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NOTES ON THE GENUS *RHIPICEPHALUS*, WITH THE DESCRIPTION OF NEW SPECIES, AND THE CONSIDERATION OF SOME SPECIES HITHERTO DESCRIBED.

BY CECIL WARBURTON, M.A., F.Z.S.

Zoologist to the Royal Agricultural Society of England, and Demonstrator in Medical Entomology to the Quick Professor at Cambridge.

(*From the Quick Laboratory, University of Cambridge.*)

(With 12 Text-figures.)

THE identification of species of *Rhipicephalus* is likely to give more trouble than is the case with any other genus of Ixodidae, for while, on the one hand, there are few species which depart greatly from the general type, on the other hand the range of variation within the species is extremely great. In no genus is it so dangerous to describe a new species from a single individual, especially if the specimen be a female.

The structural features which are fairly constant in a species are few, and not very easy of determination; for example, the exact shape of the *basis capituli* in the male is of the first importance, but a slight error of orientation under the microscope will considerably alter its apparent outline. There are two reasons for this: first, the dorsal surface of the body and that of the capitulum are usually in slightly different planes, so that when the body is horizontal the capitulum is depressed and fore-shortened; in the second place, as Dönitz (1910, p. 465) has already pointed out, the antero-lateral border of the *basis capituli* is not, like the postero-lateral border, a definite edge, but is a rounded surface, and a faulty impression of the degree of salience and

of the precise position of the lateral angle is sure to be obtained unless the capitulum is placed in an accurately horizontal position for examination.

Certain structures which are of great specific importance in other genera are practically identical in all species of *Rhipicephalus*. The dentition of the hypostome is always 3 | 3, and the coxal armature is so uniform that but slight assistance is to be expected from the study of it. A useful point, however, is the absence or presence of an anterior projection on coxa I, visible dorsally. This readily strikes the eye, is subject to comparatively little variation within the species, and at once relegates the specimen, at all events if a male, to a particular group of species.

With very few exceptions the genus is inornate, so that a specific character of great utility in *Amblyomma*, *Aponomma* and *Dermacentor* is here practically lacking. The yellow legs of *R. evertsi* Neumann, 1897, are noticeable, and some species have, as a rule, exceptionally dark scuta, but coloration on the whole—especially in specimens preserved in spirit—is a doubtfully useful specific character.

R. oculatus Neumann, 1901 and *R. evertsi* Neumann, 1897 are clearly separated from all other known species of *Rhipicephalus* by their hemispherical bead-like eyes. In a few other species the eyes are slightly prominent, but usually they are almost flat. Their comparative size is of some importance, and, to a less extent, their colour.

The size and shape of the spiracle, though by no means invariable, will often be found useful in diagnosing a species; the shape differs with the sex, that of the male always being the more elongate and comma-shaped. In some species the spiracle of the male narrows but slightly towards its termination, while in others (*e.g. R. sanguineus* Latreille, 1804) the tail of the comma is well-marked. There is usually present a more or less marked infolding of the spiracle rim on its dorsal border, but this "rim-fold" as we may call it is too variable to be of great assistance. It is often stated in the original descriptions of species of *Rhipicephalus* that "the scutum of the male covers the whole dorsum," or that this is not the case, the body extending beyond the boundary of the scutum; and in the same way the presence or absence of a caudal appendage is frequently given as a specific characteristic. As a rule it is merely a question of an unfed or of a distended male, and though distended examples certainly appear to occur more commonly in some species than in others, and caudal appendages when present to be more pronounced, it would be exceedingly unsafe to say

that these characteristics are absent in any species unless a large number of males had been examined.

Mere size seems to be of less account in *Rhipicephalus* than in any other genus of the Ixodidae. In the accompanying figures outlines are given, drawn to scale, of large and small males of three species, the individuals compared being in each case taken from the same tube of ticks, collected on the same occasion from a single animal, and connected by every grade of intermediate size. The larger specimens usually have the specific characteristics (anal plates, punctations etc.) more strongly developed than the smaller, and in most species—if not in all—well-developed individuals may be found with the body extending beyond the scutum and more or less prominent caudally.

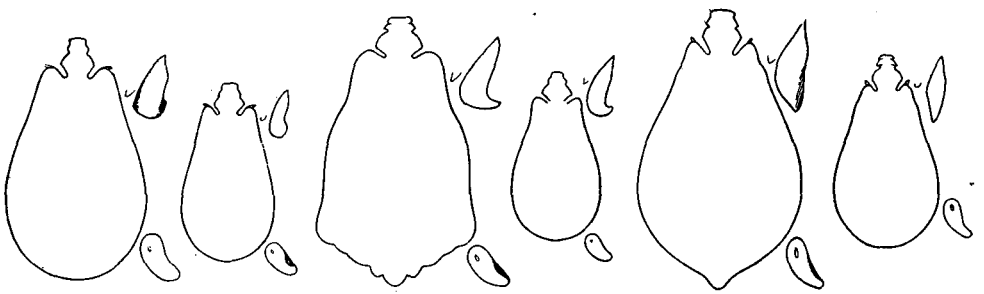

Fig. 1. Outlines of large and small ♂'s of three spp. of *Rhipicephalus* (from left to right *R. simus* Koch, 1844, *R. haemaphysaloides* (Supino, 1897) and *R. appendiculatus* Neumann, 1901). Each pair is drawn to scale from specimens taken at the same time from a single host.

