

## TWO NEW SPECIES OF TICKS FROM SOUTHERN AFRICA WHOSE ADULTS PARASITIZE THE FEET OF UNGULATES: *RHIPICEPHALUS LOUNSBURYI* N. SP. AND *RHIPICEPHALUS NEUMANNI* N. SP. (IXODOIDEA, IXODIDAE)

JANE B. WALKER, Veterinary Research Institute, Onderstepoort 0110

### ABSTRACT

WALKER, JANE B., 1990. Two new species of *Rhipicephalus* from southern Africa whose adults parasitize the feet of ungulates: *Rhipicephalus lounsburyi* n. sp. and *Rhipicephalus neumanni* n. sp. (Ixodoidea, Ixodidae). *Onderstepoort Journal of Veterinary Research*, 57, 57-75 (1990).

Theiler & Robinson (1953) described, as *Rhipicephalus follis* Dönitz, 1910, a tick species originating from Dordrecht, Eastern Cape Province. A comparison of this tick with the syntypes of *R. follis* has now shown, though, that these 2 entities are different and it is therefore redescribed below as *Rhipicephalus lounsburyi* n. sp. Its adults parasitize sheep and various wild ungulates, attaching primarily on their feet. The hosts of the immature stages are still unknown. It has now been recorded from several places in the Eastern Cape; once in Natal, at Impendle, and in the Western Cape near Swellendam and between Clanwilliam and Graafwater.

A second species, which has in the past been confused with the dassie parasite, *Rhipicephalus distinctus* Bedford, 1932, is described as *Rhipicephalus neumanni* n. sp. Its adults also attach on the feet of sheep and goats. The hosts of the immature stages are unknown. It has been widely recorded in the Bethanien and Keetmanshoop Districts of Namibia and, in South Africa, from scattered localities in the Karoo.

### INTRODUCTION

In 1953 Theiler & Robinson described, as *Rhipicephalus follis* Dönitz, 1910, the progeny of 3 female ticks collected at Dordrecht, Eastern Cape Province (OP 2820, 2821). They also listed 2 field collections from Dordrecht (OP 2791 i, ii). They compared their ticks with the original description of *R. follis* but apparently did not examine the 2 syntype males of this species (Keirans, 1985: Nuttall Collection 2110; RML 111463). In his original description of these males Dönitz (1910) stated: "Vorkommen: Unbekannt, wahrscheinlich auf Haustieren. Vaterland: Südäfrika". On the labels accompanying them, though, these ticks were said to have been collected off an undetermined host in German S.W. Africa (D.S.W. Afrika) by Knuth. Presumably they were obtained during Prof. Knuth's extensive study tour in 1906-1907, when he visited many places in both South Africa and Namibia. He did not describe this tour until just over 30 years later (Knuth, 1938 a, b). It is impossible now to determine where he collected the *R. follis* syntypes.

When males from Theiler & Robinson's reared series were compared with these syntypes it was apparent that the 2 entities are different, and it became necessary to rename their species. In this paper, therefore, it is redescribed and renamed *Rhipicephalus lounsburyi* n. sp., in honour of C. P. Lounsbury, one of the great pioneer workers on ticks and tick-borne diseases of livestock in South Africa.

The second new species described in this paper, which occurs in the Luderitz, Bethanien and Keetmanshoop Districts of Namibia and in the Karoo areas of South Africa, is named *Rhipicephalus neumanni* n. sp. in memory of Professor L. G. Neumann, of the Toulouse Veterinary School in southern France. For some years Lounsbury corresponded with Neumann and sent him ticks for identification. Recently some of Neumann's letters discussing these collections, written by him in a fine, elegant hand, were rediscovered in the Entomology Section, Onderstepoort, by Mr V. A. Macleod. These 2 great scientists between them laid a large

part of the foundation of our knowledge of African ticks and it is therefore appropriate that they should be commemorated thus.

Measurements of these ticks are given in millimetres. The range given for the adults represents the dimensions of the largest and smallest individuals in the samples on which the descriptions are based. Five nymphae and 5 larvae of *R. lounsburyi* were measured. The measurements of the *R. neumanni* nymphae and larvae were calculated from the scanning electron micrographs because the remaining unmounted specimens had inadvertently been lost.

### *Rhipicephalus lounsburyi* Walker, n. sp.

Syn. *Rhipicephalus follis sensu* Theiler & Robinson, 1953, *Onderstepoort Journal of Veterinary Research*, 26, 93-99.

**Holotype:** ♂, laboratory reared, F<sub>1</sub> generation from ♀ A collected at Dordrecht (31° 22' S, 27° 02' E), Eastern Cape Province, Republic of South Africa, on 8 August 1945; host not recorded (Onderstepoort Collection 2820).

**Allotype:** ♀ data as above.

**Paratypes:** ♂♂, ♀♀, nymphae and larvae, data as above; ♂♂, ♀♀, nymphae and larvae, laboratory reared, F<sub>1</sub> generation from ♀♀ B & C, collection data as above (Onderstepoort Collection 2821).

Two ♂♂, 2 ♀♀, nymphae and larvae (Onderstepoort Collection 2821, RML 105789) are deposited in the Smithsonian Museum Support Center, Washington D.C. 20560.

### DESCRIPTIONS

**Male** (Fig. 1, 3-8). A relatively small, inornate, shiny, dark brown tick.

**Capitulum** (Fig. 3-4). Length (including the cornua) × breadth ranging from 0,62 × 0,71 to 0,41 × 0,45, slightly broader than long. Ventral surface as illustrated.

**Basis capituli.** Length (including the cornua) × breadth ranging from 0,34 × 0,71 to 0,21 × 0,45, about twice as broad as long. Antero-lateral margins short, divergent; postero-lateral margins long, slightly concave, convergent; lateral angles short; posterior margin slightly sinuous; cornua large,

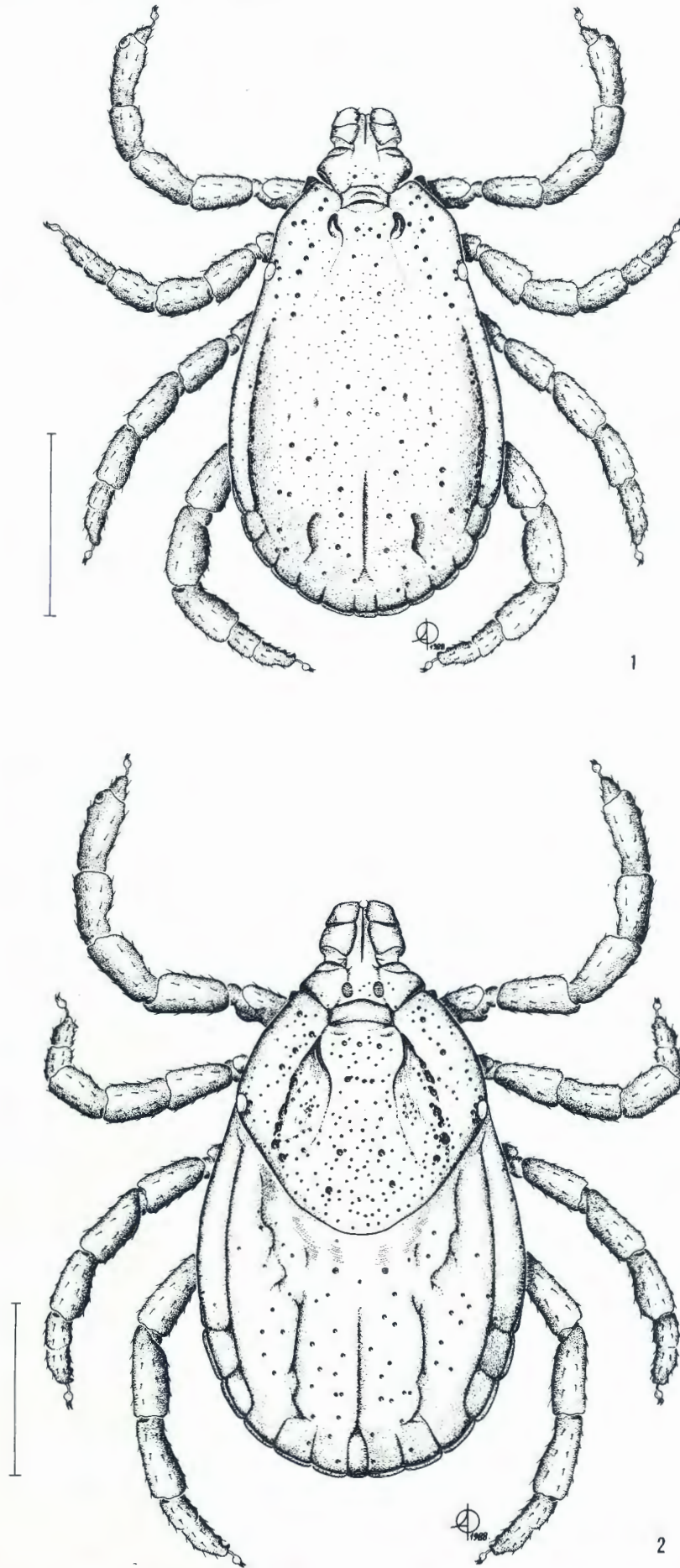


FIG. 1-2 *Rhipicephalus lounsburyi* n. sp. (OP 2820, Dordrecht, Eastern Cape), (1) male, dorsal view; (2) female, dorsal view; A. Olwage del. Scales represent 1 mm



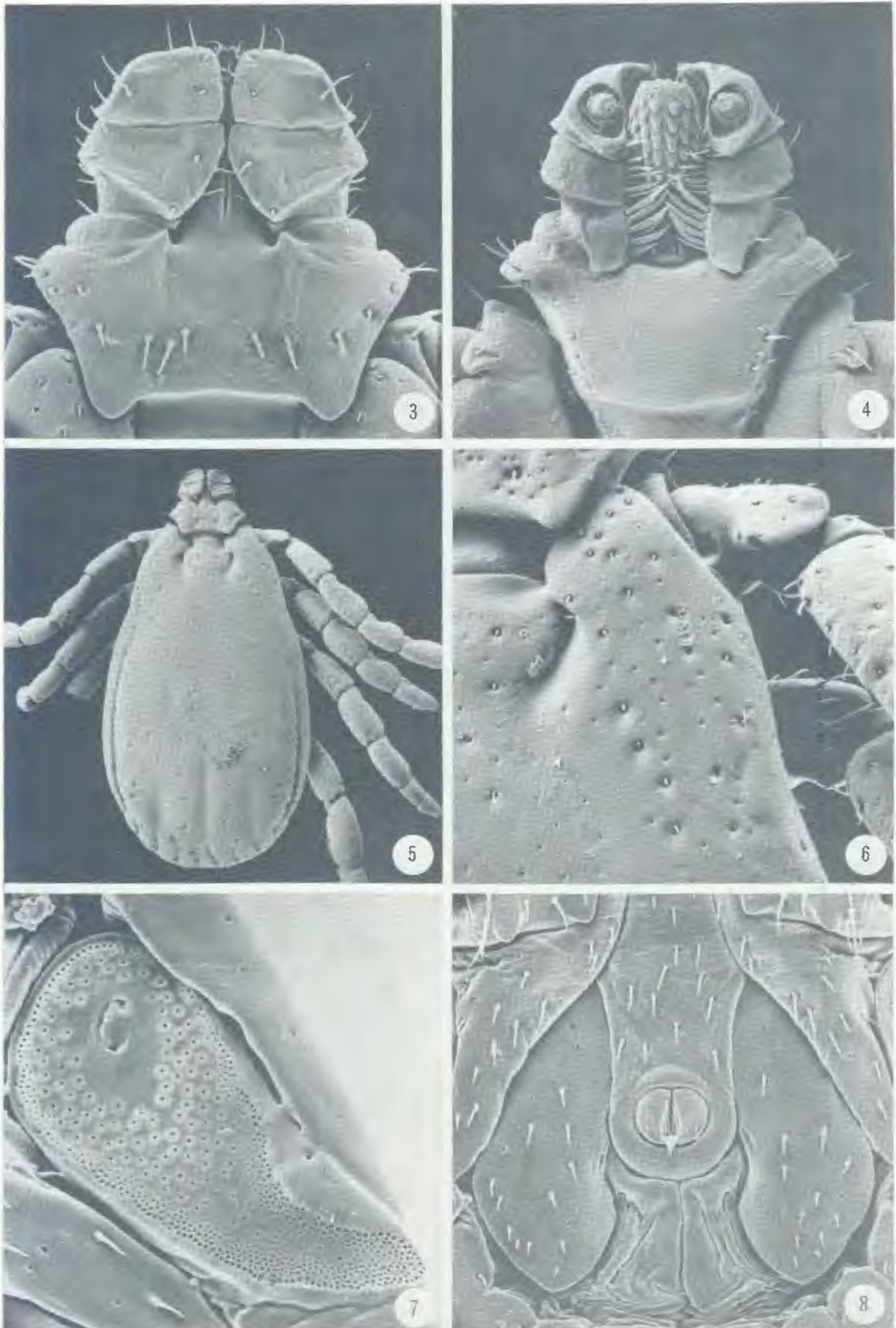


FIG. 3-8 *Rhipicephalus lounsburyi* n. sp. male (OP 2820, RML 105789, Dordrecht, Eastern Cape), (3) capitulum, dorsal  $\times 146$ ; (4) capitulum, ventral  $\times 117$ ; (5) dorsal view  $\times 20$ ; (6) scapular area  $\times 107$ ; (7) spiracle  $\times 192$ ; (8) adanal plates  $\times 90$ ; SEMs by M. D. Corwin (3, 7 & 8) and J. F. Putterill (4-6)

