It is therefore possible to separate nymphal ticks according to their sex before they moult into adults. Since *Ixodes* ticks are able to copulate soon after their moulting and before they attach to a host (Graf, 1978; Babenko, 1985; Feldman-Muhsam, 1986), preprandial insemination of females can to a high degree of certainty be prevented by adopting the size separation procedure. This is of great practical importance for different experimental investigations in the physiology and behavioural biology of ticks, and the technique of male sterilization for tick control.

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