

***IXODES (AFRIXODES) BAKERI* ARTHUR & CLIFFORD, 1961 (ACARINA: IXODIDAE): DESCRIPTION OF THE MALE AND IMMATURE STAGES FROM RODENTS AND INSECTIVORES AND NOTES ON ITS BIOLOGY IN SOUTH AFRICA**

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ABSTRACT

CLIFFORD, C. M., WALKER, JANE B. & KEIRANS, J. E., 1976. *Ixodes (Afrixodes) bakeri* Arthur & Clifford, 1961 (Acarina: Ixodidae): Description of the male and immature stages from rodents and insectivores and notes on its biology in South Africa. *Onderstepoort Journal of Veterinary Research*, 43 (3), 105-112 (1976).

The male, nymph and larva of *Ixodes (A.) bakeri* are described and illustrated with line drawings and scanning electron microscope photographs. This species was originally described from 1 female from *Otomys* sp., Nyika Plateau, Malawi. The present material consists of 28 collections from insectivores and 19 collections from rodents, Van Riebeeck Nature Reserve, Transvaal, plus 1 collection from a rodent in the Jonkershoek Valley, Cape Province, Republic of South Africa.

Its biology in South Africa is also discussed.

Résumé

***IXODES (AFRIXODES) BAKERI* ARTHUR & CLIFFORD, 1961 (ACARINA : IXODIDAE) : DESCRIPTION DU MÂLE ET DES STADES PRÉMATURÉS CHEZ RONGEURS ET INSECTIVORES ET QUELQUES NOTES PORTANTES SUR SA BIOLOGIE EN AFRIQUE DU SUD**

Les auteurs décrivent le mâle, la nymphe et la larve d'*Ixodes (A.) bakeri* au moyen de dessins et d'images photographiques au microscope à balayage électronique. La description originale de cette espèce remonte à une femelle chez *Otomys* sp., provenant du Plateau Nyika au Malawi. Le matériel présent comprend 28 collections provenant d'insectivores, 19 collections provenant de rongeurs originaires du Parc de conservation Van Riebeeck au Transvaal et une seule collection chez un rongeur provenant de la vallée Jonkershoek au Cap en République Sudafricaine.

Les auteurs discutent la biologie de cette tique en Afrique du Sud.

INTRODUCTION

Ixodes (Afrixodes) bakeri was described from a partially engorged female specimen collected from a vlei rat (syn. swamp rat), *Otomys* sp., on the Nyika Plateau, 1778 m above the north-western shore of Lake Malawi (formerly Lake Nyasa), Malawi. Arthur (1965) records this species but gives no additional data beyond the original description. We describe here the male and its immature stages taken, together with females, from rodents and insectivores collected in the Republic of South Africa. The biology of this species is also discussed.

MATERIAL EXAMINED

Forty-seven collections, 28 from insectivores (*Crocidura mariquensis* and *Myosorex varius*) and 19 from rodents (*Otomys angoniensis*, *Otomys irroratus*, *Otomys* sp. and *Rhabdomys pumilio*), totalling 1 ♂, 42 ♀, 25 N., 43L., were made in the Van Riebeeck Nature Reserve (Rietvlei Dam) (25° 53' S., 28° 17' E.), Transvaal. The vast majority of these ticks were collected from animals trapped in 1970-1971 by R. M. Davis during his study on the ecology and life history of *Otomys irroratus*. In addition 20 larvae were hatched from eggs laid by females that he had collected. One female was obtained from *R. pumilio* on 10 November 1971, by P. M. Brooks.

These ticks are assigned Rocky Mountain Laboratory numbers 64083-64128 and 64163. Portions of this collection are deposited in the collections of the Veterinary Research Institute, Onderstepoort, Rocky Mountain Laboratory and British Museum (Natural History).

The remaining specimen studied, a female, was found in December 1971 on *Rattus norvegicus*, Jon-

kershoek Valley (33° 58' S., 18° 56' E.) Stellenbosch, Cape Province, by C. T. Stuart (Rocky Mountain Laboratory number 64850).

DESCRIPTION

(All measurements are in millimetres)

Male (Fig. 1, 2)

Length from apices of scapulae to posterior body margin 1,50; width 0,95. Suboval, widest just posterior to mid-length. Colour, medium brown. Lateral groove distinct, posteriorly with definite crenulated interior margin.

