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TICKS

A MONOGRAPH OF THE *IXODOIDEA*

BY

GEORGE H. F. NUTTALL, F.R.S.,
C. WARBURTON AND L. E. ROBINSON

PART IV

(THE FIRST PART OF VOLUME II)

THE GENUS AMBLYOMMA

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W. Dönitz.

WILHELM DÖNITZ
Born 27th June, 1838, in Berlin
Died 12th March, 1912, in Berlin

TO WHOSE MEMORY THIS
FASCICULUS IS DEDICATED

THE GENUS AMBLYOMMA

By

L. E. ROBINSON,

PH.D. (CANTAB.), A.R.C.SC. (LOND.)

CAMBRIDGE

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PREFACE

As the Introduction deals with many of the topics which, in the previously published parts of this Monograph, have appeared in the Prefatory Chapter, it would be superfluous to repeat them here.

With six exceptions (*astrion, fulvum, fuscum, geoemydae, guianense* and *parvum*), types or co-types of which I have not been able to examine, the specific descriptions are original. Many of the species are here figured for the first time, and, of the 130 text-figures, 116 are original.

All the drawings were made with the aid of the Abbe-Zeiss camera-lucida. Unless otherwise specified, the scale included in each text-figure represents a length of one millimetre. The photomicrographs (Plates III–VI) were taken with a Zeiss "Planar" lens, using a Wratten K 3 light-filter and Wratten panchromatic plates.

The immature stages of very few species of *Amblyomma* are known, and I have not been able, with such scanty material, to make satisfactory specific descriptions of the larval and nymphal forms. The selection of specific characteristics is difficult, and, until examples of many different species are available for comparison, the descriptions are of doubtful value: moreover, the examination of the immature forms involves the use of cleared and mounted specimens and a high degree of magnification. I have, therefore, excluded the immature forms in my descriptions.

A brief diagnosis, embodying the salient specific characteristics, appears for the first time in this fascicle of the Monograph, as a preamble to each specific description.

For the coloured plates (I and II) I have to thank Professor G. H. F. Nuttall, who has also lent the blocks for the frontispiece portrait and for Plate VII. In all cases where text-figures other than originals have been used, acknowledgment is made in the legend.

Owing to the almost complete intermission of this work, from the time of the commencement of the war in 1914 until 1920, and since then to many interruptions and the pressure of other duties, I cannot presume that errors and omissions have been avoided. I trust that such as may be found will be few in number and not of serious importance.

The work was commenced in the Cooper Laboratory for Economic Research, Watford; the greater part was carried on in the Quick Laboratory and the Molteno Institute, University of Cambridge, and it has been completed at the Cooper Technical Bureau, 47 Russell Square, London, W.C.1.

L. E. R.

LONDON
June 1925

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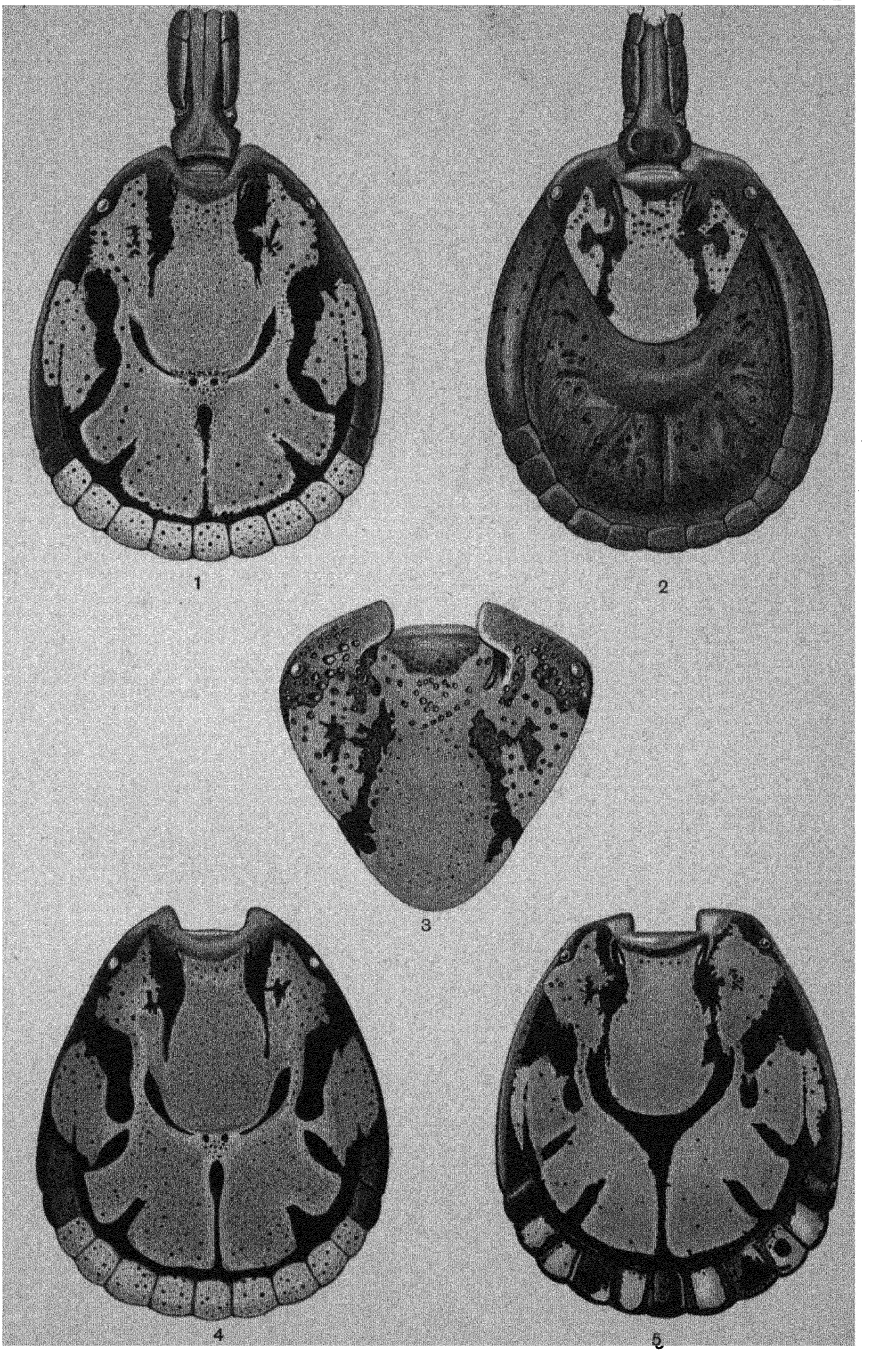

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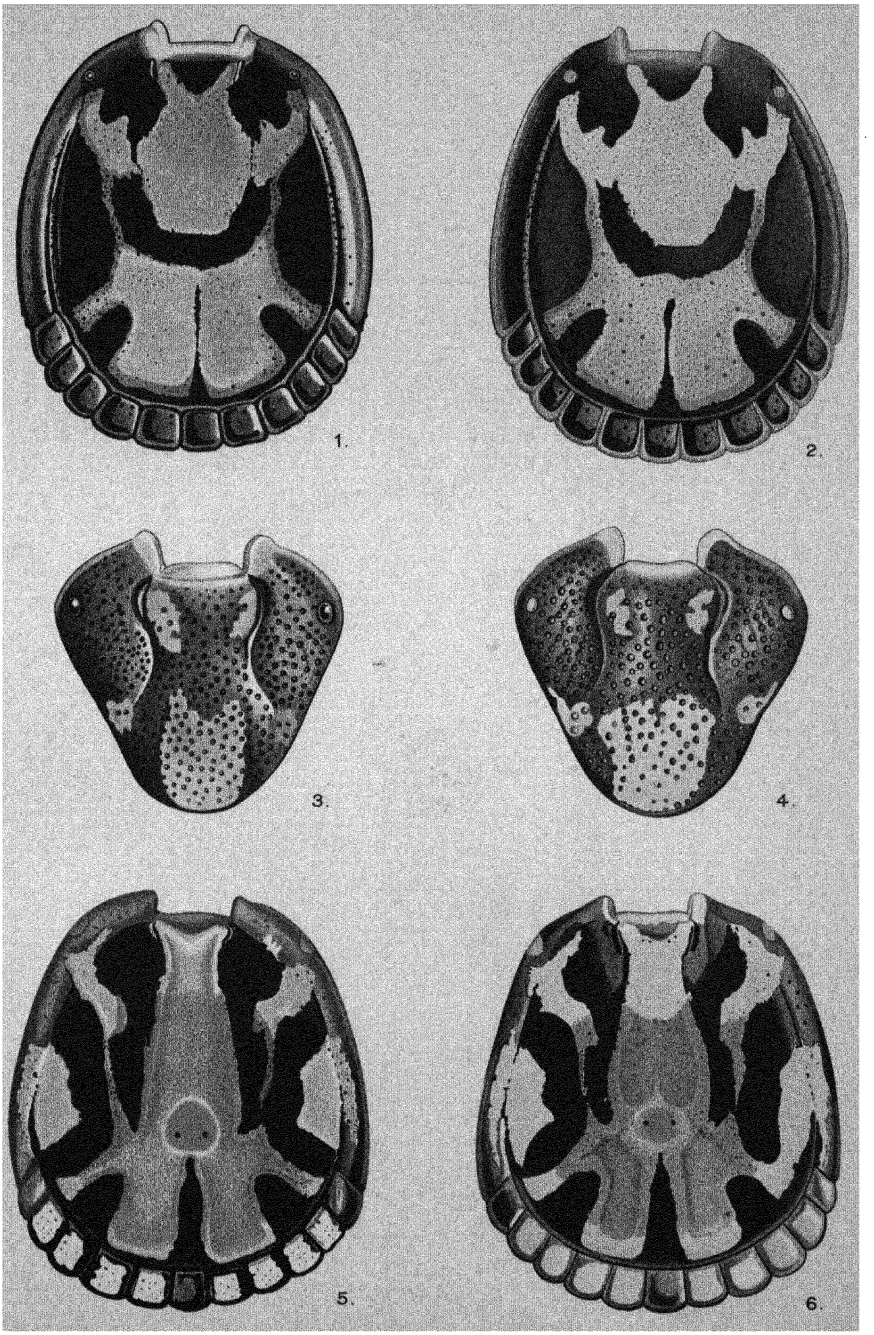