It is most unfortunate that the anal plates, which, as highly chitinised structures, might be expected to be of great taxonomic importance, are subject to very considerable variation, though there is generally recognisable a normal form of anal plate for any given species. *R. lunulatus* Neumann, 1907 has such very striking anal plates that no one could hesitate, on coming across a single well-marked individual, to describe it as a new species. Yet it differs in no other respect from *R. simus*, and we possess specimens taken from a single animal, clearly connecting the two forms of anal plate. *R. falcatus* Neumann, 1908 presents a similar phenomenon. Indeed the extreme variability of *R. simus* has led to the establishment of several species, some of which have already been suppressed, while others will at least have to be degraded into varieties.

As regards the males, we have still to consider the dorsal sculpture. The cervical and lateral grooves are of importance, and there are usually present on the posterior portion of the scutum three furrows or pits which are fairly constant for the same species and which may be called the "dorsal furrows."

The punctation of the scutum presents a great difficulty. There is certainly for each species a characteristic punctation very recognisable in typical examples, but often widely departed from in individuals, or in local varieties, and when this is the case the difference of facies between two ticks otherwise structurally identical may be very great. A striking case is the tick named by Neumann *R. falcatus*, a densely punctate form which at the first glance bears no resemblance at all to *R. simus*, where the punctations are few, and arranged in linear series. Moreover *R. falcatus* typically possesses very characteristic anal plates quite unlike those we are accustomed to expect in *R. simus*, and there is no anterior prominence on coxa I. Yet we can find no other structural points in which these forms differ, and moreover we possess a tube of ticks from Nyasaland which we have been quite unable, after repeated attempts, to sort out. There are many undoubted *R. falcatus*, a considerable number of obvious *R. simus*, and every intermediate grade of anal plate, prominence of coxa I, and punctation.

If the males of *Rhipicephalus* are difficult to identify, the characters presented by the females are even more unsatisfactory, for not only are they without anal plates, but the shape of the *basis capituli* differs little in the various species, and the anterior prominence of coxa I is never noticeable. The shape of the scutum should be noted, the presence or absence of a lateral groove, and the scutal punctation. Further assistance will be received from a study of the porose areas and of the spiracles, but, as we have already said, a single female, unless it presents some unmistakeable peculiarity, is a very unsatisfactory basis for the formation of a new species.

In identifying a male *Rhipicephalus* the best guides will be found to be, the anterior prominence on coxa I, the exact shape of the *basis capituli* carefully orientated, and the position and nature of the lateral angles (whether obtuse, acute, or about a right angle); the dorsal furrows; the anal plates, the grooves and punctations of the scutum, and the spiracles.

If the belief in the great specific variability of *Rhipicephalus* depended entirely on the study of ticks captured under natural conditions it might be argued that forms in reality distinct had been

confused, and that the species were in fact numerous, though difficult of separation. But it is strongly supported by the results obtained by the rearing of ticks in the laboratory, and this has been done over and over again in the case of common species such as *R. appendiculatus* and *R. capensis*. The wide divergence of individuals raised from a single batch of eggs is most striking, especially as regards the males. The disparity in size of captured male ticks apparently belonging to the same species was often so great as to suggest that the males lived longer than was supposed and grew after reaching maturity; especially as the larger specimens were almost always more highly chitinised and more strongly characterised, but similar differences are observed in newly emerged males which have been reared in the laboratory from nymphs taken from one host.

The genus *Rhipicephalus* is essentially African. *R. sanguineus* is practically cosmopolitan—a fact no doubt attributable to its usual host, the dog. *R. bursa* has overflowed into southern Europe, being chiefly distributed along the shores of the Mediterranean. *R. texanus* Banks, 1908 is certainly no more than a N. American variety of *R. sanguineus*, if it deserves even varietal rank, and the only known distinct Asiatic *Rhipicephalus* seems to be *R. haemaphysaloides*.

Now the writer has, during the last few years, examined many thousands of ticks collected from all parts of Africa, chiefly in connection with the work of the Entomological Research Committee. He has also, thanks to the great courtesy of various collectors and of the authorities of the chief continental museums, been able to study the actual types of nearly every so-called species of *Rhipicephalus*, and his conclusions, as far as he has been able to arrive at any, will, it is hoped, be of some interest to those who have to deal with this most puzzling group.

The first conclusion is that the genus *Rhipicephalus* is in an extremely fluid condition. There are what appear to be a considerable number of species *in the making*—forms distinct enough when characteristic examples are selected, but in many cases merging into each other by imperceptible gradations.

