

CLARIFICATION OF THE STATUS OF *RHIPICEPHALUS KOCHI* DÖNITZ, 1905 (IXODOIDEA, IXODIDAE)

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ABSTRACT

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Figures of the types of *Rhipicephalus kochi*, and of its synonym *Rhipicephalus neavei* Warburton, 1912, are presented. These are accompanied by complete descriptions of all stages of *R. kochi*, illustrated with scanning electron microscope photographs. The basic differences between this species, *Rhipicephalus pravus* Dönitz, 1910 and *Rhipicephalus punctatus* Warburton, 1912 are outlined.

R. kochi occurs south of the Equator in parts of eastern, central and southern Africa. Its adults feed most commonly on cattle, various antelopes and wild pigs, and on hares. Little is known about the hosts of the immature stages; nymphae have been recorded in a field collection once only, from *Petrodromus tetradactylus*, the 4-toed elephant shrew.

INTRODUCTION

Rhipicephalus kochi Dönitz, 1905 was described from 9 specimens off cattle in German East Africa (Tanzania): 1 ♂, 5 ♀♀ from Sadani (06°03'S, 38°47'E) and 3 ♀♀ from Lindi (10°00'S, 39°43'E). One of the females from Sadani was designated as the "type" by Dönitz.

During his revision of the genus *Rhipicephalus*, Zumpt (1943) saw the type female only, and thought all the other specimens in the type series had been lost. He regarded *R. kochi* as a doubtful species that he could not place satisfactorily. He felt, though, that there might be a link between it and *Rhipicephalus jeanneli* Neumann, 1913 and suggested that, if *R. jeanneli* were later to be found at Sadani, this species should be synonymized with *R. kochi*. In 1950 he finally did synonymize these 2 species, without further comment or explanation, and for about 17 years thereafter the name *R. kochi* was widely used for the highland cattle tick.

Theiler (1947), who treated *R. kochi* and *R. jeanneli* as separate species, noted that "in many respects *R. kochi* closely resembles the East African *R. neavei*". It is not clear, though, whether she had re-examined the types, and the differences between *R. kochi* and *R. neavei* that she listed may have been due to the poor quality of Dönitz's drawings. Subsequently, however, *R. neavei*, and also *R. neavei punctatus*, both of which were described by Warburton (1912), were synonymized with *Rhipicephalus pravus* Dönitz, 1910 by Walker (1956).

In 1962 Clifford & Anastos noted the resemblance between the genitalia of the *R. kochi* type female, as figured by Feldman-Muhsam (1956), and the genitalia of lightly, evenly punctate ticks from Upemba Park, Republic of Zaïre. They withheld final judgment pending re-examination of the *R. kochi* type and merely labelled their specimens *Rhipicephalus* sp. near *pravus*. They stated, though: "We think it is reasonable to assume that the name *R. kochi* may actually apply to these lightly and evenly punctate ticks from Upemba Park and Tanganyika".

Yeoman & Walker (1967) concluded that the specimens determined as *R. pravus* by Walker (1956) did, after all, comprise 3 species, *R. pravus* itself, *R. neavei* and *R. punctatus*. At the same time they resurrected the name *R. jeanneli* for the highland ticks that, since 1950, had been identified as *R. kochi*. Although they had not examined the type of *R. kochi* they felt the following

facts justified their decision: (1) the types of *R. kochi* and *R. jeanneli* were obtained in widely separated and ecologically different areas; (2) the slenderness of the scutum of the one remaining type female of *R. kochi*, noted by Zumpt (1943), was not characteristic of the highland ticks, and (3) as noted by Clifford & Anastos (1962), there was a great difference between the genitalia of the *R. kochi* type female and those of the highland specimens currently identified as *R. kochi*.

Matthysse & Colbo (unpublished data, 1969)⁽³⁾ examined the type material of *R. kochi* and *R. neavei* and concluded they are conspecific. They also used the name *R. jeanneli* for the highland ticks previously given the name *R. kochi*.

We have examined the type female of *R. kochi* and the type series of *R. neavei* and likewise agree they are conspecific. One of us (J.E.K.) also found the single type male of *R. kochi* from the original Sadani series, now in the G. H. F Nuttall Collection, No. 2109, in the British Museum (Natural History). This male, which is undoubtedly the specimen that was described and figured by Dönitz (1905), lacks lateral grooves and definite posterior grooves. There is a hint of a posterior median groove if the specimen is examined with oblique lighting. The punctations are moderate in size and evenly distributed over the scutum. The eyes are flat and hardly raised above the scutal surface. Coxa I has a fairly distinct anterior process, considerably more extensive than most specimens of *R. jeanneli*. The adanal shields are rather broad and hardly indented along the internal margin, and in that respect this tick resembles neither *R. kochi* nor *R. jeanneli*.

Because of the unusual characteristics of this ♂ tick, we feel it would cause further confusion to designate it as the lectotype. We are therefore designating the female tick housed in the Berlin Museum as lectotype.

Rhipicephalus kochi Dönitz, 1905

Syn. *Rhipicephalus neavei* Warburton, 1912 20 ♂♂, 10 ♀♀ from eland (*Taurotragus oryx*) near mouth of Lasangazi River, I.IX.1910, S.A. Neave. Ex Nuttall Collection 1414, [E.R.C. No. 168] British Museum (Natural History) (BMNH Reg No. 1911.12.5.16-40). Lectotype designated by Keirans & Brewster (1981).

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⁽³⁾ This information appears in a manuscript by J. G. Matthysse & M. H. Colbo entitled *The ixodid ticks of Uganda*. It was submitted to the Government Printer, Entebbe, for publication in 1969 and there are reports that approximately 6 copies were printed. Apparently, however, these copies were lost during the unrest in Uganda. Until further printed copies become available we consider this work to be unpublished.

Rhipicephalus mossambicus Santos Dias, 1950, 1 ♂ from buffalo, Mozambique, 1 June 1949. Listed as a synonym of *Rhipicephalus neavei* Warburton, 1912 by Santos Dias (1952). This specimen has not been seen by the authors.

Lectotype: ♀ from cattle, Sadani, German East Africa, Berlin Museum Catalogue No. 8490.

Paralectotype: ♂ from cattle, Sadani, German East Africa, G.H.F. Nuttall collection No. 2109, British Museum (Natural History).