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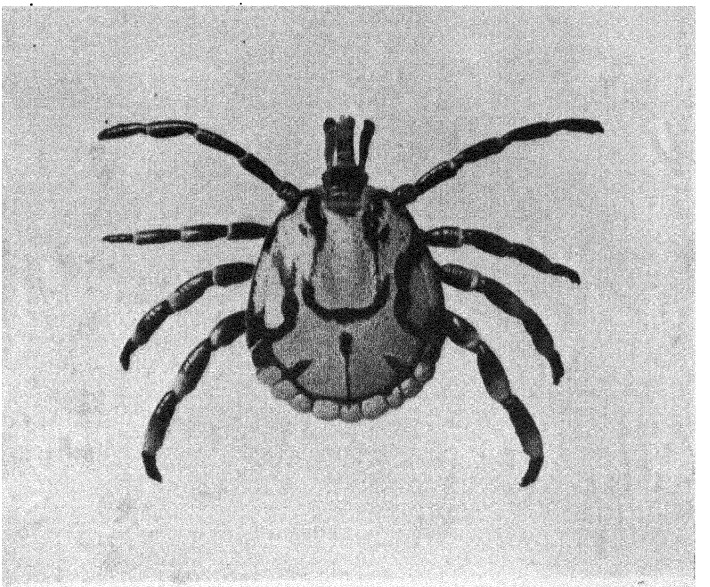
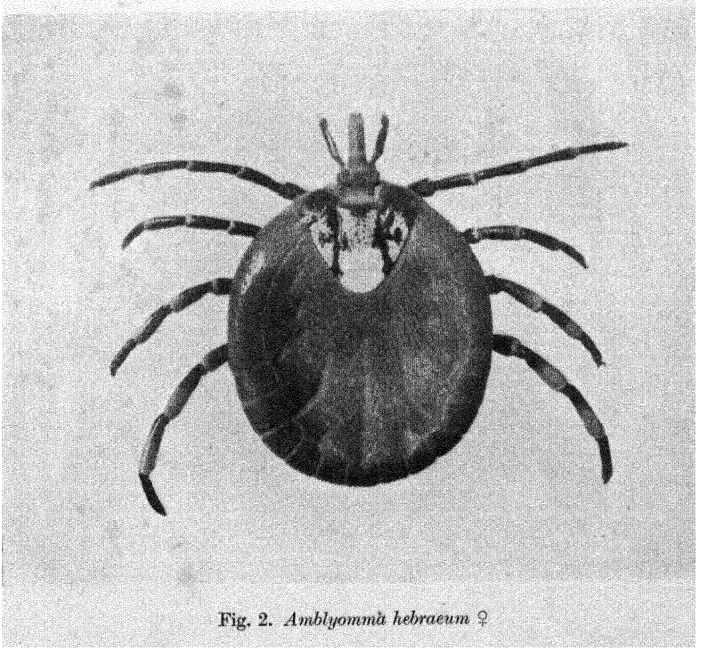


Fig. 1. *Amblyomma hebraeum* ♂



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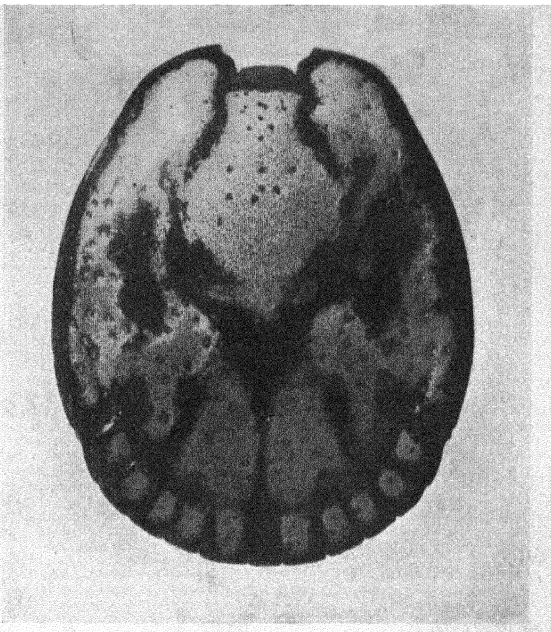

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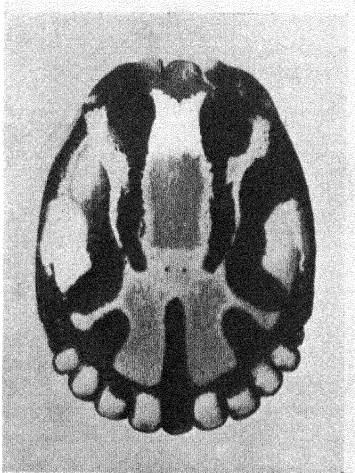


Fig. 2. *Amblyomma splendidum* ♂

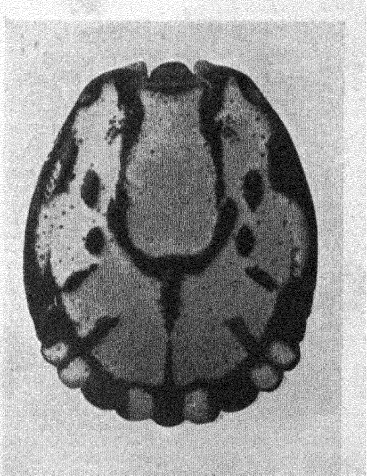


Fig. 3. *Amblyomma gemma* ♂

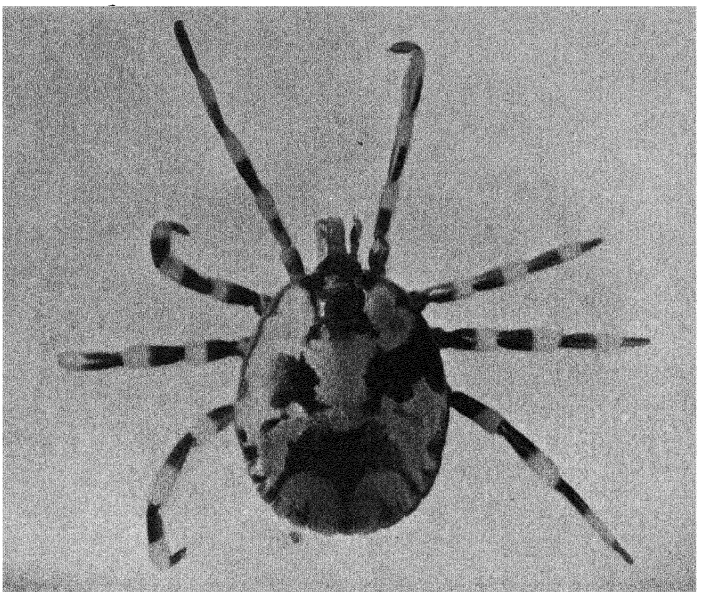


Fig. 1. *Amblyomma personatum* ♂

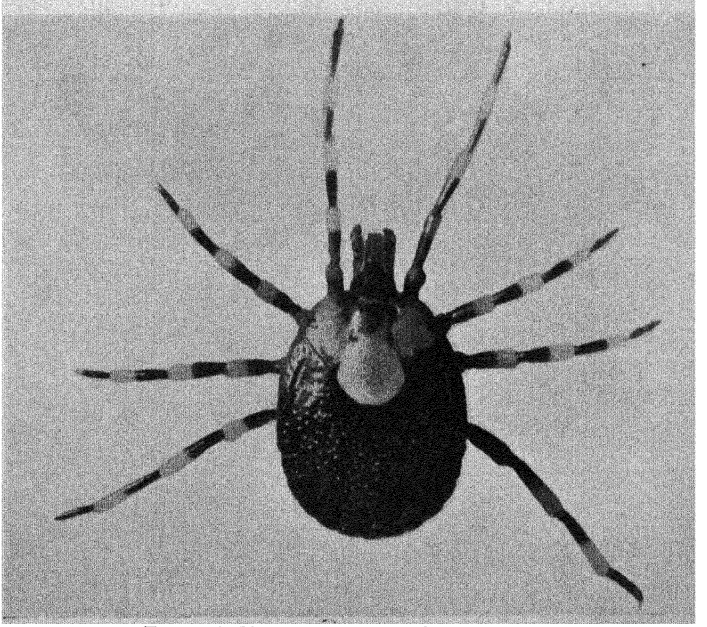


Fig. 2. *Amblyomma personatum* ♀

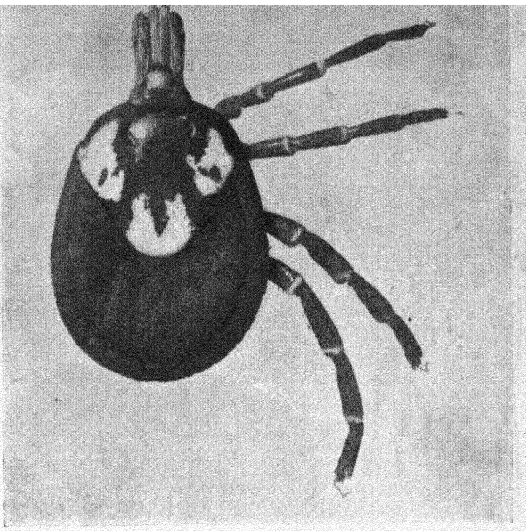
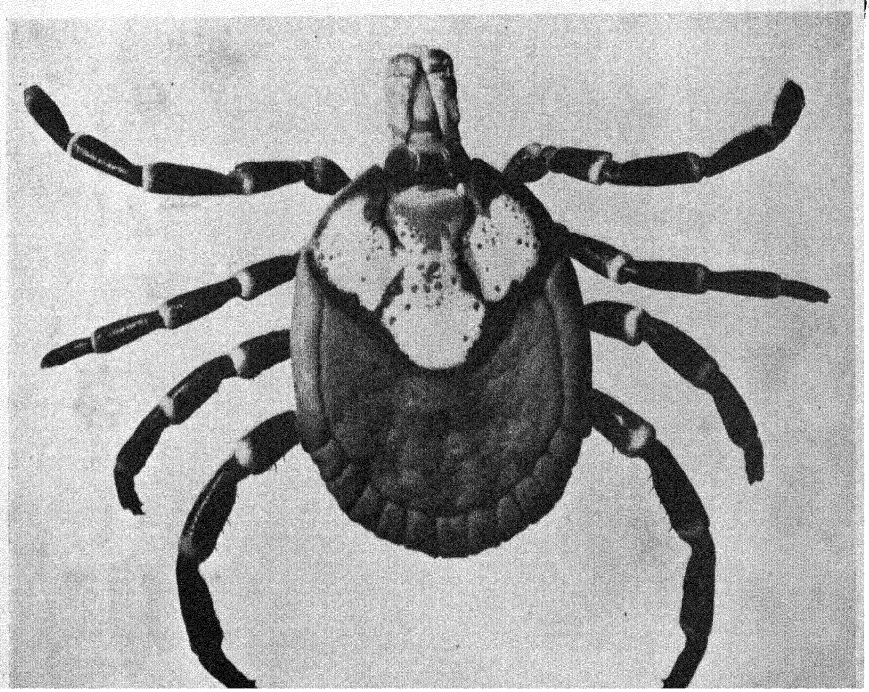