A certain number of forms—about sixteen—have been repeatedly met with in considerable numbers, and though they often include ill-characterised individuals, they each centre round a recognisable type distinct in each case. In the second place there are certain forms (*e.g. R. armatus* Pocock, 1900, *R. cuspidatus* Neumann, 1906, *R. deltoideus* Neumann, 1910) of which few examples have ever been found, but which are so peculiar that their claim to specific rank cannot be denied. Lastly there

are not a few forms which have been described either from very scanty material, or from a considerable number of examples taken on a single occasion, and presenting no very salient characteristics. Our experience in the case of the better known "species" makes it probable that, if a large number of examples were available for study, even those characteristics which appear to distinguish them would fail in the all-important quality of constancy. It is clear, then, that the taxonomy of *Rhipicephalus* is bound to be unsatisfactory, and the question to be solved is what way of tackling it is likely to be of most use to those who have to deal with the group. Forms merging into one another by imperceptible gradations are not, scientifically, distinct species—nor even distinct varieties; yet to insist on this, and to fuse together such obviously different forms as, for example, *R. simus* and *R. falcatus*, would lead to inextricable confusion, and it seems better to assign the term species, under protest, so to speak, to forms sufficiently distinct where characteristic individuals are considered, though cases are sure to arise in which an example can be attributed with equal justice to either of two such "species," and it may be even necessary to describe it by connecting with a hyphen two "specific" names—as *R. simus-falcatus*. The systematist has no need to apologise for a want of definiteness the responsibility for which lies with Nature herself.

It is from this point of view that the subjoined new "species" of *Rhipicephalus* are described, and the case of the first—*R. neavei* (see p. 7)—may be dealt with a little more fully.

Among a large number of tubes of ticks received from Nyasaland, N. Rhodesia and British E. Africa the constant recurrence of a certain form—very characteristic in well-marked examples—was noted. It seemed incredible that a tick evidently so common in those regions had remained undescribed, and yet it seemed impossible to recognise it as at all a normal form of any of the species whose establishment has been based on a considerable number of specimens. It bears a superficial resemblance to *R. appendiculatus*, but differs from it in what must be regarded as among the most constant characteristics of the male—the shape of the *basis capituli*, and the anal plates. Of the species based upon few examples and possessing no very salient characteristics it seemed, from descriptions, to have affinities with one or two—notably *R. kochi*, but the types of this species have been examined with a negative result. We have here, then, a form of *Rhipicephalus* which has at least as good a title to rank as a distinct species as the majority of those already recognised, though if only two or three examples had

ever been found, and these had chanced to be among its more ill-characterised specimens, a very inadequate idea would have been obtained of what may be considered its normal appearance.

A further word with regard to specific descriptions of *Rhipicephalus*. In view of the uniformity of certain structures throughout the genus, and of the great variability of others within the species, it seems desirable to depart from the method—which has been found convenient in the case of other genera—of proceeding at once to describe all the external features in sequence. It will be more useful to preface such a description—which will often be of a somewhat indefinite and general nature—with a brief statement of the salient characteristics upon which the species is chiefly based. A similar method has already been adopted by Dönitz (1910), who alone of previous writers has at all appreciated the very unstable nature, in species of *Rhipicephalus*, of structural features which appear to be remarkably constant in other genera.

Rhipicephalus neavei n. sp.

Figs. 2, 3.

Male. Salient features: *Inornate; Basis capituli much broader than long; lateral angles near the middle, and somewhat acute. Coxa I strongly prominent anteriorly. Punctations numerous, small, rather unequal, absent immediately in front of the eyes. Lateral grooves well-marked, including no festoons. Dorsal furrows distinct, the laterals small, oval and detached. Anal plates of characteristic shape* (see Fig. 2), *the external and posterior borders almost at right angles; the internal border projecting inwards distally. Spiracle narrow, only slightly curved.*

Detailed description:—

DORSAL ASPECT: *Palps* short, flat dorsally, articles 2 and 3 about equal; posterior border of article 2 straight; article 1 only slightly visible. *Basis capituli* with straight posterior border and strong cornua; lateral angles rather acute and directed somewhat backwards (especially on under surface), the antero-lateral border somewhat convex, the postero-lateral concave; the median field generally punctate, especially posteriorly. *Scutum* measures 3·6 × 2 mm. in a fairly well-developed specimen, punctate all over except the region immediately in front of the eyes and the fold external to the lateral grooves. The strong punctations which in the ♂ generally correspond to the lateral grooves of the ♀ are absent.

Cervical grooves deep oval pits, generally followed by shallow divergent depressions. Eyes somewhat salient, emphasized by a rather deep impression at their dorsal limit. Festoons very short, their intervals rather broad. Median dorsal furrow rather long and pointed anteriorly; lateral furrows small, oval, near the festoons but generally detached.

In well-fed specimens the body extends beyond the scutum and there is a caudal appendage terminated by a "plaque."

