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TICKS IN THE SOUTH AFRICAN ZOOLOGICAL SURVEY COLLECTION. PART VII.—SIX LESSER KNOWN AFRICAN RHIPICEPHALIDS.

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In this article the description, host list and distribution of the following species are brought up to date:— *Rhipicephalus follis, R. sulcatus, R. maculatus, R. pulchellus, R. oculatus,* and *R. pravus.*

RHIPICEPHALUS FOLLIS—DÖNITZ 1910.

Male (figs. 1–5).

Small, 3 mm. × 1½ mm., brown, elongate-oval, not widening much posteriorly; sides convex and post margin broadly rounded; widest in region of coxa IV. Anterior prominence of coxa I visible. Eyes medium-sized, flat, flush with surface of conscutum, in some specimens bounded dorsally by a few large punctations; emargination deep; cervical pit deep crescentic, cervical groove a shallow divergent depression extending backwards to the level of the eyes. Lateral grooves absent; marginal grooves deep, lined with a row of closely arranged medium punctations, including two festoons. Posterior median groove elongate, linear to spindleshaped, running into the median festoon. Postero-lateral groove shorter, shallow and oval, usually reaching fourth festoon. Festoons about equal in length, sharply marked off from one another. The specimens shew a few abnormalities; in one specimen the three central festoons are fused, but are present ventrally; in others the central festoon may be pinched out and with this pinching out of the central festoon the median groove also tends to disappear. Fine punctations shallow to very superficial, unevenly scattered over the entire surface, spreading into the lateral folds and festoons, and tending to be sparse at the sides much as in *R. appendiculatus.* Medium deeper puncts sparsely scattered, with a row of three on either side between the postero-median groove and the postero-lateral grooves, and a row of four to seven taking the place of the lateral groove; medium punctations more closely clustered on the scapula. (Specimens in which the fine punctations are very superficial may at first glance, be mistaken for small *R. simus.*) Dorsal foveae sometimes discernible. Sub-collare present.

Rostrum. About as long as broad.

Basis capituli.—1½ to 2 mm., as broad as long; auriculae pronounced, cornua well-developed; posterior margin slightly concave; postero-lateral margin very long, concave; antero-lateral margin very short. Surface very uneven, two large punctations may simulate the areae porosae of the female. A row of four hairs on the shoulders. Sub-collare present.

Palps.—About as long as basis capituli; longer than broad; article 2 slightly larger than article 3, both articles broader than long.

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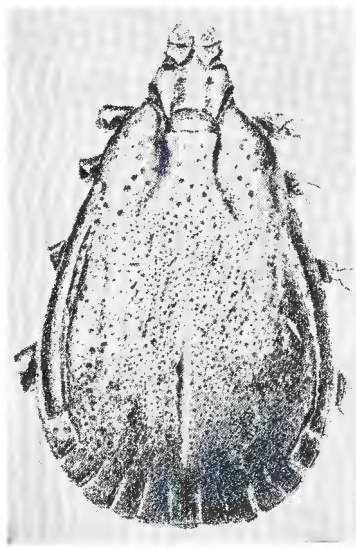

FIG. 1.—*R. follis.* Male: Dorsal view after Dönitz 1910.

FIG. 2.—*R. follis.* Male: Anal plate shewing median chitinous plate and plaques on ventral festoons, after Dönitz 1910.

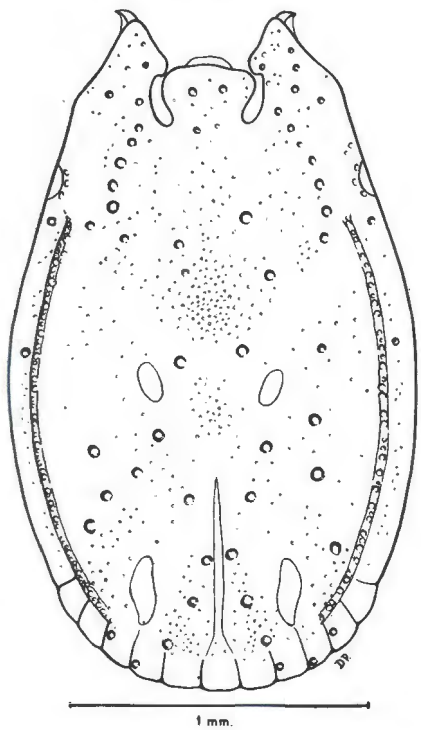

FIG. 3.—*R. follis.* Male: Conscutum, D. Pringle del.

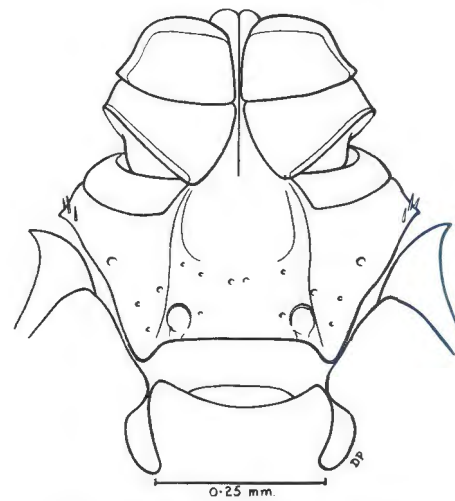

FIG. 4.—*R. follis.* Male: Rostrum, D. Pringle del.

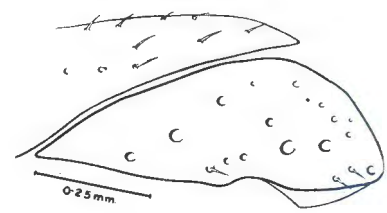

FIG. 5.—*R. follis.* Male: Anal plate and median plate, D. Pringle del.

Ventral surface.—Anal plates (fig. 2) similar to a very broad *R. capensis*. External margin straight, meeting curved posterior margin at an obtuse angle. Internal margin slightly scooped out opposite the anus and meeting the posterior margin in a curve, almost a right angle. Antero-internal angle may be sharp as in *capensis*. Large, deep punctations unevenly scattered over anal plates and accessory anals; accessory anals large, not quite as heavily chitinised as anals. Posterior to anus and mesial to each anal plate is a squarish chitinised plate (indicated in Dönitz' drawing but omitted from the description) not always easily seen and weakly developed in specimens in which the central festoon is absent or pinched out. Caudal process absent in the unengorged males ventral plates on each ventral festoon showing punctation as on dorsal festoons. Legs increasing but slightly from before backwards. No engorged males seen.

Female. (fig. 6).

Small unengorged $3\frac{1}{2}$ mm. $\times$ $1\frac{3}{4}$ mm. dark brown; coxa I not as prominent as in male.

Scutum.—Slightly longer than broad widening rapidly to eye level; posterior margin sinuous, bulging slightly where lateral groove meets postero-lateral margin. Emargination deep and wide. Eyes towards the middle of the length, flat marginal, smaller and more prominent than in the male, in some specimens bounded dorsally by a few punctations. Cervical pit deep; continuous with cervical groove, giving much the same triangular depression as is characteristic of *appendiculatus* but without the reticulated floor. Cervical groove diverging posterior to the eyes, becoming superficial and scarcely visible in the posterior one-third of the scutum. Lateral groove well-marked, reaching to postero-lateral border of scutum; not an even groove, but disturbed by lines breaking into it carrying a few large punctations. Punctations subequal, few in number and unevenly scattered. Fine punctations larger than in the male; large punctations widely separated, present on central field and in groups on the shoulders. Punctations tend to be more numerous in the posterior part of the central field, (as in *R. capensis*) reaching to the extreme edge of the scutum. In the anterior part of the central field the medium punctations tend to be absent. Sub-collare present.

Alloscutum.—Central portion a darker brown than lateral fold and festoons.

Rostrum.—Slightly-broader than long.

Basis capituli.—Almost three times as broad as long; auriculae well-marked, cornua short, blunt. Posterior margin wide, straight; postero-lateral margin slightly arched, $1\frac{1}{2}$ times as long as antero-lateral margin. A row of three hairs on shoulders. Areae porosae small, oval, parallel, $1\frac{1}{2}$ times their diameter apart. Usually a group of medium punctations on basis capituli between areae porosae.

Ventral.—Central festoon almost pinched out.

Nymph (figs. 7, 8).

Scutum.—About as broad or very slightly broader than long, widest in posterior half at the level of the eyes. Lateral margins straight, posterior margin convex, not sinuous, emargination very shallow. Cervical and lateral grooves well-developed, lateral grooves extending backwards almost to the posterior margin and running parallel with the lateral margin, cervical grooves disappearing at the level of the eyes; eyes fairly prominent.

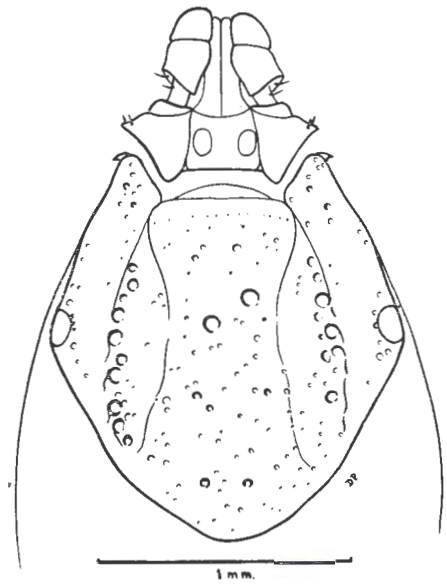

FIG. 6.—Female: Scutum and Rostrum.

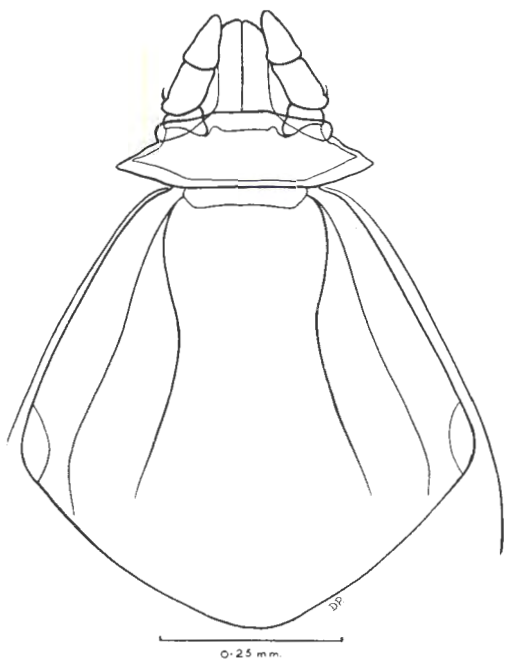

FIG. 7.—Nymph: Dorsal view.

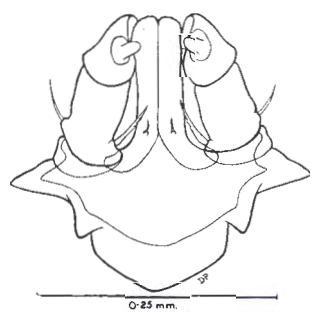

FIG. 8.—Nymph: Rostrum ventral view.

Rostrum.—Roughly triangular, broader than long, the slope of the palps not forming a continuous line with the basis capituli.

Basis capituli.—More than three times as broad as long; auriculae prominent, sharp, projecting laterally beyond the shoulders. Postero-lateral margin about as long as antero-lateral margin. Posterior margin straight; cornua absent or very slightly indicated. Sub-collare present.

Palps.—Sloping towards each other; outer margin almost a straight line, interrupted at its base by a small notch for the reception of a hair, and interrupted at the junction of articles 2 and 3. Articles 2 and 3 equally long; longer than broad. Article 2 about equally broad for its entire length and twice as long as broad.

Article 3 triangular, tapering to a blunt point. Article 1 small; visible dorsally. Ventral spur of basis capituli sharp and well-developed.

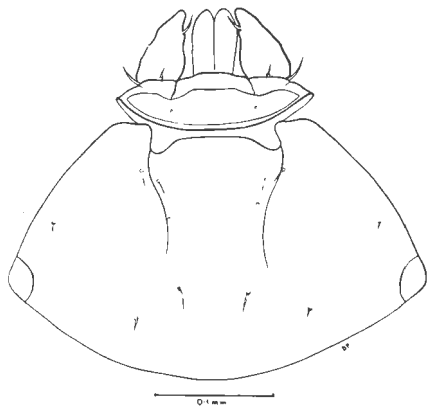

FIG. 9.—Larva: Dorsal view.

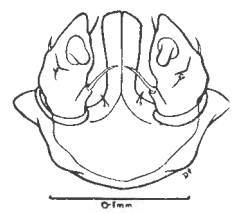

FIG. 10.—Larva: Rostrum ventral view.

Larva. (figs. 9, 10).

Scutum.—About $1\frac{1}{2}$ times as broad as long; all corners rounded. Eyes slightly prominent, situated at broadest point of scutum. Posterior and antero-lateral margins of scutum slightly convex. Cervical grooves deep, extending backwards for half the length of the scutum.

Rostrum.—Triangular, broader than long.

Basis capituli.—Three times as broad as long, auriculae prominent, not as sharp as in the nymph. Posterior margin straight to very lightly convex.

Palps.—Each palp roughly triangular, widest at base at article 2.

Articles 2 and 3.—Apparently fused. Ventral spur of basis capituli short and broadly rounded.

Type.—Two males, origin unknown, probably off domestic stock, South Africa.

The present description is based on 5 males, 6 females, nymphae and larvae, being F_1 generation of 3 females ex Dordrecht, C.P., S.A., Onderstepoort standard collections Nos. 2820, 2821.

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Discussion.

In the absence of the type specimens, the above description has been based entirely on the material in the Onderstepoort collection. Dönitz, 1910, described a tick from South Africa, " host unknown, probably off domestic stock ", with punctations fairly regular, dense, in places very dense. Punctations shallow, small, with a few scattered large punctations. The " Randplättchen " very large, the middle-one half as broad again as the adjacent ones; widely edged posteriorly with white ". Examining his figures carefully this reference to " Randplättchen " obviously refers not to the dorsal festoons but to the ventral plaques, amongst which latter he figures the central division as the largest. He does not specifically outline the plaque on each ventral festoon, unless the plaque occupies the entire ventral festoon, in which case the lighter band is included as part of the plaque. The other possible interpretation is that the plaques occupy but a portion of the festoon and the lighter band, posteriorly in the figure, represents the non-chitinised part of the festoon. This non-chitinised portion has an enamel-like appearance due to the way in which the specimen had dried out. The specimens in the Onderstepoort collection on which the above description has been based correspond in every respect to the description and figures given by Dönitz, except in respect of this enamelling on the ventral festoons and the fact that the central ventral plaque is not always larger than the rest, especially in specimens in which the central dorsal festoon is nipped out. Another feature which Dönitz has figured, but has omitted from his description, is a chitinised median element immediately behind the anus. These mesial plates vary in their degree of chitinisation according to the development of the central festoons but are generally sufficiently pronounced to stand away from the body surface.