DESCRIPTIONS

Female (Fig. 1, 2, 4–11)

Capitulum (Fig. 4, 5). Broader than long, the length \times breadth varying from $0,83 \times 0,93$ to $0,68 \times 0,78$ mm. Subcollare present, broad and oval.

Basis capituli just over twice as broad as long, the length \times breadth varying from $0,43 \times 0,93$ to $0,33 \times 0,78$ mm. Anterolateral margins straight, divergent; posterolateral margins concave, convergent; posterior margin straight; cornua small. Porose areas nearly round, *c.* 3 times their diameter apart. A few small punctations scattered over capitular surface. Two to 3 short white setae lateral to porose areas.

Palps (Fig. 4, 5). Article I long, easily visible from the dorsal surface. Article II slightly longer than article III.

Scutum (Fig. 6–8). Slightly longer than broad, the length \times breadth varying from $1,63 \times 1,45$ to $1,33 \times 1,25$ mm. Inornate, reddish brown in colour. Broadest just posterior to eyes, posterior margin sinuous. Emargination wide and deep. Eyes *c.* half-way back, flat, edged dorsally with a groove that contains a few punctations. This groove is not readily apparent on most specimens under an ordinary stereoscopic microscope. Cervical pits present, convergent, with cervical groove extending from pit to scutal midlength. Cervical fields slightly depressed. Definite lateral ridges lacking in most specimens, lightly indicated by slight elevation and cessation of punctations in others. Some of the punctations along area of lateral ridge slightly larger. Area just mesial and anterior to eyes smooth and generally devoid of medium-sized punctations, a few minute punctations are scattered in this area in some specimens. Medium-sized punctations evenly distributed in central area between eyes. A few short white setae are present in some punctations, especially in scapular area.

Alloscutum. Bears very short white setae in the punctations scattered over integument.

Ventral surface

Spiracle (Fig. 9) shorter and broader than male. Short white setae scattered over ventral surface, except for area just anterior to genital opening which bears numerous longer setae.

Genitalia (Fig. 10, 11). Opening is a short narrow V; area just anterior to opening bulging. In mounted specimens the V shape is still apparent, hyaline sclerites are small, rather close together and triangular in shape.

Male (Fig. 3, 12–17)

Capitulum (Fig. 12, 13). Broader than long, the length (including the cornua) \times breadth varying from $0,70 \times 0,79$ to $0,50 \times 0,55$ mm. Large oval subcollare present.

Basis capituli. Twice as broad as long, the length (including the cornua) \times breadth varying from $0,40 \times 0,79$ to $0,28 \times 0,55$ mm. Anterolateral borders nearly straight and divergent; posterolateral borders long, concave and convergent; lateral angles long and sharp, tilting forward slightly and extending sideways over the strong apical processes of coxa I; cornua moderate, pos-

terior border nearly straight; extremely small punctations scattered over entire surface, and a row of *c.* 10 larger punctations, each with a white seta, across posterior half of basis capituli.

Palps (Fig. 12, 13). Article I visible dorsally; article II longer than article III; both broader than long.

Conscutum (Fig. 14, 15). Length \times breadth varies from $3,15 \times 2,10$ to $2,00 \times 1,20$ mm. Inornate, brown to reddish brown in colour, narrower anteriorly, widening slightly behind eyes; in engorged specimens the body wall extends posterolaterally and a caudal process is formed posteriorly. Anterior process of coxa I visible from dorsal surface. Emargination narrow and deep. Eyes *c.* one third of the way back, marginal, nearly flat, only bulging slightly, edged with a few moderate-sized punctations dorsally. Cervical pits deep, well-marked. Cervical grooves fairly prominent, cervical fields shallow. Marginal grooves well-developed, extending forward almost to eye level. Posteromedian and posterolateral grooves present and well-developed in most specimens, the former long and narrow, the latter shorter and broad, all three grooves connect with festoons on most specimens, surfaces of grooves with reticulated surfaces. Festoons well-marked. Moderate-sized punctations generally distributed over most of the surface, many of the larger cavities have a short white seta, punctations scarce along lateral ridge and anterior to the eye in the area of cervical fields and on both sides of marginal groove. A few of the punctations along lateral ridge area and on scapulae slightly larger.

Legs. Increase slightly in size from I to IV.

Ventral surface

Adanal shields (Fig. 16). External margin nearly straight, joining the broadly rounded posterior margin in a smooth curve. Internal margin hollowed out posterior to anus, commencing at anal groove.

Accessory adanal shields represented by small chitinized points adjacent to the adanal plates.

Spiracle (Fig. 17) elongate, comma-shaped with a short process that projects to the dorsal surface. Short white setae distributed randomly over ventral surface.

Nymph (Fig. 18–23).

Capitulum (Fig. 18–20). Length (measured from tip of hypostome to posterior border of basis capituli) \times breadth varying from $0,23 \times 0,29$ to $0,24 \times 0,30$; much broader than long. Ventral surface without ventral posterolateral spurs. Lateral angle is rectangular in shape and extends over anterior border of coxa I.

Basis capituli. Length \times breadth varying from $0,10 \times 0,29$ to $0,11 \times 0,30$; nearly 3 times as broad as long. Anterolateral margins short, mildly concave or indented, divergent; posterolateral margins longer, nearly straight, strongly convergent and rather abruptly joining the straight posterior margin; no cornua. The precise appearance of the basis depends on the tilt of the capitulum.

Palps (Fig. 18, 19). Article I easily visible from dorsal surface, article II longer than III. Narrower at the base and apex, otherwise virtually even in width.

Body (Fig. 20). Length \times breadth of unfed specimen varying from $0,78 \times 0,49$ to $0,85 \times 0,54$. Alloscutum bears short scattered setae.

Scutum (Fig. 21). Length \times breadth varying from $0,48 \times 0,48$ to $0,50 \times 0,51$; about as broad as long. Emargination wide and shallow. Anterolateral borders gently convex, posterolateral borders slightly concave, meeting mid-dorsally in a broad smooth curve. Eyes at widest part of scutum, oval, raised above the level of the scutum, each edged along the internal margin by a slight

depression. Cervical fields depressed, relatively broad; their outer margins gently convex, their inner margins fairly deep and convergent initially, becoming divergent and shallower posteriorly. Scutal setae sparse; shorter and firmer than those on alloscutum.

Ventral surface

Coxae (Fig. 22). Coxa I with a relatively long, sharp external spur and a longer, broader, rounded internal spur. Coxae II, III and IV with short, sharp, external spurs.