Capitulum: Length from apices of palpi to apices of cornua 0,30; greatest width of basis at insertion of palpal article 10,24. *Basis capituli* dorsally with lateral margins diverging anteriorly, posterior margin slightly convex; cornua small but distinct, sharply pointed, about as wide as long; dorsal surface slightly indented, giving it a depressed appearance, with a raised marginal border. *Basis capituli* ventrally with mesial lobe of transverse ridge slightly more prominent than lateral lobes. *Palpi* short, broad, clavate; length 0,21, width 0,11, segments 2 and 3 subequal in length, combined length 0,175. *Hypostome* short; length of toothed portion 0,10; blunt apically; dental formula 2/2 throughout length, teeth tending toward crenulations, teeth in file 2 larger than those in file 1.

Scutum: Length 1,45, width 0,83. Scapulae short, pointed; lateral carinae absent; cervical grooves faint, diverging posteriorly; punctations small, more numerous laterally, giving a faint outline of a pseudoscutum; setae numerous and moderately long.

Venter (Fig. 2): Plate outlines as illustrated. Setae numerous, short, fine, present on all plates except anal. Punctations small, present on all plates except pregenital. Length and width of plates: median 0,69 × 0,50; pregenital 0,18 × 0,10; adanal 0,31 × 0,15; anal 0,31 × 0,20. Faint indications of jugular plates indicated at bases of Coxa I. Anal groove open posteriorly. *Spiracular plate* broadly oval, 0,20 long, 0,15 wide; goblets in 4 rows posterior to macula.

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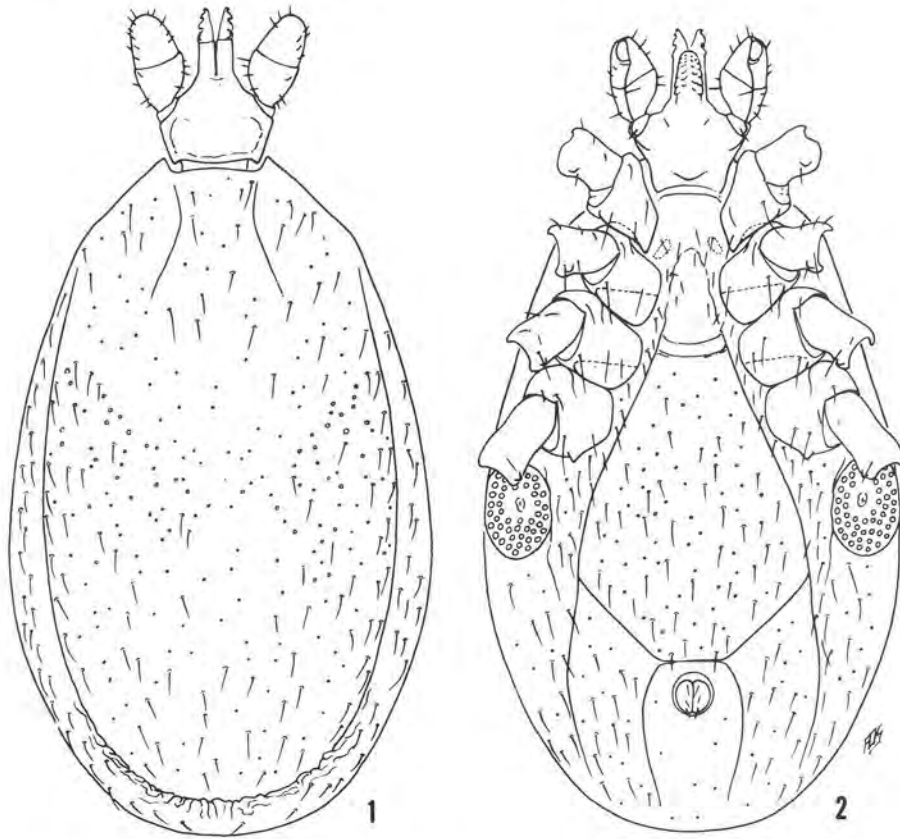


FIG. 1-2 *Ixodes bakeri* Arthur & Clifford, male, dorsal and ventral views

Legs: Coxae I-III are syncoxae. Coxa I with moderately large, bluntly rounded internal spur; Coxae II-IV lacking internal spurs. External spur present only on Coxa IV. Trochanters I-IV each with a minute spur. Tarsus I gradually tapering to claw, length 0,38, width 0,10. Tarsus IV length 0,35, width 0,08.

Female (Fig. 3)

The holotype described and figured by Arthur & Clifford (1961) had a damaged hypostome; we are therefore including a ventral view of the female capitulum to show this character. The dentition is rather unusual, being 3/3 for the entire length of the hypostome.