R. follis male, can be distinguished from *R. appendiculatus* by the incursion of the fine punctations into the smooth lateral areas (so characteristic of the latter species); by the absence of the anterior triangular depression and by the broad *R. capensis*-like anal plates. The female differs in that, though there is an anterior triangular depression, the floor in *R. follis* is not reticulated, the lateral groove, though irregularly broken, is pronounced and continues to the posterior margin. The female scutum presents the same untidy impression as does the *R. sanguineus* female, but *R. follis* female can easily be differentiated in that the lateral grooves run parallel to the lateral margin and tend to converge posteriorly, the edges of the grooves being untidy and not clear-cut. *R. follis* female differs from *R. simus* female by the more elongate appearance of the scutum due to the sharper posterior margin and the lateral groove is disturbed and reaches the posterior margin. The basis capituli in *R. follis* is three times as broad as long.

Distribution.

Dönitz' type material, 2 males, origin unknown, probably off domestic stock, South Africa. The Onderstepoort collection contains the following batches 2820, 2821 F_1 generation of 3 females, 8.8.45, ex Dordrecht, Cape Province; and 2791, i and ii. Ex Dordrecht; no date, no host reference.

R. follis is undoubtedly rare in South Africa. Its distribution, however, may be more widespread than indicated by the above records, in that it may have been overlooked during the identification of the vast number of ticks in the Zoological Survey collection. It is not an easily recognizable species.

Developmental Periods.

Average developmental periods under Laboratory conditions:—

Preoviposition	7	days.
Larvae hatch	15–18	„
Larvae harden	2–5	„
Larvae engorge	4–5	„
Larvae moult	6	„
Nymphs harden	1–4	„
Nymphs engorge	4–9	„
Nymphs moult	7–14	„
Adults engorge	3–6	„

Summary.

1. *Rhipicephalus follis.*—The male is redescribed. The female, nymph and larva are described for the first time.

2. *R. follis* is not easily recognized; it is anticipated that it is not confined to Dordrecht, Cape Province, but that it is more widespread than present records indicate.

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THEILER, G. (1947). Ticks in the South African Zoological Survey Collection, Pt. VI. *Onderstepoort Jnl.*, Vol. 21, pp. 272-273.

ZUMPT (1950). Preliminary Key to a Revision of the Genus Rhipicephalus Koch. *Documentario Moçambique* 60, p. 109.

RHIPICEPHALUS SULCATUS — NEUMANN 1908.

Male (Fig. 11, 13–15).

Small, dark brown, averaging 2·5 by 1·5–1·7 mm. (Neumann 2·9–3·4 mm. × 1·5–1·8 mm.).

Conscutum.—Narrow anteriorly, widening behind the level of the eyes; slightly convex, shiny. No anterior prominence to coxa I, coxa I may be just visible. Emargination somewhat shallow; cervical pits deep and but slightly curved; cervical groove very shallow to absent; lateral grooves absent, represented by an irregular row of punctations, which swings inward at eye-level indicating the outline of the female scutum, this outline of the female scutum not seen in all specimens; marginal groove pronounced with a definite outside edge, picked out with large punctations, including the penultimate festoon in some specimens; posterior median and postero-lateral grooves deep, widely elongate with uneven floor, finely wrinkled. Punctations deep, medium to large, densely distributed, some confluent extending onto festoons to shoulders and the lateral folds; punctations less dense at the sides. Eyes flat, flush with the surface, may be bounded dorsally by a few large punctations. *Subcollare* present.

Rostrum about as broad as long.

Basis capituli.—1½ to 2 times as broad as long, with pronounced cornua; auricula in anterior third and prominent; surface pitted.

Palps, short and broad, longer than broad, articles II and III about equal, article III triangular, the base equal to the length of article.

Ventral surface.—Anal plates can be raised from surrounding integument. Anal plate broadly triangular, external and internal margin almost straight, the scooping out on the internal margin but slight. Internal margin longer than

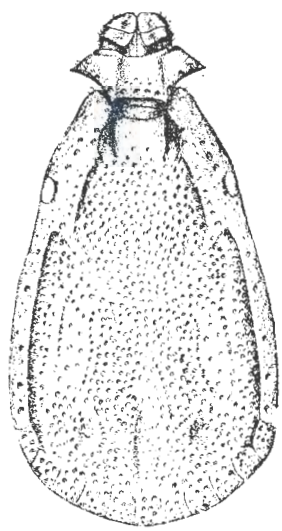

FIG. 11.—*R. sulcatus.* Male dorsum after Neumann 1908.

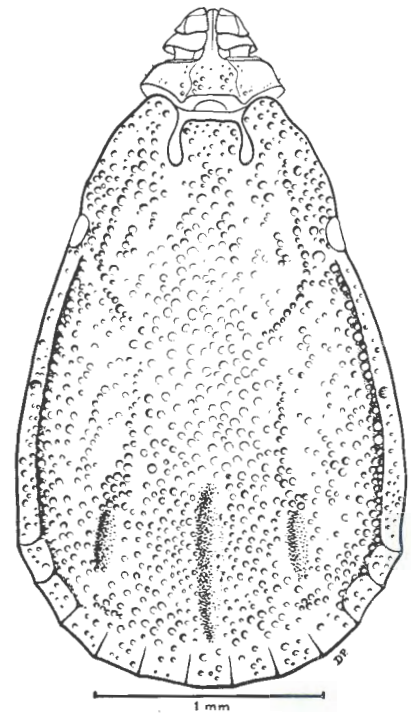

FIG. 13.—*R. sulcatus.* Male dorsum, D. Pringle del.

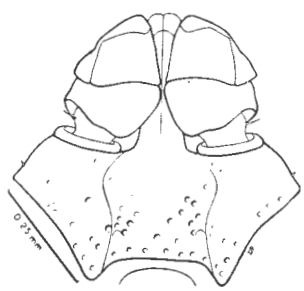

FIG. 14.—*R. sulcatus.* Male Rostrum, D. Pringle del.

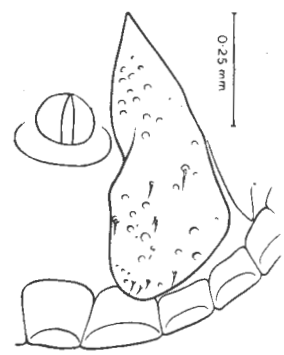

FIG. 15.—*R. sulcatus.* Male Anal plates, D. Pringle del.

external, hence the curved posterior margin meets it at a more acute angle than it does the external; heavily chitinized and deeply punctate. Accessory anals present, lightly chitinized, slender. Ventral plaques present on the festoons but not heavily chitinized. No definite caudal appendage; with engorgement all eleven festoons appear to swell equally and to turn dorsalwards.

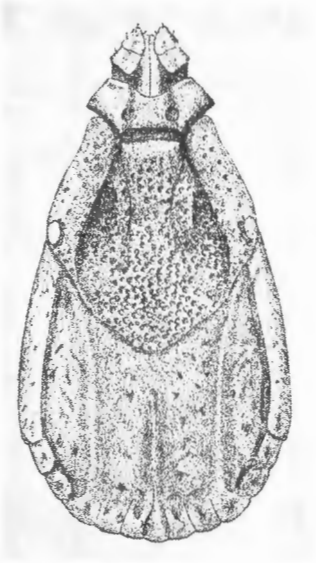

FIG. 12.—*R. sulcatus*. Female dorsum after Neumann 1908.

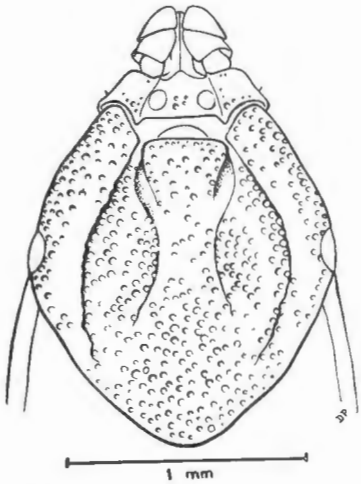

FIG. 16.—*R. sulcatus*. Female Dorsum, D. Pringle del.

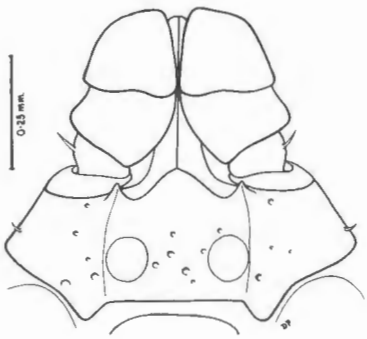

FIG. 17.—*R. sulcatus*. Female Rostrum, D. Pringle del.

Female (Figs. 12, 16–17).

Medium sized, unengorged about 3 mm. × 1·75 mm. (Neumann 3 × 1·5 mm.).

Scutum, flat, shiny, rich brown, emargination wide; as broad as long or slightly longer than broad, it appears long due to the pronounced lateral grooves and the somewhat tapering posterior sinuous margin. (Neumann 1·5 mm. × 1·25

mm.) Cervical pit short, deep; cervical groove short and inconspicuous. Lateral groove pronounced, with external ridge, and picked out with irregular punctations, which may be confluent. Eyes large, flat, flush with surface, may be bounded dorsally by a few large confluent punctations. Punctations medium to large, deep, somewhat unevenly densely scattered, sometimes confluent, extending onto lateral folds. Small subcollare present.

Rostrum broader than long.

Basis capituli about three times as broad as long. Cornua short blunt points; auricula fairly sharp, halfway forward; surface not as heavily punctate as in the male; Area porosae circular, a little more than their own diameter apart. Palps slightly longer than basis capituli and twice as long as broad. Articles II and III as long as broad. Article I visible dorsally.

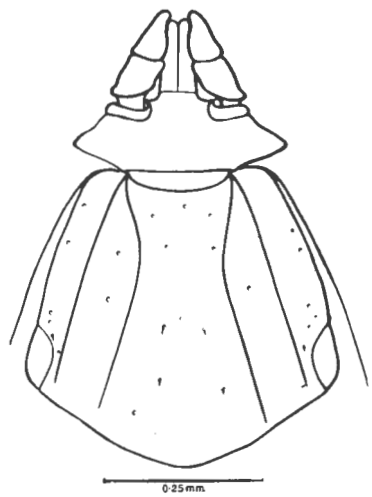

FIG. 18.—*R. sulcatus*. Nymph dorsum, D. Pringle del.

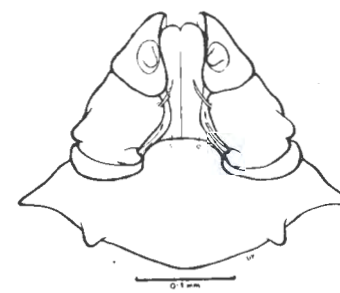

FIG. 19.—*R. sulcatus*. Nymph Rostrum ventral, D. Pringle del.

Nymph. (Figs. 18, 19.)

Scutum.—About as long as broad, widest at eye level in posterior third. Eyes slightly protuberant. Emargination shallow. Lateral margins straight to slightly convex, posterior margin very slightly sinuous. Cervical pits deep; cervical grooves narrow deep curve, extending almost to edge of scutum. Lateral grooves with raised lateral fold reaching posterior margin close to eye.

Rostrum.—Triangular, height to base 1:1·8, with a change in direction of slope where the palps meet the basis capituli.

Basis capituli broad and narrow, overlapping shoulders of the scutum; posterior margin straight to slightly convex; no cornua; postero-lateral margin subconcave, almost twice as long as the antero-lateral; antero-lateral straight with a slight upward bend where it meets the base of the palps.

Palps approximately three times as long as broad; outer margin practically a straight line, with a slight interruption where palp III meets palp II. Palps II and III about equally long, one and a half times as long as broad. Article III triangular.

Larva (Figs. 20*a*, 20*b*).

Scutum: shorter than wide 2:3, very much drawn out at the eyes; eyes slightly prominent; emargination wide and deep.

Rostrum: nearly as wide across articles II as across basis capituli.

Basis capituli, wide; posterior margin straight to slightly convex, flowing smoothly into the postero-lateral and meeting the antero-lateral at a moderately sharp angle, vaguely rounded.

Palps, fat, very wide across article II. Articles II and III do not shew up as separate units. Ventrally a spur on article III.

Descriptions based on the F_1 generation, larvae, nymphae, 6 males and 2 females, from a female off *Lepus saxatilis,* collected at Kazungulu, Northern Rhodesia.

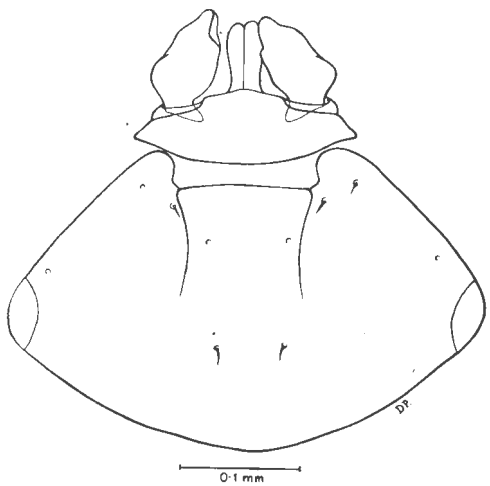

FIG. 20a.—*R. sulcatus.* Larva dorsum D. Pringle del.

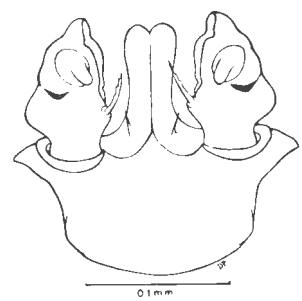

FIG. 20b.—*R. sulcatus.* Larva rostrum ventral view, D. Pringle del.

Hosts and geographical distribution.

Type material 3 males, 4 females from the Belgian Congo, described by Neumann 1908. (Museum Nat. Hist. Paris.)

Onderstepoort records. F_1 generation from female off *Lepus saxatilis* Kazungulu on 26.12.41; material sent in by Departement of Plague Research. Collection No. 2770 — One female off Leopard, from Chitala, Nyassaland, ii and iii. 3.5.49 collected by A. S. Watson.

One doubtful female amongst *R. sanguineus* off dog, Kalkfontein. Ghanzi, Ngamiland.