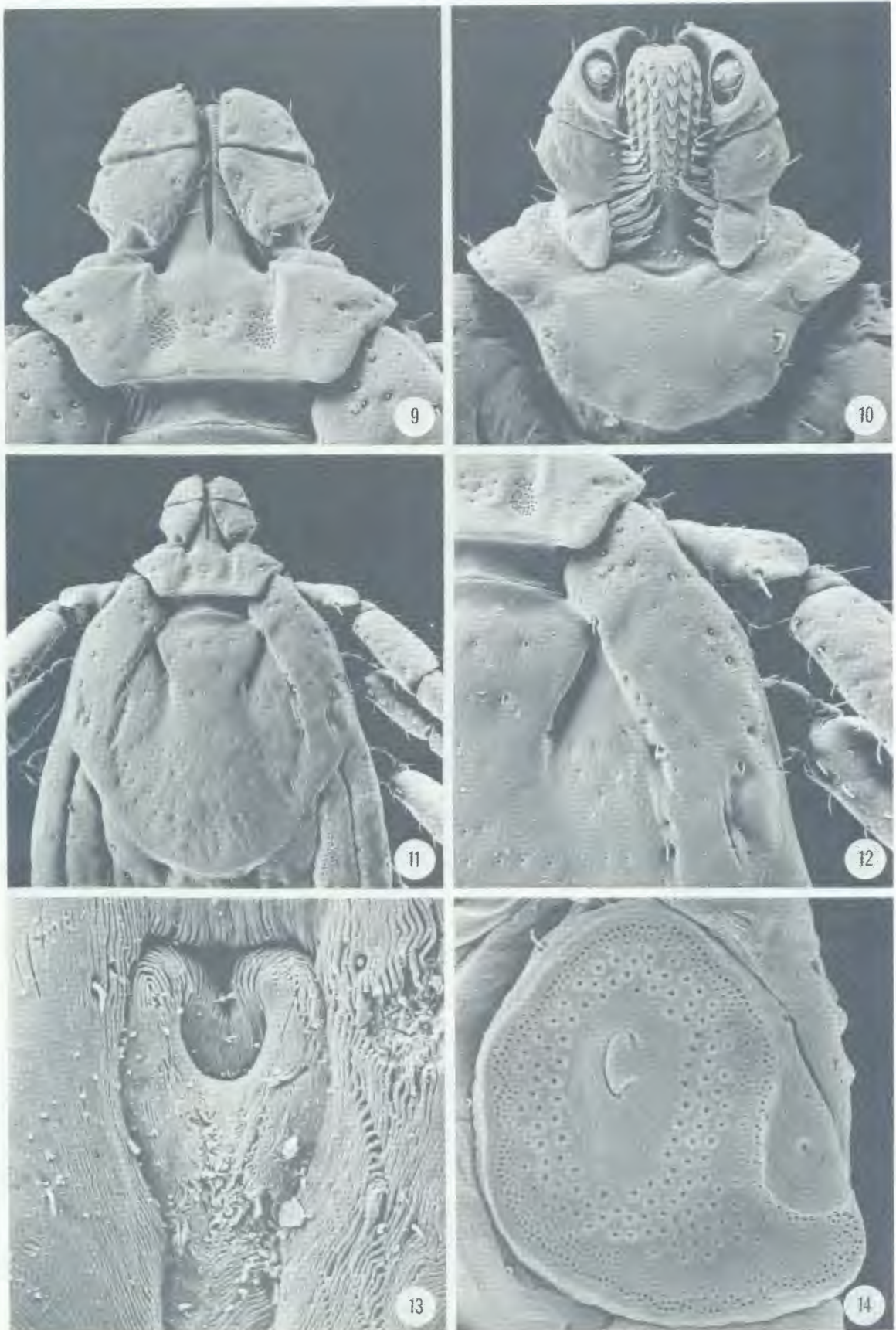


FIG. 9-14 *Rhipicephalus lounsburyi* n. sp. female (OP 2820, RML 105789, Dordrecht, Eastern Cape), (9) capitulum, dorsal  $\times 103$ ; (10) capitulum, ventral  $\times 108$ ; (11) scutum, dorsal  $\times 44$ ; (12) scapular area,  $\times 90$ ; (13) genital aperture,  $\times 276$ ; (14) spiracle,  $\times 198$ ; SEMs by J. F. Putterill (9-13) and M. D. Corwin (14)



broadly rounded. A few large setose punctations present more or less parallel to the postero-lateral and posterior borders. Wide subcollare present.

*Palps.* Length  $\times$  breadth ranging from  $0,28 \times 0,20$  to  $0,20 \times 0,13$ . Article I easily visible dorsally; article II slightly longer than article III; both articles markedly broader than long.

*Conscutum* (Fig. 1, 5–6). Length  $\times$  breadth ranging from  $2,58 \times 1,71$  to  $1,75 \times 1,21$ . Narrower anteriorly, widening behind the eyes. Anterior process of coxa I small, sharp, easily visible from the dorsal surface. Emargination relatively wide. Eyes about a quarter of the way back, only slightly convex, edged mesially by a few large setose punctations. Cervical pits short, convergent. External cervical margins sometimes, but not always, slightly depressed, divergent, extending just beyond eye level. Marginal grooves shallow, not quite reaching eye level anteriorly. Postero-median and postero-lateral grooves present but sometimes rather inconspicuous. Fes-tonons short, distinct. Punctations relatively inconspicuous; (not as pronounced as indicated in Theiler & Robinson, 1953, Fig. 3, D. Pringle *del.*). Medium-sized setose punctations scattered on the scapulae, in lines along the external cervical margins, along the marginal grooves, and scattered on the central part of the conscutum. Minute interstitial punctations scattered all over the conscutum but sometimes almost invisible at  $\times 25$  magnification under the stereomicroscope.

*Legs* (Fig. 1) more or less even in size.

*Ventral surface* bears short, scattered setae. *Spiracle* (Fig. 7) relatively long, narrowing at about two thirds of its length and curving gently towards dorsal surface.

*Adanal plates* (Fig. 8) as illustrated, relatively broad, scooped out slightly behind anus; postero-internal borders relatively short, curving gently outwards to join the much longer postero-external borders in bluntly rounded angles. *Accessory adanal plates* sharp, well chitinized.

**Female** (Fig. 2, 9–14). A relatively small, inornate, shiny, dark brown tick.

*Capitulum* (Fig. 9–10). Length  $\times$  breadth ranging from  $0,64 \times 0,78$  to  $0,47 \times 0,56$ , slightly broader than long. Ventral surface as illustrated.

*Basis capituli.* Length  $\times$  breadth ranging from  $0,28 \times 0,78$  to  $0,22 \times 0,56$ , well over twice as broad as long. Antero-lateral margins short, almost straight, divergent, meeting the long, mildly concave, convergent postero-lateral margins at acute angles; posterior margin slightly concave, cornua broadly rounded. A short row of setose punctations present on each lateral angle, parallel to the postero-lateral margin. Porose areas medium-sized, twice their own diameter apart.

*Palps.* Length  $\times$  breadth ranging from  $0,36 \times 0,23$  to  $0,25 \times 0,15$ . Article I easily visible from dorsal surface, markedly narrower than article II; article II longer than article III; article III broadly rounded apically.

*Body.* Length  $\times$  breadth of unfed specimens ranging from  $2,98 \times 1,96$  to  $1,80 \times 1,10$ . Alloscutum not deeply folded, bearing only scattered short inconspicuous white setae.

*Scutum* (Fig. 2, 11–12). Length  $\times$  breadth ranging from  $1,46 \times 1,40$  to  $0,91 \times 0,85$ , longer than broad. Inornate, dark brown, broadest about half way back, at about eye level, posterior border slightly

sinuous. Emargination wide. Eyes slightly convex, demarcated dorsally by shallow grooves. Cervical fields slightly depressed; their internal margins deeply depressed and convergent initially, becoming divergent and progressively shallower until they disappear before they reach the postero-lateral borders of the scutum; their external margins merely indicated by rows of large setose punctations. Similar setose punctations scattered on the scapulae and on the central part of the scutum, interspersed with scattered fine punctations.

*Ventral surface* bears scattered, inconspicuous, short white setae.

*Genital aperture* (Fig. 13) wide, crescent-shape.

*Spiracle* (Fig. 14) broad and rounded, with a short, broad extension projecting towards the dorsal surface of the alloscutum.

**Nymph** (Fig. 15–20)

*Capitulum* (Fig. 15–16). Length  $\times$  breadth  $0,21 \times 0,35$  to  $0,21 \times 0,37$ ; much broader than long. Ventral surface as illustrated.

*Basis capituli.* Length  $\times$  breadth  $0,09 \times 0,35$  to  $0,09 \times 0,37$ ; 4 times as broad as long. Antero-lateral margins short, straight, divergent; postero-lateral margins slightly longer, mildly sinuous, convergent; posterior margin long, straight to slightly concave; broad lateral angles projecting sideways over the scapulae. Ventrally with stout, broadly rounded, backwardly projecting spurs.

*Palps.* Length  $\times$  breadth  $0,14 \times 0,05$  to  $0,14 \times 0,06$ , sloping in towards each other. Article I barely visible from the dorsal surface; article II the longest, its outer margin bulging slightly proximally but virtually parallel with the inner margin for the rest of its length; article III relatively short, triangular, its outer margin also bulging slightly proximally, then sloping in towards the rounded tip of the palp.

*Body* (Fig. 17). Length  $\times$  breadth of unfed specimen  $1,15 \times 0,79$  to  $1,24 \times 0,83$ . Short inconspicuous setae scattered over alloscutum.

*Scutum* (Fig. 18). Length  $\times$  breadth  $0,49 \times 0,58$  to  $0,57 \times 0,60$ , broader than long. Emargination wide and shallow. Antero-lateral borders almost straight, divergent; posterior border a wide, smooth arc. Eyes at widest part of the scutum, edged dorsally by slight grooves. Cervical fields slightly depressed, relatively narrow; their outer margins parallel to the antero-lateral scutal borders; their inner margins relatively deep and convergent initially, becoming shallower and divergent and running back parallel to the outer margins. A few short scutal setae present.

*Ventral surface. Coxae* (Fig. 19). Coxa I with a long tapering external spur which overlaps coxa II plus a short sharp internal spur. Remaining coxae with external spurs only; coxa II with a long sharp spur just overlapping coxa III; coxa III with a short, sharp spur, and coxa IV with a short, broad spur.