Fig. 1. *Amblyomma tholloni* ♀



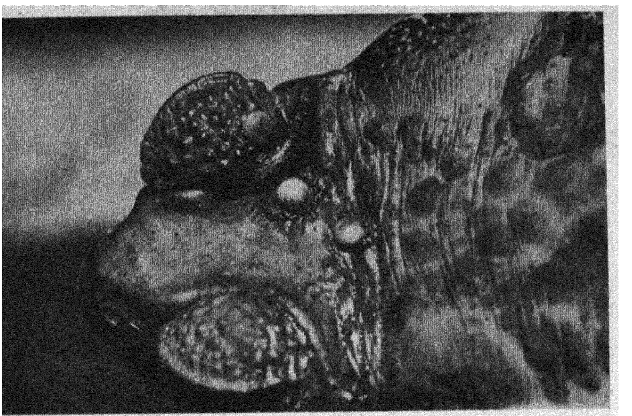


Fig. 1. 3 ♂♂ attached to host's head

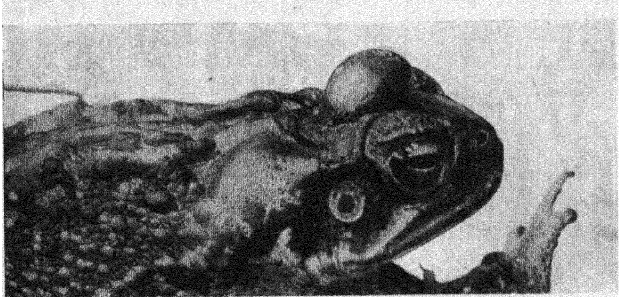


Fig. 2. Engorged ♀ in characteristic position on host's head (slightly under life-size)

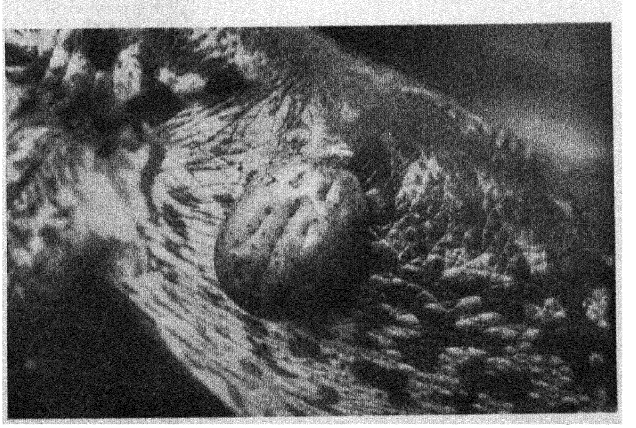


Fig. 3. Engorged ♀ attached to host's body (slightly over life-size)

Amblyomma dissimile infesting *Bufo marinus*. (From G. E. Bodkin, 1918, Parasitology, XI. Pl. II)

IXODIDAE

Genus: AMBLYOMMA.

Introduction.

The genus *Amblyomma*, by far the richest in species of the Tick genera, is especially attractive on account of the beautiful ornamentation which many of its members exhibit. The geographical distribution of the genus is remarkably extensive, comprising both the Old and New Worlds, with a north and south range extending approximately to the 40th parallels of latitude. Of the eighty-six definitely established species, about one-half are American; some eighteen species are found in Africa; Asiatic species amount to about seven; Australian species six; and the rest are distributed among certain of the Pacific islands. A single species only has been recorded from Europe (Spain).

The host range is also very wide, including examples from most of the orders of terrestrial Mammalia, particularly Ungulates. Birds are rarely attacked by the adult forms, but are frequently the hosts of the immature forms (nymphs and larvae) of certain species. The terrestrial Reptilia furnish numerous hosts among the Lacertilia, the Ophidia and the Chelonia. The Amphibia are represented by a batrachian (*Bufo*). Neumann (1911, p. 82) records a unique case of an invertebrate host of *Amb. variegatum*—a slug (*Limicolaria*). In his description of *Amb. maculatum* (1899, p. 252) he records the occurrence of the species on a beetle (*Cercus campestris*), an error which he corrects later (1901, p. 305); the host was a deer (*Cervus campestris*).

From the economic aspect the genus *Amblyomma* is less important, perhaps, than some others (*Boophilus*, *Rhipicephalus* and *Dermacentor*). A single species is definitely known to be the natural means of transmission of disease, viz. the African "Bont Tick" (*Amb. hebraeum*), which is the carrier of the infective virus of a disease affecting sheep, goats and calves in South Africa, and known as "Heart-water," from the characteristic symptom of a considerable serous effusion into the pericardial sac. *Amb. variegatum*, a species commonly found on cattle in Africa, is suspected as being a probable transmitter of Heart-water.

Recently, Maver (1911) has indicated *Amb. maculatum* as being a transmitter of Rocky Mountain Spotted Fever in man. Leaving out of account the question of disease transmission in the strict sense, many of the species of the genus *Amblyomma* cause severe injury to domestic stock —bovines, equines, sheep and goats—by the enormous quantities of blood which they abstract from their hosts when present in large numbers, and by the suppuration of the wounds which they inflict, and by general tick worry. Sloughing of the teats, and even of the entire udder, in cows, is by no means a rare occurrence in some parts of Africa where the larger bovine-infesting Amblyommas are common. In some parts of Africa pyolymphangitis and pyaemia of equines is directly attributable to the agency of ticks (*Amb. variegatum* and other species), which act as mechanical carriers of the pathogenic organisms present in the soil. Where the ticks are absent the disease does not occur, and where effective dipping measures are practised, the disease tends to disappear.

Amb. cajennense, a common species in the West Indies and Central and South America, is often a troublesome pest at certain seasons of the year, when the larvae swarm in thousands in the grass and herbage and attack both man and domestic animals with avidity. According to Hooker, Bishopp and Wood (1912, p. 141) *Amb. maculatum*, also an American species, is a source of great annoyance to domestic animals, particularly dogs, horses and cattle. It has a predilection for the insides of the ears where its bites often set up suppuration, and the lesions so formed afford opportunities for attack by the screw-worm fly (*Chrysomyia macellaria*). The larvae of the fly may destroy more or less completely the supporting cartilage of the ear, leading to an unsightly deformity known as "gotched ear."

Before turning from the economic aspect of the Amblyommas, one may quote an interesting medicinal application, recorded by Lahille (1905, p. 153) as follows: "Je dois noter en passant une curieuse application des *A. maculatum* à la médicine des derniers descendants des Indiens du Rio Negro. Lorsque les cors-aux-pieds, assez fréquents chez eux et dus à l'usage des bottes de *potro* s'enflamment, ils prennent deux à trois garrapates et ils les font se fixer autour du cor en guise des sangsues, en ayant bien soin naturellement de ne pas les blesser ensuite. Ils les laissent en place jusqu'à ce qu'elles tombent!"

The first comprehensive account of the genus *Amblyomma* is that of C. L. Koch, in his *Systematische Uebersicht über die Ordnung der Zecken* (1844). In that work he creates the genus, and gives very brief descriptions of 47 species, many of which have since lapsed into synonymy.

Three years later, in the fourth volume of his *Uebersicht des Arachnidensystems* (1847), he elaborates his previous descriptions and gives coloured figures illustrating each species, male and female, when both forms are known. In many cases his descriptions are inadequate, but where these leave one in doubt, his figures, though poor, are sometimes sufficient to make the recognition of his species certain. Fortunately, a considerable number of his types are still preserved in the Zoologische Museum, Berlin. Koch laid the foundation of the systematic classification of the ticks, but not until 1897, when Neumann published the first part of his *Revision de la Famille des Ixodidés*, was any material advance made in so far as the genus *Amblyomma* is concerned. In the intervening years isolated descriptions of a few new species were published by various authors. Neumann was the first to write really adequate specific descriptions of ticks. In his third part of the *Revision* (1899) he deals with the genus *Amblyomma*, describing 86 species of which nearly half were new and most of which are still sound. He also introduces a useful analytical key. In Part IV of the *Revision* (1901) he describes a few new species and completes the description of many forms of which one sex only had been described previously, and includes a revised analytical key, a comprehensive list of synonyms, and tables showing the geographical distribution and host relationship of the then known genera and species of the Ixodoidea. Since that time Neumann has made numerous additional contributions to the systematic literature, all of which are of the highest value. In 1909 Dönitz published his paper, "Ueber das Zeckengenus Amblyomma," in which he urges the importance of the ornamentation as an aid to the specific determination of the ornate examples. It is a somewhat remarkable fact that although Koch had commented upon the scutal ornamentation of the males, recognising that it conformed to a definite scheme, none of those who continued and extended his work during the following sixty years, appears to have realised the immense value of a systematic coordination of the various ornate patterns which most Amblyommas display on the scutum. Dönitz orders the chaos and reduces what hitherto had been unmethodical description to a coherent plan. The determination of species in the genus *Amblyomma* is often a matter of great difficulty, because the available morphological characters are few and lend themselves to little variation in combination. The ornamentation, being directly related to the underlying musculature, presents well-defined and constant features which are helpful in the highest degree, and in my specific descriptions I have made considerable use of Dönitz's methods.

In bringing this brief and incomplete review to a close, one must allude to the important papers published by Aragão, in Brazil. As previously observed, South America has a particularly rich *Amblyomma* fauna, including numerous small species devoid of conspicuous distinguishing characters. Aragão has had the advantage of access to the fine collection of Brazilian and other South American ticks at the Instituto Oswaldo Cruz, Rio de Janeiro, a collection which he no doubt has been mainly instrumental in forming. His numerous contributions to the systematic literature are highly important.

Space forbids one to make mention in these introductory remarks of all the authors to whose contributions to the literature reference has been made in the subsequent pages, but to whom I now make grateful acknowledgment.

I am deeply indebted to Mr W. F. Cooper for the facilities which he placed at my disposal over a considerable period of time, without which it would have been impossible for me to undertake this work.

I have also to offer my best thanks to all those who have so generously lent type and other specimens, through the intermediation of Professor G. H. F. Nuttall, especially to the Directors of the Zoological Museums of Paris, Berlin and Hamburg, the British Museum, the Museum of the École nationale vétérinaire, Toulouse, and, last but not least, to Professor Nuttall, for the unlimited use which he has allowed me to make of what was originally his private collection, but which he has recently presented to the Molteno Institute for Research in Parasitology, in the University of Cambridge, a collection beyond compare in its wealth of material; also to Mr C. Warburton, for his generous advice and help, particularly in connexion with the many controversial matters which unavoidably arise in a systematic work of this nature.

Explanation of Terms and Signs.

In my specific descriptions I have used the terminology which has been generally adopted in this Monograph. For the explanation of most of the terms and signs used, I would refer the reader to Part II, pp. 127–132. In the descriptions of the species of the genus *Amblyomma* I have found it necessary to introduce a few additional terms, particularly in the terminology relating to the ornamentation.

Capitulum = the "rostrum," "head" or "false head" of various authors.

Basis capituli: *cornua*, in the well-developed form that they exhibit in some other genera of ticks, are rarely found in the Amblyommas. The term *postero-lateral angle* has been used with the qualifications *salient*, *non-salient*, etc.

Palps: the relative lengths of the second and third articles are often an important feature and should be noted.

Hypostome: the dentition is indicated by the sign 3 | 3, 4 | 4, meaning that the specimen possesses three or four longitudinal files of teeth on each half of the hypostome. In some cases a short mesial file of small denticles is present on each side, such cases being signified by $3\frac{1}{2}$ | $3\frac{1}{2}$.

Dorsum: In the descriptions of the female the term is applied to the dorsal surface of the body exclusive of the scutum.

Venter = the whole ventral surface of the body.

Genital grooves: unimportant in the genus *Amblyomma*.

Ventral plaques: present in most male Amblyommas; of little use as specific characters except in forms where they attain exceptional dimensions (*Amb. longirostre, Amb. geayi*).