Two doubtful females off *Crocuta crocuta,* Achiva River. Gulu, Uganda.

Cooley 1934 records it off *Pronolagus randensus,* Silverton, Pretoria.

In Kortman's 1944 Dakar, Senegal, collection there are 2♂ and 4♀ which have provisionally been identified as *R. sulcatus,* taken off a goat.

Zumpt's Record.—A few females amongst a collection of *R. sanguineus* off *Felis pardus,* Tanganyika.

Developmental periods.

Summer time.

Preoviposition Larvae hatch	... ...	44 days.
Larvae engorge	3–5	„
Larvae moult	8–18	„
Nymphae engorge	5–6	„
Adults did not attach.		

Discussion.

Neumann 1908 described this species from three males and four females from the Belgian Congo without giving further details. He gave an excellent description and stressed that it differed from *R. capensis* in that in *sulcatus* the abundant punctations tended to remain discrete and did not become confluent, as was often the case in *capensis,* it also differed in its deep lateral grooves, and in that in the female the large punctations in the lateral groove tended to be confluent.

Bequaert 1930 recorded specimens also from the Belgian Congo which agreed with Neumann's description and figures, but remarked "yet I have my doubts as to whether *R. sulcatus* and *R. capensis* are specifically distinct". Zumpt 1943 re-examined Bequaert's material and identified his specimens as *R. capensis longus.*

The species thus remained unrecorded until Zumpft 1942 redescribed it from 16 males and 33 females off *Felix pardus* from Tanganyika, which he took to be *sulcatus.* Zumpt's material, however, when compared with the above F_1 ticks, was found not to be *sulcatus,* but rather some heavily punctate forms of *R. sanguineus.* Amongst his females were some undoubted *sulcatus.*

Although Bequaert and Theiler (1943, 1947) tended, from Neumann's descriptions and illustrations, to confound this species with *R. capensis,* it is easily distinguished from the latter by its more elongate scutum both in the male and in the female and by its anal plates. To differentiate it from some of the coarser forms of *R. sanguineus* is more difficult and in all probability it will be found to have been identified as *R. sanguineus,* more especially since it would seem, from the meagre records available, that it is a tick off carnivores. It differs from *R. Serranoi* Dias 1950 in that in the *R. serranoi* male the punctations marking the lateral groove are absent, the posterior grooves are mere depressions, the posterior margin of the anal plate is more nearly horizontal; in the *serranoi* female there is no definite lateral groove, this is represented by a row of punctations which may sometimes give an appearance of a groove, the scutum is more circular; cornua inapparent.

Summary.

1. *R. sulcatus,* Neumann 1908. The male and female are redescribed and the nympha and larva described for the first time, from material reared at Onderstepoort.

2. The known hosts and localities are listed.

3. Its affinities are discussed.

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RHIPICEPHALUS MACULATUS. Neumann 1901.

Male (figs. 21–25).

Size 4 mm. × 3 mm.; 2·3 mm. × 1·7 mm. (adults from Zululand up to 6 mm. × 4·5 mm.). A broad tick; width at eye level to widest portion is as 3·5–3·9 to 5; light to dark brown, more usually dark brown, mostly shiny; convex; coxa I just visible dorsally.

Conscutum: there is a tendency for the convex scutum to bend over towards the ventral surface so that at first glance the tick gives the appearance of an Aponomma, as is shewn by the shading in Warburton's 1912 fig. 10. Eyes flat, flush with the surface or slightly prominent. Emargination deep, cervical grooves usually short, deep, crescentic pits; in one or two specimens carried on as straight shallow divergent lines. Lateral groove absent; a lateral field is roughly outlined by an irregular row of a few large punctations. Posterior grooves absent. In those specimens in which the cervical groove is followed by a shallow depression, three shallow depressions may be present posteriorly; these depressions, however, must be looked upon not as true grooves, but rather merely as depressions caused by the severe contraction of the dorso-ventral muscles; they cannot be looked upon as true grooves in that the surface throughout is smooth and undisturbed and does not shew that very fine shagreening or those very fine rugosities usually seen in posterior grooves. Festoons: short, pronounced. The fovea are not easily recognized. They are present immediately *behind* the central yellow patch; they approximate the punctations in size, but are much shallower. Punctations medium-sized, tending to appear in clusters anteriorly, thus there is a cluster on either scapula, on the anterior central field and an irregular cluster behind the level of the eye; posteriorly an irregular row takes the place of the lateral groove; the lateral fields and festoons are usually smooth; in the more typical shiny specimens the punctations in the posterior half appear singly and widely scattered; in the less shiny specimens some of these single widely-spaced punctations may be replaced by a cluster of two or three punctations, so that some specimens appear more heavily punctate than others, but even in these more heavily punctate forms the original single punctate pattern is maintained. Very fine, very superficial punctations may sometimes be seen on the otherwise shiny patches.

As to the ornamentation, as often as not there is no enamelled pattern developed at all. Even when a pattern is present it does not shew that vivid enamelled effect so characteristic of the Amblyommas and of the Aponommas, which effect appears to be associated with a definite structural change of the scutal chitin; the pattern here appears more as dirty creamish blotches, which do not seem to be so definitely associated with structural changes of the chitin. The most prevalent pattern is a central blotch, of variable shape and size at

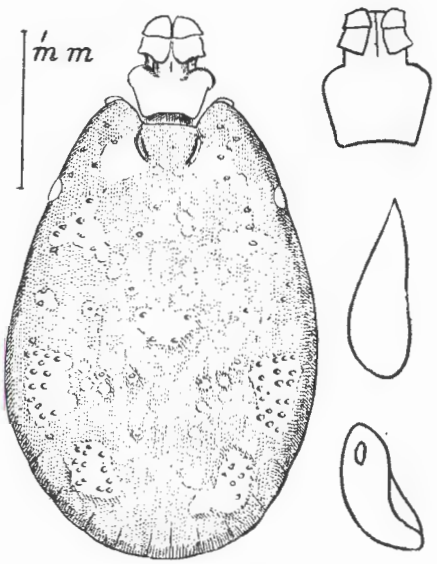

FIG. 21.—*R. maculatus* ♂ Dorsal aspect (rostrum omitted) after Warburton 1912 fig. 10; shewing the association between the enamelling and the punctations.

FIG. 22.—*R. maculatus* ♂ Dorsal aspect, after Warburton 1932 fig. 9, shewing the fully enamelled pattern.

approximately the level of the posterior edge of the female scutum; one or two smaller, fainter blotches may be developed to either side of this also approximately edging the female scutum. (Fig. 21). In the few specimens in which the pattern is more pronounced it is seen that the enamelling is deposited round the punctations, the separate deposits may be isolated or may become confluent as in Warburton 1912 fig. 10; in not one specimen studied however, has the pattern become as continuous as that figured by Warburton 1932. This association of enamelling with the punctations is also noted by Dias 1948.

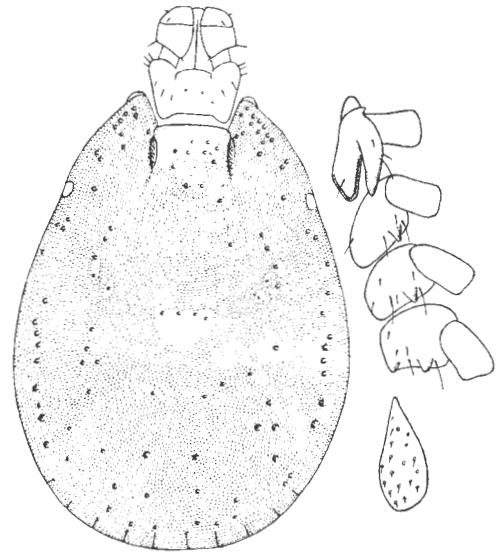

FIG. 23.—*R. maculatus* ♂ Dorsal aspect to shew punctation pattern. Bedford del.

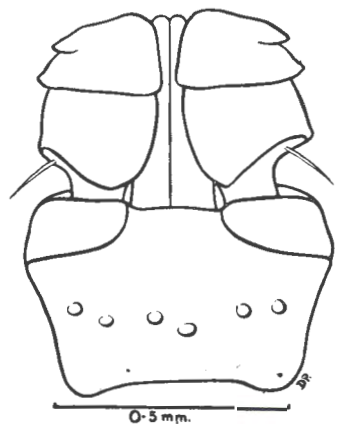

FIG. 24.—*R. maculatus* ♂ Rostrum. Dorsal view. D. Pringle del.

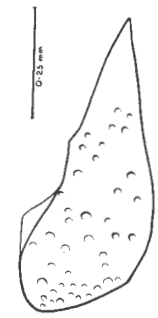

FIG. 25.—*R. maculatus* ♂ Anal Plate. D. Pringle del.

Rostrum. (Fig. 24.)

Basis capituli almost as broad as long, almost quadrangular in outline in that there is no lateral angle. Posterior margin concave, cornua blunt, hardly developed at all; postero-lateral margins long, antero-laterals virtually non-existent; a row of four to five deep punctations at about level of posterior third. In the absence of the lateral angle there is also no auricula ventrally, or at most merely an indication of one. Base of palps well developed.

Palps: Article I long and narrow, so that article II stands well away from the basis capituli. Articles II and III about equally broad; article II one and a half times as broad as long, widest towards the middle; article III flat, overlapping article II. Articles II and III with dorsal edges strengthened. Ventrally the lobe carrying the palpal hairs on article I is very long and overlaps the basis capituli.

Legs, uniformly brown; leg 4 markedly larger than leg 1.

Ventral surface: Anal plates (Fig. 25) twice as long as broad; internal margin a straight line, with a small concavity opposite the anus, passing gradually into the convex posterior margin; external margin straight at first then very slightly convex, this curvature continuous with the convex posterior border; longest axis mesial to the midline of the plate, punctations present, large, deep and fairly numerous. No indications of accessory plate.

Ventral festoons pronounced and well chitinized; in newly moulted specimens no indications of a caudal appendage, in engorged specimens the appendage is well developed.

Female (Figs 26–27).

Unengorged 2–$\frac{2}{3}$ mm. $\times$ 2 mm. to 4$\frac{1}{2}$ mm. $\times$ 2–$\frac{2}{3}$ mm.

Scutum ornate, shiny, smooth; slightly wider than long 1·9 mm. $\times$ 2·1 mm. to 1$\frac{1}{2}$ $\times$ 1$\frac{2}{3}$ mm.; posterior and postero-lateral margin usually broadly rounded; antero-lateral slightly curved, broadest at level of the prominent eyes about half-way back. Emargination fairly deep. Cervical groove short and deep, slightly curved, converging; in a few specimens a shallow posterior diverging depression was present dependent on the amount of contraction of the dorso-ventral muscles. No lateral groove. Punctations: a cluster of large punctations on each shoulder reaching to eye level, and a cluster in the central field between the cervical grooves. A row of large punctations marks off the lateral field, punctations in the posterior half of the scutum small, superficial, with a few scattered, slightly larger and deeper ones. The general surface is a light to dark brown; the enamelled pattern, when present, is yellow and occupies a greater or lesser part of the posterior central field; anteriorly it merges gradually into the brown of the ordinary chitin, it may reach as far forward as eye level; in very few instances does it encroach on the lateral field.

Rostrum (Fig. 27). As broad as long.

Basis capituli two and a half times as broad as long; posterior margin straight, cornua short and broad; postero-lateral margin long and convex; antero-lateral very short, lateral angle very far forward; basis capituli widest ventrally; base of palps prominent. Areae porosae deep, circular, almost twice their own diameter apart. Ventrally the auriculae are very short; posterior margin a smooth curve without a ventral spine or the spine only shows up as a small corner.

Palps: rather long, articles overlap slightly so that the external contour is disturbed. Article I visible dorsally, fairly long; article II slightly broader than long, with a pronounced angle at its posterior internal corner; article III broader than long, almost as long and as broad as II, anterior margin flatly rounded.

Legs: All alike, not as stout as in the male.

Dorsum: Short, stiff, white hairs present in all the punctations in the recently moulted specimen, those situated in the posterior depressions do not seem to fall off as readily as do the rest; those in the posterior medians seem to remain the longest.

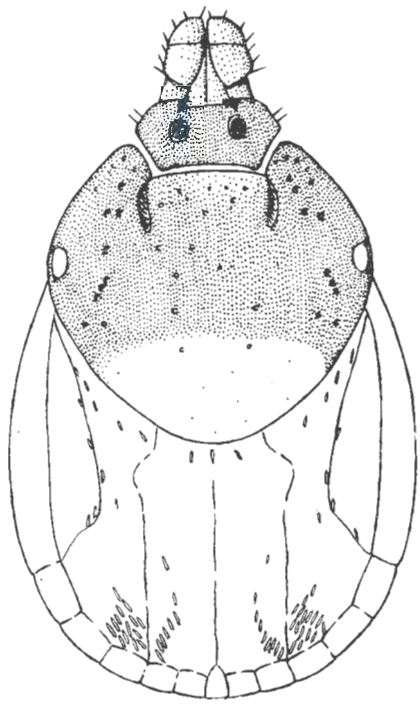

FIG. 26.—*R. maculatus* ♀ Dorsal aspect, Bedford, del.

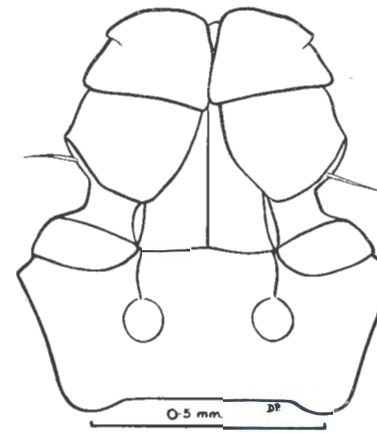

FIG. 27.—*R. maculatus* ♀ Rostrum. Dorsal aspect, D. Pringle, del.

Nymph (Figs 28–29).

Size 1·3 mm. × ·83 mm. when freshly moulted.

Scutum ·48 mm. × ·56 mm. to ·52 mm. × ·64 mm.; somewhat circular in outline, slightly broader than long; widest at eye level just beyond halfway back; posterior and postero-lateral margins a continuous curve; antero-lateral margin almost straight, slightly convex. Eyes prominent. Emargination shallow. Cervical groove pronounced, reaching to posterior level of eye; no definite lateral groove. A few large punctations evenly spaced.

Rostrum frequently stands well away from the shoulder, about as long as broad; palps almost perpendicular to the basis capituli.

Basis capituli very characteristic; three times as broad as long; widest anteriorly; posterior border straight; no cornua; postero-lateral slightly curved; antero-lateral very short and almost parallel to the posterior; only a slight bulge in place of a spur ventrally.