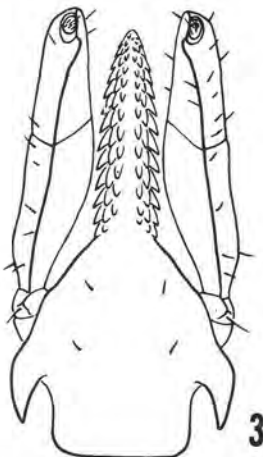


FIG. 3 *Ixodes bakeri* Arthur & Clifford, female, capitulum, ventral view

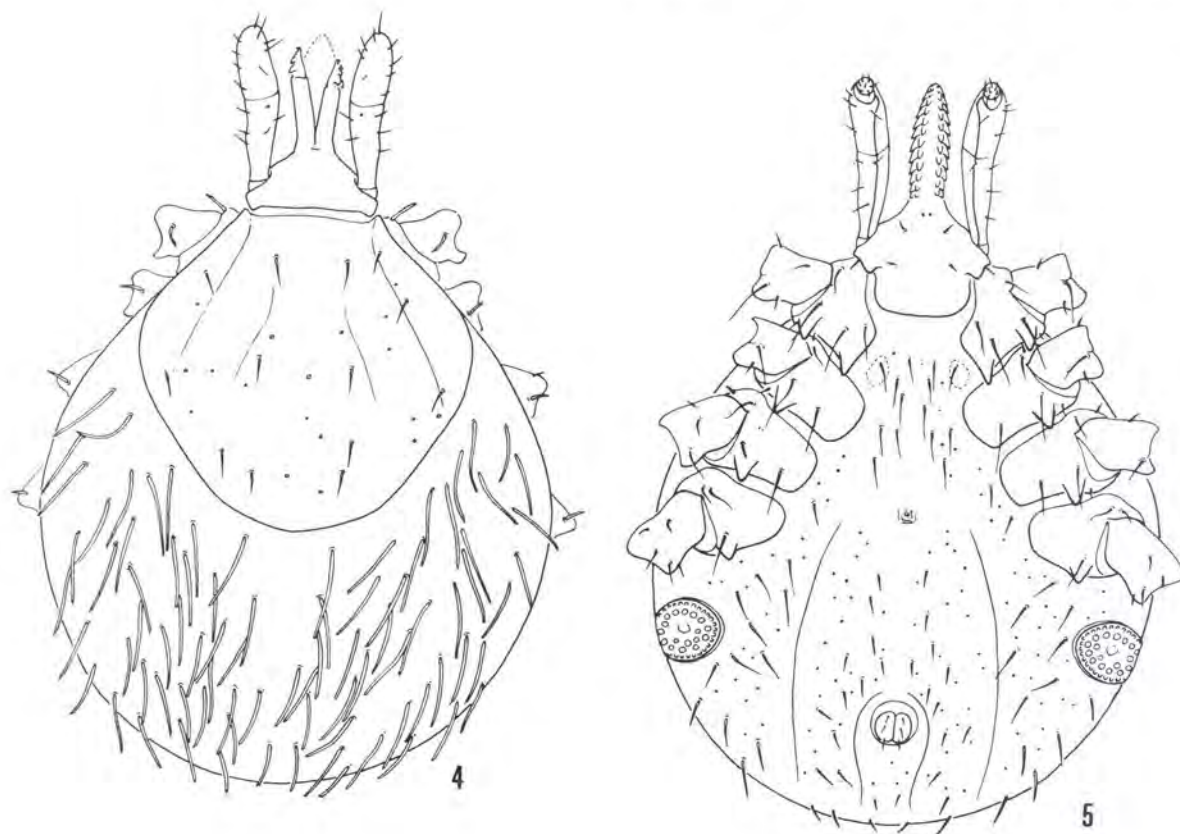
Nymph (Fig. 4-9)

Measurements from 5 unengorged to slightly engorged specimens (1 slide mounted). A range is given followed by an average in parentheses.

Body: Length from apices of scapulae to posterior body margin 0,71-0,84 (0,77), width 0,46-0,74 (0,61), widest just anterior to spiracular plate. Outline suboval.

Capitulum: Length from palpal apices to cornua apices 0,23-0,27 (0,25), width at level of cornua 0,16-0,20 (0,18). *Basis capituli* dorsally with posterior margin straight; cornua minute, bluntly rounded, lateral margins nearly straight. *Basis capituli* ventrally (Fig. 6) with short, triangular, posteriorly directed auriculae, external margins posterior to auriculae slightly constricted; posterior margin slightly convex. *Palpi* elongate, narrow, 0,20-0,24 (0,22) long, 0,038-0,050 (0,049) wide; articles 2 and 3 subequal in length, combined length 0,18-0,22 (0,19). *Hypostome* (Fig. 7) arising from a medial anterior extension of basis, elongate, bluntly rounded; length of toothed portion 0,14-0,18 (0,15). Dental formula 2/2 throughout length, a few minute denticles apically; 11 teeth in file 1, 12 in file 2.