*Spiracle* (Fig. 20). Ovate, with a slightly irregular margin; numerous large pores in the central area, with smaller pores around the periphery.

**Larva** (Fig. 21–24)

*Capitulum* (Fig. 21–22). Length  $\times$  breadth  $0,08 \times 0,16$  to  $0,10 \times 0,16$ ; much broader than long. Ventral surface as illustrated.

*Basis capituli.* Length  $\times$  breadth  $0,03 \times 0,16$  to  $0,04 \times 0,16$ ; 4 times as broad as long. Antero-lateral margins short; postero-lateral margins longer, curv-



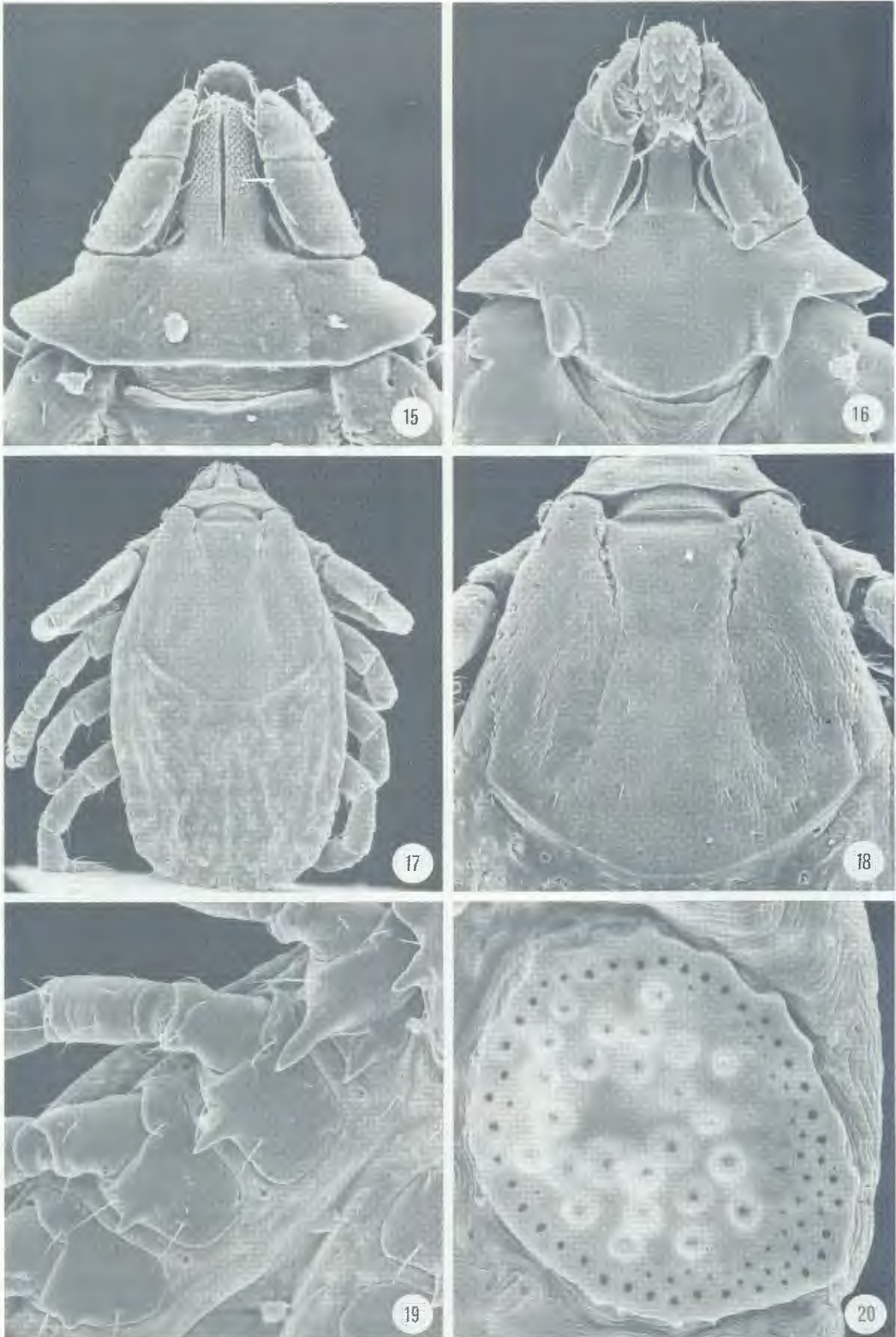


FIG. 15–20 *Rhipicephalus lounsburyi* n. sp. nymph (OP 2820, RML 105789, Dordrecht, Eastern Cape), (15) capitulum, dorsal  $\times 260$ ; (16) capitulum, ventral  $\times 278$ ; (17) dorsal view,  $\times 75$ ; (18) scutum,  $\times 159$ ; (19) coxae,  $\times 304$ ; (20) spiracle,  $\times 670$ ; SEMs by R. G. Robbins (16, 17, 19 & 20) and M. D. Corwin (15 & 18)

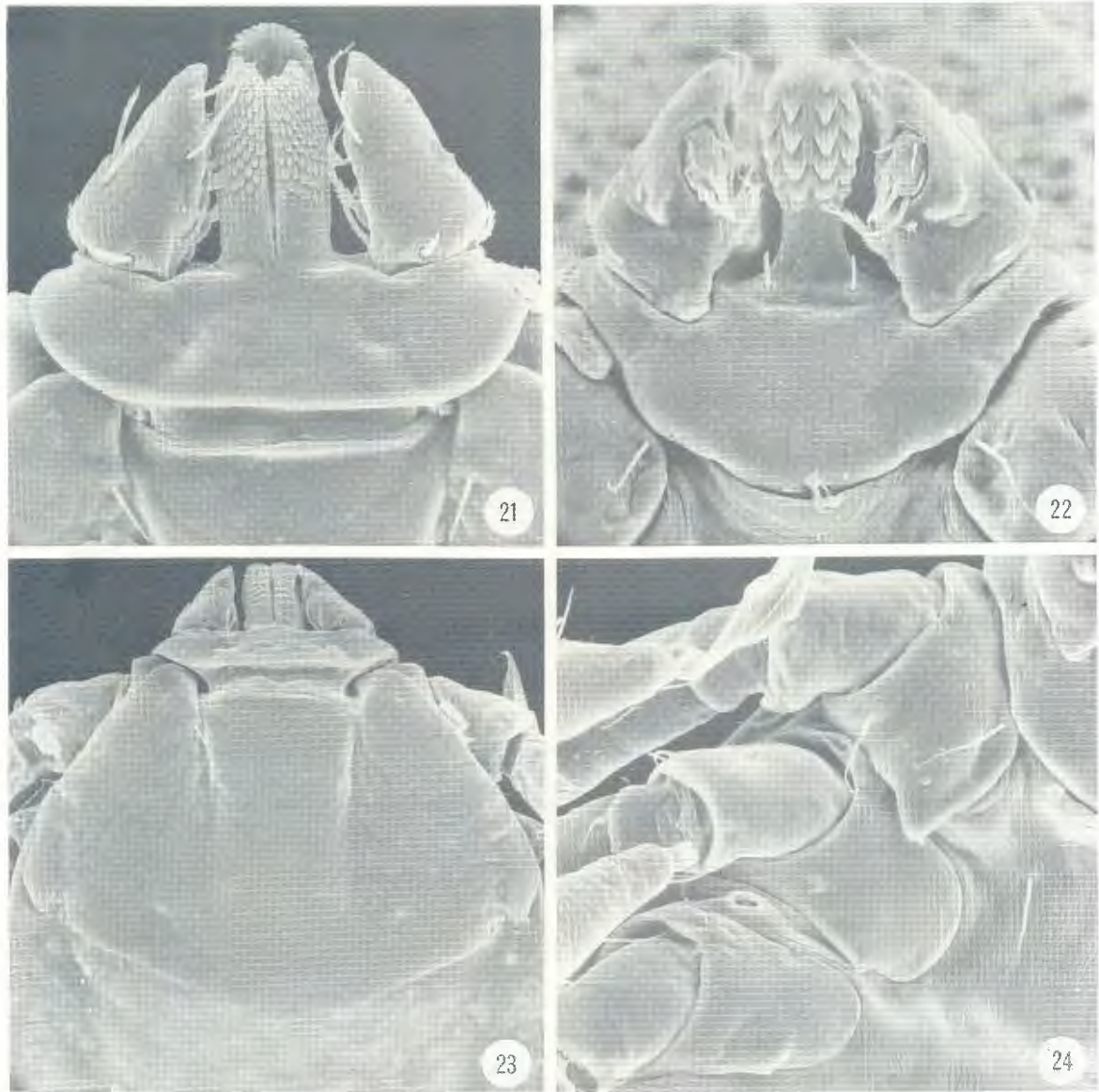


FIG. 21-24 *Rhipicephalus lounsburyi* n. sp. larva (OP 2820, RML 105789, Dordrecht, Eastern Cape), (21) capitulum, dorsal  $\times 660$ ; (22) capitulum, ventral  $\times 765$ ; (23) scutum;  $\times 263$ ; (24) coxae,  $\times 548$ ; SEMs by R. G. Robbins (21, 23 & 24) and M. D. Corwin (22)

ing round smoothly to join the long, virtually straight posterior margin; laterally bluntly rounded.

**Palps.** Length  $\times$  breadth 0,05  $\times$  0,04 to 0,06  $\times$  0,04; sloping in towards each other; broadest at the base, then tapering gradually to narrowly rounded tips.

**Body.** Length  $\times$  breadth of unfed specimen 0,50  $\times$  0,41 to 0,53  $\times$  0,42.

**Scutum** (Fig. 23). Length  $\times$  breadth c. 0,23  $\times$  0,35 (length impossible to measure in most mounted specimens because the posterior border of the scutum is obscured by faecal matter). Emargination wide. Antero-lateral borders mildly convex, divergent; posterior border a smooth shallow curve. Eyes at widest part of the scutum, delimited mesially by shallow grooves. Cervical grooves short, very slightly convergent.

**Ventral surface. Coxae** (Fig. 24) A single spur present on each coxa, that on coxa I being the largest and sharpest; spur on coxae II and III much smaller.