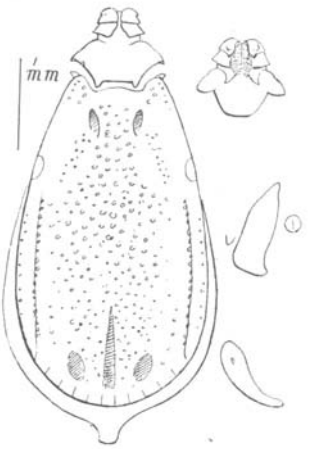

Fig. 2. *R. neavei* n. sp. ♂. Dorsal aspect, ventral view of capitulum, anal plates and spiracle. Original, C. W.

VENTRAL ASPECT: *Integument* often much lighter coloured than the scutum, legs and plates. *Auricular ridges* of basis capituli well-marked, and directed somewhat backwards. *Coxal armature* normal. *Anal plates* typically as described above, but subject to considerable variation, the angle formed by the external and posterior borders being sometimes more obtuse, and the inner protuberance less noticeable; accessory plates only indicated by a very slight chitinous point. *Legs* long.

Female. *Capitulum*: basis capituli like that of the ♂, with the antero-lateral border rather more convex; porose areas small, circular, two diameters apart; palps somewhat larger than in the ♂, article 1 more visible. *Scutum* about 1·3 × 1·1 mm.; eyes rather large and salient, and situated somewhat posteriorly; cervical grooves well-marked, converging at first, then sharply diverging; lateral grooves absent, but there is a convex smooth region on either side; the median field is closely and fairly uniformly punctate and there are a few

punctations on the scapulae, but the area immediately in front of the eyes is glossy and devoid of punctations as in the ♂. In exceptional specimens the lateral punctations of the median field are so emphasized as almost to amount to a lateral groove. *Spiracle* short-oval, with only a slight dorsal projection.

This species bears a superficial resemblance to *R. appendiculatus*, but the shape of the basis capituli and of the anal plates in the ♂ and the absence of lateral grooves in the ♀ are sufficient to differentiate it from that form. It seems to be more nearly allied to *R. kochi* and *R. cuneatus*.

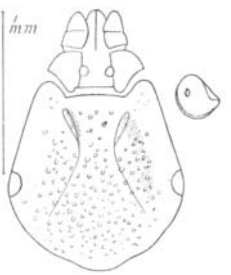

Fig. 8. *R. neavei* n. sp. ♀. Dorsal view of capitulum and scutum, and spiracle. Original, C. W.

Described from a large number of specimens taken in N. E. Rhodesia from the "bush-pig," eland, "bush-buck," "impala," kudu and man; in Nyasaland from the roan antelope, "bush-buck," "wart-hog," *Lepus* spp., cattle and grass; in British East Africa from the goat and the buffalo. The specimens which appeared most characteristic and were selected as types 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]. Types at British Museum and Cambridge.

Specimens of this tick were sent to Geheimrath W. Dönitz who agrees that it is a form unknown to him. The presence of a lateral groove in the ♂ and its absence in the ♀ caused him to suspect that they belonged to different species, but not only do they constantly occur together, but the strong line of punctations which are the true representatives in male ticks of the female lateral groove is here absent.

R. neavei var. **punctatus** n. var.

Figs. 4, 5.

Male. Like *R. neavei*, but: *Body* narrower and more elongate (scutum 3 × 1·6 mm. in fairly well-developed specimens). *Basis capituli* with lateral angles less acute and not recurved. *Scutum* more deeply and

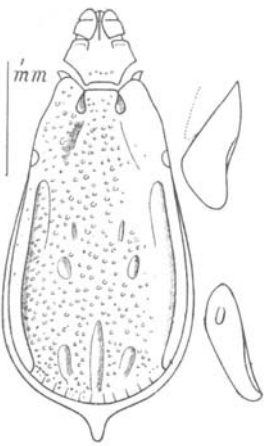

Fig. 4. *R. neavei* var. *punctatus* n. var. ♂. Dorsal view, anal plates and spiracle. Original, C. W.

uniformly punctate, only the lateral margins behind the eyes being nearly free from punctations. *Anal plates* with angle formed by external and posterior borders obtusely rounded; no accessory plates visible in any of the examples seen.

Female. Like *R. neavei*, but: Scutum longer and more oval, punctate all over, including the lateral border. Fairly distinct lateral grooves, or at all events a clearly marked lateral ridge. Porose areas larger and nearer together.

Described from 13 ♂s and 8 ♀s from Kudu, near Fort Mlangeni, Central Angoniland, Nyasaland (Neave, v. 1910, E. R. C. No. 132), 1 ♀ from *Impala aepiciros melampur* (sic) on N.-W. shore of L. Nyasa (Neave, VII. 1910, E. R. C. No. 127), and 1 ♀ from reed-buck, Valley of Rukuru R., N. Nyasaland (Neave, 26. VI. 1910, E. R. C. No. 158).