Palps about twice as long as broad. Article I visible dorsally. Articles II–III about equally long. Article II as broad as long. External contour of article III interrupted by a slight projection outlining the cap-like termination so pronounced on the ventral surface.

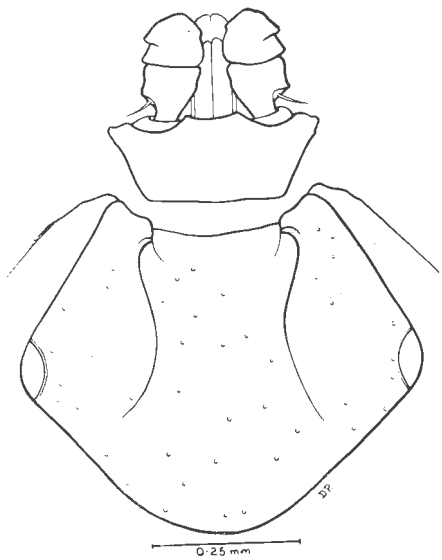

FIG. 28.—*R. maculatus*. Nymph. Dorsal aspect. D. Pringle del.

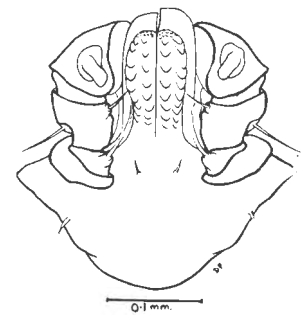

FIG. 29.—*R. maculatus*. Nymph. Rostrum. Ventral aspect. D. Pringle del.

Larva (Figs. 30–31).

Scutum broad, almost twice as broad as long. Eyes prominent. Emargination shallow; cervical pits, short, deep crescentic, converging.

Rostrum short and rounded, slightly broader than long.

Basis capituli; posterior margin long, slightly concave; no cornua; postero-external angle rounded and almost a right angle, no lateral angle, the sides are rounded, sub-parallel, base of palp large. No ventral spur. Palps longer than broad, widest at junction between articles 2 and 3. Articles 2 and 3 about equally large, and broader than long; contours rounded.

Type.—R. maculatus ♂ Neumann 1901 off *Platymeris horrida;* Cameroons. Berlin Museum.

R maculatus ♀ Warburton 1912 East Africa; Cambridge and British Museum.

R ecinctus ♂, Neumann 1901; origin unknown; Berlin Museum.

Larva and *nymph* described from offspring of a female off a Rhinoceros, Mkuzi reserve, Zululand, reared at Onderstepoort.

Occurrence.

The type specimen was recorded from the Cameroons; Warburton records it from Uganda, and from Masongalini and Mtito Andei in Kenya; Neumann records it from Mt. Njiro, Kenya; Onderstepoort has collections from the Mkuzi, Hluhluwe and Umfolozi reserves and off the Ubombo flats, Zululand. According to Lewis 1939, in Kenya it is more of a lowland tick than is *R. pulchellus,* and is confined to country below 4,000 feet. It has not been found in the colder, moist highlands. This agrees with the S. African records, Zululand being low-lying and warm with an average annual rainfall over 35″. Dias 1948 reports it from various areas in Moçambique.

Host.—It has been collected off buffalo, zebra, kudu, rhinoceros, bushbuck, elephant, duiker and warthog, and only incidentally off man. The record of the type specimen off a beetle must also be looked upon as representing an accidental host.

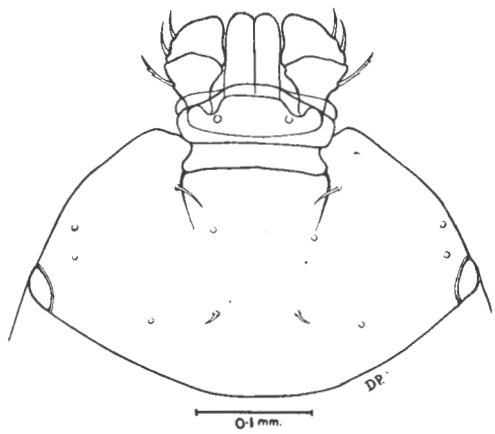

FIG. 30.—*R. maculatus.* Larva. Dorsal view. D. Pr.ngle del.

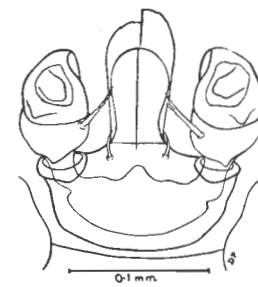

FIG. 31.—*R. maculatus.* Larva. Rostrum. Ventral aspect. D. Pringle del.

Classification.

General discussion.

The descriptions given above are based entirely on the offspring of one gravid female collected in the Mkuzi game reserve off a Rhinoceros on 12.5.44.

Neumann 1901 in his original description of the male gives the essentials of the colour pattern, when he states " Couleur général brun-rouge, avec tâches jaunâtres, dont une impaire triangulaire, vers le milieu de la longueur, une de chaque côte en dehors du sillon cervical, une triangulare a base marginale vers le tiers postérieur, une autre plus petite en arrière de celle ci, plus un grand nombre de petites tâches circulaires, isoleés ou confluentes, ayant chacune pour centre une ponctuation ". These characteristics are also noted by Dönitz 1907, and figured by Warburton 1912.

If we conceive of the entire pattern of the male as being made up of greater or lesser amounts of *enamelling centred* around the single or clustered *punctations,* then the descriptions of *R maculatus* given by Neumann, Dönitz, Bedford and Hewitt, and by Warburton all fall into place, and it is seen that R. *maculatus* is a species quite distinct from *R pulchellus;* in which latter there is no association, whatsoever, between the enamelling and the punctation pattern.

In the material from the one gravid female unfortunately there is no specimen shewing the full colour pattern as illustrated by Warburton 1932; the most ornate male only shews about two-thirds of the pattern, but there is sufficient of it to confirm Neumann's statement that the enamelling follows the punctation pattern.

In the female on the contrary the enamelling is confined to the posterior central area and seldom if ever invades the punctate areas; at the most it extends forwards just beyond eye level where the enamelling gradually fades and merges with the ordinary brown chitin.

Synonymy.

The synonymy is:—

R. maculatus ♂, Neumann 1901.

R. maculatus ♀ Neumann 1901; according to Zumpt 1942 these are true *maculatus*.

R. ecinctus ♂, Neumann 1901.

Nec. R. ecinctus ♀ Neumann 1908.

R. maculatus ♀ Warburton 1912.

Nec. R. ecinctus Paoli 1916.

Warburton 1932 after studying the type specimens comes to the conclusion that *R. ecinctus* and *R. maculatus* are synonymous.

Developmental Periods.

	Onderstepoort.	Dias 1948.
	Days.	*Days.*
Preoviposition	12–13	8–15
Eggs hatch	24–29	36–46
Larvae harden	—	—
Larvae feed	4– 7	5– 8
Larvae moult	12	10–12
Nymphae harden	—	—
Nymphae feed	4– 9	4– 5
Nymphae moult	18–21	24–32
Adults harden	—	—
Adults feed	6–13	14–41

SUMMARY.

(*a*) The description of the ♂ and the ♀ is brought up to date; it is shewn that the enamelling in the male follows the punctation pattern.

(*b*) The *larva* and the *nymph* are described for the first time.

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RHIPICEPHALUS PUCHELLUS GERSTÄCKER 1873; THE ZEBRA TICK; THE YELLOW BACKED TICK.

Male (*Figs.* 32-34).

Variable in size averaging between 4 mm. × 2·2 mm. to 5·6 × 3·3 mm. (Cunliffe gives it as 2·4 × 1·6 mm. to 4·4 × 3·4 mm.), very ornate with a very pronounced black and white pattern; coxa I prominent when viewed dorsally, shoulder hollowed out slightly.

Conscutum: Long and fairly narrow, width at eye level to width at spiracle as 3·25–3·6 to 5. Eyes prominent, deep yellow. Emargination narrow; shoulders narrow and pointed. Cervical groove short and deep; lateral groove absent, represented by an irregular row of medium punctations widely spaced; three posterior grooves present, the median long and narrow, the postero-laterals often fairly wide depressions; punctations not numerous, medium, mostly scattered singly and wide apart, with a small cluster on the shoulders and a small cluster anterior to the postero-lateral grooves, very fine shallow punctations evenly distributed; fovea prominent. Ornamentation in the form of brown patches on a uniform background of white enamelling; an impair posterior patch touching the festoons 3–9, and including the three posterior grooves, trilobed anteriorly; two lateral longitudinal patches to the inside of the lateral row of punctations, reaching from the last festoon forwards to some distance behind the eye, each side giving off a branch inwards; these branches point to the fovea but never meet one another; an anterior pair commencing at the cervical groove and diverging to a level beyond the eyes. These brown marking may vary in size and may sometimes become somewhat broken up, but the white always retains its enamelled looks and never gives the appearance of unpigmented chitin (so often seen in *R. maculatus*); festoons well developed and, like the lateral field, white.

Rostrum (Fig. 34): almost as broad as long.

Basis capituli heavy-looking, twice as broad as long; cornua large and heavy; posterior margin short, slightly convex; postero-lateral long, convex, converging slightly posteriorly; antero-lateral very short; lateral angle not pronounced; the basis capituli is at its widest ventrally; base of palps prominent; a row of six to eight punctations, each carrying a white hair.

Palps: Article I visible dorsally, fairly broad; articles II and III flattened with edges strengthened; article II not quite twice as broad as long; article III almost as broad as II but shorter and flatter. Subcollare developed as a separate element and highly chitinized.

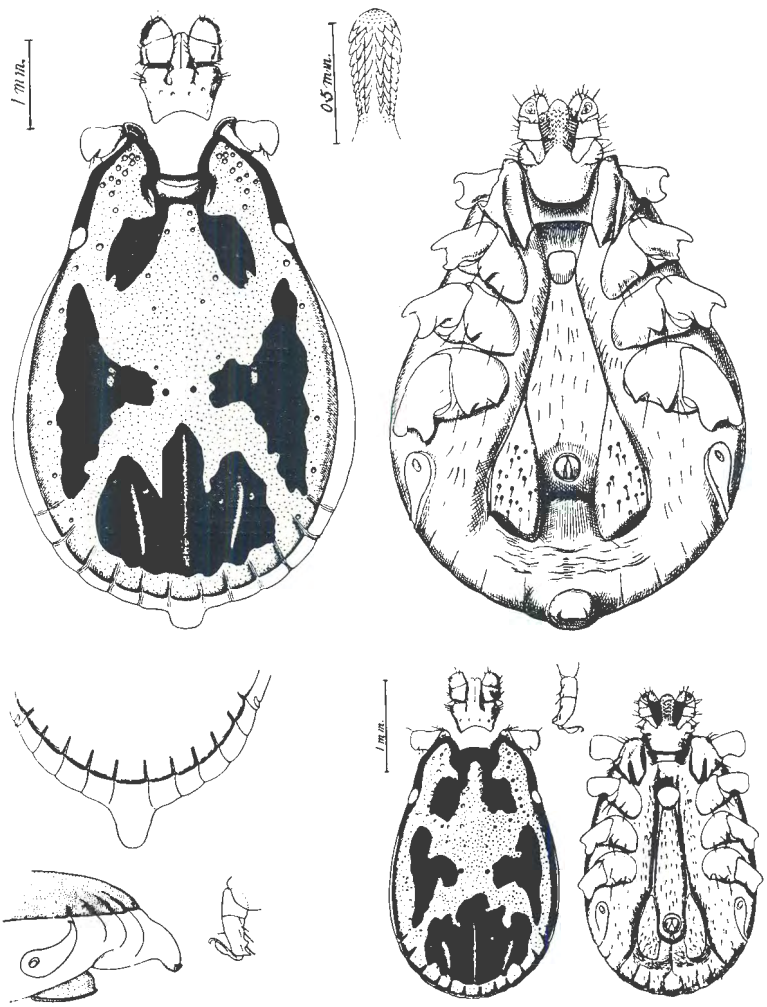


FIG. 32.—*R. pulchellus*. extreme types of males, dorsal and ventral aspects; tarsi iv; hypostome of larger male; posterior end of another large well fed individual, dorsal and lateral aspects, shewing orientation of the caudal appendage and of the anal plates.

After Cuncliffe 1913. Fig. 4.

Legs: A marked increase in size from leg 1 to leg 4. An irregular strip of white enamelling along the dorsal surface of the legs, more pronounced in legs 3 and 4; not always seen in legs 1 and 2.

Ventral surface: As on the conscutum and on the basis capituli, the white hairs are not easily rubbed off; hairs on the coxae exceptionally long.

Anal plates twice as long as broad; internal margin straight (Warburton figures it as slightly convex) meeting the posterior margin at an angle. External margin straight at first then slightly convex meeting the posterior margin in an obtuse angle; posterior margin straight (Warburton figures it as slightly concave). Numerous large punctations with white hairs. Adanals absent. Caudal process large.

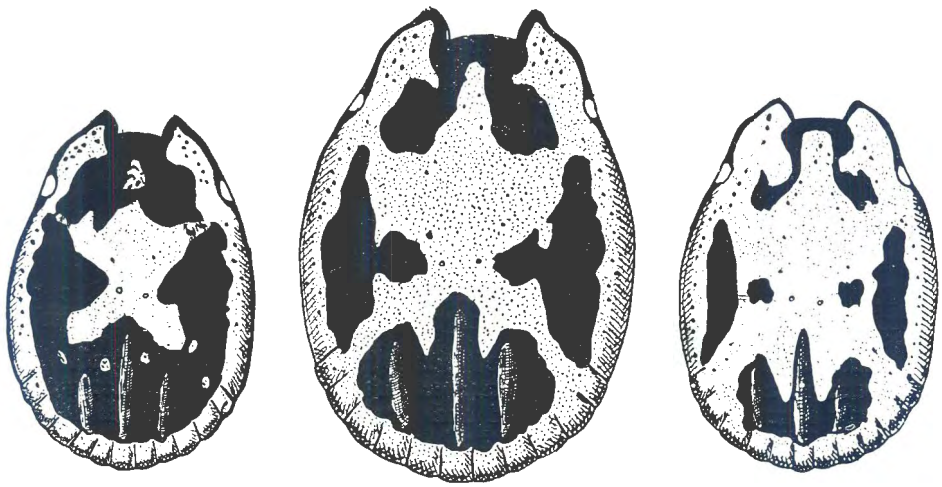


FIG. 33. –*R. pulchellus,* males, shewing ornamentation of normal form (central figure) and of the two extreme forms, the three scuta being drawn to the same scale.