Spiracle (Fig. 23). Nearly round, with a few pores in the centre surrounded by a peripheral belt of numerous closely-set pores.

Larva (Fig. 24–28)

Capitulum (Fig. 24–27). Length (measured from tip of hypostome to posterior border of basis capituli) \times breadth varying from $0,112 \times 0,108$ to $0,116 \times 0,112$, slightly longer than broad. Ventral surface as illustrated.

Basil capituli. Length \times breadth varying from $0,044 \times 0,108$ to $0,048 \times 0,112$. Lateral margins nearly straight, gently curve posteriorly to meet the straight posterior margin.

Palps (Fig. 24, 25). Constricted at the base, then widening markedly; narrowing at apex.

Body (Fig. 26). Length \times breadth of unfed specimen varying from $0,40 \times 0,36$ to $0,45 \times 0,38$.

Scutum (Fig. 27). Length \times breadth varying from $0,250 \times 0,320$ to $0,264 \times 0,340$. Emargination wide and shallow. Anterolateral borders slightly convex; posterolateral borders also slightly convex, meeting mid-dorsally in a broad, shallow curve. Eyes at widest part of the scutum, raised above the level of the scutum and delineated dorsally by a shallow groove. Cervical grooves short, slightly convergent.

Ventral surface

Coxae (Fig. 28). A single large triangular spur on coxa I; a smaller more rounded spur on coxa II and III.

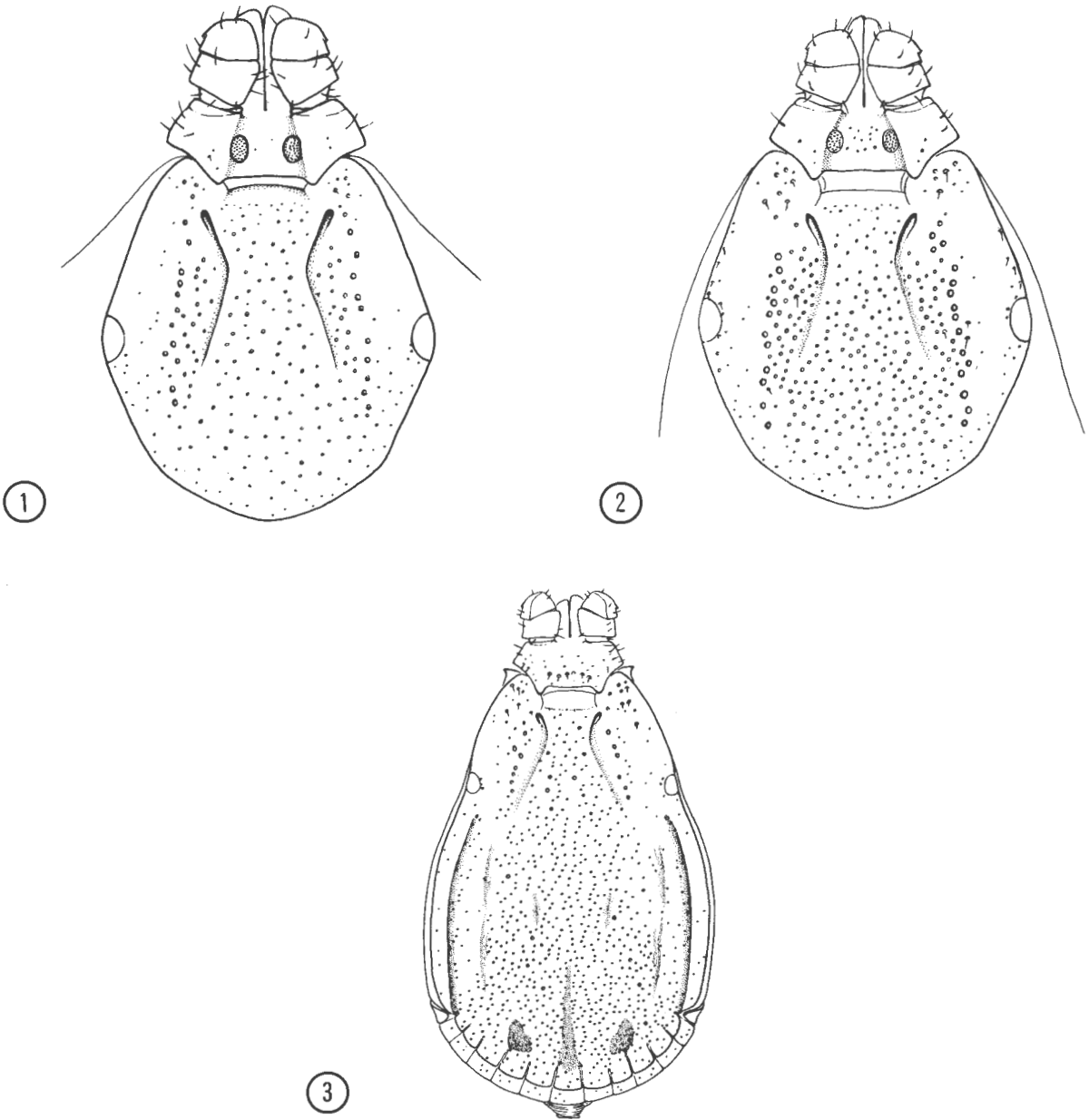


FIG. 1–3 *Rhipicephalus kochi* Dönitz, 1905; (1) lectotype female (Berlin Museum catalogue No. 8490) capitulum and scutum; (2) female from type series of *Rhipicephalus neavei* Warburton, 1912 [British Museum (Natural History)], capitulum and scutum; (3) male from type series of *Rhipicephalus neavei* Warburton, 1912 [British Museum (Natural History)], dorsal view