Ventral scutes: chitinous thickenings of the ventral surfaces of the festoons, usually slightly salient at their posterior margin, and sometimes protruding beyond the posterior margin of the body (*Amb. incisum, Amb. integrum*).

Ornamentation: In my descriptive nomenclature I have adopted in nearly all cases the nearest equivalents in English to the terms used by Dönitz (1909). These equivalents are tabulated as follows:

Ocular spot	= Augenfleck.
Frontal spot	= Stirnfleck.
Cervical spot	= Cervicalfleck.
Cervical stripe	= Cervicalstrich, -streif.
Limiting spot	= Grenzfleck.
Lateral spots	= Seitenflecke.
Falciform stripe	= Sichelfleck, -streif, Falx.
Antero-accessory stripe	= Kelchstreif, -strich, vorderer Nebenfleck.
Marginal spot	= Randfleck.

Figs. 1 and 2 are sufficiently explanatory of the nomenclature relating to the ornamentation.

Ocular spot: A dark-coloured spot surrounding the eye, more or less expanded on the mesial side of the eye.

Cervical spot: A dark spot or patch surrounding the anterior part of the cervical groove, and often encroaching on the scapular field.

Cervical stripe: A more or less narrow dark band extending posteriorly from the cervical spot.

Limiting spot: A dark spot situated at the postero-lateral margin of the scutum in the ♀, and occupying a corresponding position in the ♂.

Frontal spot: A small spot situated in the lateral field of the scutum between the cervical stripe and the antero-lateral margin, sometimes isolated, often fused with one or more of the surrounding dark markings.

Lateral spots: Three spots in the lateral field of the scutum of the ♂, sometimes conjoined to form a *lateral band*, usually represented in the ♀ by short grooves or shallow dimple-like depressions in a corresponding position on the dorsum.

Falciform stripe: A crescentic transverse dark stripe in the middle of the scutum of the ♂, its lateral horns usually directed forward and sometimes fused with the neighbouring dark markings.

Antero-accessory stripes: A pair of more or less longitudinal dark stripes situated on the mesial side of the lateral spots, often more or less fused with the sur-

rounding dark markings, represented in the ♀ by a pair of short grooves situated immediately posterior to the scutum.

Marginal spots: A series of four more or less distinct pale spots on the marginal ridge or fold between the eye and the external festoon (see *Amb. dissimile*, *Amb. marmoreum*). Sometimes represented by a continuous pale stripe (*Amb. limbatum*, *Amb. cajennense*).

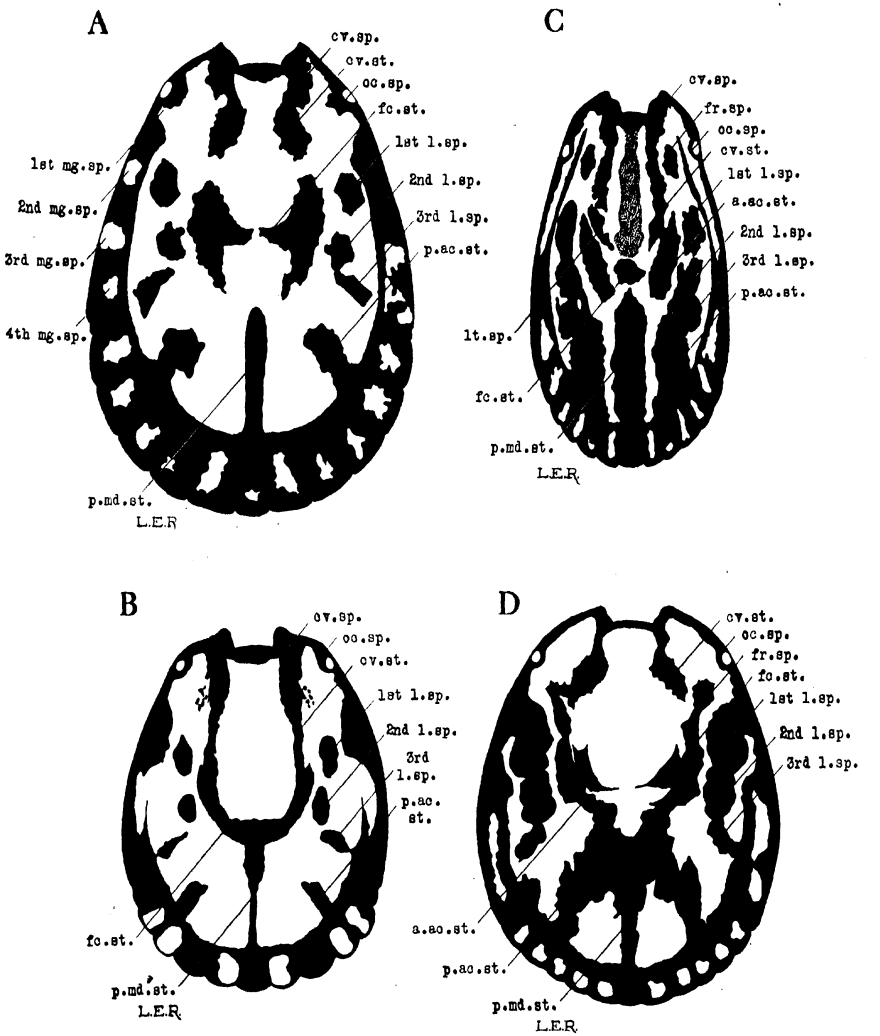


Fig. 1. Ornamentation of scutum in male Amblyommas. A, *Amb. nuttalli*; B, *Amb. gemma*; C, *Amb. maculatum*; D, *Amb. petersi*. *a.ac.st.* antero-accessory stripe, *cv.sp.* cervical spot, *cv.st.* cervical stripe, *fc.st.* falciform stripe, *fr.sp.* frontal spot, *l.sp.* lateral spot, *lt.sp.* limiting spot, *mg.sp.* marginal spot, *oc.sp.* ocular spot, *p.ac.st.* postero-accessory stripe, *p.md.st.* postero-median stripe.

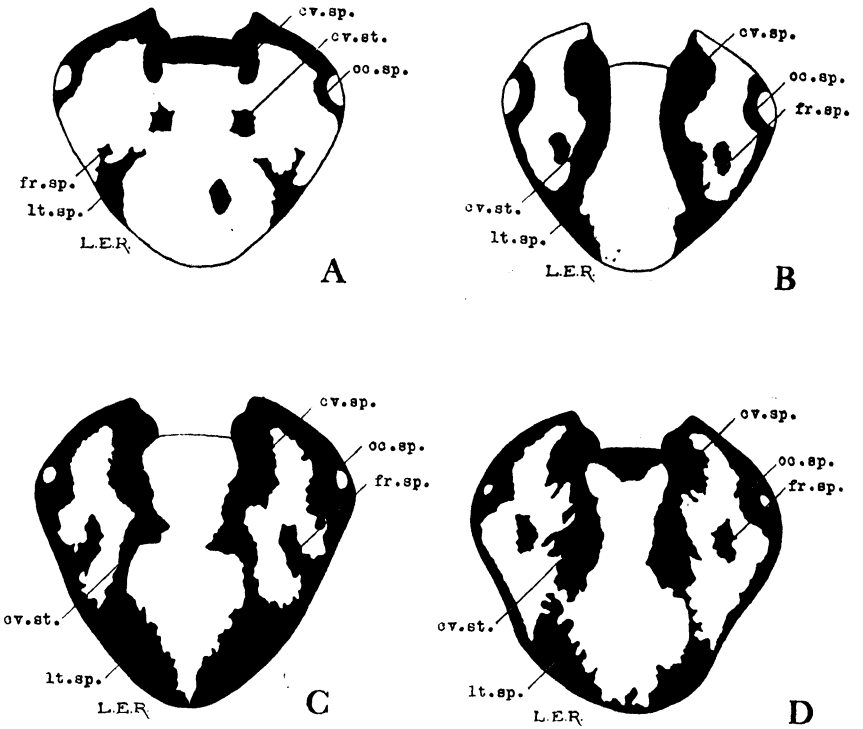


Fig. 2. Ornamentation of scutum in female Amblyommas. A, *Amb. petersi*; B, *Amb. coelebs*; C, *Amb. nuttalli*; D, *Amb. latum*. *cv.sp.* cervical spot, *cv.st.* cervical stripe, *fr.sp.* frontal spot, *lt.sp.* limiting spot, *oc.sp.* ocular spot.

Postero-median stripe: A dark stripe commencing posteriorly at the median festoon and running forwards along the median line towards the centre of the scutum. Sometimes fused anteriorly with the falciform stripe; its anterior extremity may taper to a fine point (*Amb. astrion*, *Amb. variegatum*) or be expanded into a large knob-like extremity (*Amb. eburneum*, *Amb. marmoreum*); represented in the ♀ by the postero-median groove.

Postero-accessory stripes: A pair of symmetrical stripes, each of which commences posteriorly near the third festoon and is directed forwards in a vertical direction, sometimes inclined towards the middle line, or even horizontal (*Amb. integrum*, *Amb. cruciferum*).

The scutal ornamentation of the Amblyommas is usually clearly defined in the living specimens. The dark coloration appears to be mainly hypodermal, for in specimens in which the soft parts have been destroyed by clearing in potash solution for mounting as transparent preparations, the ornamentation disappears almost completely. In alcohol or formalin preserved material, the pale ground colour generally assumes a darker tint, with iridescent red, green and metallic coppery

coloration. If the preservation is adequate the ornamentation usually remains distinct. In dried pinned specimens, the pale ground tends to become lighter coloured, and as a rule such specimens demonstrate the ornamentation very clearly. In cases where the ornamentation has become obscured by defective preservation it is often possible to make it visible by examining the specimens while immersed in alcohol.

The ornamentation of the scutum is subject to a certain amount of variation, which is dependent on the relative size or extent of the dark

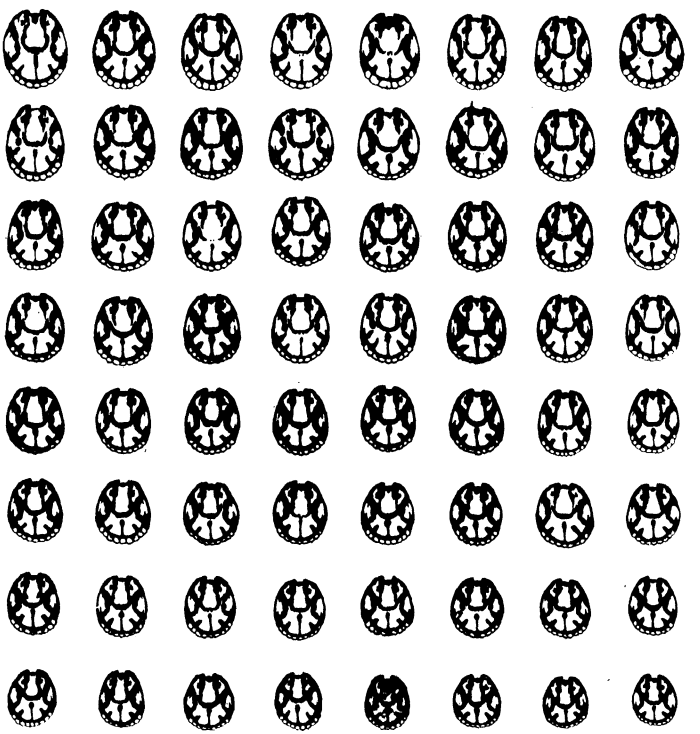


Fig. 3. *Amblyomma hebraeum* ♂. Diagram showing variation of ornamentation of scutum in 64 examples taken at random from a lot of specimens collected at Gonubie, East London, S. Africa.

markings. The general scheme of arrangement and disposition does not vary in individual species. This will be evident from an examination of Figures 3 and 4 illustrating the scutal pattern in sixty-four examples of *Amb. hebraeum* and twenty examples of *Amb. variegatum* respectively, taken at random.