After Cuncliffe 1913. Fig. 3.

Female (fig. 35).

Unengorged $4\frac{2}{3} \times 2\frac{1}{2}$ mm.; Ornate.

Scutum large, longer than broad; emargination broad and deep; eyes prominent in the second quarter behind the shoulder; posterior margin rounded, postero-laterals convex; antero-laterals slightly convex, hollowed out opposite coxa I giving a sharp shoulder. Cervical groove short, deep and wide. No lateral groove. Punctations: a few medium-sized punctations on the shoulder reaching to the anterior margin of the eye, three to four in the central field between the cervical grooves, one or two posteriorly behind the eyes. The main portion of the scutum is covered by fine superficial punctations evenly distributed. The entire scutum shews white enamelling except for a narrow strip of brown immediately in front of the eyes, and in the anterior portion of the central field. This ivory white enamelling may spill over onto the posterior central part of the basis capituli.

Dorsum: Dark brown in the freshly moulted specimens, bears numerous heavy, white, clavate hairs in all its depressions.

Rostrum: about as long as broad.

Basis capituli more than twice as broad as long; cornua short and broad; posterior margin straight; postero-lateral margin long and slightly concave; antero-lateral very short; base of palps large. Areae porosae large oval, with a little groove anteriorly; wider apart than the longest diameter; situated in a sunken median area. Posterior margin with enamelling.

Palps: Article I visible dorsally, though not nearly as long as in the male. Article II slightly longer than article III, broader than long. Article III flat, nearly twice as broad as long.

Legs stout, all alike. A white enamel strip along the dorsal surface, equally noticeable on all four legs.

Ventral surface: as in the male the hairs are exceptionally long.

Type. R. pulchellus. 3♂, Aruscha, Tanganyika; and Lake Jipe Zanzibar. Berlin Museum. 10 Rhinoceros (Coll; Trouessart).

R. marmoreus. 1♂ Bularli, West Somaliland; British Museum.

Occurrence.

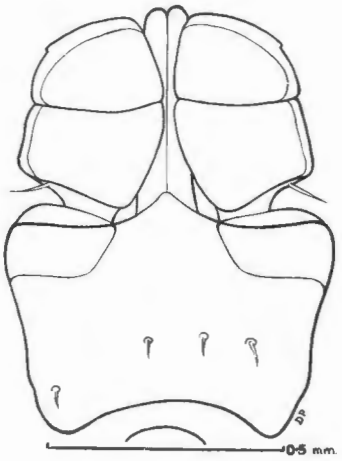
R pulchellus seems to be confined to East Africa; thus far it has been reported from Abyssinia, Somaliland, Tanganyika, Uganda, Kenya and Zanzibar.

According to Lewis 1939 *R. pulchellus* thrives best on plains, in acacia desert grass—and in acacia tall grass—savannah east of the Rift valley in Kenya; it is commonly found on the Athi, Kamati and Kapiti plains in the North Frontier district, and in the Ngong district of the Masai reserve; it is a common tick in Nairobi. It also occurs in Tanganyika and Uganda, though normally absent from districts higher than 6,600 feet. It may be said to be a species of the lower highlands and to a less extent of the coastal zones. In the higher altitudes it prevails in the open or semi-open and dry, hot areas, but it continues to maintain itself in the hot and less humid regions near the sea and the inland lakes. It seems to be fairly resistant to short periods of cold.

Stella 1938 reports it as occurring in various localities in Italian Somaliland.

Hosts.

The hosts listed are: Cattle, horse, donkey, sheep, goat, pig, dog; *Syncerus caffer,* buffalo; *Taurotragus oryx* (antelope oreas), the eland; *Connochaetes gnou* (*Catoblepas gnu*), the black wildebeest; *Equus burchelli böhmi,* the East African zebra; *Phacochoerus* sp., the Warthog; *Rhinoceros* sp.; *Kobus ellipsiprymnus,* the waterbuck; *Connochaetes taurinus albojubatus,* the white bearded wildebeest; *Strepsiceros imberbis,* the lesser kudu; *Alcelaphus* (*Bubalis*) *caama* is listed, this would be the Cape haartbeest, the East African haartbeest is *Alcelephas lichtensteini; Oryx beisa calotes,* the fringe-eared oryx; *Aepyceros melampus,* the impala; *Felis leo,* the lion; the striped hyaena (listed as *H. striata*) probably *Hyaena dubbah;* and wild dogs; incidental occurrences on man and on *Francolinus fusca.* Stella lists zebu, lion and zebra from Somaliland; Onderstepoort has specimens off the camel from Dagabur, Somaliland.



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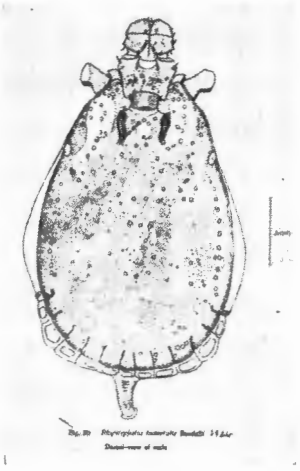

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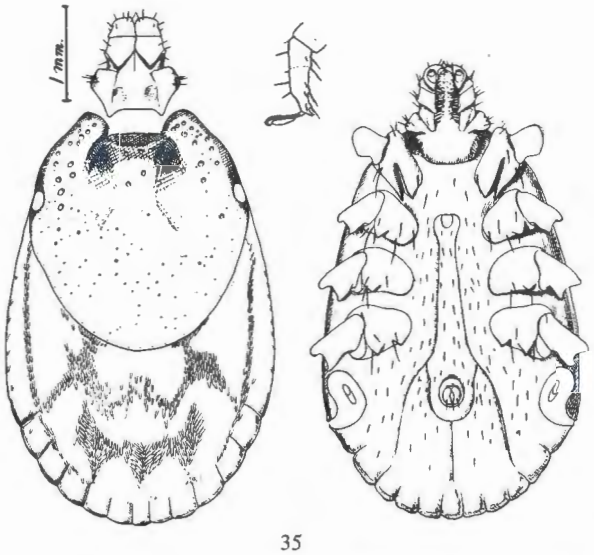

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FIG. 34.—*R. pulchellus,* ♂ Rostrum, dorsal aspect. D. Pringle, del.

FIG. 35.—*R. pulchellus,* ♀ dorsal and ventral aspects; tarsus iv. after Cumliffe 1913. Fig. 6.

FIG. 36.—*R. humeralis.* Rondelli 1926 after Zumpt 1950.

Classification.

General discussion.

Due to its vivid pattern *R. pulchellus* is one of the easiest rhipicephalids to recognize. Even if the enamelling may sometimes be somewhat faded the deeply pigmented dark brown areas always remain prominent; whereas in *R. maculatus* if the ornamentation is absent there are no deeply pigmented brown areas.

The correct synonymy is: *Dermacentor pulchellus* Gerstäcker 1873.

Rhipicephalus pulchellus Gerstäcker. Neumann 1897.

Rhipicephalus marmoreus Pocock 1900.

Nec. *Rhipicephalus ecinctus.* Neumann 1901.

Rondelli 1926 describes *R. pulchellus var. humeralis,* fig. 36, which Zumpt 1942 recognizes as a subspecies. As we have not seen the description we are not in a position to express a considered opinion as to the validity of this subspecies.

Zumpt 1950 in his key gives the males thus:—

Conscutum with ivory-coloured markings, legs with ivory-coloured outer edge.

40 Conscutum with five large, black or reddish brown markings on an ivory background. Posterior grooves present 2·5–5 mm. East Africa.

pulchellus.

—Only the shoulders of lighter shade, at times also a spot diagonally behind the eye. Posterior grooves wanting. Ground colour of conscutum reddish brown. Can be distingueshed by these characters from pulchellus, of which it was originally described as a variety. Somaliland, Kenya.

humeralis.

The females of *R. humeralis* have not yet been described.

R. pulchellus. Development periods. Lewis 1932.

	Days.	Temperature °C.
Preoviposition	8	26–29
Eggs hatch	36	22–26
Larvae harden	7	—
Larvae feed	3	—
Larvae moult	12	21–24
Nymphae harden	7	—
Nymphae feed	3	—
Nymphae moult	26	21–26
Adults harden	7	—
Adults feed	6	—
TOTAL	151	

These periods were obtained by feeding the tick on the local hare, *Lepus capensis crawshayi.* The small number of larvae which fed to repletion indicates that the hare is not the normal host in nature. The larvae could not be fed either on calves or on sheep. The normal host for the larvae or nymphs is not yet known.

Summary.

(*a*) The description of the ♂ and of the ♀ is brought up to date.

(*b*) The host list and geographical distribution is given.

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RHIPICEPHALUS OCULATUS — NEUMANN 1901. THE HARE-TICK.

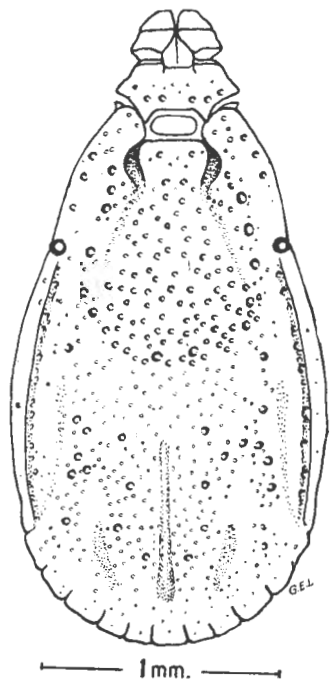
Male (Figs. 37–39).

A small tick, average size 3·1 mm. × 1·5 mm. to 3·6 mm. × 2·2 mm.; variable from light chestnut brown to very dark brown to black. Coxa I projection visible dorsally; conscutum elongate, emargination deep to take the long cornua. Eyes; small, hemispherical, oculated, varying in colour with the tinting of the scutum. Cervical pit deep, long; cervical grooves shallow, diverging rapidly to behind level of the eyes. Lateral groove, absent, represented by a row of 4 large, shallow punctations, marking off a wide shoulder area; marginal grooves well-developed, with a pronounced outer edge, carrying irregular punctations, including last or sometimes also penultimate festoon. Festoons well-developed. Posterior grooves, large, well-developed, floor unevenly pitted and wrinkled; median elongate widening posteriorly; laterals, elongate ovals, more usually disconnected from the festoons.

Punctations: There is an all over dispersal or fairly deep small medium punctations, larger and more densely arranged anteriorly, (somewhat exaggerated in fig. 37). Distributed fairly regularly over the entire scutum are a few large punctations, most readily seen between the posterior grooves. As in *R. evertsi*

mimetica, a tick typical of the dry regions of South West Africa, there is a tendency for punctations to become confluent, forming irregular corrugations (usually symmetrical) with uneven floors. The amount and the degree of development of these rugosities vary considerably from tick to tick. The most prominent and most frequently developed groove runs parallel to the marginal groove, as depicted in fig. 37. A small round subcollare present.

Rostrum: slightly shorter than wide (1 : 1·5) excluding the cornua. *Basis capituli* almost 2·5 times as wide as long (excluding the cornua); postero-lateral margin concave much longer than antero-lateral, auricula sharp and prominent; cornua large, posterior margin straight. Surface uneven, central area cut off from the sides by a slight ridge, an uneven row of 5 to 6 punctations parallel to the posterior margin. Ventrally auricula pronounced.



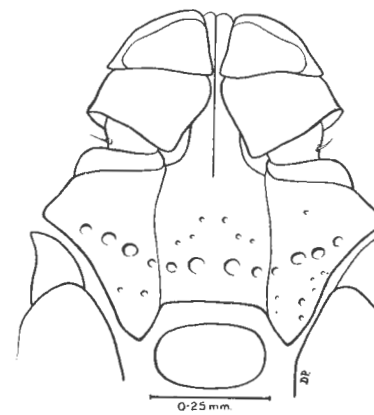


FIG. 37.—*R. oculatus* male Dorsum. G. E. Laurence del.

FIG. 38.—*R. oculatus* male Rostrum. D. Pringle del.

Palps broad, slightly shorter than basis capituli (without cornua). Articles II and III equally long, Article II wider than III as 1 : 1·3. Ventrally the bristle bearing spur on Palp I is a strong elongate triangle.

Legs: Markedly increasing in size from I to IV.

Ventral surface: Chitinous plaques to the ventral festoons well-developed. Anal plates large, can be lifted away from the general body surface; surface heavily punctate; longest line almost on the internal margin. External margin straight, posterior margin straight pointing sharply backwards, so that external line is much shorter than internal; internal margin with but a slight dent;

posteriorly it bends suddenly outwards to meet the posterior margin almost at right angles, the internal angle may have a small sharp point, as in *R. capensis.* The accessory anal may be represented by a cuticular fold ending in a lightly chitinised point. As in *R. appendiculatus* the caudal appendage is long, ends in a small chitinous plate; originates from opposite the central festoon only.

Female. (Fig. 40).

Unengorged female same size as the male, from $3 \times 1 \cdot 5$ mm. upwards. Colour from light chestnut to dark brown to black.

Scutum as broad as long (not including the shoulders); but looks much longer than broad due to the very high shoulders and the very pronounced lateral grooves; posterior margin sinuous, its two halves usually meeting fairly sharply; in the specimen drawn not so sharply. Eyes: small, hemispherical, oculated and conspicuous. Emargination deep and wide to take the long cornua; cervical pit small, continuous with the cervical groove; cervical grooves deep converging at first then diverging and becoming shallower.

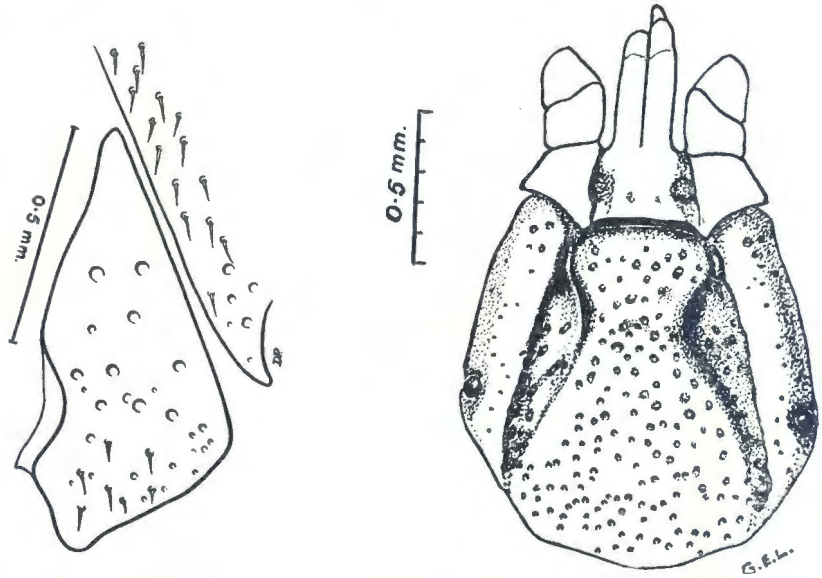


FIG. 39.—*R. oculatus* male Anal plate. D. Pringle del.