Scutum (Fig. 8): Length 0,39-0,46 (0,42), width 0,46-0,53 (0,49). Outline broadly rounded posteriorly. Lateral carinae diverging from scapular fields, reaching posterior border, running approximately parallel to lateral scutal margins; cervical grooves faint, beginning as shallow posterior grooves thence diverging slightly. Punctations few, moderately deep, evenly scattered. Setae few, short, slightly longer medially. Scapulae small, bluntly rounded.

FIG. 4-5 *Ixodes bakeri* Arthur & Clifford, nymph, dorsal and ventral views

Dorsum (Fig. 4) and **venter** (Fig. 5) as illustrated. **Spiracular plate** nearly circular, longest dimension 0,075-0,100 (0,090), goblets large. A small, roughly ovoid, jugular plate located mesial to spur of Coxa I, its longest dimension 0,041 (measured from 1 slide mounted specimen). Anal valves with 3 pairs of setae. Anal groove open anteriorly.

Legs: (Fig. 9). Coxa I with a moderately long, pointed, triangular internal spur; internal spurs absent on II-IV. External spurs large, triangular, present on all coxae. **Trochanters** lack spurs. Tarsus I 0,237-0,269 (0,251) long; 0,063-0,078 (0,073) wide. Tarsus IV 0,175-0,207 (0,189) long; 0,050-0,062 (0,052) wide.

Larva (Fig. 10-15)

Terminology for larval chaetotaxy follows Clifford & Anastos (1960).

Body: Subcircular, widest just posterior to Coxa III. Length of 5 unengorged specimens, excluding capitulum, ranged from 0,384-0,415 (average 0,399), width 0,336-0,366 (average 0,358). A partially engorged specimen measured 0,610 long by 0,519 wide. **Sensilla sagittiformia** absent. Dorsal setae 13 pairs; 2 pairs of central dorsals, CD₁ 0,019-0,031 (0,025), CD₂ 0,022-0,026 (0,024); 7 pairs marginal dorsals, MD₁ 0,024-0,029 (0,026), MD₇ 0,017-0,024 (0,021); 4 pairs of supplementaries. Ventral setae 14 pairs plus pair on anal valves; 3 pairs of sternals, St₁ 0,024-0,034 (0,029); 3 pairs of preanals, 0,017-0,024 (0,021). Figure 11 shows a supernumerary PA on the left side of the larva; 5 pairs of premarginals; 3 pairs of marginal ventrals, MV₁ 0,019-0,024 (0,023). Anal groove open anteriorly.

Capitulum: Length 0,132-0,144 (0,136) from palpal apices to posterior margin of basis, width at insertion of palpal article 1 0,106-0,108 (0,108). **Basis capituli** dorsally with posterior margin straight, lateral margins converging anteriorly, cornua absent; ventrally (Fig. 12) basis slightly constricted posterior to bluntly rounded indications of auriculae, posterior margin broadly rounded. Posthypostomal setae 2 pairs, PH₁ 0,005-0,007 (0,007). PH₂ 0,002-0,007 (0,004); distance between PH₁ 0,046-0,055 (0,051), between PH₂ 0,041-0,048 (0,044). Palpi elongate 0,122-0,134 (0,128) long, 0,031-0,043 (0,036) wide; setae 0 on segment 1, 10 dorsally and 3 ventrally on segments 2 and 3 combined (suture between 2 and 3 indistinct), segment 4 with about 10. **Hypostome** (Fig. 13) denticle portion 0,084-0,089 (0,086) long, 0,038-0,046 (0,041) wide; dental formula 2/2 throughout, apex with very small corona of fine hooklets.

Scutum: (Fig. 14). Length 0,238-0,390 (0,273), width 0,293-0,464 (0,343). Outline as illustrated. Setae 4 pairs, SC₃ 0,010-0,019 (0,015); SC₄ 0,007-0,014 (0,011). **Lateral carinae** present along scutal margin. Cervical grooves weakly developed, nearly parallel anteriorly, then divergent near midlength, nearly reaching the posterior scutal border.

Dorsum (Fig. 10) and **venter** (Fig. 11) as illustrated.

Legs: (Fig. 15). Coxa I with a moderately large, bluntly triangular internal and external spur; Coxae II and III each with a small, bluntly rounded external spur; internal spurs absent but with an indication of slight surface thickening replacing spurs. **Trochanters** lack spurs. Tarsus I 0,134-0,151 (0,143) long, 0,050-0,055 (0,054) wide, setae number 2 prehalleral pairs and 3 groups of 4 each ventrally and laterally.