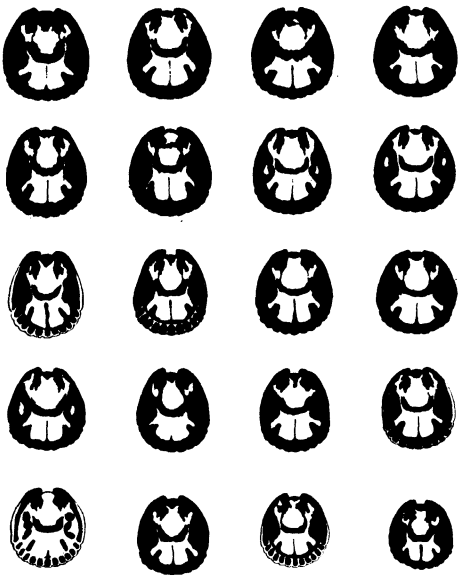


Fig. 4. *Amblyomma variegatum* ♂. Diagram showing variation of ornamentation of scutum in 20 examples taken at random from a lot of specimens collected in Kenya, E. Africa.

Genus AMBLYOMMA Koch, 1844.

Synonymy and Literature.

Acarus 1758. Linnaeus, C., pp. 615–618.—**1778.** De Geer, C., p. 154.—**1794.** Fabricius, J. C., pp. 425–434.

Ixodes 1805. Fabricius, J. C., pp. 351–356.—1863. Gerstaecker, C. E. A., p. 344.

Cynorhaestes 1804. Hermann, J. F., pp. 63, 67, 68.

Rhynchoprion 1804. Hermann, J. F., pp. 69, 71.

Amblyomma 1844. Koch, C. L., pp. 223–231.—**1847.** Idem, pp. 15–20, 50–98.—**1861.** Fürstenberg, M. H., p. 208.—**1877.** Murray, A., pp. 187–188, 201–203.—**1880.** Bertkau, P., pp. 109–110.—**1890.** Canestrini, G., pp. 483, 486, 488.—**1892.** Marx, G., pp. 233, 235.—**1896.** Osborn, H., p. 261.—**1897.** Neumann, L. G., p. 325.—**1899.** Idem, pp. 107, 108, 109, 200–283.—**1900.** Ward, H. B., pp. 204, 205 (1900 *a*); p. 436 (1900 *b*).—**1901.** Salmon, D. E., and Stiles, C. W., pp. 470–477.—**1901.** Neumann, L. G., pp. 295–313, 319, 320, 321, 322, 327–333.—**1905.** Lahille, F., pp. 14, 16, 17, 18, 19, 21, 23, 32–42.—**1907.** Dönitz, W., pp. 78–80.—**1909.** Dönitz, W., pp. 440–482; Rohr, C. J., pp. 147–193.—**1911.** Neumann, L. G., pp. 53–92.

Adenopleura 1872. Macalister, A., p. 287.—**1877.** Murray, A., p. 200.

Xiphiastor 1877. Murray, A., p. 201.

GENERIC CHARACTERS: Metastriata, i.e. with anal grooves embracing the anus posteriorly. Generally ornate with dark spots and stripes on a

pale ground. Eyes and festoons present. Palps usually long, with article 2 especially long. Basis capituli of variable form. The ♂ without adanal shields but often with ventral plaques. Spiracles sub-triangular or comma-shaped.

Type species: *Amblyomma cajennense* (Fabricius).

The anal grooves are represented in the majority of the Amblyommas by a semicircular or V-shaped groove with bowed limbs, which may or may not attain and merge into the genital grooves. From the median portion of this circumanal part of the groove, a median anomarginal groove usually runs posteriorly towards the median festoon. Neither the anal nor the genital grooves are of any specific importance in the genus.

The definitely inornate species are few (*Amb. sublaeve*, *Amb. cuneatum* and one or two others). Several species which at first were described as being inornate, have shown distinct ornamentation when adequately preserved material has become available.

The eyes of most Amblyommas are flat or only slightly convex and not orbited. In some species they may be very indistinct (e.g. *Amb. helvolum*, *Amb. sublaeve*). In a few species (e.g. *Amb. latum*, *Amb. parvitarsum*, *Amb. variegatum*) they are hemispherical and orbited.

The palps may be short, especially in the males of certain species (*Amb. furcula*, *Amb. cyprium*).

The ventral plaques are present in the males of most species and attain exceptionally large dimensions in *Amb. geayi* and *Amb. longirostre*. In the case of the latter, this feature led to the placing of the species in other genera (*Hyalomma*, *Haemalastor*). They bear no relationship however to the adanal plates of *Rhipicephalus*, *Boophilus* and *Hyalomma*.

In addition to the features of sexual dimorphism common to all Ixodid ticks, one or two species show further external structural differences in the two sexes (e.g. the coxal and the hypostomal armature in *Amb. goeldii*).

Analytical Key to the Species of the Genus AMBLYOMMA.

Males.

			PAGE
1.	Marginal groove continuous	2	
	,, ,, incomplete or absent	30	
2.	Coxa I with two long contiguous equal or subequal spurs	3	
	Coxa I with one or both spurs short or medium	5	
3.	Scutum elongate oval, spurs on coxa I very long and acute	*ovale* (*fossum* form)	25
	Scutum broad oval	4	
4.	Coxa I with broad flattened spurs	*coelebs*	30
	,, I ,, slender acute spurs	*oblongoguttatum*	33
5.	Coxae II and III each with a short spur not so broad as long, or barely broader than long	6	
	Coxae II and III each with a broad salient ridge-like spur	14	
6.	Coxa I with the external spur long and acute	7	
	Coxa I with the external spur short or medium, not acute	10	
7.	Coxa IV with a long spur	8	
	,, IV ,, ,, short spur	*parvum*	37
8.	Coxa I with a well-developed internal spur	9	
	,, I ,, an insignificant internal spur	*maculatum*	40
9.	Scutum extensively dark-coloured, with pale ornamentation near the periphery	*americanum*	45
	Scutum with dark-coloured salient spots and stripes on a pale ground	*cajennense*	48
10.	Coxa I with the external spur longer than the internal spur, marginal groove striated	*triguttatum*	54
	Coxa I with equal or subequal spurs	11	

			PAGE
11.	Basis capituli trapezoidal, ventral plaques exceptionally large	*geayi*	59
	Basis capituli rectangular	12	
12.	Scutum with extensive pale ornamentation (Cargados Is., Indian Ocean)	*loculosum*	63
	Scutum with scanty pale ornamentation (S. America)	13	
13.	Scutum reddish-brown	*concolor*	66
	,, yellowish-brown	*pseudoconcolor*	69
14.	Palp with a large, transverse retrograde spur on the ventral face of article 1	*cooperi*	72
	Palp without such spur	15	
15.	Scutum with conspicuous large discrete punctations interspersed with fine punctations	16	
	Scutum with or without coarse punctations, the latter crowded in places and more or less confluent when present	20	
16.	Scutum pale-coloured with scanty brown ornamentation.	17	
	Scutum entirely dark-coloured, or with large and distinct spots and stripes	18	
17.	Coxa IV with a long stout spur	*crenatum*	75
	,, IV ,, ,, short rounded spur	*clypeolatum*	79
18.	Scutum extensively dark-coloured, characteristic spots and stripes obscured	*paulopunctatum*	82
	Scutum with distinct characteristic spots and stripes	19	
19.	Scutum with postero-median stripe much dilated at its anterior extremity	*marmoreum*	86
	Scutum with postero-median stripe not appreciably dilated at its anterior extremity	*nuttalli*	90
20.	Eyes small, hemispherical, orbited	21	
	,, flat or slightly convex, not orbited	23	
21.	Festoons particoloured	*lepidum*	94
	,, uniformly dark-coloured	22	

			PAGE
22.	Scutum with punctations coarse and crowded, a red lateral patch enclosed by the conjoined lateral spots and the dark margin	*pomposum*	97
	Scutum with few coarse punctations near the margins, the lateral spots and margin usually confused to form a solid dark lateral patch	*variegatum*	101
23.	Festoons, excepting the external, all pale coloured	*hebraeum*	104
	Festoons particoloured, some pale, others dark	24	
24.	Falciform stripe present	25	
	,, ,, absent	28	
25.	Scutum with postero-accessory stripes more or less fused with the 3rd lateral spots .	*cohaerens*	107
	Scutum with postero-accessory stripes well-separated from the 3rd lateral spots .	26	
26.	Scutum with numerous coarse punctations, postero-accessory stripes small, almost horizontal	*integrum*	111
	Scutum with fine punctations, postero-lateral stripes inclined	27	
27.	Scutum with postero-median stripe much expanded at its anterior extremity . .	*eburneum*	116
	Scutum with postero-median stripe with a small knobbed extremity. . . .	*gemma*	119
28.	Scutum with a small central vermilion-red spot (West Africa)	*splendidum*	123
	Scutum without red spot	29	
29.	Scutum with postero-median stripe in the form of a narrow band, extending at least to the posterior third of the scutum .	*cohaerens*	107
	Scutum with postero-median stripe in the form of a squat isosceles triangle, postero-accessory stripes triangular, very large .	*astrion*	125
30.	Marginal groove distinct	31	
	,, ,, rudimentary or absent .	37	

			PAGE
31.	Coxa IV with a very long acute spur	32	
	,, IV without a long acute spur	33	
32.	Marginal groove interrupted opposite the 5th festoon only	*furcula*	126
	Marginal groove not extending posteriorly beyond the external festoon	*brasiliense*	129
33.	Marginal groove interrupted behind the eye, scapular angles ventriflexed and pointed	*australiense*	134
	Marginal groove not interrupted behind the eye	34	
34.	Scutum large, elongate, ventral plaques exceptionally large (S. America)	*longirostre*	137
	Scutum small or medium, broad oval	35	
35.	Scutum much narrowed anteriorly, "bellows-shaped"	*cuneatum*	140
	Scutum almost elliptical	36	
36.	Scutum with pale spots at the posterior end	*limbatum*	143
	,, without pale spots at the posterior end	*moreliae*	148
37.	Eyes hemispherical, orbited	*latum*	151
	,, flat, not orbited	38	
38.	Coxa I with two spurs	39	
	,, I ,, a single spur	*albopictum*	155
39.	Coxa IV with two spurs	40	
	,, IV ,, a single spur	45	
40.	Hypostome dentition 3 | 3	41	
	,, ,, 4 | 4	43	
41.	Body with long peripheral hairs	*hirtum*	156
	,, almost glabrous	42	
42.	Scutum golden-yellow with scanty pale brown ornamentation (Argentine Rep., S. America)	*testudinis*	160
	Scutum with extensive dark ornamentation (Central and S. America)	*dissimile*	163