FIG. 40.—*R. oculatus* female Dorsum. G. E. Laurence del.

Lateral groove does not shew the same clear-cut outer edge as is seen in the marginal groove of the male; this edge is cut into by some of the larger punctations lying in it; lateral groove reaches to the posterior margin. Punctations, medium, distributed over the scutum; a few large, scattered; larger punctations, not always readily seen. As in the male there is a tendency for some of the medium seized punctations to be confluent and to form shorter grooves, more especially so in the cervical fields. Due to the pronounced lateral and cervical grooves the cervical fields appear as triangular depressions, much as in *R. appendiculatus.*

Sub-collare short and wide.

Rostrum slightly longer than broad 1:1·3 (not including cornua). *Basis capituli* three times as broad as long (excluding the cornua). Cornua strong, wide apart. Postero-lateral margin concave, much longer than antero-lateral, auricula sharp, posterior margin a straight line. Areae porosae sub-circular, a little more than their own diameter apart; a definite ridge cutting off central field from either side. Surface not as heavily punctate as in the male.

Palps slightly broader than long. Article II broader than III; III nearly as long as II.

Legs: there is not the same marked increase in size from before backwards as there is in the male.

Nymph. (figs. 41–42).

0·9 mm. × 0·5 mm. unengorged, about 2 × 2 mm. engorged.

Scutum: About as broad as long; due to the pronounced lateral grooves and the raised lateral folds it looks longer than broad, posterior margin ending sharply rounded. Eyes prominent, hemispherical; emargination wide and shallow. Cervical groove reaches to posterior margin. Lateral groove well-developed edging a raised lateral fold, extending to posterior margin.

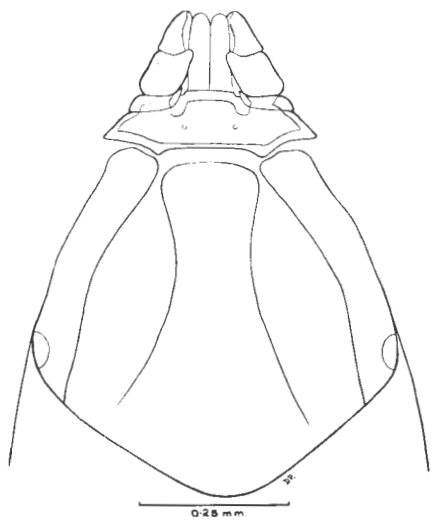


FIG. 41.—*R. oculatus* nymph Dorsum.
D. Pringle del.

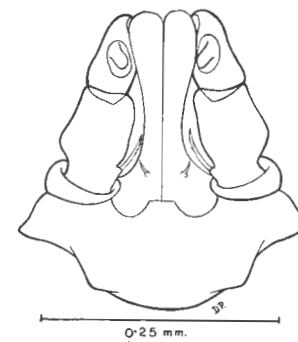


FIG. 42.—*R. oculatus* nymph
Rostrum ventral.
D. Pringle del.

Rostrum wider than long 1·5:1. *Basis capituli* about three times as broad as long; postero-lateral margin straight to concave, twice as long as antero-lateral, meeting it at an acute angle (angle in drawing too acute); cornua feebly developed (too strong in drawing), posterior margin straight to faintly concave.

Palps longer than scutum, outer margin almost a straight line, Article III as long as II, Article II slightly broader than III.

Larva: (figs. 43–44). About 0·15 mm. unengorged.

Scutum wider than long, all margins faintly convex; posterior margin broad and blunt. Emargination wide and deep. Eyes prominent, hemispherical. Cervical groove short deep.

Rostrum wider than long, Basis capituli rectangular, three times as long as wide (resembles *R. evertsi* somewhat), palps short and broad, widest at the middle, with a convex outer margin. Article III has a pronounced spur ventrally.

Type: 2 males, 2 females: Coll.: by Borchmann from *Lepidus timidus.* (*Lepus capensis sp.*). Damaraland (Berlin museum) and 1 female from cattle at Kilosa in East Africa. One of these ♂ Zumpt 1942 designated as lectotype.

The above description is based on the F_1 generation of a female from Omandumba, Omaruru, South West Africa, 27.4.44. Collection number 2810.

	R. oculatus.
Developmental Period.	
	Days.
Preoviposition	13–15
Eggs hatch	13–14–17
Larvae feed	2– 4– 8
Larvae moult	8–13–16
Nymphae harden	3
Nymphae feed	4– 7–10
Nymphae moult	13
Adults feed	8–14
Survival Periods.	*Months.*
Unengorged larvae	3
Unengorged nymphae	5
Unengorged adults	2–2½

Hosts.

The Onderstepoort records, and other available data, show *R. oculatus* adults to be parasitic essentially on wild hares; the immature stages may also be found on the hares, but seem to prefer elephant shrews (14) and sometimes also shrews (2), elephant shrews, shrews and hares occurring in the same habitats. South African field mice are notoriously free of ticks; thus far the plague research collections give but three records of *R. oculatus* nymphae off field mice.

Hares are undoubtedly the first choice. In the drier parts of South Africa, where goats occur, the goats are readily infested. The Onderstepoort records (including Cooley's records) include one horse, one donkey, three bovines, two sheep and one pig. Infestation of wild game appears to be incidental, unless our records are inadequate; the only hosts recorded thus far are: Steenbuck, *Rhapicerus campestris* (2), Eland, *Taurotragus oryx,* Bushbuck, *Tragelaphus scriptus sylvaticus,* Springbuck (3) *Antidorcas marsupialis hofmeyeri,* Gemsbuck, *Oryx gazella,* Kudu, *Strepsiceros strepsiceros,* Impala, *Apyceros melampus.*

Distribution.

Thus far *R. oculatus* has been recorded only from South West Africa and the Transvaal. The present available data show it to be present in most of the drier areas of the Union. It is apparently more common in South West Africa. Gordonia, Hay, Kenhardt, Prieska, Hopetown, Britstown, De Aar, Richmond and Williston districts than in the other areas; it is also present, but less abundant apparently, in Sutherland, Graaff Reinet, Cradock, Murraysburg, Middelburg, Willowmore, Steytlerville, Jansenville, Uitenhage, Alexandria, Bathurst, Albany and East London, all areas below ten inches of rainfall. It occurs in a few areas with a higher rainfall—up to 20″—e.g. Wellington, Worcester, Oudtshoorn, Aliwal North, Lady Grey, Herschel, Bloemfontein, Pietermaritzburg, Nongoma, Zululand, Piet Retief, Potchefstroom, Rustenburg, Brits, Pretoria, and in the dry northern parts of Potgietersrust, Zoutpansberg and Pilgrimsrest.

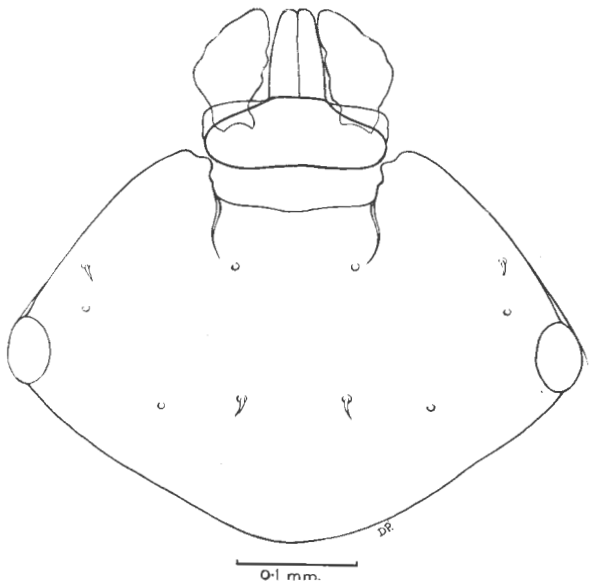


FIG. 43.—*R. oculatus.* Larva Dorsum.
D. Pringle del.

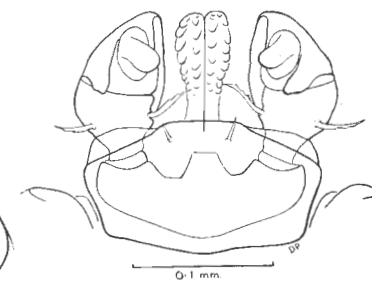


FIG. 44.—*R. oculatus.* Larva
Rostrum ventral.
D. Pringle del.

Beyond the Union boundaries it has been recorded from Palapye and Nokanen in Bechuanaland; Bulawayo, Sitalika (Barotseland) in Southern Rhodesia; Sousa Dias, 1950, records it from Bocoio in the Lobito district. Onderstepoort has records of immature stages from Karamoja (2) and from near Kisumu in Kenya. It appears to be absent from West Africa, Moçambique and the Belgian Congo. This absence may be more apparent than real; future more detailed collections may show it to be present in the drier regions of these countries.

Discussion.

R. oculatus cannot readily be confused with any other Rhipicephalid. It differs from *R. evertsi,* which is also oculated, in that the *evertsi* ♂ has larger, denser punctations of equal size, and red legs; the *evertsi* ♀ has no lateral groove.

In the *evertsi* larvae the rostrum is longer, and in the nymph the palps are club-shaped and not triangular. Its affinities to *R. pravus* are discussed under this latter species.

1. *R. oculatus* male and female have been redescribed; the nymphae and larvae have been described for the first time.
2. The host list and geographical distribution have been given.
3. The adults are essentially parasitic on hares, the immature stages on hares and on elephant shrews.

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RHIPICEPHALUS PRAVUS.

Male (figs. 45, 47, 48) 3·4 mm. × 2·1 to 3·7 × 2·4 mm. (Zumpt 3–4 × 1·5–2 mm.)

Conscutum: Elongate, convex, shiny, brown, anterior prominence of Coxa I visible dorsally, eyes flat to slightly convex, subcircular to oval, flush with body surface ventrally; dorsally edged by a few large confluent punctations which may form a definite groove; in some specimens this furrow along its dorsal margin may give the eye the appearance of being orbited. Emargination deep, cervical pit deep, convex; cervical groove converging at first, then diverging, fading out beyond the level of the eyes. External groove absent; marginal groove indicated by the straight edge of the lateral fold which is edged with an uneven row of medium and small punctations, ending at the last festoon. Posterior median groove elongate, narrow, embracing the median festoon, postero-median shorter, wider, embracing festoon 4; the floor of the posterior grooves finely wrinkled. Irregularly developed depressions, anterior to the posterior grooves, are frequently seen, indicated in the sketch by stippling. These grooves are shown in Warburton's fig. 4. Punctations dense, fine, tending to be less dense towards the sides, medium-sized punctations unevenly scattered over the scutum, most readily seen on the shoulders.

Rostrum: Slightly broader than long excluding the sharp cornua.

Basis capituli: Twice as broad as long excluding the cornua; postero-lateral margin long, concave, about twice as long as the almost straight antero-lateral; auricula well developed; cornua well developed; posterior margin straight to slightly convex. Surface heavily punctate, with larger and smaller punctations.

Palps: Short and broad; Article II broader than III, II and III equally long; Article III one and a half times as broad as long, article II relatively broader. Article I but slightly visible dorsally.

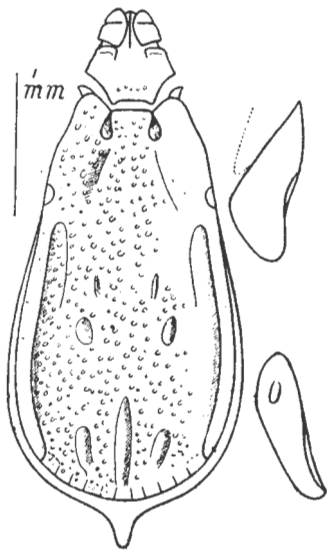

FIG. 45.—"*R. neavei var. punctatus*". Male — after Warburton, 1912.

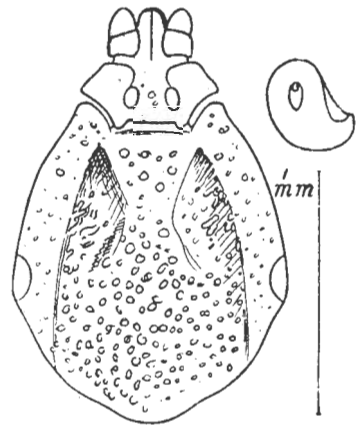

FIG. 46.—"*R. neavei var. punctatus*". Female — after Warburton, 1912.

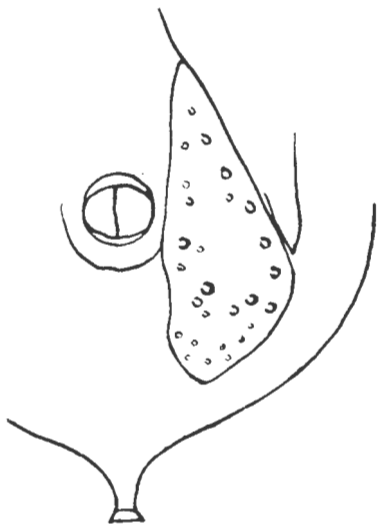

FIG. 48.—*R. pravus*. Male, anal plate. G. E. Laurence del.

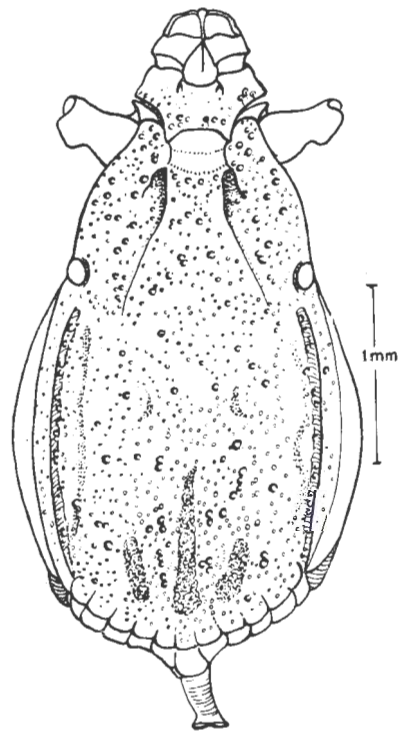

FIG. 47.—*R. pravus*. Male, dorsal view. G. E. Laurence del.