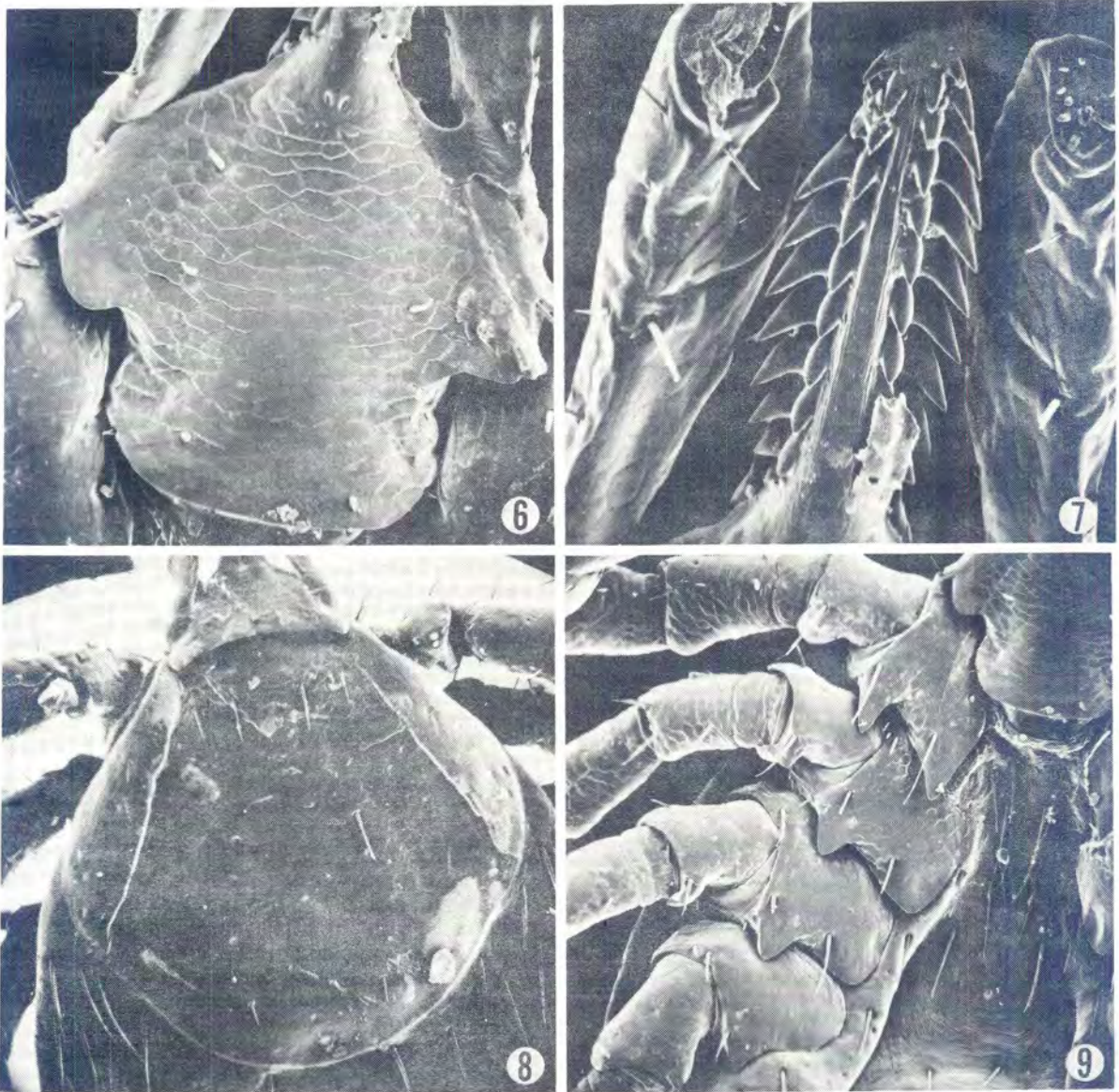
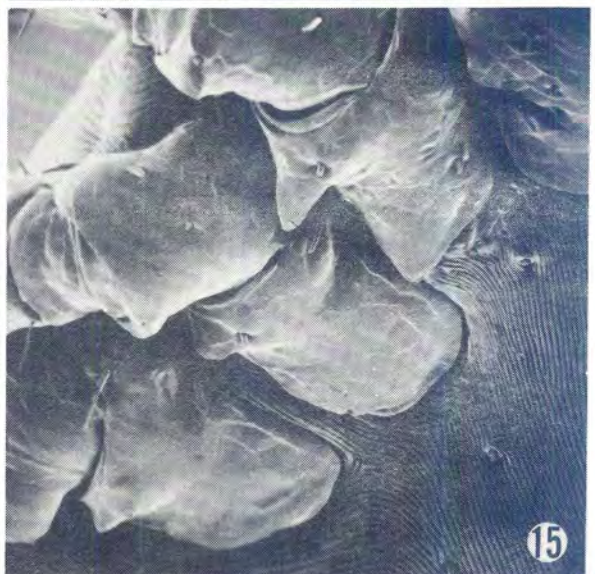
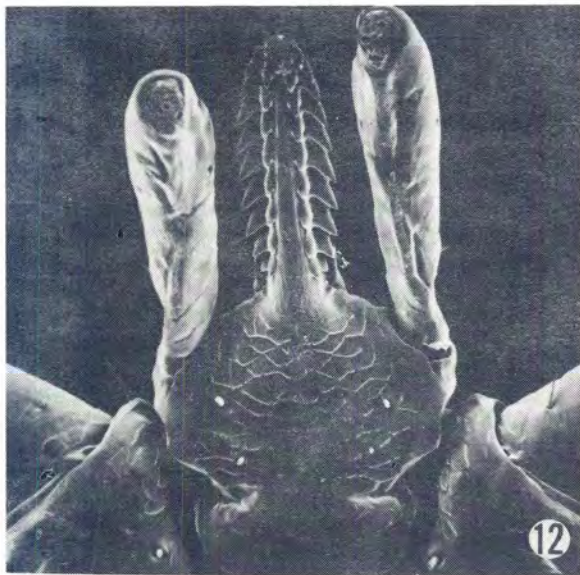