LIFE CYCLE IN THE LABORATORY

*R. lounsburyi* is a 3-host species. In Table 1 its developmental periods under laboratory conditions as determined by Theiler & Robinson (1953) are given. These authors did not state what hosts the ticks were fed on, nor did they give details of the conditions under which the ticks were maintained

TABLE 1 Developmental periods of *Rhipicephalus lounsburyi* n. sp. (syn. *Rhipicephalus follis sensu* Theiler & Robinson, 1953) under laboratory conditions

Developmental stages	Developmental periods (days)
Preoviposition	7
Larvae hatch	15-18
Larvae harden	2-5
Larvae engorge	4-5
Larvae moult	6
Nymphae harden	1-4
Nymphae engorge	4-9
Nymphae moult	7-14
Adults engorge	3-6



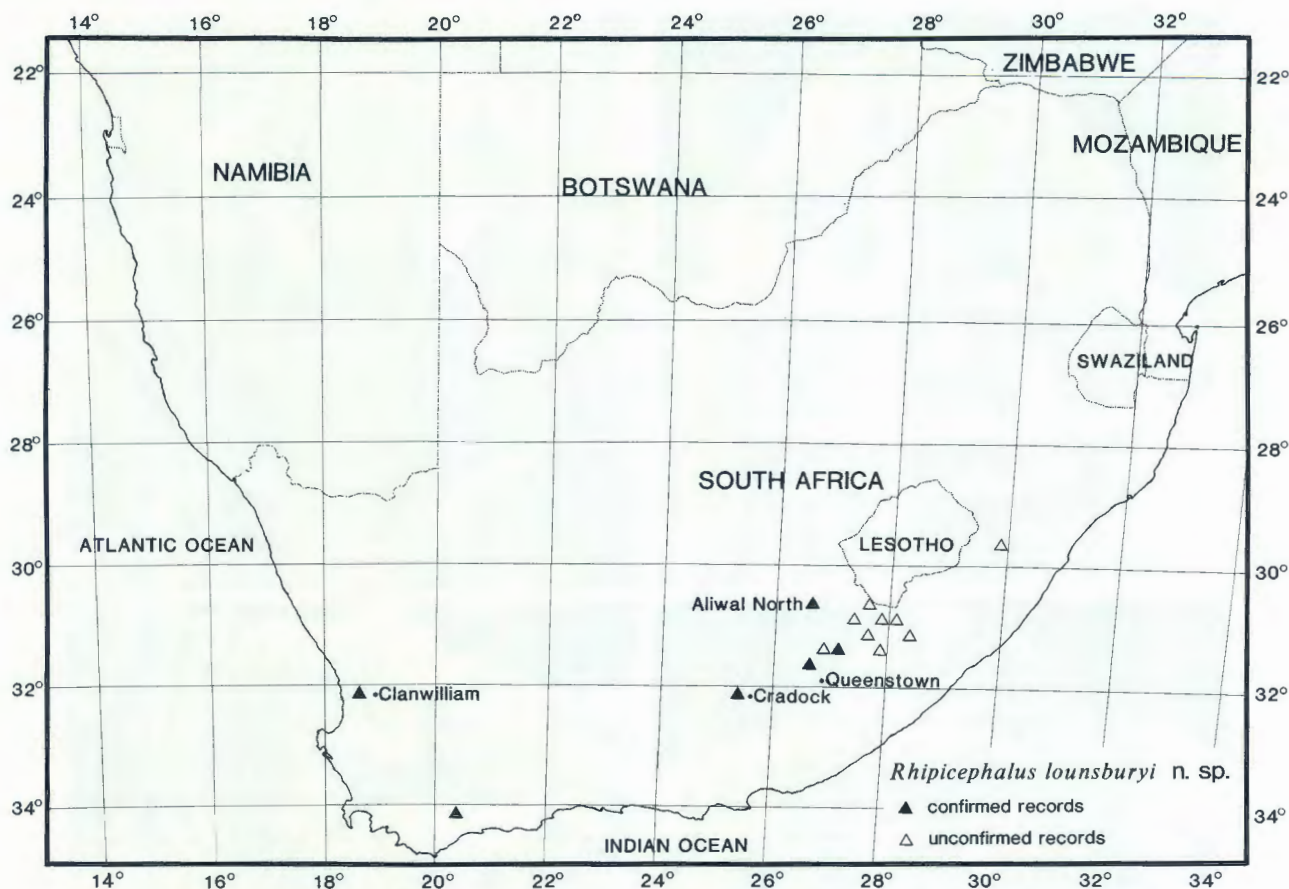


FIG. 25 *Rhipicephalus lounsburyi* n. sp.: distribution

during the non-parasitic phases of their lives. The developmental periods of these non-parasitic phases are remarkably short, which suggests that the ticks were kept at relatively high temperatures.

The species has not been reared again since.

#### HOST RELATIONSHIPS

Theiler & Robinson (1953) did not record the host of the strain on which they based their description of this tick. Subsequently Theiler (1962) stated: "The adults of this species are essentially parasites of domestic stock; the hosts of the immature stages are unknown".

To date, though, the only domestic animals from which *R. lounsburyi* adults have been recorded are sheep (8 collections), on which they attach on the feet, between the claws and on the heels. The collection dates given indicate that these adults are most active in autumn, winter and early spring (May–September).

*R. lounsburyi* adults have also been collected from various wild ungulates. Horak, Sheppey, Knight & Beuthin (1986), who listed them as a *Rhipicephalus* sp., found them on 9/30 vaal ribbok (*Pelea capreolus*) and 6/16 bontebok (*Damaliscus dorcas*) that they examined, mainly on the feet and lower legs of these animals. In addition I. G. Horak (personal communication, 1988) has collected this tick from the mountain reedbuck (*Redunca fulvorufula*), the black wildebeest (*Connochaetes gnou*) and the eland (*Taurotragus oryx*).

The hosts of the immature stages are still unknown.

#### ZOOGEOGRAPHY

The distribution of *R. lounsburyi* is shown in Fig. 25. The original collections were made at Dordrecht (31° 22' S, 27° 02' E), Eastern Cape Province (Theiler & Robinson, 1953). In 1958 Gertrud Theiler (unpublished data) listed the following places where this tick had also been collected in Barkly East District, some of them individual farms: Balloch (30° 42' S, 27° 42' E); New England (30° 51' S, 27° 29' E); Glen Almond (30° 52' S, 27° 29' E); Moshesh's Ford (30° 51' S, 27° 46' E); Mt. Nephin (given as Mt. Niven, 30° 48' S, 28° 01' E) and Middelfontein (31° 01' S, 27° 37' E), also Kromdraai, Knoppies, Dunover Park and Kalkfontein, which have not as yet been located. She quoted local residents (Messrs Mukheibir Bros.) as having observed that "the tick has spread right through the Barkly East area, particularly on the mountain farms and along the river belts". Later, in her own personal copy of Theiler (1962, under *R. follis*), she added further place names by hand: Maclear District, at Goodhope (31° 02' S, 28° 18' E); Elliot (31° 20' S, 27° 51' E); Wodehouse District, at Koupslaagte (31° 27' S, 26° 55' E) and, in Natal, the Impendle area (29° 36' S, 29° 52' E).

More recently *R. lounsburyi* has been collected in the Eastern Cape at Aliwal North (30° 42' S, 26° 43' E), and I. G. Horak (personal communication, 1988) has found it in the Mountain Zebra National Park (32° 15' S, 25° 27' E), near Cradock. It has also been recorded in the Western Cape in the National Bontebok Park (34° 04' S, 20° 28' E) near Swellendam (Horak *et al.*, 1986), and from a hilly area



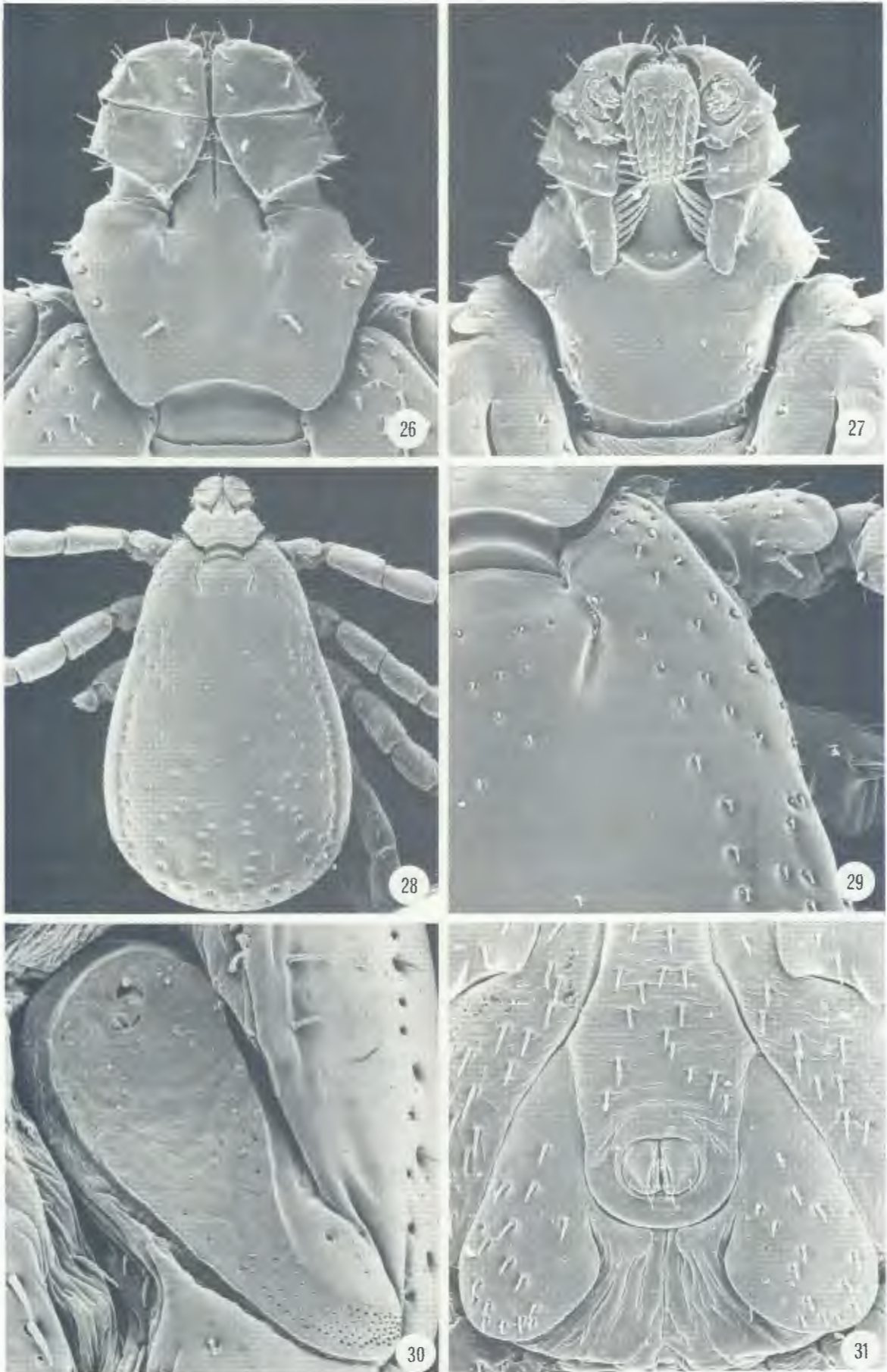


FIG. 26-31 *Rhipicephalus neumanni* n. sp. male (J. D. Bezuidenhout 5666, RML 65728, Keetmanshoop, Namibia), (26) capitulum, dorsal  $\times 107$ ; (27) capitulum, ventral  $\times 107$ ; (28) dorsal view  $\times 28$ ; (29) scapular area  $\times 100$ ; (30) spiracle  $\times 193$ ; (31) adanal plates  $\times 81$ ; SEMs by M. D. Corwin



between Clanwilliam and Graafwater (at c. 32° 10' S, 18° 42' E) in Calvinia District.

Thus present indications are that *R. lounsburyi* occurs mainly, but not exclusively, in mountainous and hilly areas in South Africa. In Natal Impendle is at an altitude of about 2 300 m (7 500 feet) with a mean annual rainfall of some 1 140 mm (45 in.) (F. B. W. du Casse, personal communication, 1988). In Barkly East District Knoppies is said to be at an altitude of over 2 400 m (8 000 feet), while Moshesh's Ford and Birkhall are at about 1 800 m (over 6 000 feet) (Gertrud Theiler, unpublished data, 1958). The mean annual rainfall at Barkly East is 686 mm, and at Aliwal North 536 mm, falling mainly in the summer (Weather Bureau, 1986). The vegetation in all these areas consists of various types of grassland (Acocks, 1975). According to White (1983) the area stretching between Aliwal North, Sterkstroom and Queenstown is in a Highveld grassland zone, which gives way eastwards to Afromontane vegetation.

In the Western Cape, though, *R. lounsburyi* has been recorded in somewhat lower, drier areas with a winter rainfall regimen and Cape shrubland (fynbos) vegetation (White, 1983). The Bontebok National Park is at an altitude of just under 200 m with a mean annual rainfall of 460 mm. The vegetation is mainly coastal Renosterbosveld (i.e. low shrubs 30–70 cm high). The area between Clanwilliam and Graafwater is at an altitude of approximately 600 m in the 201–300 mm rainfall zone. The vegetation here is *Macchia* (fynbos) and succulent Karoo (Acocks, 1975).

#### DISEASE RELATIONSHIPS

*R. lounsburyi* is not known to be a vector of any pathogenic organisms. Nevertheless the adults may have a deleterious effect on sheep. Gertrud Theiler (unpublished data, 1958) commented: "Although sheep do not become lame the farmers contend they lose condition and in some cases sheep have even died as a consequence. Lambs also are attacked severely".