			PAGE
43.	Coxal spurs small, very widely separated, trochanters II–IV with spurs (Dutch New Guinea)	*papuana*	171
	Coxal spurs medium, not very widely separated	44	
44.	Scutum with dark ornamentation clearly defined (Florida, Alabama and Cuba)	*tuberculatum*	174
	Scutum with dark ornamentation ill-defined (S. America)	*humerale*	179
45.	Coxa III with two spurs	46	
	,, III ,, a single spur.	47	
46.	Scutum dark-coloured, with distinct pale ornamentation (India)	*supinoi*	183
	Scutum pale, with feeble ornamentation (Haiti)	*cruciferum*	187
47.	Coxa I with two long contiguous equal or subequal spurs	48	
	Coxa I with one or both spurs short or medium	52	
48.	Coxa I with spurs slender and acute	*ovale* (*striatum* form)	25
	,, I ,, stout flattened spurs	49	
49.	Coxa IV with a long spur	50	
	,, IV ,, ,, short or medium spur	51	
50.	Scutum ornate, with small pale spots on a dark ground	*calcaratum*	191
	Scutum inornate, entirely dark-coloured, punctations densely crowded, ridge-like spurs on coxae II and III slightly bifid	*multipunctum*	194
51.	Palps short, subconical, with a salient ridge surrounding the posterior border of article 2, ventral face of article 1 broadly expanded	*nodosum*	196
	Palps long, subcylindrical, ventral scutes of festoons salient at the posterior margin, bifid	*incisum*	199

			PAGE
52.	Coxa II with two spurs, the internal spur very small	*scutatum*	202
	Coxa II with a single spur	53	
53.	Coxae II and III with a short spur, not so broad as, or barely broader than, long	54	
	Coxae II and III each with a broad curved salient ridge, or a rounded spur much broader than long	66	
54.	Hypostome dentition 3 | 3	55	
	„ „ 4 | 4	61	
55.	Coxa I with moderately long or stout spurs	56	
	„ I „ small short spurs	58	
56.	Scutum large, elongate, with numerous deep and coarse punctations	*varium*	205
	Scutum small, punctations fine or medium and shallow	57	
57.	Coxa I with two acute subequal spurs, punctations fine	*pacae*	209
	Coxa I with unequal spurs, the external spur acute, punctations medium and shallow	*mantiquirense*	212
58.	Scutum subtriangular, inornate (S. America)	*fulvum*	215
	„ oval, small	59	
59.	Scutum ornate, with six symmetrical pale spots, an Aponomma-like species (East Indies and Australasia)	*helvolum*	216
	Scutum indistinctly ornate or inornate (Galapagos Is.)	60	
60.	Scutum indistinctly ornate, with an oblique depression extending inwards and forwards from the external festoon	*boulengeri*	219
	Scutum inornate, characteristic spots and stripes represented by shallow depressions	*darwini*	221
61.	Coxa IV with a long spur	62	
	„ IV „ „ short spur	63	

			PAGE
62.	Scutum with numerous coarse punctations distributed generally (Guiana, S. America)	*guianense*	222
	Scutum with few punctations distributed marginally (Australia)	*albolimbatum*	224
63.	Scutum coarsely punctate	64	
	,, with medium or fine punctations .	65	
64.	Scutum subcircular, postero-accessory stripes represented by oblique shallow depressions	*caelaturum*	227
	Scutum broad oval, narrower in front, postero-accessory stripes almost horizontal, not depressed	*cyprium*	233
65.	Scutum indistinctly ornate, punctations numerous and of medium size (Brazil, S. America)	*pictum*	238
	Scutum inornate, punctations very fine (Solomon Is.)	*nitidum*	240
66.	Scutum ornate	69	
	,, inornate.	67	
67.	Hypostome dentition 3 | 3	68	
	,, ,, 4 | 4	*goeldii*	241
68.	Coxa IV with a broad rounded spur (S. Asia)	*sublaeve*	244
	Coxa IV with a short triangular spur (S. America).	*fuscum*	248
69.	Scutum extensively dark-coloured, with very fine punctations	*tholloni*	249
	Scutum with extensive pale coloration .	70	
70.	Scutum flat, with numerous coarse punctations (S. Asia).	*testudinarium*	253
	Scutum convex, with scanty coarse punctations (Africa)	71	
71.	Scutum with postero-median and postero-accessory stripes forming a figure resembling a bird with expanded wings .	*personatum*	257
	Scutum with antero-accessory and postero-accessory stripes forming an hourglass-shaped figure	*petersi*	260

Females.

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1.	Coxa I with equal or subequal spurs	2	
	,, I ,, unequal spurs, the external spur much longer than the internal	6	
2.	Coxa I with medium or short spurs	3	
	,, I ,, long spurs	12	
3.	Coxa IV with two spurs	62	
	,, IV ,, one spur	4	
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5.	Coxae II and III with spurs as long as broad, or not much broader than long	18	
	Coxae II and III with spurs in the form of a broad salient ridge	41	
6.	Scutum ornate	7	
	,, inornate, small (1·5 mm.)	*parvum*	37
7.	Eyes flat or only slightly convex, not orbited	8	
	,, hemispherical, orbited	*parvitarsum*	38
8.	Coxa I with distinct internal spur	9	
	,, I ,, insignificant internal spur	*maculatum*	40
9.	Coxae II and III with broad flat ridge-like spurs	10	
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10.	Scutum extensively dark-coloured, a pale spot at the posterior angle	*americanum*	45
	Scutum pale with dark markings, a small chitinous tubercle at the postero-internal angle of each festoon	*cajennense*	48
11.	Coxa I with a broad flat internal spur, basis capituli very short in proportion to its breadth	*mantiquirense*	212
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	,, I ,, stout spurs	14	
13.	Coxa I with very long acute spurs . .	*ovale*	25
	,, I ,, moderately long spurs, basis capituli short in proportion to its breadth	*oblongoguttatum*	33
14.	Hypostome dentition 3 | 3	15	
	,, ,, 4 | 4, small chitinous tubercle at the postero-internal angle of each festoon	*incisum*	199
15.	Coxa I with long flattened spurs. . .	16	
	,, I ,, moderately long stout spurs, a small almost inornate species . . .	*pacae*	209
16.	Scutum with extensive pale coloration .	*coelebs*	30
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17.	Coxa IV with spur broader than long, basis capituli sub-rectangular	*nodosum*	196
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18.	Hypostome dentition 3 | 3	19	
	,, ,, 4 | 4	30	
19.	S. American species (including Galapagos Is.)	20	
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20.	Basis capituli subtriangular . . .	21	
	,, ,, rectangular	23	
21.	Scutum elongate oval, almost lozenge-shaped, hypostome lanceolate . . .	*longirostre*	137
	Scutum triangular or cordiform . . .	22	
22.	Cervical grooves in the form of deep oval fossettes, tarsi abruptly attenuated. .	*varium*	205
	Cervical grooves deep and narrow anteriorly, continued posteriorly as shallow depressions	*geayi*	59
23.	Coxa I with stout spurs	*bispinosum*	62
	,, I ,, small spurs	24	
24.	Palps with a stout retrograde spur on the ventral face of article 1	25	
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25.	Scutum reddish-brown	*concolor*	66
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27.	Scutum ornate	28	
	,, inornate	*cuneatum*	140
28.	Dorsum with long stout whitish hairs	29	
	,, without such hairs	*helvolum*	216
29.	Scutum large, cordiform, very coarsely punctate (Cargados Is., Indian Ocean)	*loculosum*	63
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30.	Scutum inornate	31	
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31.	Scutum large, broad cordiform, scapular angles terminating in deflected points (Australia)	*australiense*	134
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32.	Scutum with postero-median field almost devoid of large punctations	33	
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33.	Basis capituli with a median depression and a narrow curved groove between the porose area and the lateral margin	*triguttatum*	54
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35.	Cervical grooves extending to the posterior third of the scutum	*albolimbatum*	224
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	,, triangular, much broader than long (Sumatra, Borneo)	*geoemydae*	230
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45.	Postero-internal angles of festoons salient, scutum very large, scapular angles pointed	*crenatum*	75
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47.	Scutum with three large conspicuous and clearly-defined pale spots, a lozenge-shaped spot in each lateral field, and an hourglass-shaped spot in the median field	*paulopunctatum*	82
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48.	Scutum with few very large punctations scattered over the entire surface, interspersed with very fine punctations . .	49	
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61.	Scutum triangular, pale areas extensive, punctations irregular	*testudinarium*	253
	Scutum cordiform, brown, with small irregular pale spots, large discrete punctations	*clypeolatum*	79
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63.	Body with long whitish hairs	64	
	„ almost or completely glabrous	65	
64.	Hairs tufted round the posterior border, palps club-shaped	*hirtum*	156
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65.	Scutum ornate	66	
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67.	Scutum with few punctations in the antero-lateral fields, almost absent elsewhere	*dissimile*	163
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68.	Eyes bulging laterally beyond the margin of the scutum (Singapore)	*extraoculatum*	170
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69.	Eyes small, hemispherical, orbited	*latum*	151
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70.	Coxa I with spurs distinctly longer than those on the other coxae, internal spurs on coxae II–IV very small	71	
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1. AMBLYOMMA OVALE Koch, 1844.

Figs. 5 and 6.

Synonymy, Literature and Iconography.

Amblyomma ovale Koch, C. L., 1844, p. 227, brief description of the ♂: 1847, pp. 79–80, description of the ♂; Tab. XIV, Fig. 52, ♂ dorsum (coloured). 1899, Neumann, L. G., pp. 252–253, description of ♂. 1911, Neumann, L. G., p. 77, brief description of ♂ and ♀.

Amblyomma striatum Koch, C. L., 1844, p. 228, brief description of the ♂: 1847, p. 85, description of the ♂; Tab. XV, Fig. 57, ♂ dorsum (coloured). 1899, Neumann, L. G., pp. 211–213, description of the ♂ and ♀. 1911, Neumann, L. G., pp. 75–76, brief description of ♂ and ♀.

Amblyomma oblongum Koch, C. L., 1844, p. 229, brief description of the ♀: 1847, pp. 86–87, description of the ♀; Tab. XVI, Fig. 58, ♀ dorsum (coloured).

Amblyomma confine Koch, C. L., 1844, p. 229, brief description of the ♀: 1847, p. 87, description of the ♀; Tab. XVI, Fig. 59, ♀ dorsum (coloured).

Amblyomma auronitens Berlese, A., 1888, p. 192, description of the ♂; Tab. XIII, Fig. 9, ♂ dorsum. 1911, Neumann, L. G., p. 89, brief description of the ♂.

Amblyomma fossum Neumann, L. G., 1899, pp. 217–218, description of ♂ and ♀. 1911, Neumann, L. G., p. 77, brief description of the ♂ and ♀.