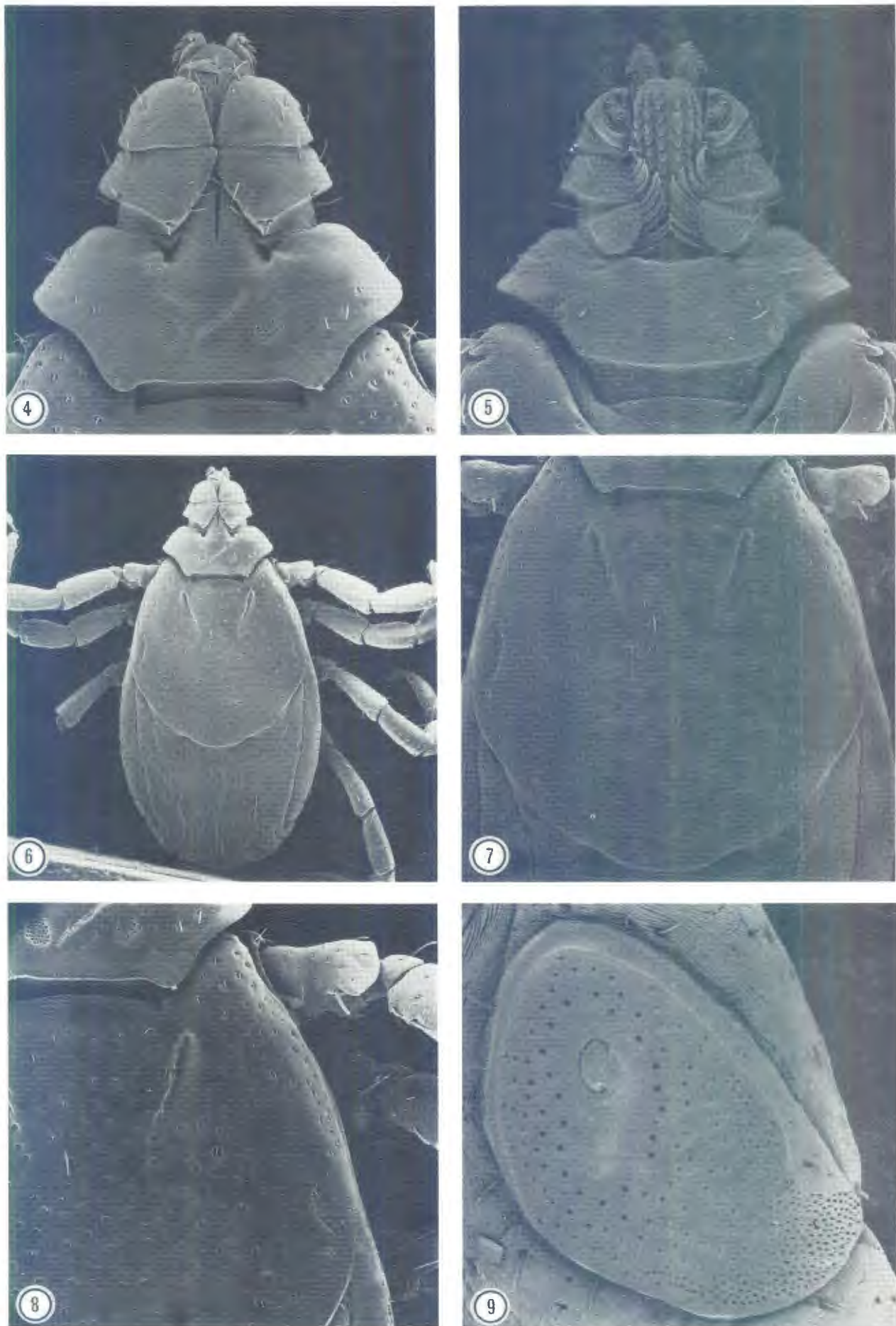


FIG. 4-9 *Rhipicephalus kochi* Dönitz, 1905 female (RML 65686), (4) capitulum, dorsal 92×; (5) capitulum, ventral 92×; (6) dorsal view 27,5×; (7) scutum 64×; (8) close-up of eye 88×; (9) spiracle 200×

DISCUSSION

R. kochi is most closely related to *R. pravus* and *R. punctatus*, and criteria for the separation of the adults of these 3 species were outlined by Walker (1974). These features are still useful, as are the characteristics of the female genitalia, which have been added below. Thus, the basic features separating these 3 species are as follows:

R. pravus (Fig. 29–31): Scutum relatively long and slender; punctations markedly uneven in size; eyes definitely convex; cervical fields of female parallel-sided. Female genitalia an elongated V and the area within the aperture raised and bulging [see also Walker (1956) Fig. 3 & 4-♂, Fig. 7-♀].

R. punctatus (Fig. 32–34): Scutum intermediate in shape between *R. pravus* and *R. kochi*; punctations numerous and heavy, but not quite even in size; eyes not quite flush with the scutum but neither as convex nor the same shape as those of *R. pravus*; cervical fields of female not quite parallel-sided; female genitalia a broadly rounded U, entire area within the aperture bulging [see also Warburton (1912), Fig. 4-♂, Fig. 5-♀].

R. kochi: Scutum relatively short and broad; punctations fine and more even in size than those of *R. pravus*; eyes absolutely flush with scutum or only very slightly convex; cervical fields of female not quite parallel-sided; female genitalia a short narrow V, area in aperture itself depressed, area anterior to aperture bulging as in *R. pravus* and *R. punctatus* (Fig. 10, 31 & 34) [see also Warburton (1912) Fig. 2-♂, Fig. 3-♀].

R. kochi can occasionally be confused with *R. appendiculatus*. However, the depressed, shagreened cervical areas seen in *R. appendiculatus*, the length/width ratio of the basis capituli and the shape of the adanal shields will usually differentiate males of these two species. The depressed, shagreened cervical areas characteristic of *R. appendiculatus* will also separate females, but a much easier feature to distinguish them is the form of the genital aperture, which is cup-shaped in *R. appendiculatus* and a short V in *R. kochi*.

LIFE CYCLE IN THE LABORATORY

R. G. Pegram (unpublished data, 1982) reared a Zambian strain of *R. kochi* successfully in the laboratory (Table 1). All stages were kept at $\pm 27^{\circ}\text{C}$ and 80% RH, and rabbits were used as hosts. The F_1 generation larvae and nymphae fed poorly, but the F_2 generation fed better, and more rapidly, with fewer mortalities.