#### *Rhipicephalus neumanni* Walker, n. sp.

**Holotype:** ♂ collected from sheep, on farm "Soutdoringvlei" (c. 26° 05' S, 17° 10' E), Bethanien District, Namibia, on 20 September 1971 by J. D. Bezuidenhout (Onderstepoort Collection 3141 i).

**Allotype:** ♀, data as above.

**Paratypes:** 7 ♂♂, 11 ♀♀ collected from goat, on farm "Gurus No. 77" (27° 06' S, 19° 08' E), Keetmanshoop District, Namibia, on 30 April 1985 by W. J. Louw (Onderstepoort Collection 3141 ii); 2 ♂♂, 1 ♀, collected from sheep, on farm "Wegkruip 130" (c. 26° 18' S, 16° 47' E), Bethanien District, Namibia, in November 1972 by J. D. Bezuidenhout (Onderstepoort Collection 3141 iii); 4 ♂♂, 2 ♀♀, collected from sheep, on farm "Kamgarus 63" (c. 26° 46' S, 18° 42' E), Keetmanshoop District, in April 1973 by C. Thirion (deposited in RML Collection No. 119860); 2 ♀♀, 2 ♂♂, collected from sheep, on farm "Naus 27" (c. 25° 50' S, 16° 30' E), Bethanien District, Namibia, in April 1972 by State Veterinarian, Marienthal [deposited in British Museum (Natural History), London, Collection No. 1990.1.18.1–4].

#### DESCRIPTIONS

**Male** (Fig. 26–31, 49). A moderate-sized, inornate dark brown tick closely resembling *Rhipicephalus distinctus* Bedford, 1932, in general appearance.

**Capitulum** (Fig. 26–27). Length (including the cornua) × breadth ranging from 0,88 × 0,78 to 0,63 × 0,58; not quite as broad as long. Ventral surface as illustrated.

**Basis capituli.** Length (including the cornua) × breadth ranging from 0,48 × 0,78 to 0,43 × 0,61, approximately a third broader than long. Dorsally with antero-lateral margins short, divergent; postero-lateral margins long, almost straight, convergent; lateral angles short and blunt; posterior margin concave; cornua smoothly rounded. A few large punctations present, each containing a short seta. Wide subcollare present.

**Palps.** Length × breadth ranging from 0,40 × 0,28 to 0,34 × 0,20. Article I easily visible dorsally; article II only slightly longer than article III, both articles markedly broader than long.

**Conscutum** (Fig. 28–29, 49). Length × breadth ranging from 3,52 × 2,21 to 2,77 × 1,78. Narrower anteriorly, widening behind the eyes. Anterior process of coxa I easily visible from dorsal surface. Emargination relatively wide. Eyes less than a third of the way back, marginal, very slightly bulging, edged dorsally by a few large punctations. Cervical pits short, convergent. Marginal grooves shallow, not reaching eye level anteriorly. Postero-median and postero-lateral grooves generally rather shallow and inconspicuous, completely absent in some specimens. Festoons quite well marked. Punctuation pattern made up of 3 elements. Large discrete punctations, each containing a short seta, scattered on the scapulae, in lines along the external cervical margins and the marginal grooves, and around the postero-median and postero-lateral grooves. Slightly smaller setose punctations present on the central part of the conscutum, and numerous minute interstitial punctations that are almost invisible under the stereomicroscope scattered all over it.

**Legs** (Fig. 49) more or less even in size.

**Ventral surface** bears scattered, fairly numerous setae. **Spiracle** (Fig. 30) relatively long, narrowing at about two thirds of its length and curving gently towards dorsal surface.

**Adanal plates** (Fig. 31). As illustrated, broadly rounded posteriorly and tapering towards the anterior end. **Accessory adanal plates** well chitinized, bluntly rounded.

**Female** (Fig. 32–37, 50). A moderate-sized, dark brown tick closely resembling *R. distinctus* in general appearance.

**Capitulum** (Fig. 32–33). Length × breadth of specimens measured ranging from 1,00 × 0,92 to 0,90 × 0,83, but varies in individual specimens from slightly longer than broad to slightly broader than long. Ventral surface as illustrated.

**Basis capituli.** Length × breadth ranging from 0,41 × 0,92, to 0,41 × 0,83; slightly over twice as broad as long. Antero-lateral margins slightly sinuous, divergent, meeting the concave, convergent postero-lateral margins in sharp points; lateral angles relatively long and slightly hunched in appearance; posterior margin long, mildly concave; cornua barely indicated. A short row of about 3 setose punctations present on each lateral angle, parallel to the postero-lateral margin. Porose areas fairly small, just over twice their own diameter apart.

**Palps.** Length × breadth ranging from 0,60 × 0,30 to 0,50 × 0,22. Article I easily visible from dorsal surface, markedly narrower than article II: article II



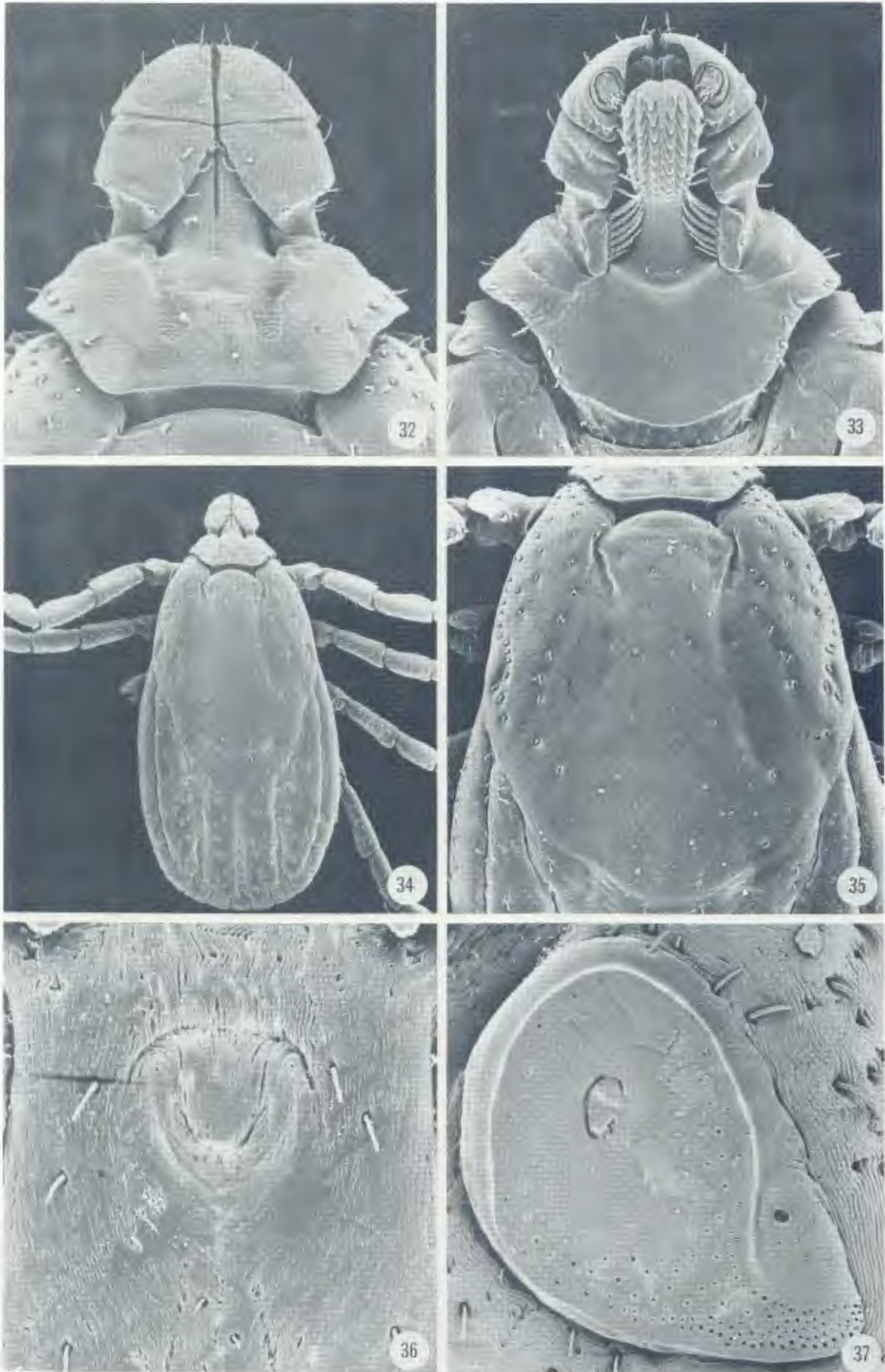


FIG. 32–37 *Rhipicephalus neumanni* n. sp. female (J. D. Bezuidenhout 5666, RML 65728, Keetmanshoop, Namibia), (32) capitulum, dorsal  $\times 105$ ; (33) capitulum, ventral  $\times 92$  (34) dorsal view  $\times 19$ ; (35) scutum  $\times 51$ ; (36) genital aperture  $\times 308$ ; (37) spiracle  $\times 344$ ; SEMs by M. D. Corwin



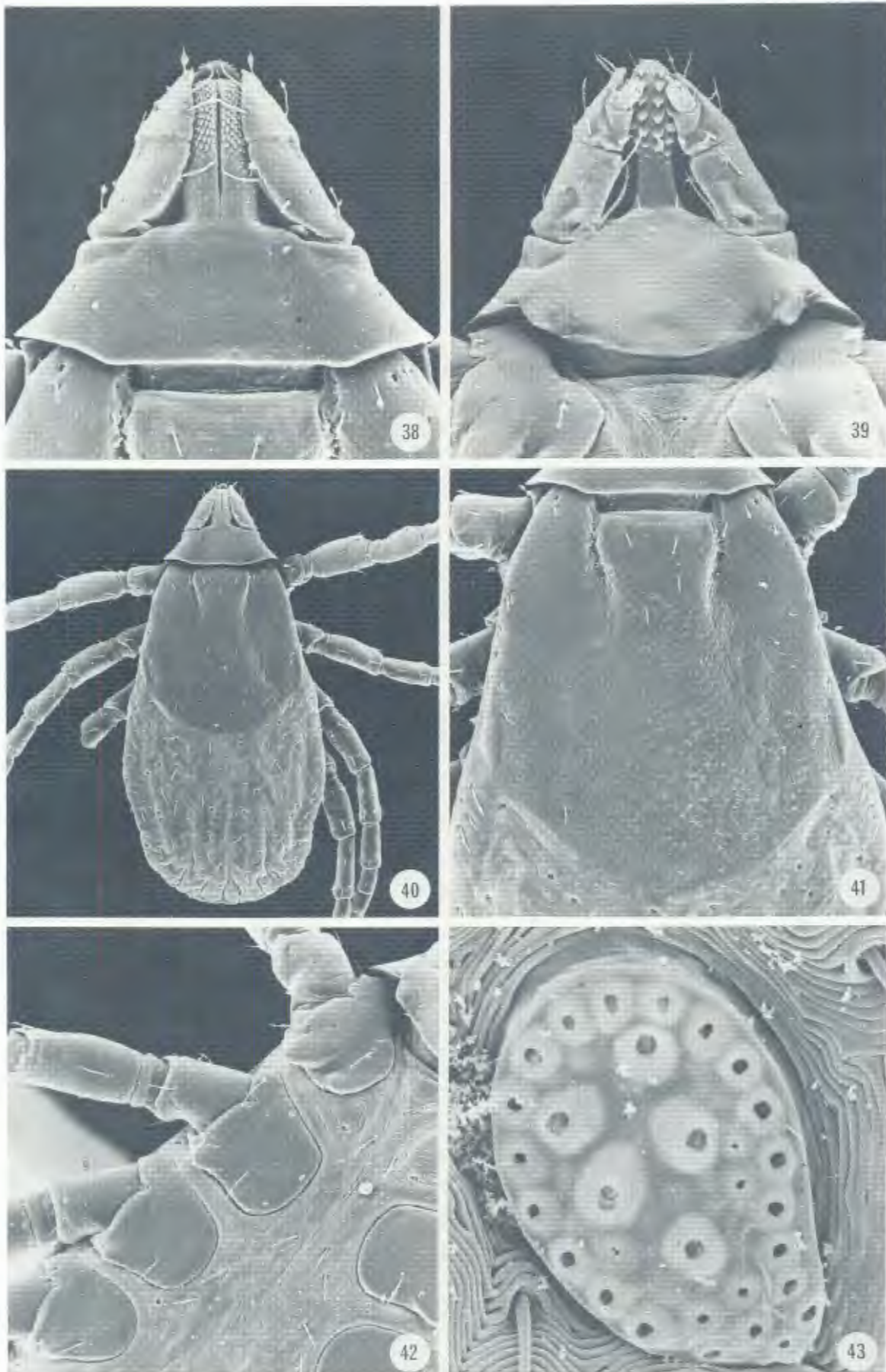


FIG. 38-43 *Rhipicephalus neumanni* n. sp. nymph (J. D. Bezuidenhout 5666, RML 65728, Keetmanshoop, Namibia), (38) capitulum, dorsal  $\times 261$ ; (39) capitulum, ventral  $\times 294$ ; (40) dorsal view  $\times 77$ ; (41) scutum  $\times 159$ ; (42) coxae  $\times 191$ ; (43) spiracle  $\times 1129$ ; SEMs by M. D. Corwin