After making a careful comparison between numerous specimens of *Amb. fossum* Neumann, from various parts of S. America, and *Amb. ovale* (Koch's type, Berlin Museum), I have no hesitation in declaring them to be identical. The principal distinguishing characteristic of *Amb. striatum* in Neumann's description is the absence of the marginal groove. Koch, in his description of *Amb. striatum* (1847, p. 85), makes the statement "mit einer Randfurche," but later in the same description "ohne deutliche Randfurche." His figure of *Amb. striatum* (Tab. XV, Fig. 57) shows a marginal groove contouring the festoons. From the examination of several lots of ♂s I have come to the conclusion that the *striatum* variety is merely a less strongly chitinised form than the *fossum* variety. In one lot comprising numerous ♂s collected

from the same host, I have found both varieties with intermediate forms. In another lot of 3 ♂s from another host, two belong to the *fossum* variety and the third to the *striatum* form. This explains the apparent contradiction in Koch's description. The ♀s are less easily distinguishable in the two varieties; the *striatum* form is generally paler in colour, the punctations on the scutum smaller and the venter more hairy than in the *fossum* form.

Male (Fig. 5). Diagnosis: A small tick; scutum elongate oval; ornate, with reddish-brown spots and stripes on a pale ground; marginal groove continuous (indistinct or absent in the *striatum* variety); basis capituli with two small depressions simulating the porose areas of the ♀; hypostome dentition 3 | 3; coxa I with two very long, contiguous, pointed spurs; a broad, salient ridge on each of coxae II and III, a moderately long spur on coxa IV.

Description. *Body*: *L.* 2·7–4·2 mm., *W.* 1·65–2·7 mm.; contour elongate oval, lateral margins sub-rectilinear or slightly convex, sometimes slightly concave at the level of the eyes. *Scutum*: convex, scapular

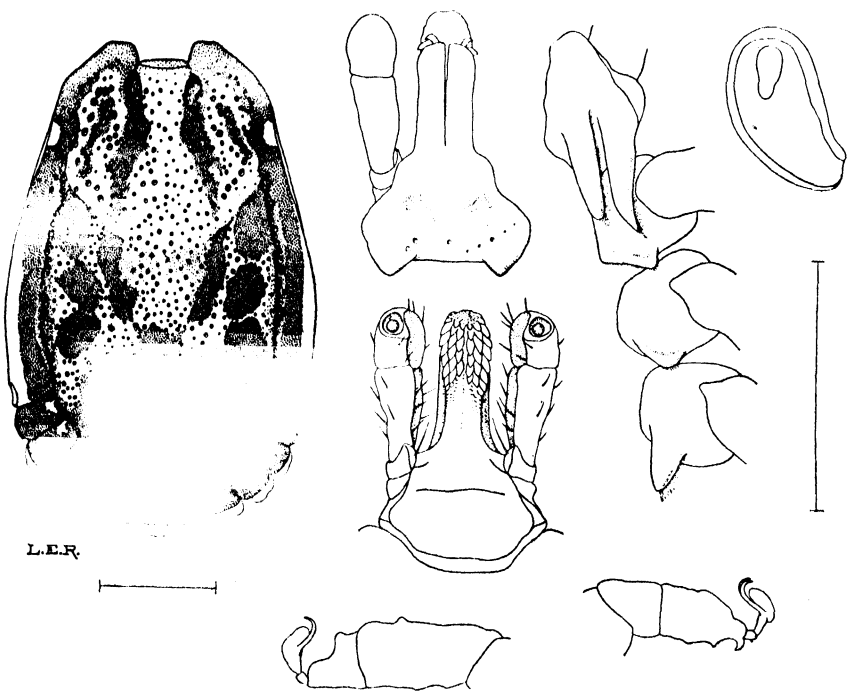


Fig. 5. *Amblyomma ovale* ♂. Scutum, capitulum from dorsal and ventral aspects, coxae, spiracle, tarsi I and IV. (N. 2774.)

N.B. In this and the following figures, the dimension line represents a length of 1 millimetre, unless otherwise specified.

angles truncated; ornate, with reddish-brown spots and stripes on a yellowish ground (in the *striatum* variety the ornamentation is less distinct and the ground colour is generally paler than in the *fossum* variety); postero-median and postero-accessory stripes short and broad, the latter almost vertical; lateral spots large, oval, more or less conjoined; antero-accessory stripes slightly divergent anteriorly; cervical stripes long, tapering posteriorly; frontal spots elongate (the entire median field is sometimes dark-coloured, obscuring, more or less, the cervical stripes, frontal spots and antero-accessory stripes); marginal ridge with a short, narrow, pale stripe bordering the marginal groove opposite the lateral spots; cervical grooves deep anteriorly, often continued for a short distance posteriorly as shallow, divergent depressions; marginal groove commencing some distance behind the eyes, continuous (indistinct or absent in the *striatum* variety); punctations numerous, deep, variable in size and density of distribution in different examples; eyes moderately large, pale and flat; festoons long, well-defined, dark-coloured or with irregular pale markings especially on the 1st, 3rd and 5th. *Venter*: pale earthy-yellow, finely wrinkled and punctate, with scattered whitish hairs; genital aperture opposite coxa II; spiracles large, broad comma-shaped; festoons with ventral scutes (dark-brown in the *fossum* variety) more or less salient at the posterior margin. *Capitulum*: *L.* 0·75–1·10 mm., basis sub-triangular, postero-lateral angles salient, lateral margins convex; with a pair of small depressions simulating the porose areas of the ♀; palps club-shaped, article 2 about one-and-a-half times as long as article 3; hypostome rather short and broad, spatulate, dentition 3 | 3. *Legs*: medium, rather slender, pale reddish-brown, narrowly annulate with white at the extremities of the articles; coxa I with two very long, pointed, contiguous spurs, the external slightly the longer and more sharply pointed, with the tip slightly deflected laterally; a broad, salient ridge on each of coxae II and III; a moderately stout, pointed spur, of variable length, on coxa IV; tarsi attenuated in talus; pulvilli large.

Female (Fig. 6). Diagnosis: A small tick; scutum triangular-cordiform, about as broad as long; ornate, with reddish-brown markings on a pale ground; basis capituli sub-triangular, lateral margins very convex; hypostome dentition 3 | 3; coxa I with two very long, slender, contiguous, pointed spurs; a broad, salient ridge on each of coxae II and III; a single, short spur on coxa IV.

DESCRIPTION. *Body*: *L.* 4·0 mm., *W.* 2·6 mm.; contour elongate oval, narrow in front; dorsum earthy-brown with scattered coarse punctations,

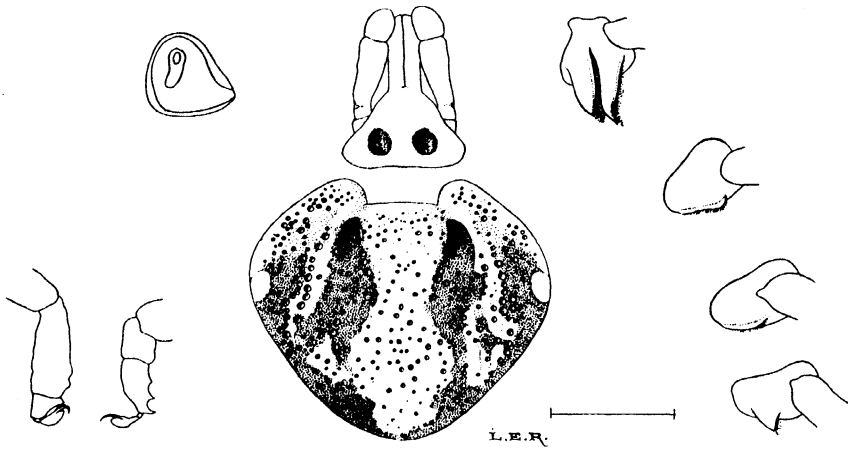


Fig. 6. *Amblyomma ovale* ♀. Scutum, capitulum, coxae I IV, spiracle, tarsi I and IV (N. 2224.)

marginal groove continuous, festoons well-defined. *Scutum*: triangular-cordiform, about as broad as long, 2·3 × 2·2 mm.; posterior angle rather narrow, postero-lateral margins rectilinear or slightly convex, antero-lateral margins convex; ornate, with extensive pale coloration in the median and lateral fields; cervical stripes narrow, divergent, usually extending posteriorly to fuse with the limiting spots; frontal spots elongate, sometimes represented by dark-coloured punctations only; scapular angles dark-coloured; cervical grooves deep anteriorly, shallow and divergent posteriorly; punctations numerous, deep, often confluent in places in the lateral fields, variable in size in different specimens; eyes moderately large, pale and flat. *Venter*: light earthy-brown, with scattered hairs or almost glabrous; genital aperture opposite the interspace between coxae II and III; spiracles moderately large, triangular, with rounded angles. *Capitulum*: *L.* 1·3 mm.; basis sub-triangular, postero-lateral angles slightly salient; lateral margins convex; porose areas medium, oval, divergent, widely-separated; palps relatively longer than in the ♂, club-shaped, article 2 about twice as long as article 3; hypostome sub-spatulate, dentition 3 | 3. *Legs*: stouter than in the ♂, otherwise similar; spur on coxa IV smaller.

Geographical Distribution and Hosts.

Central and **S. America**, from **Mexico** to the **Argentine Republic**. The type came from Mexico and Koch's synonymous forms from Brazil. Berlese's specimen (*Amb. auronitens*) is from the Rio Apa, Brazil-Paraguay frontier. Neumann, in his description of *Amb. striatum* (1899, p. 213) records ♂s and ♀s, off *Canis azarae*, and ♀s, off *hunting dog*, Göldi coll., Colonia Alpina, Brazil; ♀, labelled "oblongum Koch, Bahia" (Berlin Mus.); a ♀, from I. of Marajo, Brazil (Gilles de la Tourette coll.); and a ♂, from Darien, Colombia, Geay coll. (Paris Mus.). Neumann's description of *Amb. fossum* (1899, p. 218) is based on ♂s and ♀, from Costa Rica, Lafon coll. (Paris Mus.), and a ♂, from Buenos Ayres, Argentine Republic. In his most recent description (1911, p. 76) he gives *Canis familiaris* L., *Cervus virginianus* Erxl., and *Homo sapiens* L., as hosts and adds Uruguay to the list of countries. I have examined the following lots of specimens in the Cambridge collection and elsewhere: **British Guiana**: ♂ and ♀, off *dog*, Upper R. Berbice, Hollandia, 21. IV. 1913, Rev. J. Aiken coll. (I.B.E. 871). **Brazil**: ♂, ♀, off *Canis azarae*, Prof. L. G. Neumann donor (N. 223); ♂, ♀, off *dog*, Pirauba, State of Minas, VII. 1907, Dr H. de B. Aragão donor (N. 1263); ♂, ♀, off *dog*, Cantagallo, State of Rio de Janeiro, III. 1908, Dr H. de B. Aragão donor (N. 1271); (?) off *dog*, I. 1914 (N. 2688); ♂s, off *Galictis vittata*, Joinville, Province of Sta. Catharina, W. Ehrhardt coll. (N. 3404); ♂s, off *Canis familiaris* L. or *Nasua socialis*, Province of Sta. Catharina, 5. VIII. 1918, W. Ehrhardt coll. (N. 3405). **Bolivia**: ♂s, off *Speothas venaticus*, Charuplaya, 1900, the Hon. N. C. Rothschild donor (N. 566). **Paraguay**: ♂s and ♀s, host not specified, v. 1913, Prof. L. E. Migone coll. (N. 2219); ♀s, off *cow*, San Pedro, v. 1913, Prof. L. E. Migone coll. (N. 2222 *b*); ♀, off *hunting dog*, v. 1913, Prof. L. E. Migone coll. (N. 2224); ♀s, off *Tapirus* sp., v. 1913, Prof. L. E. Migone coll. (2224 *a*); ♂s and ♀s, off *jaguar*, San Pedro, 12. XII. 1913, Prof. L. E. Migone donor (N. 2774 and 2775); ♂s, ♀s and nymphs, off *Canis azarae*, Asuncion, 1904, Dr A. Kotlán donor (N. 3415); ♀, host not specified, Puerto Cooper, H. Rance coll. (W. F. Cooper coll.). Ribaga (1902, p. 508) records a ♀ from San Pedro (Misiones, Argentina).