Some of the specimens of *R. neavei* taken by Old from roan antelope near Marisba, Nyasaland, 1. 1911 (E. R. C. Nos. 226–227 *a*) showed a

tendency to approach this variety[1]. Types at British Museum and Cambridge.

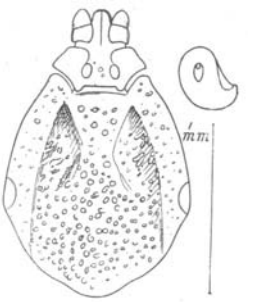

Fig. 5. *R. neavei* var. *punctatus* n. var. ♀. Capitulum, scutum and spiracle. Original, C. W.

R. longiceps n. sp.

Figs. 6, 7.

Male. Salient features: *Inornate; Basis capituli not much broader than long; lateral angles distinctly anterior and slightly obtuse. Coxa I strongly prominent anteriorly. Punctations very numerous, deep, uniform, discrete, on every portion of the scutum. Lateral grooves well-marked, including one festoon. Dorsal furrows deep, linear, nearly parallel, sub-equal. Anal plates* (see Fig. 6) *like those of R. capensis; accessory plates very characteristic, long and superficial. Spiracle narrowing abruptly to a long uniform tail.*

Detailed description:—

DORSAL ASPECT: *Palps* rather long, flat or slightly concave dorsally, article 3 longer than 2, and with posterior raised ridge; article 1 fairly visible. *Capitulum*: Basis capituli of the *R. appendiculatus* type, the postero-lateral border about twice as long as the antero-lateral; posterior border straight, with fairly marked sharp cornua, numerous punctations. *Scutum* (about $3 \times 1{\cdot}8$ mm. in average specimens) red-brown, uniformly and deeply punctate all over, including the lateral borders and festoons; cervical grooves nearly circular pits, not continued as posterior depressions; festoons longer than broad and very punctate. Dorsal furrows linear, sub-equal, nearly parallel. *Body*, with light

[1] Some ticks which Dönitz has alluded to as *R. pravus* (Dönitz, 1910, p. 479) but has never formally described, and of which he has kindly sent us specimens, seem to belong to this variety, though their eyes are exceptionally prominent.

yellow integument, extends far beyond the scutum posteriorly in distended specimens, the caudal appendage being unusually strong, but without a terminal plaque. Red-brown plaques correspond to the festoons on either side. Only one of the 37 ♂s was without the caudal appendage, and in this the accessory plates were hardly visible.

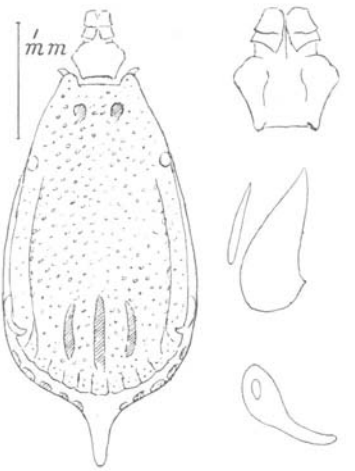

Fig. 6. *R. longiceps* n. sp. ♂. Dorsal aspect, capitulum, anal plates and spiracle. Original, C. W.

VENTRAL ASPECT: *Integument* yellowish-white in all the specimens. *Auricular ridges* slight. *Coxa* I rather short; coxa II triangular; the internal spur almost absent on coxae II and III; the spurs on coxa IV small and well separated. *Anal plates* somewhat clavate, usually with an internally directed point (as in *R. capensis*); they tend to become broader distally in large specimens. Accessory plates long superficial strips of hard chitin, salient posteriorly. *Legs* rather long; pads long. *Spiracles* enlarged anteriorly, then constricted to a long slightly curved tail of uniform width.

Female. *Capitulum* remarkably long (0·8 mm.), due chiefly to the unusual length of articles 2 and 3 of the palps; basis capituli punctate, with straight posterior border and slight cornua; porose areas large, the interval rather greater than the diameter. Palps with article 1 long, but partly concealed by article 2 which is very long and produced backward to a point; article 3 long and narrowing distally. *Scutum* sub-circular, deeply emarginate, deeply punctate all over:

lateral grooves fairly well-marked for two-thirds the length; cervical grooves fairly deep and only slightly convergent. *Dorsum* with numerous very large punctations. *Spiracle* short comma-shaped, rather sharply recurved.

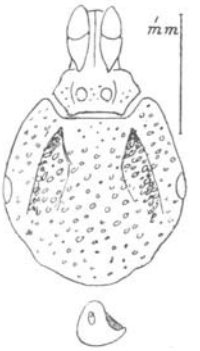

Fig. 7. *R. longiceps* n. sp. ♀. Capitulum, scutum and spiracle. Original, C. W.