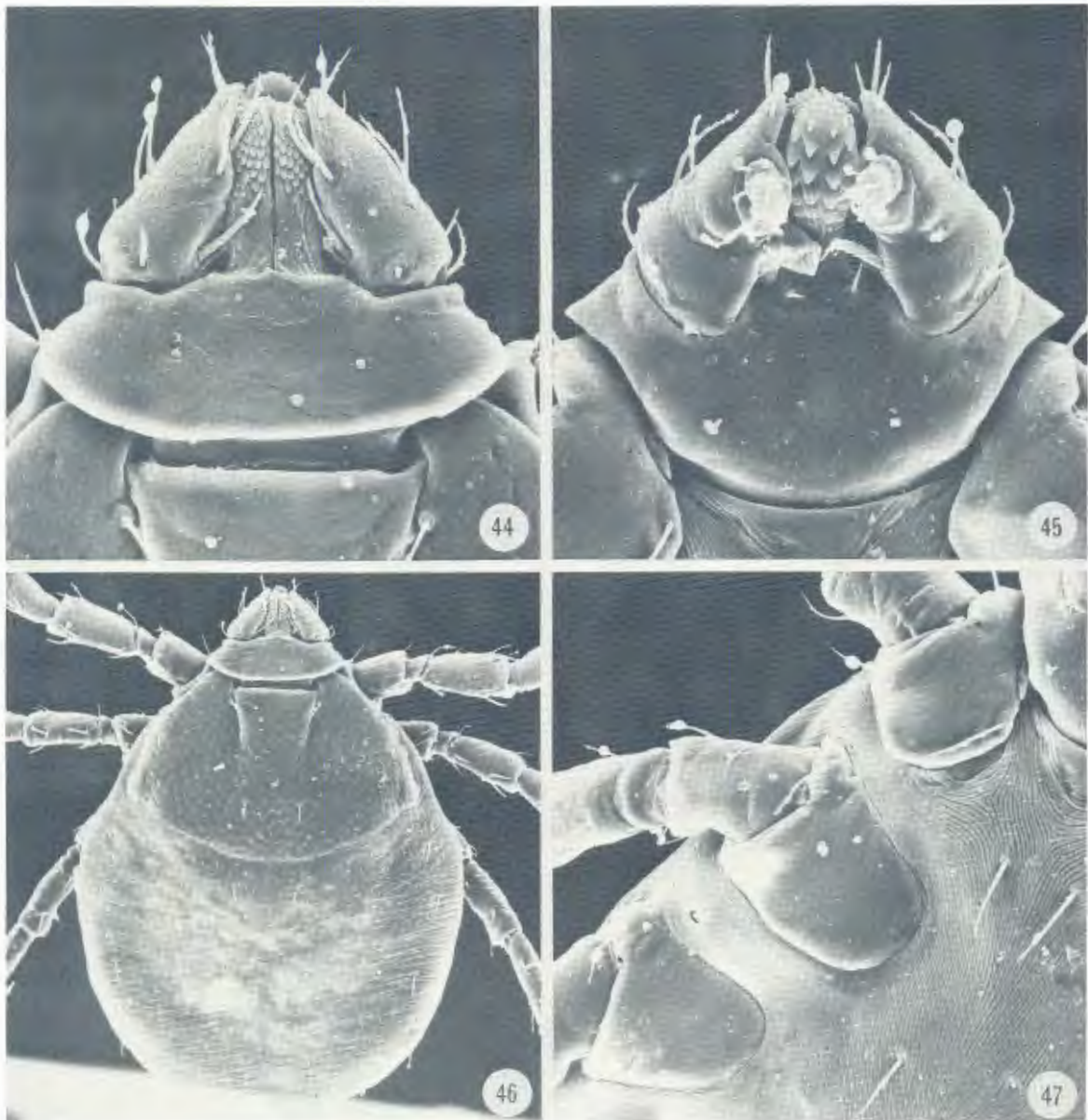


FIG. 44–47 *Rhipicephalus neumanni* n. sp. larva (J. D. Bezuidenhout 5666, RML 65728, Keetmanshoop, Namibia), (44) capitulum, dorsal  $\times 553$ ; (45) capitulum, ventral  $\times 526$ ; (46) dorsal view  $\times 203$ ; (47) coxae  $\times 411$ ; SEMs by M. D. Corwin

longer than article III; article III wedge shaped, its outer margin curving smoothly from its junction with article II to the apex of the palp, its inner and posterior margins almost straight.

**Body.** Length  $\times$  breadth of very slightly engorged specimens ranging from  $4,23 \times 2,60$  to  $3,46 \times 2,20$ . Alloscutum not deeply folded, bearing only scattered short, inconspicuous white setae.

**Scutum** (Fig. 34–35, 50). Length  $\times$  breadth ranging from  $2,20 \times 1,98$  to  $1,82 \times 1,72$ ; longer than broad. Inornate, dark brown; broadest about half-way back, just behind the eyes; posterior border sinuous. Emargination wide; antero-median margin of scutum convex. Eyes just anterior to broadest part of scutum, marginal, slightly bulging, delimited dorsally by a few large, setose punctations. Cervical pits short, convergent; cervical fields slightly depressed, delimited along their outer margins by irregular rows of large setose punctations. Similar punctations scattered on the scapulae, and a few slightly smaller setose punctations present on central

part of scutum. Numerous minute interstitial punctations scattered all over scutum. In general scutal surface slightly undulating.

**Ventral surface** bears scattered, rather inconspicuous, short white setae.

**Genital aperture** (Fig. 36) quite wide, with the sides of the opening converging towards the straight posterior margin.

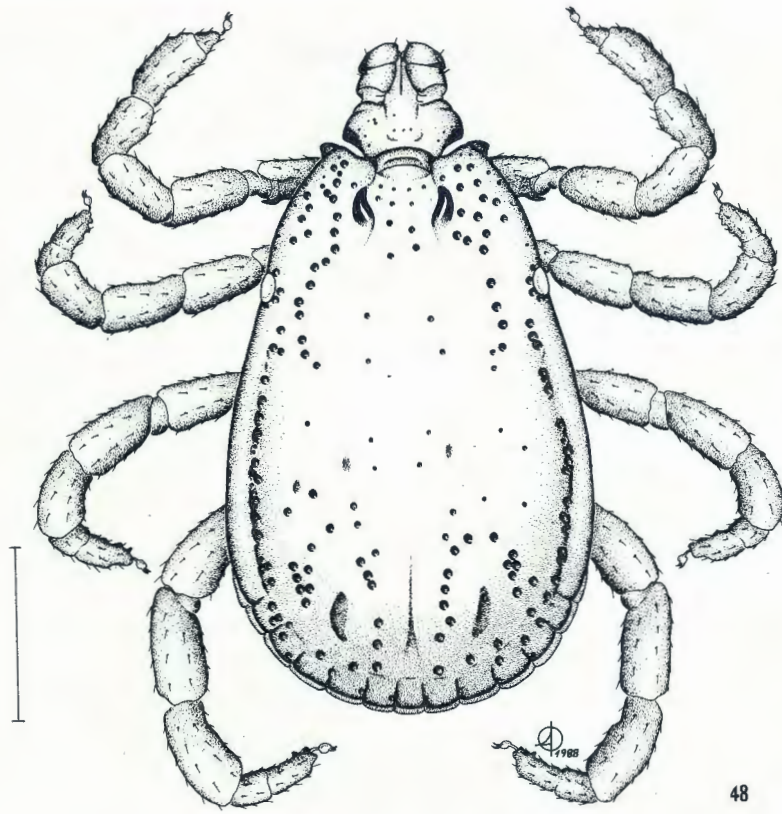
**Spiracle** (Fig. 37) broad and rounded, with a short, narrow extension projecting towards the dorsal surface of the alloscutum.

**Nymph** (Fig. 38–43).

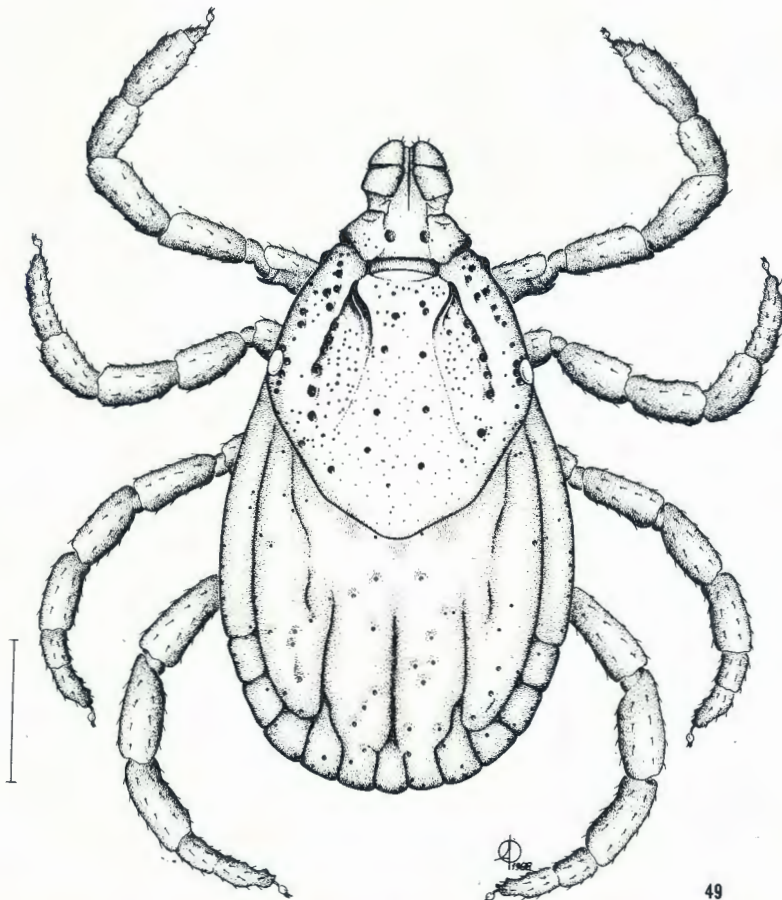
**Capitulum** (Fig. 38–39). Length (from tip of hypostome to posterior border of basis capituli)  $\times$  breadth c.  $0,22 \times 0,32$ , much broader than long. Ventral surface as illustrated.