TABLE 1 Life cycle of *Rhipicephalus kochi* in the laboratory (R. G. Pegram, unpublished data, 1982)

Developmental stage	Developmental periods (days)	
	F ₁	F ₂
Pre-oviposition	9	6–7
Incubation	26	29
Larval feeding	4–6	4–7
Larval moulting	15	11–15
Nymphal feeding	5–6	3–5
Nymphal moulting	13–15	12–13
Female engorgement	7–8	—



FIG. 10–11 *Rhipicephalus kochi* Dönitz, 1905 female, (10) genitalia unmounted 305,5×(RML 65686); (11) genitalia, lectotype (Berlin Museum catalogue No. 8490), mounted 328,5×

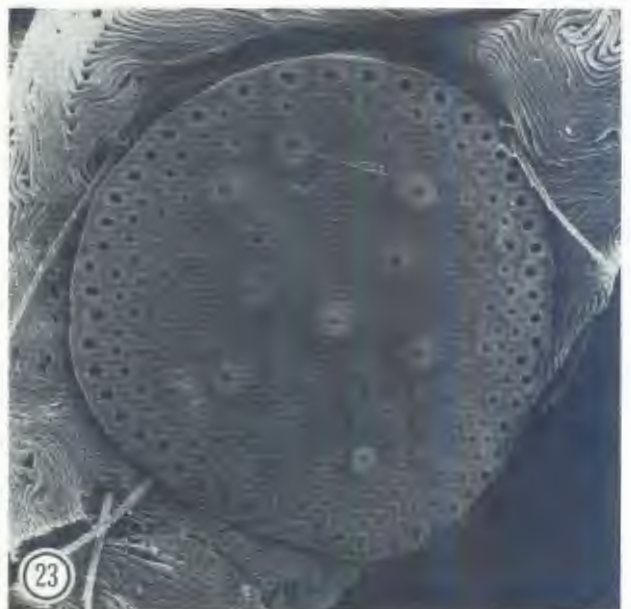
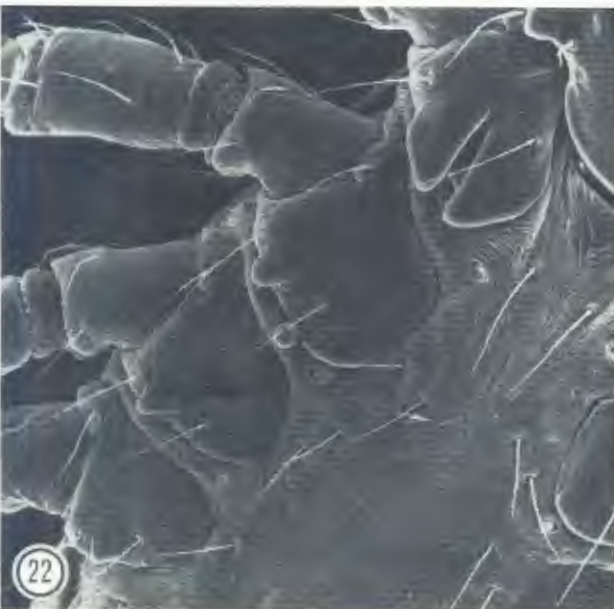
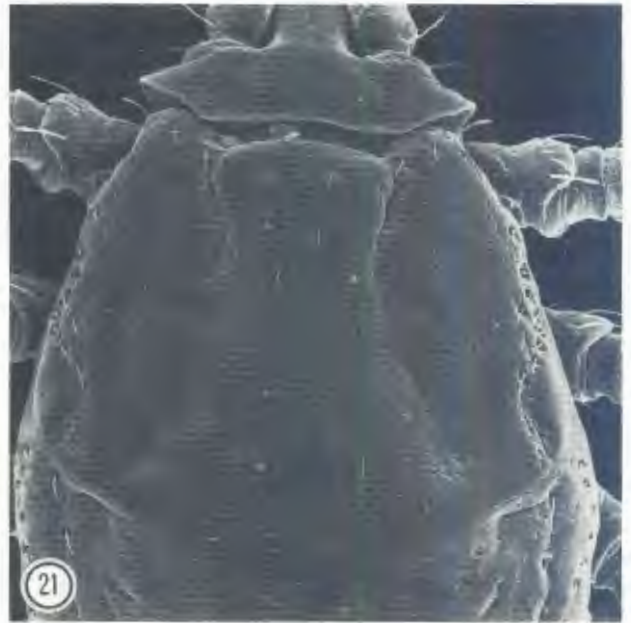
FIG. 12–17 *Rhipicephalus kochi* Dönitz, 1905 male RML 65686, (12) capitulum, dorsal 100×; (13) capitulum, ventral 100×; (14) dorsal view 27×; (15) close-up of eye 96×; (16) adanal shields 90,6×; (17) spiracle 181×

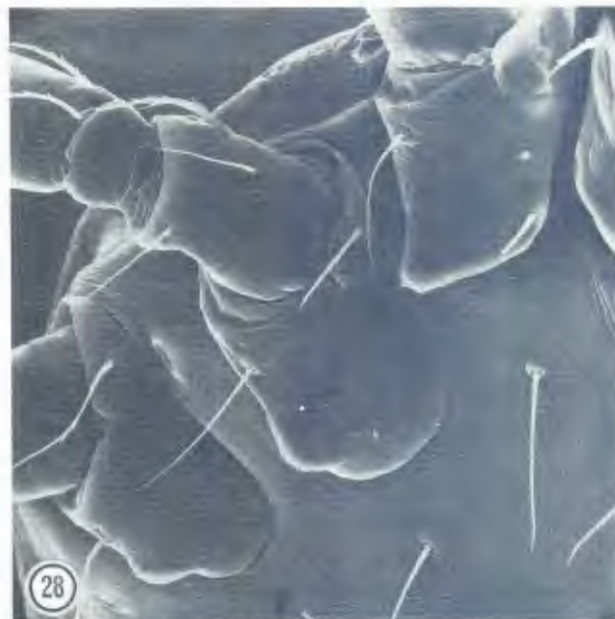
FIG. 18–23 *Rhipicephalus kochi* Dönitz, 1905 nymph (RML 116144), (18) capitulum, dorsal 264×; (19) capitulum, ventral 264×; (20) dorsal view 97×; (21) scutum 158×; (22) coxae 211×; (23) spiracle 616×

FIG. 24–28 *Rhipicephalus kochi* Dönitz, 1905 larva (RML 116144), (24) capitulum, dorsal 524×; (25) capitulum, ventral 524×; (26) dorsal view 150×; (27) scutum 208×; (28) coxae 436×

FIG. 29–34 *Rhipicephalus pravus* Dönitz, 1910 (RML 65690), (29) female, scutum 53×; (30) male, dorsal view 27×; (31) female, genitalia 177×; *Rhipicephalus punctatus* Warburton, 1912 (RML 105012), (32) female, scutum 53×; (33) male, dorsal view 27×; (34) female, genitalia 177×









BIOLOGY IN THE FIELD

The following sections on the hosts and distribution of *R. kochi* are a synthesis of the available information on this tick. Many of the records have already been published by Warburton (1912, as *R. neavei*); Wilson (1950, as *R. neavei*); Santos Dias (1960; as *R. neavei*); Clifford & Anastos (1962, as *Rhipicephalus* sp. near *pravus*); Yeoman & Walker (1967, as *R. neavei*); MacLeod (1970, as *R. neavei*); Walker (1974); MacLeod, Colbo, Madbouly & Mwanaumo (1977, as *R. neavei*); MacLeod & Mwanaumo (1978, as *R. neavei*), and Keirans (1982). To these we have added unpublished records based on specimens that we have seen, most of them from collections of the British Museum (Natural History); the Rocky Mountain Laboratory; the South African Institute for Medical Research, and R. G. Pegram. Further unpublished records, from Zimbabwe, were contributed by R.A.I. Norval.