Described from 18 ♂s and 3 ♀s (No. 351) from "Klipspringer Bok" taken by Dr F. C. Wellman in 1907 in the Benguella Hinterland, Angola, long. E. 15° 05′ lat. 12° 44′, altitude 1360 metres, and 19 ♂s and 2 ♀s (No. 393) in a mixed collection of ticks taken by the same collector in the same district during 1908 but with no host recorded. Types in Cambridge.

R. sculptus n. sp.

Figs. 8, 9.

Male. Very large, a well-developed specimen measuring 4 mm.

Salient features: *Inornate; Basis capituli not much broader than long. Lateral angles anterior. Coxae somewhat prominent. Lateral grooves, dorsal furrows, anal plates and spiracles much as in R. supertritus. Sculpture of scutum very characteristic, glossy raised ridges defining a very distinct pseudo-scutum and outlining the dorsal furrows; the rest of the surface consisting of extremely rough shagreened tracts from which arise raised areas which are deeply punctate.*

Detailed description:—

In most respects much like *R. supertritus* Neumann, 1907, but: Average size somewhat larger. *Basis capituli* rather broader in comparison. *Coxa* I less prominent anteriorly, the projection curving sharply

outward. *Legs* yellower, contrasting strongly with the dark brown of the highly chitinised portions of the body. *Accessory plates* absent.

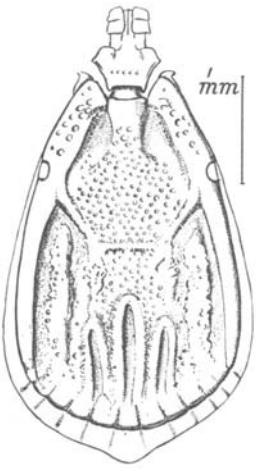

Fig. 8. *R. sculptus* n. sp. ♂. Dorsal aspect. Original, C. W.

Female. Like *R. supertritus*, but: Larger, the scutum measuring 1·8 × 1·8 mm. *Scutum* with lateral ridges less divergent and longer, converging behind the eyes, so that the whole strongly punctate central area is framed by a glossy raised border; a raised punctate area or island

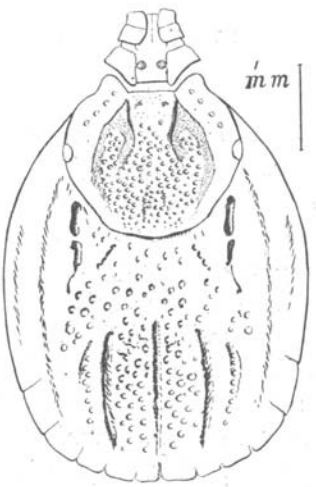

Fig. 9. *R. sculptus* n. sp. ♀. Dorsal aspect. Original, C. W.

is present in the region between the cervical grooves and the lateral ridges. *Dorsum* strongly punctate and grooved (see Fig. 9).

The short white hairs on the dorsum, especially along the marginal grooves, are extremely stout and thickly set.

Described from 11 ♂s and 5 ♀s (E. R. C. No. 230 *a*) from roan antelope, Mpalali R., Marimba, Nyasaland (Old, I. 1911) in company with *R. supertritus*, *H. aegyptium* and *B. australis*. 1 ♂ (E. R. C. No. 227 *a*) from the same locality and host (Old, I. 1911) in company with numerous other species. 3 ♂s and 1 ♀ (No. 115 *b*) from zebra, S. Rukura Valley, N. Nyasaland (Neave, VI. 1910) in company with *R. simus*, *R. capensis*, *R. sanguineus* and ticks of other genera. Types at British Museum and Cambridge.

R. appendiculatus, *R. supertritus* and *R. sculptus* are three forms closely allied and in certain structural points practically identical, but presenting quite a different facies on account of their progressively complicated scutal sculpture in both sexes.

Notes on some obscure species of Rhipicephalus.

R. ecinctus Neumann, 1901 and **R. maculatus** Neumann, 1901.

In his *Révision de la Famille des Ixodidés*, Part IV, 1901, Neumann described *R. maculatus* ♂ and ♀ and *R. ecinctus* ♂. *R. maculatus*, curiously enough, was taken from a beetle, *Platymeris horrida*, in the Cameroons; *R. ecinctus* ♂ was described from specimens from an unknown source in the Berlin Museum. Later ("Notes sur les Ixodidés," VI. *Arch. de Parasitol.* 1908), Neumann recorded the occurrence of *R. ecinctus* on the buffalo at Mt. Njiro, British E. Africa, and described what he took to be its female. In the same tube were specimens of *R. pulchellus*, *R. simus* and *R. oculatus*.

Through the great courtesy of the authorities of the Berlin Museum I have been able to examine the types of these species, and I have also recently received, through the Entomological Research Committee, further specimens which throw an unexpected light on the subject. The specimens in question are these:

(1) 5 typical *R. ecinctus* ♂s and 4 ♀ ticks unmistakeably belonging to them, taken (in company with *R. supertritus* and *R. evertsi*) from a buffalo in British E. Africa by Dr H. S. Stannus, I. 1911 (E. R. C. No. 193).