**Basis capituli.** Length  $\times$  breadth c.  $0,11 \times 0,32$ ; three times as broad as long. Antero-lateral and postero-lateral borders both long and slightly concave, meeting in sharp lateral angles that project sideways





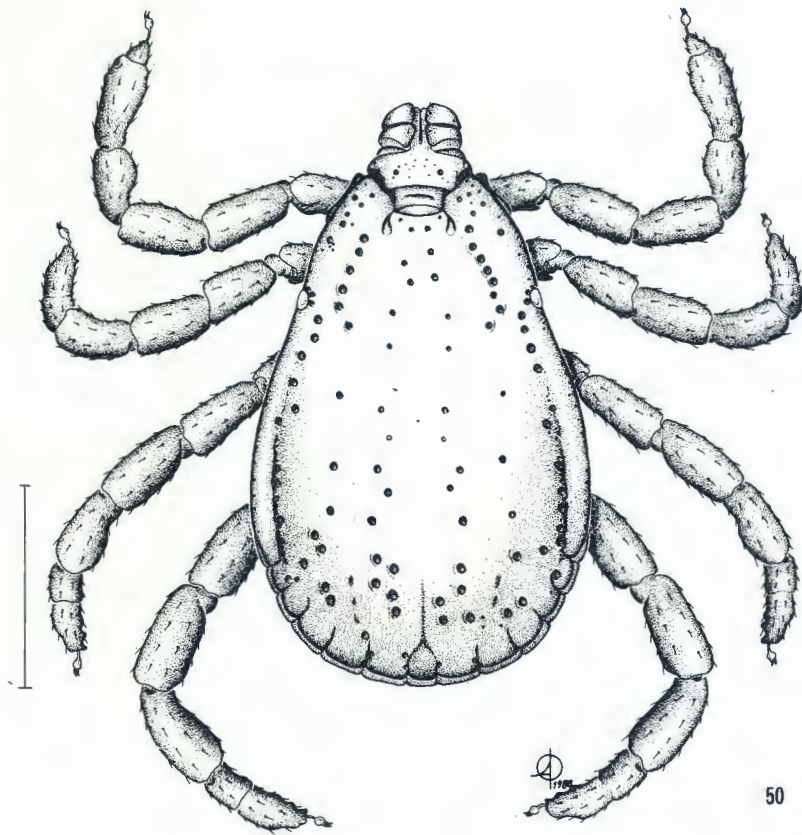
48



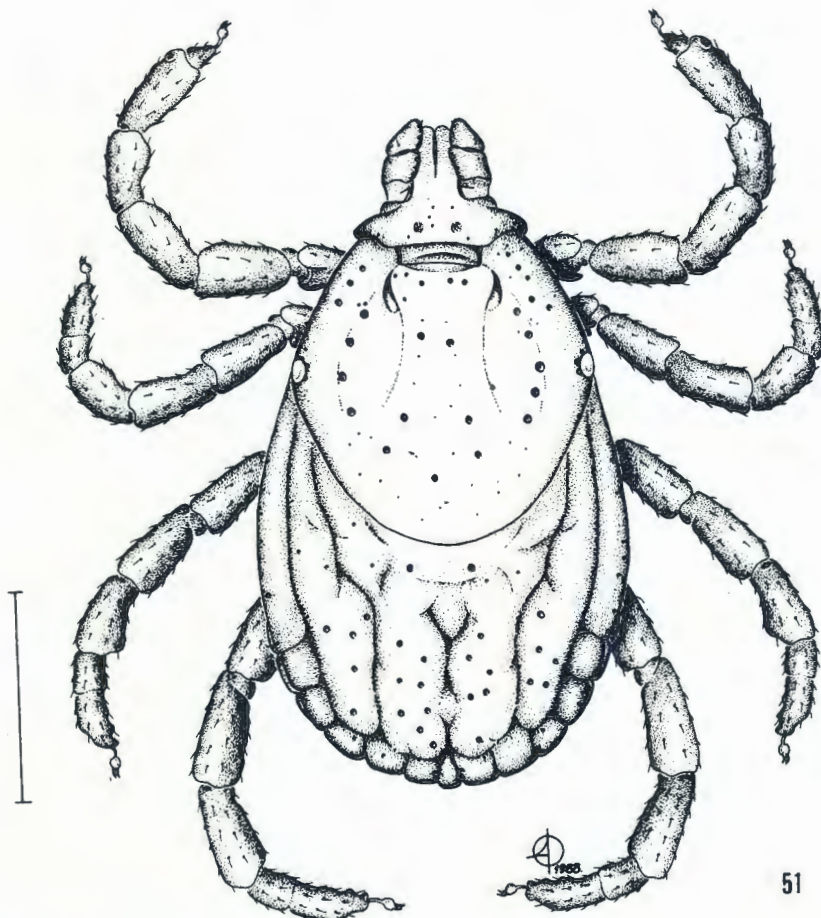
49

FIG. 48-49 *Rhipicephalus neumanni* n. sp. adults (J. D. Bezuidenhout 5189, Bethanien, Namibia), (48) Male, dorsal view; (49) female, dorsal view; A. Olwage del. Scales represent 1 mm





50



51

FIG. 50-51 *Rhipicephalus distinctus* Bedford, 1932, adults (OP 2794v, ex Kimberley District), (50) male, dorsal view; (51) female, dorsal view; A. Olwage del. Scales represent 1 mm



just beyond the coxae of the 1st pair of legs; posterior border straight. Ventrally short blunt spurs present.

**Palps.** Length  $\times$  breadth c.  $0,15 \times 0,05$  at base of article II. Article I barely visible from the dorsal surface; article II about twice as long as broad, broadest proximally, its outer margin slightly concave; article III much shorter than article II, and very slightly broader proximally, then tapering to a sharp point distally.

**Body** (Fig. 40). Length  $\times$  breadth of unfed specimen c.  $0,85 \times 0,51$ . Alloscutum bears scattered fine white setae.

**Scutum** (Fig. 41). Length  $\times$  breadth c.  $0,48 \times 0,46$ , longer than broad. Emargination wide and quite deep. Antero-lateral borders long, mildly convex and only slightly divergent; posterior border in form of a single smooth, fairly deep, curve. Eyes at widest part of scutum, well over half-way back, long and narrow in shape, delimited dorsally by slight depressions. Cervical pits short, convergent; cervical fields long and divergent, but only slightly depressed along internal margins and in general rather inconspicuous. Scutal setae fine, sparse.

**Ventral surface** (Fig. 42). Coxa I with large, broad external spur and short rounded internal spur. Coxae II, III and IV with external spurs only, decreasing progressively in size from II–IV.

**Spiracle** (Fig. 43) broadly oval, tapering slightly towards the dorsal surface.

#### Larva (Fig. 44–47)

**Capitulum** (Fig. 44–45). Length (from tip of hypostome to posterior border of basis capituli) c.  $0,094 \times 0,133$ ; much broader than long. Ventral surface as illustrated.

**Basis capituli.** Length  $\times$  breadth c.  $0,046 \times 0,133$ ; nearly 3 times as broad as long. Antero-lateral borders short, divergent, meeting the long, smoothly convex posterior border in short, bluntly rounded lateral angles.

**Palps.** Length  $\times$  breadth c.  $0,068 \times 0,330$  at widest point, slightly constricted proximally, then widening before they start tapering gradually to narrowly rounded tips.

**Body** (Fig. 46). Length  $\times$  breadth of unfed specimen c.  $0,48 \times 0,44$ .

**Scutum.** Length  $\times$  breadth c.  $0,21 \times 0,34$ . Emargination wide and shallow. Antero-lateral borders slightly convex, divergent; posterior border in form of a single smooth shallow curve. Eyes at widest part of scutum, slightly convex. Cervical grooves short, slightly convergent.

**Ventral surface** (Fig. 47). Coxa I with spur in form of a broad protuberance on posterior border. Coxa II with only a slight convexity on posterior border. Coxa III with no indication of a spur.

#### DISCUSSION

*Rhipicephalus neumanni* adults, which have a predilection for sheep and goats, closely resemble those of *Rhipicephalus distinctus* Bedford, 1932, a parasite of dassies (hyraxes) (*Procapra*, *Dendrohyrax* and *Heterohyrax* spp.) that is widely distributed in eastern, central and southern Africa (Theiler, 1962). Both Bedford (1932) and Bedford & Graf (1935) recorded a collection of adult ticks from sheep, Victoria West, Cape Province, as *R. distinctus* (syn. *Rhipicephalus punctatus* Bedford, 1929). These ticks have now been reidentified as *R. neumanni*. But,

besides the fact that these 2 species have completely different host preferences, a careful comparison of the accompanying line drawings of *R. neumanni* (Fig. 48–49, 52–54) with those of *R. distinctus* (Fig. 50–51, 55–57) shows that they differ morphologically. In general *R. neumanni* is the larger of these 2 species. The males also differ markedly in the shape of their bases capituli and palps, to some extent in their punctation patterns, and in the shape of their adanal plates. In the females the scutum of *R. neumanni* is more strongly punctate, and its posterior border is markedly sinuous, whereas the scutum of *R. distinctus* is lightly punctate and its posterior border is smoothly rounded.

#### LIFE CYCLE IN THE LABORATORY

Data on the life cycle of *R. neumanni* under laboratory conditions are given in Table 2 (J. D. Bezuidenhout, personal communication, 1989).

TABLE 2 Developmental periods of *Rhipicephalus neumanni* n. sp. under laboratory conditions (J. D. Bezuidenhout, personal communication, 1989)

Developmental stages	Developmental periods (days)	
	Mean	Range
Preoviposition	7	6–10
Larvae hatch	32	30–37
Larvae harden	14	14
Larvae engorge	4	3–6
Larvae moult	13	11–15
Nymphae harden	14	14
Nymphae engorge	6	4–7
Nymphae moult	27	24–30
Adults harden	21	21
Adults engorge	6	4–9
Total	144	131–163

This tick behaves as a 3-host species. The larvae and nymphae were fed on rabbits and the adults on sheep. One female laid a total of 3 420 eggs. When kept in an incubator unfed larvae survived for  $\pm 150$  d, unfed nymphae for  $\pm 180$  d, and adults for over 150 d.

#### HOST RELATIONSHIPS

By far the commonest recorded hosts of *R. neumanni* adults are sheep (23 collections). They have also been found on both Karakul and Boer goats (8 collections), and once on a horse. They usually attach on the feet between the claws and, according to a farmer in the Williston area, have been known to affect up to 300 sheep at a time.

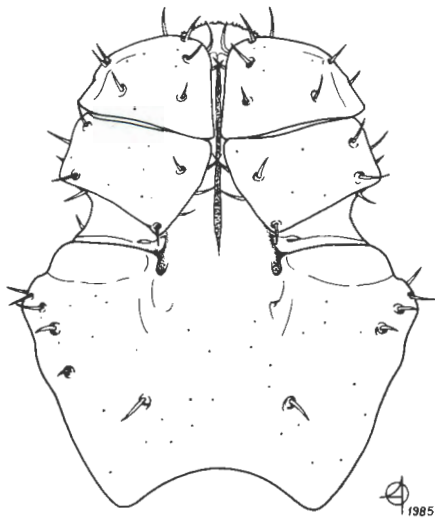
The majority of collections were made in autumn and early winter (March 2; April 24; May 4; June 1), plus a few in spring and early summer (September 1; November 5).

The hosts of the immature stages in the field are unknown.