Hosts (Table 2)

Adults of *R. kochi* apparently feed most commonly on cattle, wild pigs, and various antelopes, i.e., on members of the order Artiodactyla. There are also several records from hares; Wilson (1950) particularly mentioned that this tick was a common ectoparasite on *Lepus whytei* in the Dowa District of Nyasaland (now Malawi).

In most cases, even careful examination has apparently resulted in the collection of only small numbers of ticks from individual animals (Yeoman & Walker, 1967; R. G. Pegram, personal communication, 1982). Clifford & Anastos (1962) do, however, record large collections from 2 bush pigs (138 ♂♂, 152 ♀♀ from 1 animal and 137 ♂♂, 135 ♀♀ from the other) and Zumpt collected 64 ♂♂, 94 ♀♀, from another bush pig (South African Institute for Medical Research collection 9/14/2).

Wilson (1950) found that *R. kochi* attached most commonly on the udders and flanks of cattle. He collected engorged females from September–March, when the atmospheric humidity was low. He added that, although 1 female oviposited, and the eggs hatched in 33–39 days, the larvae failed to engorge on cattle.

Little is known about the hosts of the immature stages of this tick. Yeoman & Walker (1967) mentioned the possibility that 3 nymphae found with a male of *R. kochi* on a 4-toed elephant shrew belonged to this species; this record has now been verified.

The number of records of *R. kochi* listed for some of the individual host species in Table 2 are undoubtedly conservative. This is because several of the authors whose data we have quoted do not say how many collections they saw from each animal species. Each host featured in their lists, therefore, can be credited with 1 record only in our table.

Zoogeography (Fig. 35)

R. kochi, as herein described, occurs south of the Equator in parts of eastern, central, and southern Africa.

We have no recent, unequivocal, evidence that this species occurs in West Africa. *R. neavei* was listed from Ghana (formerly the Gold Coast) by Stewart (1933) but it is impossible to check this record, and we have disregarded it. In Uganda also, early records of *R. neavei* (Meitani, 1935; Wilson, 1948) almost certainly represent species other than *R. kochi*. Matthysse & Colbo (unpublished data, 1969) comment: "We have not found *R. kochi* in Uganda, nor any unquestionable records of its occurrence. The reports of *R. neavei* in Uganda (mainly from Karamoja District) generally refer to *R. pravus* but we have seen ticks from a higher rainfall area identified by S. G. Wilson that were *R. hurti*".

TABLE 2 Host records of *Rhipicephalus kochi*

Hosts	No. of records
(a) Domestic animals	
Cattle	124
Sheep	2
Goats	9
Horse	1
Donkey	1
Camel	1
Dog	1
(b) Wild animals	
Four-toed elephant shrew (<i>Petromodromus tetractylus</i>) ¹	1 (1 ♂, 3 NN)
Scrub hare (<i>Lepus saxatilis</i>)	1
Crawshay's hare (<i>Lepus crawshayi</i>) ²	6
Whyte's hare (<i>Lepus whytei</i>)	1
Porcupine (<i>Hystrix africae-australis</i>)	1
Lion (<i>Panthera leo</i>)	1
Leopard (<i>Panthera pardus</i>)	1
African elephant (<i>Loxodonta africana</i>)	1
Black rhinoceros (<i>Diceros bicornis</i>)	1
Burchell's zebra (<i>Equus burchelli</i>)	3
Bush pig (<i>Potamochoerus porcus</i>)	27
Wart hog (<i>Phacochoerus aethiopicus</i>)	5
Giraffe (<i>Giraffa camelopardalis</i>)	2
African buffalo (<i>Syncerus caffer</i>) ³	17
Nyala (<i>Tragelaphus angasi</i>) ⁴	6
Bushbuck (<i>Tragelaphus scriptus</i>)	14
Greater kudu (<i>Tragelaphus strepsiceros</i>) ⁵	19
"Kudu"	2
Eland (<i>Taurotragus oryx</i>)	6
Yellow-backed duiker (<i>Cephalophus sylvicultor</i>)	1
Red duiker (<i>Cephalophus natalensis</i>)	3
Common duiker (<i>Sylvicapra grimmia</i>) ⁶	7
Reedbuck (<i>Redunca arundinum</i>)	1
Waterbuck (<i>Kobus ellipsiprymnus</i>) ⁷	1
Roan antelope (<i>Hippotragus equinus</i>)	6
Sable antelope (<i>Hippotragus niger</i>) ⁸	12
Lichtenstein's hartebeest (<i>Alcelaphus lichtensteini</i>) ⁹	3
Impala (<i>Aepyceros melampus</i>)	4
Klipspringer (<i>Oreotragus oreotragus</i>)	6
Kirk's dikdik (<i>Madoqua kirkii</i>)	2
Oribi (<i>Ourebia ourebi</i>)	1
Steenbok (<i>Raphicerus campestris</i>)	1
Grysbok (<i>Raphicerus melanotis</i>)	3
Suni (<i>Neotragus moschatus</i>) ¹⁰	1
(c) Bird	
Black-bellied korhaan (<i>Lissotis melanogaster</i>)	1

Synonyms of hosts:

- ¹ *Petromodromus rovumae rovumae*, in Yeoman & Walker (1967)
- ² *Lepus capensis crawshayi*, in Clifford & Anastos (1962)
Lepus europaeus crawshayi, in Yeoman & Walker (1967)
- ³ *Bubalus caffer*, in Clifford & Anastos (1962)
- ⁴ *Nyala angasii angasii*, in Santos Dias (1960); "Newala antelope" in Nuttall Collections 1600, 1602 in the BM(NH)
- ⁵ *Strepsiceros strepsiceros strepsiceros*, in Santos Dias (1960)
- ⁶ "Gwape", in Wilson (1960); "gwapi" in Nuttall Collection 2393 in BM(NH)
- ⁷ *Kobus ellipsiprymnus ellipsiprymnus*, in Santos Dias (1960)
- ⁸ *Ozanna grandicornis grandicornis*, in Santos Dias (1960)
- ⁹ *Sigmoceros lichtensteini lichtensteini*, in Santos Dias (1960)
- ¹⁰ *Nesotragus livingstonianus zuluensis*, in Santos Dias (1960)

In Kenya, almost all the early records of *R. neavei* refer to *R. pravus*. Walker (1974), who re-examined all the available specimens identified in the past as *R. neavei* by E. A. Lewis, A. J. Wiley and S. G. Wilson, found that all but one of their collections were *R. pravus*, not *R. kochi*. To date, the only confirmed records of *R. kochi* in Kenya are from the Coast Province at Taveta (03°24'S, 37°41'E) and Voi (03°23'S, 38°34'E).

Currently, there are more records of *R. kochi* from Tanzania than from anywhere else. Its distribution there was detailed by Yeoman & Walker (1967), and only a few records have been added since to those that they give. These new records come from Sanya Juu

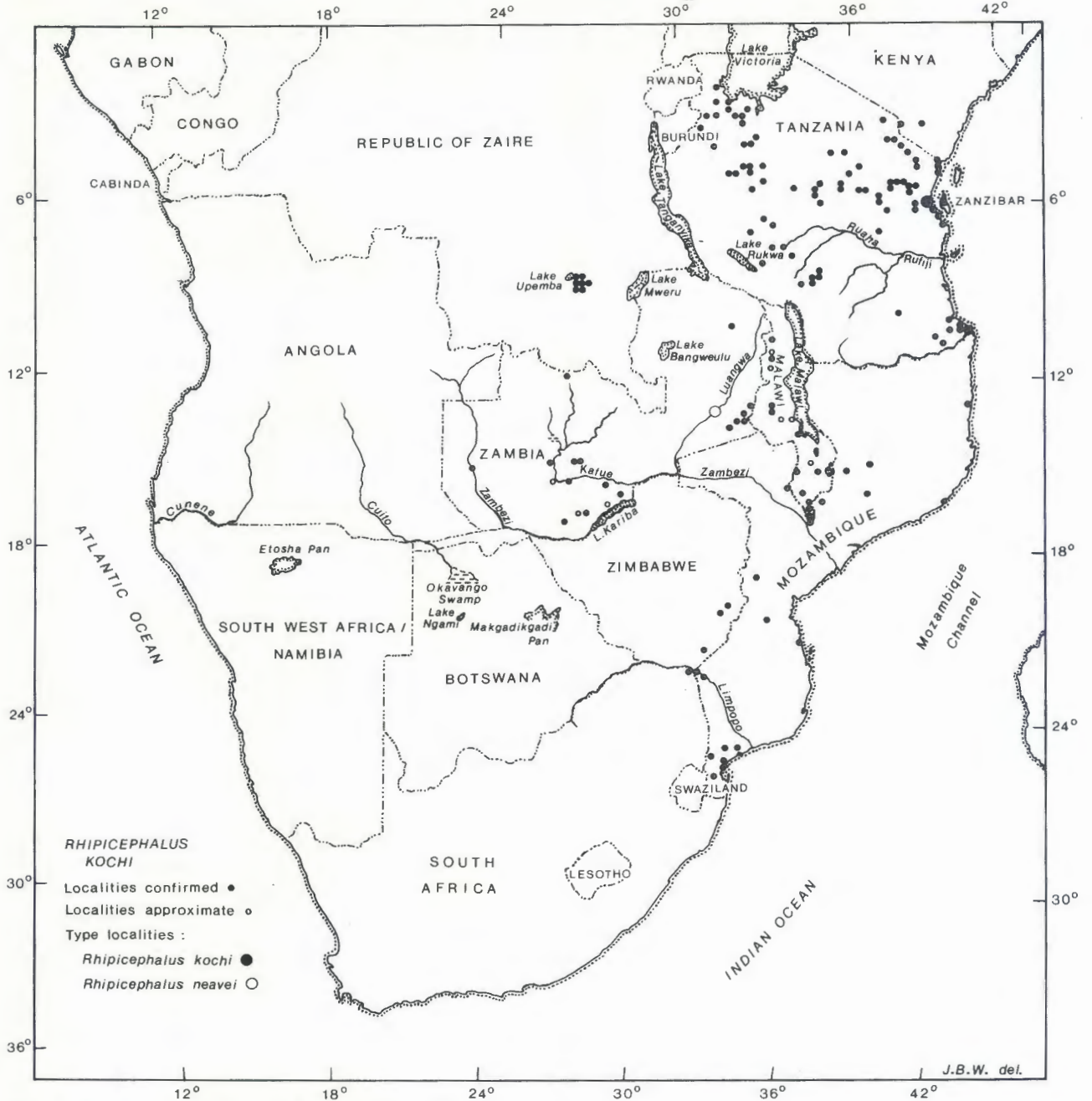


FIG. 35 Distribution of *Rhipicephalus kochi* Dönitz, 1905

(03°11'S, 37°04'E); Lushoto (04°47'S, 38°17'E); Sadani (06°03'S, 38°47'E); Kilimatindi (05°51'S, 34°57'E); Lindi (10°00'S, 39°43'E); Mtwara (10°16'S, 40°11'E) and Zanzibar Island (06°10'S, 39°20'E). There are still large parts of Tanzania in which this tick has not as yet been collected. In most of the region lying between Lake Victoria and Kilimanjaro it probably does not exist. Numerous collections have been made in this area, from both domestic and wild animals, and it was not found. But its absence from some parts east of Lake Tanganyika and south of the Rufiji River may be apparent rather than real. Much of this country is inhabited by tsetse flies (*Glossina* spp.) and domestic livestock are virtually absent, so relatively few tick collections have ever been made there (Yeoman & Walker, 1967, Maps 8, 9 & 10).