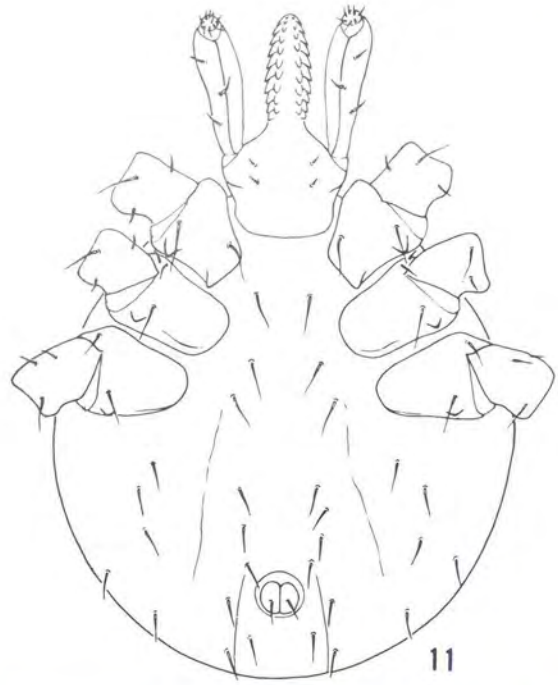
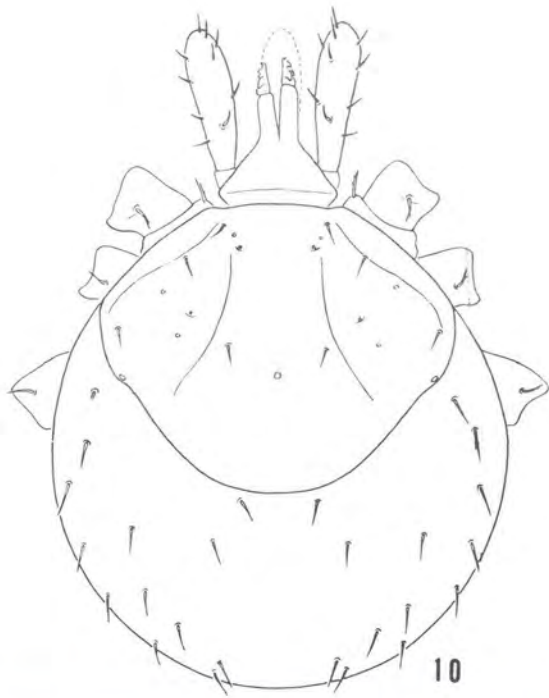