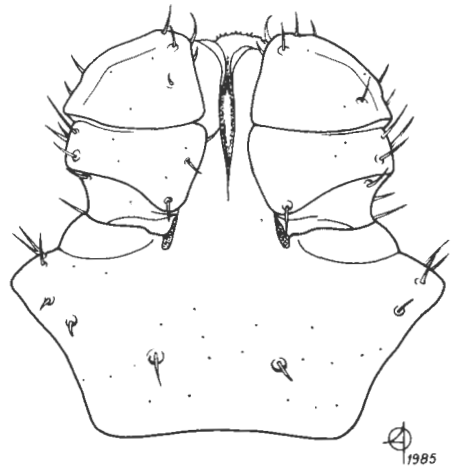
#### ZOOGEOGRAPHY

*Rhipicephalus neumanni* is common in parts of southern Namibia. In South Africa it has as yet been recorded from scattered localities only in the Karoo (Fig. 58). In Namibia it has been collected in Luderitz District on the farm Kliphhoek 72 (27° 17' S, 16° 42' E); in Bethanien District on the farm Helmeringshausen 12 (25° 42' S, 16° 50' E); Kosos 11 (25° 44' S, 16° 50' E); Conradie 2 (25° 48' S, 17° 16' E); Naus 27 (25° 50' S, 16° 30' E); Lovedale 14 (25° 56' S, 16° 43' E); Sorento 32 (26° 04' S, 16° 44' E);





52



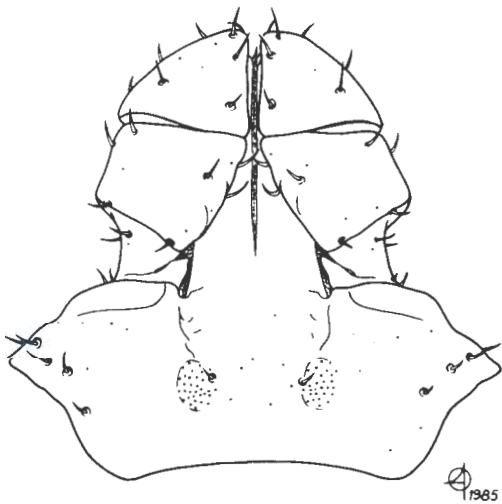
55



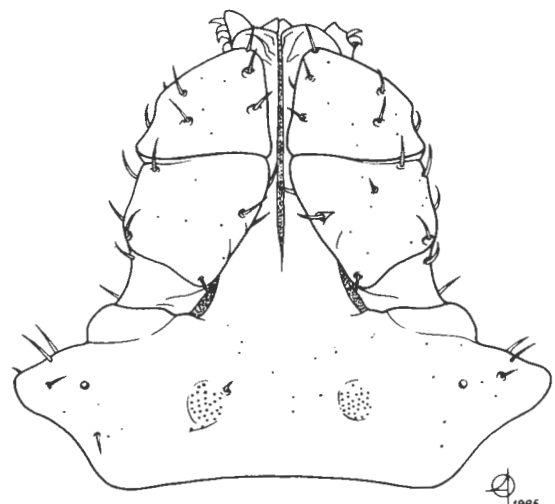
53



56



54



57

FIG. 52-57 *Rhipicephalus neumanni* n. sp. adults (J. D. Bezuidenhout 5666, RML 65728, Keetmanshoop, Namibia), (52) male capitulum, dorsal; (53) male adanal plate; (54) female capitulum, dorsal. *Rhipicephalus distinctus* Bedford, 1932, adults (OP 2794v, RML 65726, ex Kimberley District), (55) male capitulum, dorsal; (56) male adanal plate; (57) female capitulum dorsal; A. Olwage del.



TWO NEW SPECIES OF TICKS FROM SOUTHERN AFRICA

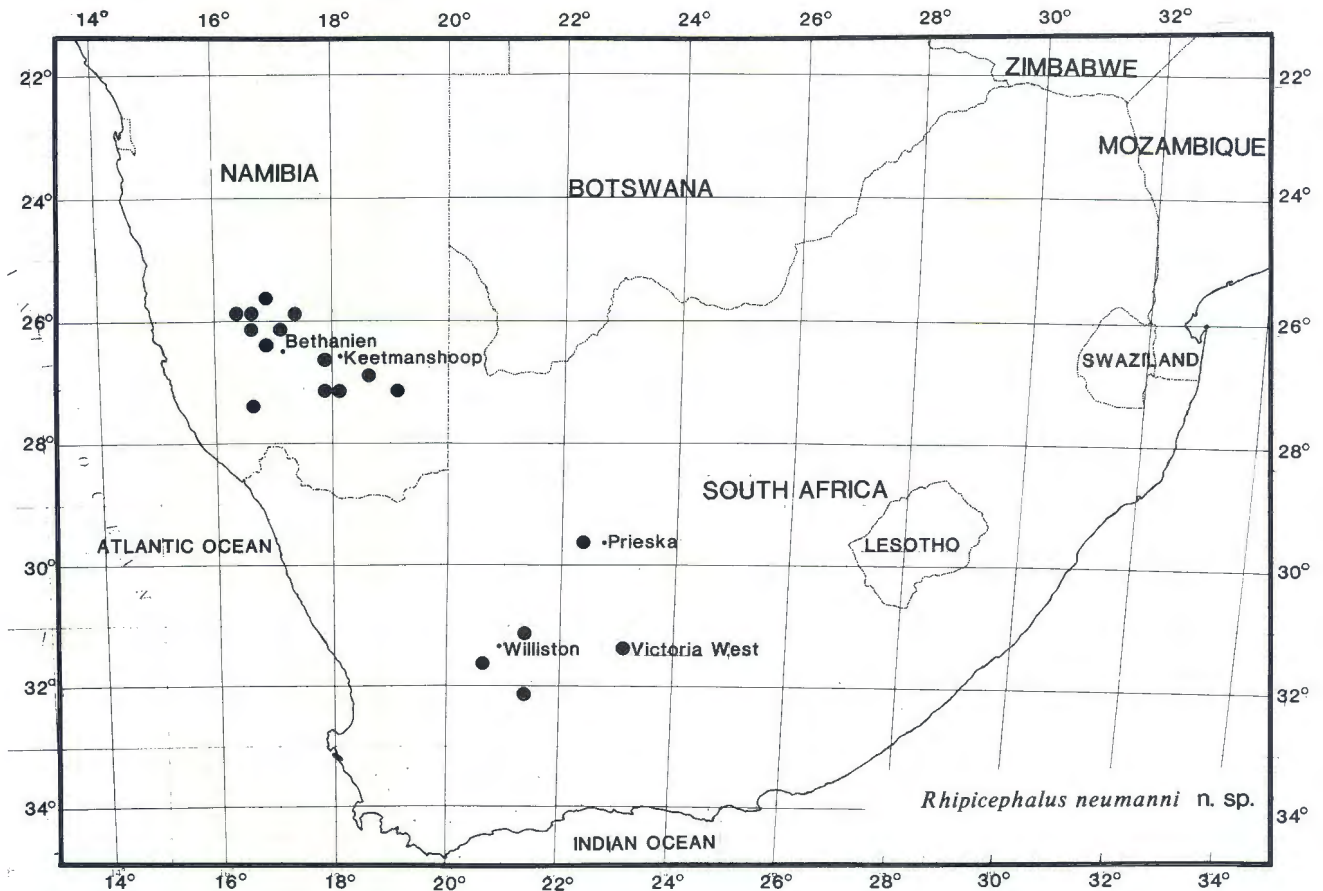


FIG. 58 *Rhipicephalus neumanni* n. sp.: distribution

Gamochas 31 (26° 05' S, 16° 40' E); Soetdoeringvlei 55 (26° 05' S, 17° 10' E); and Wegkruip 130 (26° 18' S, 16° 47' E); and in Keetmanshoop District on the farms Kyk Op 1 (26° 40' S, 17° 50' E); Oiams 63 (26° 46' S, 18° 42' E); Donkermodder 60 (26° 52' S, 18° 40' E); Steinveld 117 (27° 06' S, 18° 08' E); Gurus 77 (27° 06' S, 19° 08' E), and Springfontein 110 (27° 15' S, 17° 50' E). In South Africa it has been recorded in Prieska District on the farm Bloubospoort (29° 45' S, 22° 22' E); in Williston District on the farms Kleinmeestersklip (31° 08' S, 21° 16' E) and Leendertsrivier (31° 37' S, 20° 41' E); in Fraserburg District on the farm Eselfontein (32° 09' S, 21° 25' E), and in Victoria West District at Victoria West itself (31° 24' S, 23° 09' E).

These collection points are all in mountainous or hilly semi-desert areas, at altitudes ranging from about 1 000–1 500 m in 100–300 mm summer rainfall zones. Most are in bushy Karoo-Namib shrubland vegetation (White, 1983). In South Africa there are also a few records in dwarf Karoo Shrubland. Further collecting may well show that *R. neumanni* is far more prevalent in the Karoo than these scattered records suggest.

DISEASE RELATIONSHIPS

Farmers report that the adults of *R. neumanni* cause lameness and footrot in sheep because they attach between the claws of the animals' hooves. According to J. D. Bezuidenhout (personal communication, 1989), up to 30 % of the sheep in a flock may be affected.

ACKNOWLEDGEMENTS

I am most grateful to Dr Anne S. Baker [British Museum (Natural History), London] for lending me

the syntypes of *R. follis*. Prof. I. G. Horak kindly allowed me to quote a number of his unpublished records of *R. lounsburyi*, which I much appreciate. I also thank Dr D. H. Strydom for making numerous collections of *R. neumanni* in SWA/Namibia, Dr J. D. Bezuidenhout for rearing this tick and Miss I. H. Heyne for making her unpublished records from Namibia available to me.

I was greatly helped with the preparation of the illustrations by Messrs M. D. Corwin, J. F. Putterill and R. G. Robbins, Miss I. H. Heyne and Mr D. G. de Klerk (scanning electron micrographs); Mr A. Olwage (line drawings), and Mrs A. Kotzé (maps), all of whom I thank most sincerely.

REFERENCES

ACOCKS, J. P. H., 1975. Veld types of South Africa with accompanying veld type map. 2nd edn. *Memoirs of the Botanical Survey of South Africa*, No. 40, 128 pp.

BEDFORD, G. A. H., 1932. A synoptic check-list and host-list of the ectoparasites found on South African Mammalia, Aves, and Reptilia. (Second Edition). *18th Report of the Director of Veterinary Services and Animal Industry, Union of South Africa*, 223–523.

BEDFORD, G. A. H & GRAF, H., 1935. Ticks, tick-borne diseases and their eradication in South Africa. II. The transmitters of East Coast fever and redwater in cattle. *Farming in South Africa*, 10 (106), 14–17, 20 (Reprint No. 11, 1935).

DÖNITZ, W., 1910 Die Zecken Südafrikas. In: SCHULTZE, L. Zoologische und anthropologische Ergebnisse einer Forschungsreise im westlichen und zentralen Südafrika ausgeführt in den Jahren 1903–1905, 4, 3 Lieferung. *Denkschriften der Medizinisch-naturwissenschaftlichen Gesellschaft zu Jena*, 16, 398–494 + plates 15, 16 a, b, 17.

HORAK, I. G., SHEPPEY, K., KNIGHT, M. M. & BEUTHIN, C. L., 1986. Parasites of domestic and wild animals in South Africa. XXI. Arthropod parasites of vaal ribbok, bontebok and scrub



- hares in the western Cape Province. *Onderstepoort Journal of Veterinary Research*, 53, 187–197.
- KEIRANS, J. E., 1985. George Henry Falkiner Nuttall and the Nuttall tick catalogue. *United States Department of Agriculture, Agricultural Research Service, Miscellaneous Publication No. 1438*. Washington D.C.: U.S. Government Printing Office.
- KNUTH, P., 1938a. Ueber meine Studienreise nach Africa in den Jahren 1906 und 1907. Part 1. *Berlin tierärztliche Wochenschrift*, (1), 14–16.
- KNUTH, P., 1938b. Ueber meine Studienreise nach Africa in den Jahren 1906 und 1907. Part 2. *Berlin tierärztliche Wochenschrift*, (2) 30–32.
- THEILER, GERTRUD, 1962. The Ixodoidea parasites of vertebrates in Africa south of the Sahara (Ethiopian Region). Project S9958. Report to the Director of Veterinary Services, Onderstepoort. Mimeographed.
- THEILER, GERTRUD & ROBINSON, BRITHA N., 1953. Ticks in the South African Zoological Survey Collection. Part VIII. Six lesser known African rhipicephalids. *Onderstepoort Journal of Veterinary Research*, 26, 93–136 + map.
- WEATHER BUREAU, 1986. Climate of South Africa—Climate statistics up to 1984 (WB 40). Pretoria: Government Printer.
- WHITE, F., 1983. The vegetation of Africa. A descriptive memoir to accompany the UNESCO/AETFAT/UNSO vegetation map of Africa, + maps. Paris: UNESCO.