Westwards, in the Republic of Zaïre (formerly the Belgian Congo), *R. kochi* has been collected only in and adjacent to the Upemba National Park (Clifford & Anastos, 1962). Here it is recorded from Mabwe (08°39'S, 26°31'E); the gorge of the Pelenge River (c. 08°37'S,

26°53'E); Kaswabilenga (c. 08°46'S, 26°44'E); the Katongo River area (08°48'S, 26°59'E); Kenia, near Lusina (08°56'S, 27°12'E); Ganza (c. 09°13'S, 26°44'E); Kaziba (c. 09°08'S, 26°57'E), and Kimitunu (not located).

In Zambia, all but 3 of our records of *R. kochi* come from 2 areas, 1 in the south-west corner of the country between the Luangwa River and the Malawi border and the other further west in the region bounded roughly by Mumbwa (14°59'S, 27°04'E), the southern part of the Kafue National Park and Lake Kariba. The types of *R. neavei* come from south-east Zambia; Warburton (1912) notes that they "were taken by Mr S. A. Neave from an eland near the mouth of the Tasangazi R., Luangwe Valley, N.E. Rhodesia [E.R.C. No. 168]". On the label accompanying the collection, however, the type locality is given as the Lasangazi River. This is almost certainly the river marked as the Lusengazi on the map in Neave (1911), currently spelled as Lusangazi, at 13°25'S, 31°34'E. Other records in south-west Zambia come from Chipangali (13°10'S, 32°46'E); Mawene

(13°28'S, 32°42'E); Msandile (13°29'S, 32°43'E); Kalichero (13°33'S, 32°24'E); Chipata (13°39'S, 32°40'E), and Kalindi (13°53'S, 32°05'E). Westwards, in the Kafue-Kariba area, there are records from Mwangwa (15°10'S, 25°58'E); Kabulwebulwe Resettlement area (15°05'S, 26°44'E); Lutale (15°10'S, 26°53'E); the southern part of the Kafue National Park (c. 15°52'S, 25°51'E, in MacLeod, 1970); Namwala (15°45'S, 26°26'E); the Kalomo Plateau (17°02'S, 26°30'E); Choma District (c. 16°49'S, 26°59'E); Chifwepa Village (16°58'S, 27°02'E); Mwangula (15°49'S, 27°59'E), the lower Gwembe Valley (c. 16°38'S, 27°47'E), and the Changa area (16°17'S, 28°25'E). In addition, there are isolated records from three widely separated places, in the north-east at Chinga Farm, Chinsali (10°33'S, 32°04'E); in the north at Solwezi (12°11'S, 26°24'E), and in the west in the Mongu area (15°17'S, 23°08'E).

In parts of Malawi *R. kochi* is apparently common, but it does not occur throughout. Wilson (1950) noted its absence from cattle in Lilongwe District, and it has by no means always been present in cattle tick collections we have seen from various areas. To date, there are records from the following places, some of which can be located approximately only: Runyinya River (10°59'S, 33°44'E); Mzimba District (c. 11°30'S, 33°30'E); Mombera (11°41'S, 33°43'E); West Nyasa (c. 11°50'S, 33°40'E); Marimba area (c. 13°10'S, 33°40'E); Bua River (13°17'S, 33°33'E, at Bua Bridge); Dowa District (c. 13°35'S, 34°20'E); "S.W. Shore of Lake Nyasa" (c. 13°35'S, 34°20'E); Chitala District (c. 13°40'S, 34°16'E); Ntakataka (14°14'S, 34°31'E); the upper Shire River (c. 15°04'S, 35°13'E); Zomba (15°23'S, 35°20'E); Ligowi (15°29'S, 34°40'E); the Chapananga area (15°55'S, 34°26'E); Mwanza River (16°07'S, 34°50'E); Tomali (16°09'S, 34°47'E); Ruo District (c. 16°25'S, 35°15'E); Chiromo (16°33'S, 35°08'E); the lower Shire Valley (c. 16°55'S, 35°15'E); and the Ndamera area (17°06'S, 35°13'E).

In Zimbabwe *R. kochi* has so far been found only in the south-east, on Sabi-Tanganda Estate (20°09'S, 32°23'E); nearby in the Chipinga lowveld and further south on the Matibi No. 2 Communal Land/Gona-rezou boundary (c. 21°35'S, 31°40'E).

According to Santos Dias (1960), *R. kochi* is abundant in Mozambique. He records it there from the following places: Malema Pemba (formerly Porto Amelia) (12°57'S, 40°30'E); Gurue (15°15'S, 37°00'E); Ile (16°01'S, 37°12'E); Morrumbala (17°10'S, 35°35'E); Chimoio (19°00'S, 33°23'E); Mossurize (20°40'S, 32°51'E); Machanga (20°58'S, 35°00'E); Govuro (21°23'S, 35°05'E); Pafuri (formerly Alto Limpopo) (22°26'S, 31°20'E); Magude (25°02'S, 32°40'E); Sabie (25°19'S, 32°14'E); Vila Luisa (formerly Marracuene) (25°44'S, 32°41'E); Maputo (formerly Lourenço Marques) (25°58'S, 32°34'E), and Umbeluzi (26°02'S, 32°22'E). We also have records from Chicualacuala (22°33'S, 31°42'E) and Macia (25°02'S, 33°06'E).

In South Africa *R. kochi* has as yet been recorded in the extreme north-east of the country only, at Pafuri (22°23'S, 31°12'E).

R. kochi has been found in areas that range in altitude from sea level to about 1800 m, with an annual rainfall between about 500 and 1300 mm. It is primarily an inhabitant of Woodland and Wooded Savanna in which the dominant trees are either *Brachystegia* spp., sometimes accompanied by *Julbernardia*, or—less commonly—*Colophospermum mopane* and a variety of other dry area species (AETFAT/UNESCO, 1958). In a few parts of

central Tanzania and in Kenya it has also been found in areas classified by AETFAT as Wooded Steppe dominated by *Acacia* and *Commiphora* [referred to by Yeoman & Walker (1967) as Semi-arid Bush Thicket]. Usually, though, it does not occur in this type of vegetation.

DISEASE RELATIONSHIPS

R. neavei was stated to be a vector of *Theileria parva*, the causative agent of East Coast fever, by Lewis, Piercy & Wiley (1946). This reference, however, almost certainly pertains to *R. pravus*, not to *R. kochi*, because the strain of ticks these authors used came from the Machakos District of Kenya where *R. pravus* is known to be common (Walker, 1974).

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¹ Association pour l'Étude Taxonomique de la Flore d'Afrique Tropicale

² United Nations Educational, Scientific and Cultural Organization

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