Sub-collare: Well developed, almost spherical.

Legs: Increasing in size from before backwards; as in *R. appendiculatus* leg IV markedly larger than I.

Ventral surface. Anal plates: Triangular; external margin a straight line, meeting the slightly convex posterior margin at a very obtuse, rounded angle; internal margin slightly sinuous, the hollowing out posterior to the anus; posterior internal angle about a right angle, anterior internal angle obtusely rounded without a small spur. Surface heavily and irregularly punctate; accessory anals absent, represented by a ventricular fold without special chitinization (Zumpt gives them as chitinized). Zumpt figures the range of variations shown by the type material from Mpapua.

Caudal process: Springing from central festoon only, long, ending in a chitinous cap. Ventral festoons but lightly chitinized.

Female (Fig. 49).

Unengorged: 3·5–4 mm. × 1·5–2 mm. *Engorged:* Up to 12 × 2·75 mm. (Zumpt 2·5–3·5 mm. × 1·3–1·5 mm.)

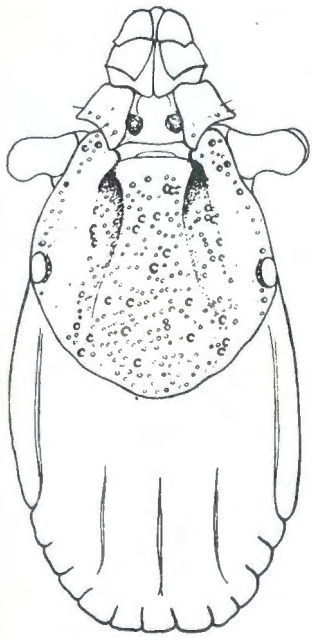

FIG. 49.—*R. pravus.* Female, dorsal view. G. E. Laurence del.

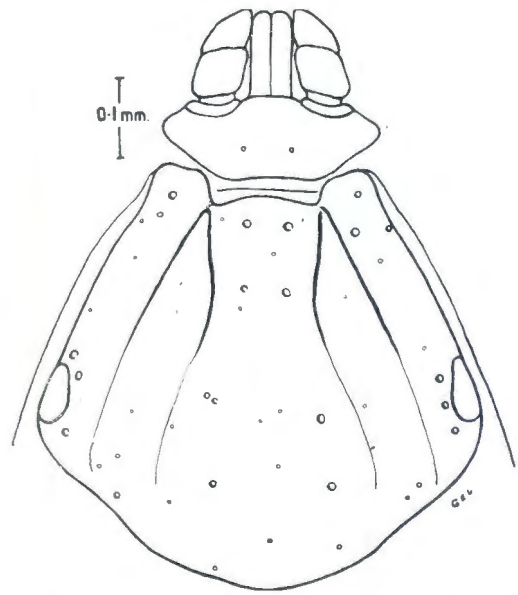

FIG. 50.—*R. pravus.* Nymph, dorsal view. G. E. Laurence del.

Scutum: Including the high shoulders, slightly longer than broad; brown, shiny; posterior margin sinuous, ending roundly; emargination deep and wide. Eyes conspicuous, more oval than in the male, convex dorsally, flatter ventrally and flush with the surface; dorsally edged by a furrow formed by confluent punctations. Cervical pit deep, short, passing immediately into deep cervical grooves, grooves convergent at first, then diverging and becoming shallower. Raised lateral folds present, but not edged by a lateral groove; the lateral groove

replaced by a very uneven row of punctations. Warburton gives " Fairly distinct lateral grooves, or at all events a clearly marked lateral ridge ". This is shown in his figure. A deep triangular depression anteriorly, where the " lateral groove " meets the cervical. Punctations, medium, dense, with a few irregularly scattered larger ones, most readily seen on the shoulders. In some specimens these larger punctations are more conspicuous than in others. The same irregular depressions seen as in the male.

Sub-collare present.

Rostrum: Triangular, slightly broader than long.

Basis capituli $2\frac{1}{2}$–3 times as broad as long. Postero-lateral margin concave, longer than the straight antero-lateral; auriculae well developed, cornua broad and strong. Posterior margin straight. Surface, punctate but smoother than in the male. Areae porosae circular, far apart.

Palps: Short and broad. Article II and III about equally long. II slightly broader than III. Article III ending bluntly rounded.

Legs: IV not markedly larger than I.

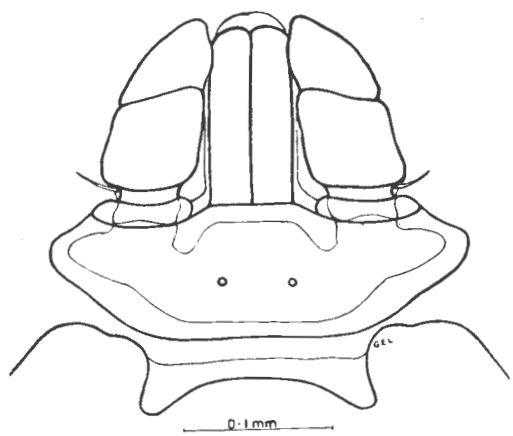

FIG. 51.—*R. pravus.* Nymph — rostrum, dorsal view. G. E. Laurence del.

Nymph. (Fig. 50–52.) About 1·1 mm. × 18 mm.

Scutum: Slightly broader than long, widest at eye level; posterior margin sinuous, ending widely rounded; emargination wide, eyes conspicuous; cervical pit deep, cervical groove deep at first, then becoming shallower and reaching almost to posterior margin. Lateral groove pronounced anteriorly, becoming shallower from before backwards, reaching to posterior margin. The cervical fold about as broad as the lateral fold.

Rostrum: Broader than long, the palps meeting the basis capituli at a marked angle.

Basis capituli at least two and a half times as broad as long. Postero-lateral margin slightly concave, longer than the straight antero-lateral; auricula blunt; no cornua, posterior margin straight to faintly concave.

Palps: Articles longer than broad. Article II longer than III; III a blunt triangle.

Larva (Fig. 53–55.)

Scutum: Broader than long, eyes prominent, about half way back; posterior margin convex, widely rounded, emargination wide and deep; cervical pit deep.

Rostrum: Slightly broader than long.

Basis capituli: about twice as broad as long; no auriculae, widest anteriorly at the junction with the palps. No cornua, posterior margin a continuous curve with the postero-lateral.

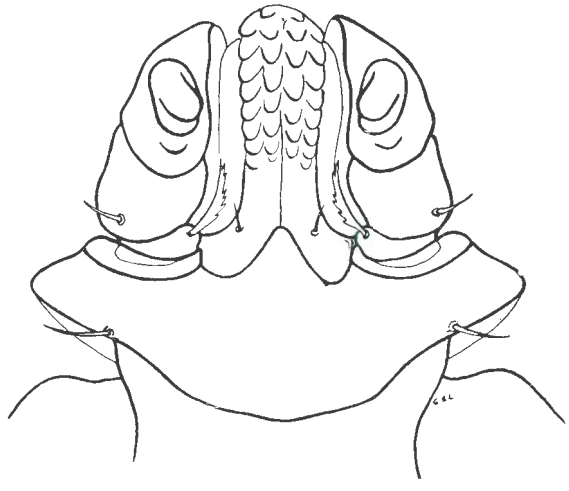

FIG. 52.—*R. pravus.* Nymph — rostrum, ventral view. G. E. Laurence del.

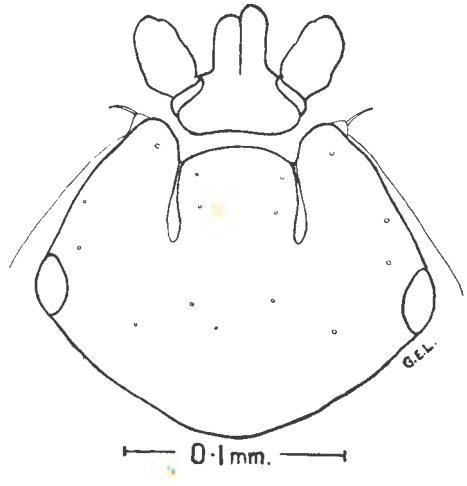

FIG. 53.—*R. pravus.* Larva — dorsal view. G. E. Laurence del.

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Palps: Short and broad; articles II and III do not show up as separate units, ends distally widely rounded.

Type. R. pravus. Dönitz 1910 does not designate any specific specimens as types, he merely states that *R. pravus* is found on buffalo, giraffe and various antelopes on the Massai steppes in East Africa (Zumpt 1942 states " Die Typen stammen von Mpapua ").

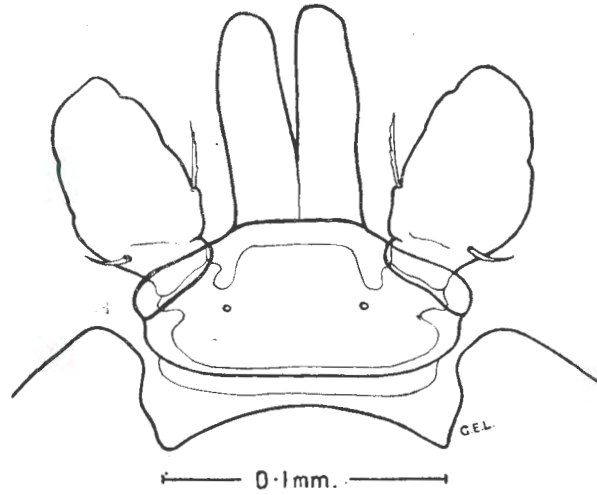

FIG. 54.—*R. pravus.* Larva — rostrum, dorsal view.
G. E. Laurence del.

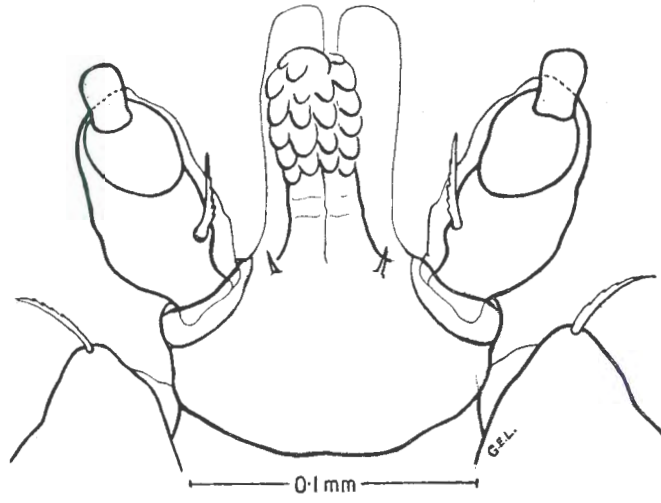

FIG. 55.—*R. pravus.* Larva — rostrum, ventral view.
G. E. Laurence del.

R. neavei-punctatus. Warburton 1912. 13 males and 4 females from kudu, Fort Mlangeni, Central Angoniland, Nyasaland; 1 female from impala, N.W. Shore Lake Nyassa; 1 female from reedbuck, Valley of the Rukuru River, N. Nyasaland, and some doubtful specimens from roan antelope near Marisba, Nyasaland.

Description.

The above description is based on material collected at Fairmount, Edenburg, Orange Free State; and on larvae and nymphae reared at Onderstetpoort.

Hosts.

R. pravus (syn. *neavei punctatus*) *adults* have been collected off domestic stock, sheep, cattle, goats, donkeys and dogs. Onderstepoort records show *R. pravus* to have been collected off:— *Lepus capensis; Poëlagus* sp., *Lepus saxatilis, Lepus whytei;* off the bucks:— duiker, oribi, steenbok, klipspringer, bushbuck, nyala, Brights' gazelle, Grant's gazelle, impala, reedbuck, hartebeest, oryx, kudu, buffalo and giraffe. Amongst the carnivores it has been collected off: spotted hyaena, leopard, lion and the genet; it has also been found on the warthog. *Immature stages* are recorded off field mice, *Mastomys coucha. Aethomys namaquensis auricomis* and *Aethomys chrysophilis* and the elephant shrews: *Elephantulus rupestris* and *Nasilio brachyrhynchus.* Santos Dias, (private correspondence) adds the waterbuck, eland and sable antelope, and the warthog.

Distribution.

South Africa.—When the zoological survey was started this tick was not recognized as a separate species, and it was undoubtedly listed at times as a very coarse *R. appendiculatus* or as a doubtful *R. capensis,* or a *R. sp. "eyed".* Howard's *R. bursa* (*Ann. Tvl. Mus.* I, 6. 130 fig. VIIIh., Xh) is in all probability this species.

The records of its occurrence in the Union are hence not as accurate as they might be. Its distribution, from the data available, falls roughly into two main blocks: I. The block associated with the *Bushveld* vegetation, reaching northwards into Rhodesia and westwards into the Kalahari of Bechuanaland. Actual records exist from areas in the districts of Zoutpansberg, Pietersburg, Potgietersrust and Waterberg in the northern Transvaal, in Schweizer Reneke and Wolmaransstad in the western Transvaal; in Kimberley, Philipstown and Hanover, with an outlier at Prieska in the north-western Cape; and reaching via *Bushveld* incursions into the *Brokenveld* of Bethulie, Rouxville, Zastron, Edenburg, Fauresmith, Southern Bloemfontein and Thaba 'Nchu, in the Orange Free State. All areas below the 20″ average annual rainfall. II. The block in the Eastern Cape Province in the districts of Humansdorp, Uitenhage, Jansenville, Somerset East and Adelaide.

In the discussion on the distribution of *R. appendiculatus* in Tick Survey Part II, (*Onderstepoort Jnl.,* XXII p. 283, 1949) attention is drawn to the aberrant *R. appendiculatus* in the *Brokenveld* of Fauresmith and adjoining districts, and the question is raised whether the tick is a true *R. appendiculatus,* an arid adapted strain, or possibly another species of brown tick having different environmental potentialities. Further collections, and the rearing of F_1 generations from gravid females collected in the Edenburg district, have shown the tick to be typical *R. pravus,* when compared with Zumpt's typical specimens. (*c.f.* figs. 47—48. with Zumpt 1942, p. 547 figs. 8 and 9).

Extra the Union.—The available records show it to be present in eastern Bechuanaland, from Mahalapye, Palapye and South of Kazungulu; in north western Bechuanaland at Dikate, Tatamoga and Kobe in the Maun district. Immediately across the Bechuanaland border the tick occurs at Kalundu in the Caprivi Zipfel and at Tjankwe in the south eastern corner of Southern Rhodesia.