FIG. 6-9 *Ixodes bakeri* Arthur & Clifford, nymph, (6) basis capituli, ventral view 301 × ; (7) hypostome, ventral view 463 × ; (8) scutum dorsal view 103 × ; (9) coxae I-IV, ventral view 140 × (SEM photos)

FIG. 10-11 *Ixodes bakeri* Arthur & Clifford, larva, dorsal and ventral views

FIG. 12-15 *Ixodes bakeri* Arthur & Clifford, larva, (12) capitulum, ventral view 301 × ; (13) hypostome, ventral view 560 × ; (14) scutum, dorsal view 201 × ; (15) coxae I-III, ventral view 402 × (SEM photos)



DISCUSSION

Ten years elapsed between the original description of this species from Malawi and its rediscovery in the Republic of South Africa. Further collections from rodents and insectivores in suitable intermediate areas will undoubtedly produce additional material.

Arthur & Clifford (1961) pointed out the close relationship between females of *Ixodes bakeri* and *I. colasbelcouri*, a species collected from Malagasy rodents and insectivores. The males of these 2 species are also similar. However, the hypostome of the male of *I. bakeri* lacks the enlarged basal denticles that are characteristic of *I. colasbelcouri* males. Further, the male of *I. bakeri* lacks the lateral carinae which are present on *I. colasbelcouri* males.

Figures of the immature stages of *I. colasbelcouri* given by Arthur (1957) preclude any detailed comparison with those of *I. bakeri*. However, Arthur states that the nymph of *colasbelcouri* lacks carinae and cervical grooves, both of which are present in *bakeri*, and the presence or absence of these structures would appear to provide a means for separating these 2 entities. Other features, such as the shape of the capitulum dorsally and the auriculae, would also appear to help differentiate these 2 species.

Larvae of these 2 species are easily separated because *I. colasbelcouri* has 5 pairs of central dorsal setae, while *I. bakeri* has only 2 pairs. Also, the auriculae of *colasbelcouri* are well developed and pointed, whereas this structure is weakly developed and blunt in *I. bakeri*. In addition the presence of lateral carinae along the scutal margin of *I. bakeri* is unusual for the genus *Ixodes*.

In their review of the subgenera of *Ixodes*, Clifford, Sonenshine, Keirans & Kohls (1973) state that larvae of the subgenus *Afrixodes* possess 4-7 pairs of central dorsal setae. Larvae of *I. bakeri* have 2 pairs of central dorsals but in other respects are typical *Afrixodes*.

HOSTS AND ECOLOGY

The hosts from which *I. bakeri* was collected are listed in Table 1. With only 2 exceptions, the immature ticks were found on the insectivores (*Crocidura mariquensis*, the black musk shrew, and *Myosorex varius*, the forest shrew). However, apart from 5 females found feeding on 4 of the shrews, the adult ticks favoured the rodents (*Otomys angoniensis*, the Angoni vlei rat; *Otomys irroratus*, the vlei rat;

Otomys sp.; *Rattus norvegicus*, the brown rat, and *Rhabdomys pumilio*, the striped mouse). According to Arthur & Clifford (1961), the only other known specimen of this tick, the holotype female, was also collected from *Otomys*.

The Van Riebeeck Nature Reserve, where all but 1 of our ticks originated, was described by Davis (1973). It lies 20 km S.E. of Pretoria at an altitude of approximately 1 500 m in the highveld grassland. It has a mean annual rainfall of 723 mm, of which 84% falls in showers and thunderstorms during the hot summer months (November-February). The winter (May-August) is dry, with mild days and cold, often frosty, nights.

The permanent study grid laid out by Davis, where most of the animals were trapped, was in a low-lying, treeless, marshy area in the south-eastern part of the Reserve. In this area Davis noted that *O. irroratus* "uses its extensive runway system for most of its activities" and, furthermore, that "all of the rodent and shrew species present used many of the same runways". The vlei rat almost always nested on the ground under a thick shelter of vegetation, where it made an open, shallow, bowlshaped nest out of chewed-up bits of any available vegetable matter. Only once did he find it nesting in a shallow excavation beneath some large rocks, and twice in burrows; in his experience it only burrowed in dry or exposed positions, not in places where the soil was too wet nor where there was plenty of cover. It seems unlikely, therefore, that *I. bakeri* belongs to the burrow-inhabiting group of species in the genus *Ixodes*.

Except in July, Davis trapped for 3-4 days per month from March 1970 to February 1971, and again in May, July and November 1971. His collections show that, in this area, the activities of the different stages of *I. bakeri* are markedly seasonal, with the larvae feeding in the second half of summer, autumn and early winter, the nymphae in autumn, the first half of winter and early spring and the adults in the first half of summer. Davis (personal communication, 1975) commented: "The cessation of adult tick activity in mid-summer was very obvious and pronounced". More *Otomys* were trapped in January and February 1971 than in the preceding 2 months (Davis, 1973), but no *I. bakeri* adults were found on these animals. The reason for this is unknown.

This tick seems to be inactive in late winter (Fig. 16). It was not found on 13 *Myosorex* and 2 *Crocidura* examined in July 1970, nor on 5 *Myosorex*, 3 *Crocidura* and 4 *O. irroratus* examined the following month. In July 1971, 12 *O. irroratus* and 1 *O. angoniensis* were examined and were also found to be free of *I. bakeri* (Davis, personal communication, 1975).

Ecological conditions in the Jonkershoek Valley are very different from those in the Van Riebeeck Nature Reserve. This valley is in the south-western Cape Province, at an altitude of approximately 180-200 m, and has a typically Mediterranean climate, with dry summers and wet winters. The annual rainfall is usually over 1 000 mm.