(2) 9 ♂ ticks showing various grades of maculation between *R. ecinctus* and *R. maculatus*, and taken from the same host during the same month by Dr Stannus (E. R. C. No. 194).

(3) 4 ♂s and 6 ♀s, the ♂s completely uniting *R. ecinctus* and *R. maculatus* and the ♀s as in tube (1), collected from grass at Masongalini, British E. Africa by S. A. Neave, IV. 1911 (E. R. C. No. 263).

(4) 12 ♂s and 16 ♀s, the ♂s mostly *R. maculatus* but some approaching *R. ecinctus*, and the ♀s as before, also taken from grass by S. A. Neave at Mtito Andei, III. 1911 (E. R. C. No. 264 *c*).

From the consideration of these specimens and of the types, two things are abundantly clear; first that *R. maculatus* and *R. ecinctus* are identical, and secondly that the ♀ is as yet undescribed, wrong ♀s having been attributed to both the supposed species.

Now in examining the ♂ types of *R. maculatus* and *R. ecinctus* it was impossible to find any difference except in the maculations of the scutum, and even in the type *R. ecinctus* ♂ the central white spot was distinctly visible. The most characteristic white blotches on a typical *R. maculatus* are a central spot, two rather linear splashes behind the pseudo-scutum, two lateral spots rather behind the middle, and two others more posterior.

In all our specimens the central spot persists, the post-pseudoscutal splashes being next in order of persistency. The other spots are feebly present in some specimens and vividly in others.

R. maculatus and *R. ecinctus* are therefore identical, and the ♀, hitherto undescribed, is diagnosed below.

What, then, are the ♀s which have been attributed to these supposedly different forms?

Now the alleged ♀ of *R. maculatus* is undoubtedly *R. pulchellus* Gerstäcker, 1873 ♀. In the original description it was described as like *R. pulchellus* with certain differences—mostly trifling, and the differences come well within the range of variation we have observed in the numerous specimens of undoubted *R. pulchellus* ♀s we have seen.

The alleged *R. ecinctus* ♀ is a somewhat aberrant *R. simus* ♀. In the original description of *R. ecinctus* ♀ Neumann noted its similarity to *R. simus*. The capitula are precisely alike, the scutum only being rather unusual, but in view of the remarkable tendency to variation already alluded to in *R. simus* there can be little doubt as to the correctness of this conclusion, especially as *R. simus* was present in the tube from which *R. ecinctus* ♀ was described.

To recapitulate, *R. maculatus* takes priority, *R. ecinctus* falling into synonymy. *R. maculatus* ♀ Neumann, 1901 becomes a synonym of *R. pulchellus* ♀, and *R. ecinctus* ♀ Neumann, 1908 is a synonym of *R. simus* ♀. The true ♀ of *R. maculatus* is here described for the first time, and the ♂ is re-described.

R. maculatus Neumann, 1901.

Figs. 10, 11.

Male. Salient features: *Ornate; Basis capituli nearly as long as broad, with sides sub-parallel, rounded in front—coxa I only slightly prominent—punctations few, medium, scattered—lateral grooves absent—dorsal furrows faint or absent—anal plates long, rounded; no accessory plates.*

Detailed description:—

DORSAL ASPECT. *Capitulum*: palps medium, flattened, article 1 fairly visible, article 2 with postero-internal angle somewhat produced; basis capituli like that of *R. pulchellus*, the sides sub-parallel, only slightly salient laterally very near the anterior end; cornua very slight.

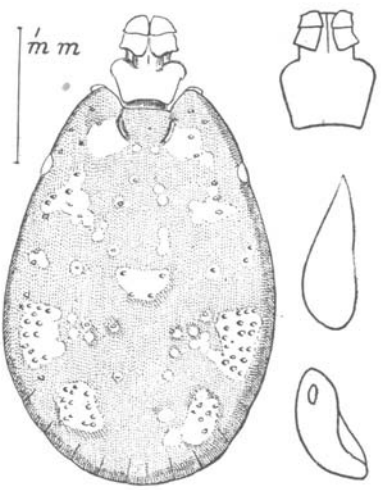

Fig. 10. *R. maculatus* ♂. Dorsal aspect, capitulum, anal plate and spiracle. Original, C. W.

Scutum (3·5 × 2·4 mm. in an average specimen) rather convex, smooth, decorated by white maculations which are more or less obsolete in many specimens; the chief (see Fig. 10) are a median spot and four pairs of

lateral irregular blotches; when all are absent but the median spot the form is that which was described as *R. ecinctus*; cervical grooves deep pits; lateral grooves absent, but indicated by irregular groups of punctations. Eyes medium, rather salient; festoons of moderate length, the externals progressively shorter.

No specimen exhibited a well-marked caudal process.