Further Southern Rhodesian records are from West Nicholson, Bulawayo and Nyati. As yet there are no records from the northern regions of Southern Rhodesia; further collections may, however, show *R. pravus* to be present throughout, though never very common. Collections of ticks from Northern Rhodesia are but few, the available Onderstepoort records show the tick to be present at Mongu in W. Barotseland, at Machile near Mazabuku; further east approaching Nyasaland it seems to be fairly prevalent in the Luangwa valley, where it has been found in great abundance at Isoka, and in lesser numbers at Musagames, Fort Hill, Chinga and at Chinsali. It was first described as *R. neavei var. punctatus* from Nyasaland by Warburton 1912. It seems to be fairly common in this territory where it has subsequently been recorded by Wilson and Zumpt. Onderstepoort collection has specimens from Chinunka and Chitala. The type for *R. pravus* was described from Mpapua, Tanganyika; Zumpt states it to be most common in the Tanganyika Highlands e.g. Aruscha, Kilimatinde, Kondoa-Irangi, Mkalama, and Morogoro; Zumpt also records it from Kenya, Mt. Nyro and Mt. Loroghi. Its occurrence in the Belgian Congo seems to be confined mainly to the Ruanda-Urundi regions; Onderstepoort has records from Nyakatali, Kisenyi, Bukumba, Murombi, as also from Costermansville, and from the River Mura in the Elizabethville district. It figures as *R. bursa* at Nya Lukemba and at Kasongo in Newstead *et al.*, and at Kibombo and Bukama in the publications by Schwetz and Bequaert. In Uganda it has been collected by Chorley at Patiko, Gulu; at Jie, Lolito and Ngoropo in the Karamoja regions. These Uganda records link up with Hoogstraals' findings (in the press) for the Anglo Egyptian Sudan; i.e. Torit, Ikoto and Magwe. The furthest north record is from Ambouli, French Somaliland. (Hoogstraal in the press) and from Dieredawa in Abyssinia. Santos Dias records it from Matola (Marracuene) and from the Maputo area in Southern Lourenço Marques. Thus far *R. pravus* has been considered as essentially an East African species; it does, however, also occur in West Africa. Sousa Dias 1948 records it in Angola in the highland districts of Bailundo, Huambo, Caála and Lubango. Unsworth records it from Jakiri and Babanke in the Cameroons.

Vegetation, rainfall and temperature.

In the absence of detailed information of each collecting site, and working with maps, it would appear that *R. pravus* shows a preference for *Bushveld* or *dry Parklands,* it avoids *open grass lands* or the more *humid Parklands.* It occurs in areas with seasonal rainfall alternating with fairly long dry periods, and with a rainfall above 10 inches and below 25 inches. It appears to be relatively frost resistant, being firmly established in areas with over 90 days of frost per annum (Fauresmith Block).

Discussion Systematics.

Dönitz 1910 gave a very brief description of *R. pravus.* Warburton 1912 comments that Dönitz kindly sent him some of his *R. pravus* specimens and that these agreed with his newly described *R. neavei var punctatus* " though their eyes were exceptionally prominent ". Bequaert 1930 suspects that Warburton redescribed *R. capensis var compositus* as *R. neavei punctatus.* Zumpt shows this record to be *R. longus.*

Dönitz in 1905 already suggested that " the older records of the occurrence of *R. bursa* in South Africa might not have been reliable and that hence many incorrect identifications were made ". There is no doubt but that these inaccurate records for *R. bursa* have been perpetuated in the literature and in the text books up to the present times.

No further publications appeared for some time, but most recent workers were in the meanwhile labelling this tick as *R. neavei punctatus,* since it agreed with Warburton's descriptions and drawings. (Figs 45–46.)

Zumpt 1942 redescribed *R. pravus* from Tanganyika; he gives the eyes as "leicht gewölbt und etwas vertieft stehend"; he sinks both *R. neavei* and *R. neavei punctatus* as synonyms of *R. appendiculatus.* In 1950 he re-establishes *R. neavei* and bases his key description on two pairs taken by Neave off an eland near the mouth of the Tasangazi River in North East Rhodesia; he still maintains that *R. neavei var. punctatus* is, according to the description but a deeply punctate *R. appendiculatus.*

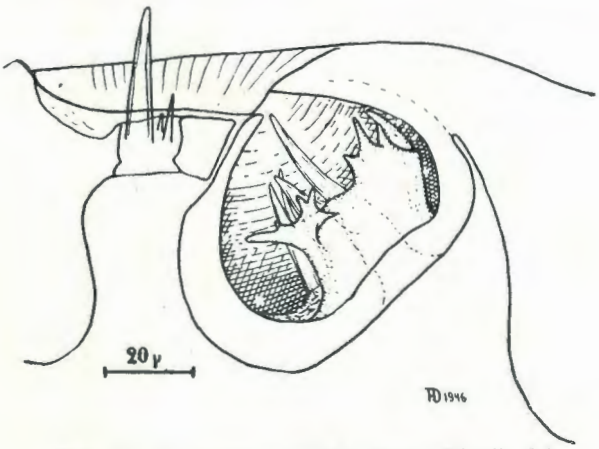

FIG. 56.—*R. pravus.* Haller's organ. Dinnik del.

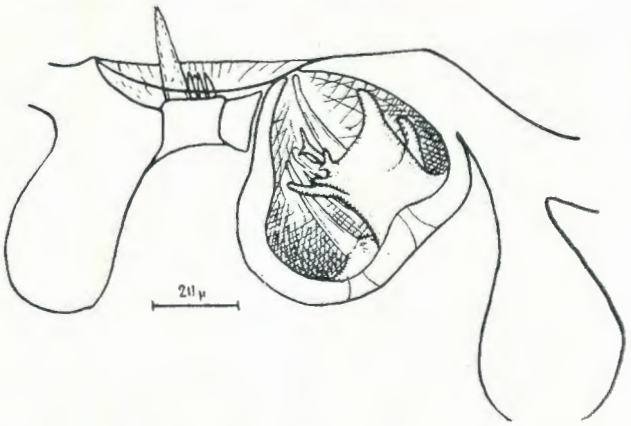

FIG. 57.—*R. oculatus.* Haller's organ. Dinnik del.

Map: Shewing distribution of *R. pravus* and *R. oculatus* in South Africa, relative to rain fall. Compare this map also with the vegetation map given in Tick Survey I.

Zumpt in his drawings and in his descriptions, gives the eyes for *R. pravus* as being surrounded by a groove and resembling that of *R. oculatus,* except that it is not so distinctly hemispherical. A study of typical specimens from Zumpt's

collection, shows the eye to be " not regularly hemispherical, but flattened ventrally and anteriorly and elongated, and is flush with the body surface. Dorsally, only, is it edged by a groove; also it is situated at the edge of the scutum ", as given by Dönitz in his brief description.

Upon comparing Zumpt's specimens with Warburton's 1912 description we notice that all the points tally, the eye being described as " somewhat salient, emphasized, by a rather deep impression at their dorsal limit ". All the Onderstepoort material was identified as *R. neavei punctatus* until Zumpt published a fuller description of *pravus,* and until a comparison of the Onderstepoort material with specimens of Zumpt's *pravus* showed them all to fall within the specific range of variations (compare figs. 47–48 of specimens from Edenburg O.F.S. with Zumpt's figs. 8 and 9 of paratypes from Mpapua).

It is Zumpt's opinion that *R. pravus* has been listed as *R. oculatus* by several of the older workers, including Neumann. Working through the records, however, and studying some of Lewis' material and the present known distribution of the two species, it would seem that it has been confounded rather with *R. bursa* another species in which the eyes also bulge, without, however, being hemispherical, and whose punctation pattern shows some resemblance to that of *R. pravus.* Santos-Dias 1950 quoting Neumann 1897 also records *R. bursa* from Somaliland, Tanganyika, Cape (i.e. South Africa) Loango, Angola, Gaboons Senegambia and Congo. Most of these records are undoubtedly also *R. pravus* (and not *R. oculatus* as surmised by Zumpt). Neumann's 1901 *R. bursa* records are possibly a mixture of *R. oculatus* for Cape, Pondoland and Walvis Bay and *R. pravus* for Transvaal and Lourenço Marques and possibly Portuguese Guinea.

Zumpt, private correspondence, has drawn attention to the dissimilarity of Haller's organs, as worked out by J. Dinnik; it is with the latter's permission that I include drawings of Haller's organ of *R. pravus* and *R. oculatus.* (Figs. 56–57).

The synonymy of *R. pravus* would thus be:—

R. pravus.	Dönitz 1910.
R. neavei punctatus.	Warburton 1912.
R. bursa ex parte.	Howard 1908.
R. neavei punctatus.	Sousa Dias 1948.
R. neavei punctatus.	Unsworth 1949 (private notes).
R. neavei punctatus.	Wilson.
R. bursa.	Schwetz 1927 p. 134.
R. bursa.	Newstead, Dutton and Todd 1907 p. 100.
R. bursa.	Lewis 1932, 1939 (ex parte) (No locality reference).
R. bursa.	Bequaert 1931, (p. 235).
R. bursa.	Santos Dias 1950 (p. 174) ex parte.
R. bursa.	Neumann 1897, 1901, 1911, ex parte.
R. appendiculatus.	Zumpt 1942, ex parte.

Since going to press we have received Santos Dias' 1951 publication " Mais Rhipicephalus de Moçambique " (*An. Inst. Med. Trop. Lisboa,* 8. 373–389), in which he shews *R. neavei punctatus* to be a valid species, and not a synonym of *R. appendiculatus* as Zumpt 1942 maintained. He also lifts it from a variety of *R. neavei* and gives it specific status as *R. punctatus,* thus *R. punctatus* Warburton 1912 (Dias 1951) nec *punctatus* Bedford 1929 falls as a synonym of *R. pravus.*

Laboratory rearing.

It is most difficult to rear *R. pravus* under laboratory conditions at Onderstepoort on the usual experimental animals. The tick mostly dies out at the larval stage and but few reach the nymphal stage, so that it has been found impossible to test it as a disease carrier. The indications are that it is a three host tick.

Development periods.

Pre-oviposition	5–9–15–26 days.
Egs hatch	21–47 ,,
Larvae engorge	6–10 ,,
Larvae moult	9–21 ,,
Survival period Larvae	2–4 months.

Summary.

1. The description of *Rhipicephalus pravus* adults is given; the nymph and larva are described for the first time. The synonymy is also brought up to date.

2. The geographical distribution is given; it is seen that *R. pravus* is not confined to East Central Africa as it was first thought; it seems to be associated with the Parkland type of vegetation.

3. The adults feed on the larger mammals, the immature stages on elephant shrews and field mice.

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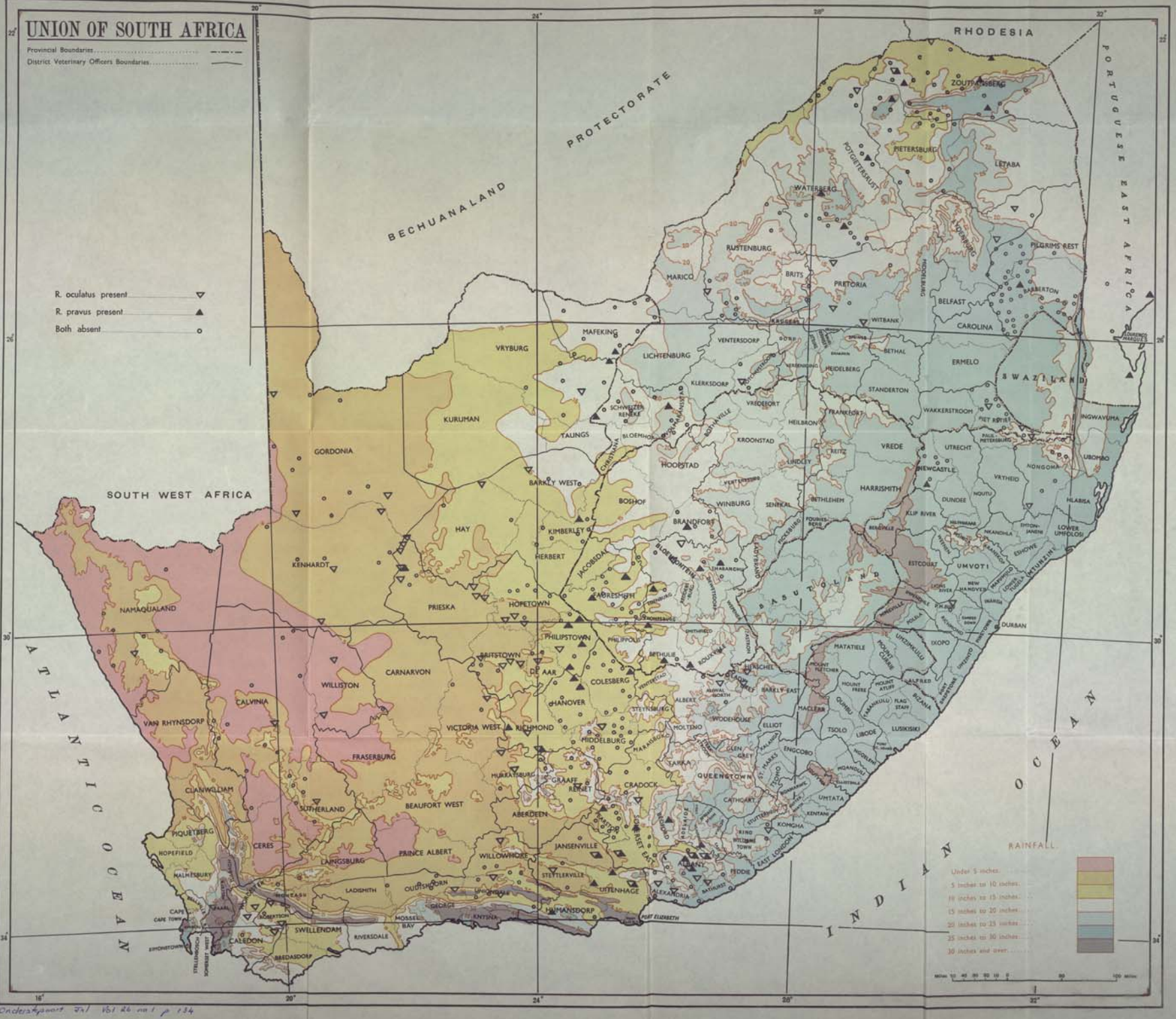

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