Trapping was carried out in an area with several small artificial vleis (swamps) surrounded by fairly large beds of *Phragmites communis* and *Typha capensis*. Oak and poplar woods were also present in the vicinity (C. T. Stuart, personal communication, 1975). Thus, although in this case the saying: "One swallow does not make a summer" may well apply, it is interesting that the only female of *I. bakeri* collected so far in this area was also found in December.

TABLE 1 *Ixodes bakeri*: host relationships

Hosts	No. of animals infested	No. of ticks			
		♂	♀	N.	L.
Insectivora, Soricidae					
<i>Crocidura mariquensis</i>	6	—	2 ⁽¹⁾	3	21
<i>Myosorex varius</i>	24 ⁽²⁾	—	3	21	23
	<u>30</u>		<u>5</u>	<u>24</u>	<u>44</u>
Rodentia					
<i>Otomys angoniensis</i>	2	—	7	—	1
<i>Otomys irroratus</i>	9	1	16	1	—
<i>Otomys</i> sp.....	3	—	8	—	—
<i>Rattus norvegicus</i>	1	—	1	—	—
<i>Rhabdomys pumilio</i>	5	—	6	—	—
	<u>20</u>	<u>1</u>	<u>38</u>	<u>1</u>	<u>1</u>

⁽¹⁾ Both ticks attached to 1 shrew
⁽²⁾ One collection contained ticks from 3 shrews

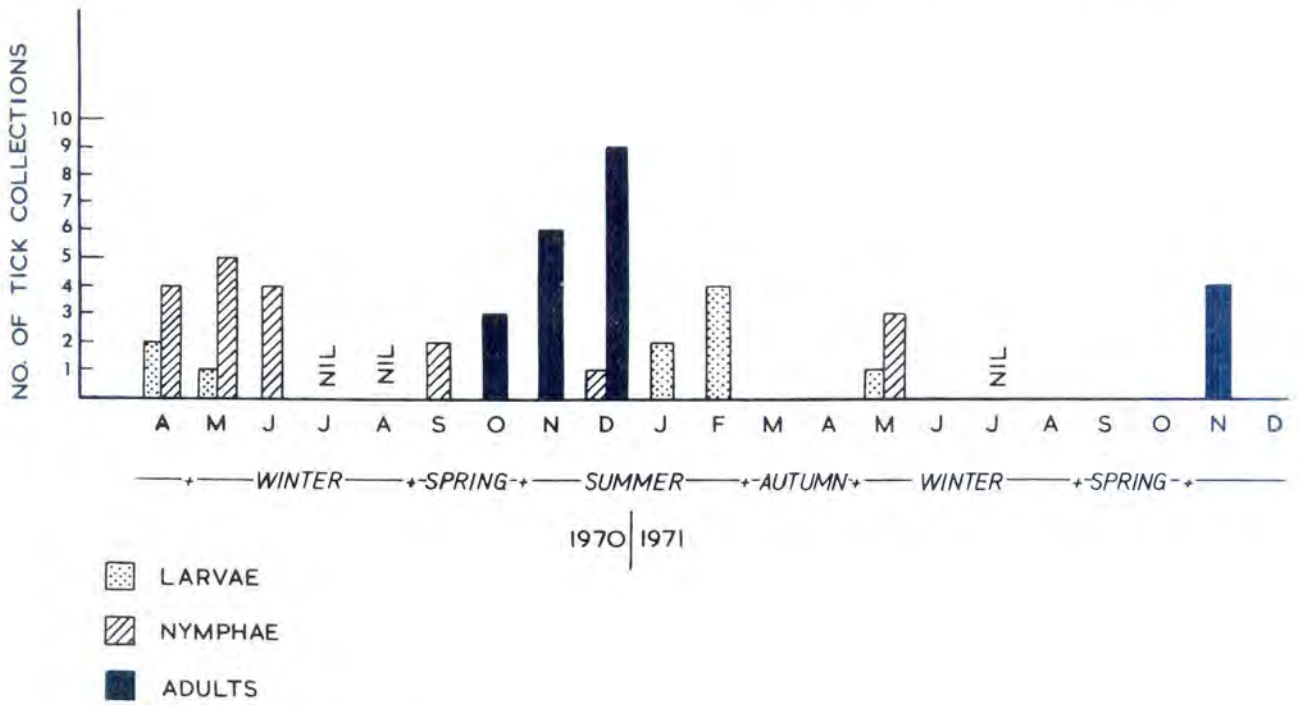


FIG. 16 *Ixodes bakeri* Arthur & Clifford, seasonal activity

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