VENTRAL ASPECT. *Integument* of the same colour as the scutum and coxae. *No auricular ridge* on the basis capituli. *Coxa* I very short; coxae II–IV with spurs rather strong, especially the externals. *Anal plates* with internal border nearly straight, external and posterior borders convex. No accessory plates. *Spiracles* rather narrow and not much curved. *Legs* strong.

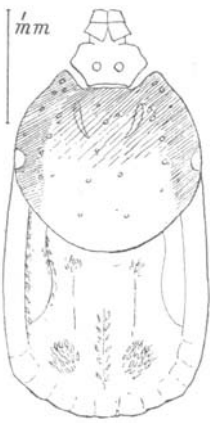

Fig. 11. *R. maculatus* ♀. Dorsal aspect. Original, C. W.

Female. Ornate, the *scutum* presenting a yellowish-white median posterior area, shading off to brown in the front, and variable in size and intensity. *Capitulum*: palps rather long, article 2 somewhat prolonged at its postero-internal border; basis capituli only slightly salient laterally; porose areas medium, far apart. *Scutum* sub-circular, smooth, with few punctations; cervical grooves well-marked; lateral grooves absent or faintly visible at their origin, but indicated by irregular large punctations, external to which the scutum is dark brown; eyes medium. *Dorsum* like that of *R. pulchellus*, having similar patches of clavate white hairs postero-laterally. *Spiracle* sub-triangular, the white area somewhat sharply curved dorsally.

The ♀ greatly resembles that of *R. pulchellus* in general structure but may be immediately distinguished from it by the scutum. The

yellowish-white area is much more restricted, being confined to the region between the usual position of the lateral lines, and it quite lacks the hard enamelled appearance presented by *R. pulchellus*, in which almost the whole of the scutum is of a vivid white. Moreover the scutum of *R. maculatus* ♀ is comparatively much shorter and nearly circular. Types (of ♀) at British Museum and Cambridge. The type ♂ is in the Berlin Museum.

R. simus, R. lunulatus and R. glyphis.

Geheimrath Dönitz very kindly sent us the type specimen of *R. glyphis* ♂ for examination. It is a dry specimen, mounted on a long entomological pin, and therefore not easy to examine from all aspects, but after the closest study I could find no difference between it and

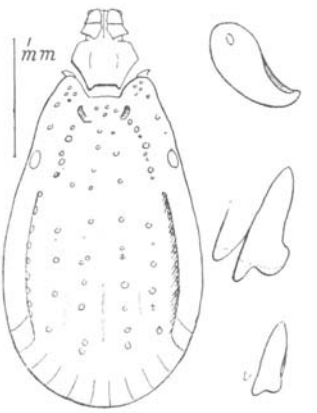

Fig. 12. *R. simus* var. *lunulatus*. Dorsal aspect, spiracle, anal plates (typical), anal plates of another specimen. Original, C. W.

the types of *R. lunulatus* Neumann in the British Museum. I therefore regard *R. glyphis* Dönitz, 1910, as a synonym of *R. lunulatus*. But, in the light of numerous fresh specimens in the collections of the Entomological Research Committee I am unable to consider *R. lunulatus* as anything more than a variety of *R. simus*—and that only in the somewhat loose sense in which the term is applicable to varieties of *Rhipicephalus*. Now *R. lunulatus* ♂ is in all respects a somewhat small *R. simus* except for its very striking anal plates, but unfortunately these grade into each other absolutely, and, moreover, the projections which give to the anal plates of *R. lunulatus* their very distinctive facies are

often transparent and give the effect of being superposed on the anal plates proper to *R. simus*. The females also, of which we possess several specimens, differ from a typical *R. simus* ♀ in having their scuta usually more angular and more punctate, but the females of undoubted *R. simus* differ considerably in this latter respect.

The *lunulatus* form of *R. simus* occurs frequently on large mammals in Nyasaland. The ♂ type was from a horse in the Congo Free State, near the river Lualaba.

To recapitulate, *R. lunulatus* must be degraded to a variety of *R. simus*. *R. glyphis* lapses to a synonym of *R. simus* var. *lunulatus*.

R. longus Neumann, 1907.

The single type specimen (a male) of this species proves, on careful examination, to be a somewhat ill-characterised example of *R. falcatus*. Among the numerous specimens of *R. falcatus* possessed by us there are several specimens which match it precisely. *R. longus* (type at Cambridge) therefore lapses and becomes a synonym of *R. falcatus*.

R. supertritus and **R. coriaceus**.

The types of *R. supertritus* Neumann, 1907 in the British Museum are identical with the form described by Nuttall and Warburton (N. and W. 1907) as *R. coriaceus*.

The descriptions both bear the date 1907, but as that of *R. coriaceus* was only published on Dec. 28, *R. supertritus* doubtless has priority. *R. coriaceus*, therefore, becomes a synonym of *R. supertritus*.

REFERENCES.

The references are to the "Bibliography of the Ixodoidea" in *Ticks, a Monograph of the Ixodoidea*, Cambridge University Press, 1911.