2. AMBLYOMMA COELEBS Neumann, 1899.

Figs. 7 and 8.

Lit.: Neumann, L. G., 1899, p. 223, specific description of the ♂; 1906, pp. 213–214, revised description of the ♂, specific description of the ♀; 1911, pp. 70–71, brief description of the ♂ and ♀.

Male (Fig. 7). Diagnosis: A medium-sized, ornate tick; marginal groove continuous; punctations very numerous; festoons long, rectangular, very clearly defined; capitulum short and broad; coxa I with two stout, contiguous spurs; a broad flat spur on each of coxae II and III, a moderately long spur on coxa IV.

DESCRIPTION. *Body*: *L.* 5·5 mm., *W.* 4·4 mm., contour broad oval, widest behind middle. *Scutum*: convex, dark brown with characteristic ornamentation—(1) a large pale patch in each antero-lateral field, interrupted on the internal side by the dark-coloured frontal spot, converging posteriorly towards the median line and forming the outline of a pseudoscutum; (2) a pair of symmetrically disposed pale patches at the posterior end of the scutum, separated from one another by the width of the postero-median stripe and extending laterally as far as the separation of the 2nd and 3rd festoons; (3) a smaller pale spot on each side, between the postero-accessory stripe and the 3rd lateral spot; (4) small irregular pale spots on the median field of the scutum, before and behind the falciform stripe and internal to the lateral spots; (5) small detached pale spots on the marginal ridge, and (6) pale spots on the 3rd and 5th festoons; the dark spots and stripes are so fused together as to be individually indistinguishable; the postero-median and postero-accessory stripes forming a large dark-coloured patch occupying the centre of the posterior half of the scutum; the three lateral spots fused to form a dark patch in each lateral field; marginal groove continuous, commencing some distance behind the eyes in a series of contiguous punctations, narrow and deep in the posterior portion; cervical grooves short, deep and curved; punctations very numerous, moderately large, deep, confluent in places; eyes pale and flat; festoons long, rectangular, very clearly-defined. *Venter* with few scattered short hairs, slightly rugose; genital aperture opposite coxa II; spiracles large, broad, comma-shaped. *Capitulum*: *L.* 1·6 mm., basis rectangular, postero-lateral margins non-salient, two shallow depressions corresponding in position with the porose areas of the ♀; palps stout, club-shaped, article 1 with a blunt,

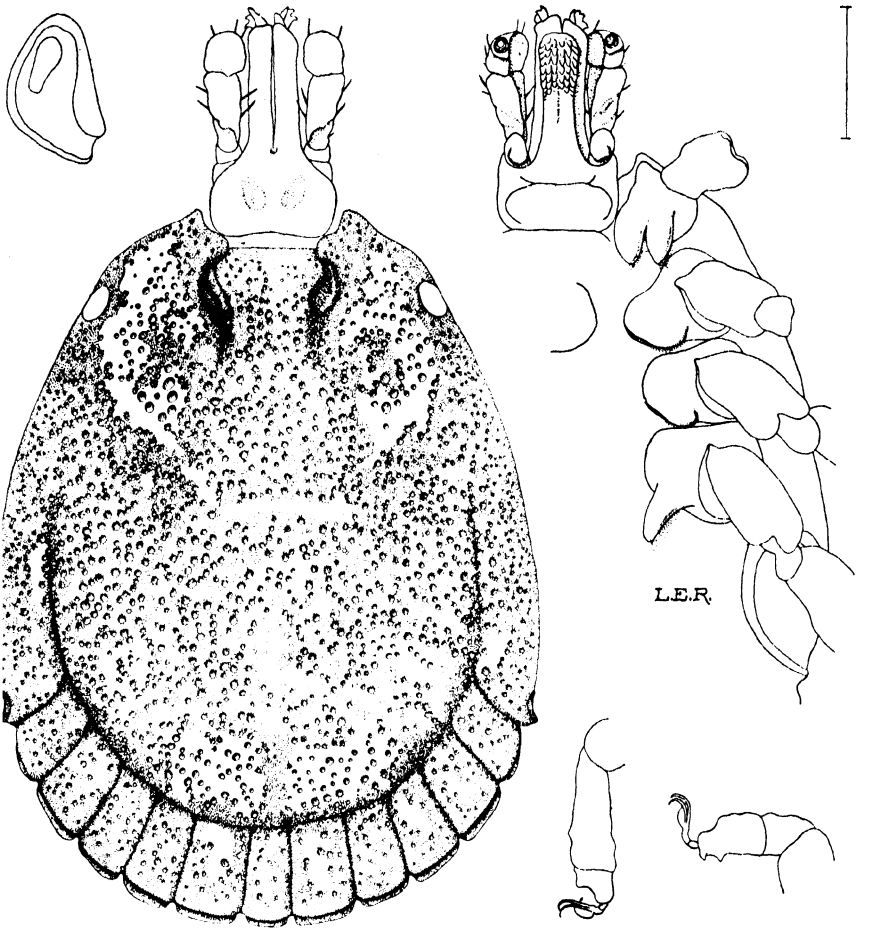


Fig. 7. *Amblyomma coelebs* ♂. Scutum, capitulum from dorsal and ventral aspects, coxae I–IV, spiracle, tarsi I–IV. (N. 2780.)

ventral prominence, article 2 contracted in its postero-dorsal part, barely twice as long as article 3; hypostome rather short, spatulate, dentition 3 | 3. *Legs*: stout, long, dark-brown in colour; coxa I with two equal, stout, flattened, contiguous and pointed spurs; a single, broad, rounded, plate-like spur on each of coxae II and III, a single moderately long and slightly curved spur on coxa IV; tarsi abruptly attenuated.

Female (Fig. 8). Diagnosis: A medium-sized tick; scutum cordiform, with characteristic ornamentation; punctations numerous, deep; cervical grooves deep anteriorly, long **S**-shaped; eyes large; capitulum with postero-lateral angles slightly salient, porose areas large, oval and divergent; coxa I with two moderately large contiguous spurs; coxae II and III each with a broad, flat, plate-like spur; coxa IV with a blunt spur a little longer than broad.

Description. *Body*: *L.* 5·0 mm., *W.* 3·8 mm., contour oval; dorsum dark-brown, glabrous, punctate; marginal groove present; festoons well-defined. *Scutum*: cordiform, 2·5 × 2·8 mm., general ground colour pale, with a narrow dark margin extending from the ocular spot to the limiting spot; antero-lateral margin pale-coloured; cervical stripes extending posteriorly to fuse with the limiting spots; frontal spots small, adjoining the cervical stripes; cervical grooves deep anteriorly, long **S**-shaped, continued posteriorly by shallow, divergent depressions extending to the posterior third of the scutum; eyes large, pale and flat. *Venter*: dark-brown, glabrous, punctate; genital aperture opposite posterior

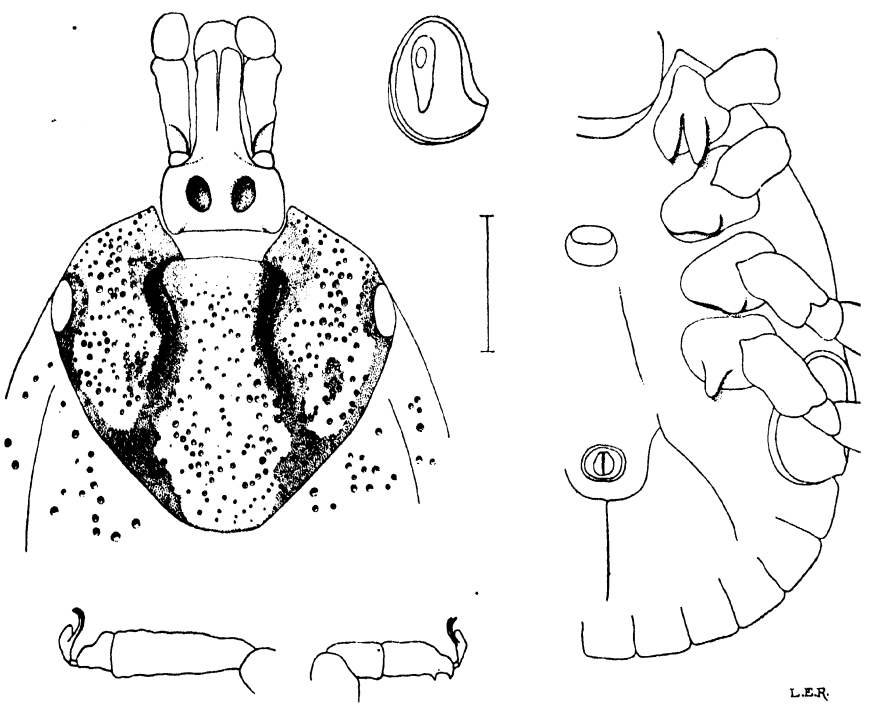


Fig. 8. *Amblyomma coelebs* ♀. Scutum, capitulum, spiracle, venter, tarsi I and IV. (N. 2781.)

border of coxa II; spiracle large, broadly oval, with a short dorsal process. *Capitulum*: *L.* 1·6 mm., basis rectangular, postero-lateral angles slightly salient; porose areas large, oval, divergent, interval equal to diameter; palps stout, club-shaped, article 2 more than twice as long as article 3; hypostome broad, spatulate, dentition 3 | 3. *Legs* long; coxae as in ♂, except that the spur on coxa IV is much shorter, barely longer than broad; tarsi attenuated in talus.

Gorged ♀s may attain a length of 12 mm. and a breadth of 8 mm.

Geographical Distribution and Hosts.

The ♂s originally described by Neumann (1899) came from Guanajuato, **Mexico**, A. Dugès coll., host not specified. Neumann's later description (including ♀) is based on ♂s and ♀s, off *Tapirus* sp., Province of Chiquitos, **Bolivia**, S. America. The Cambridge collection contains a ♂ co-type (N. 2780), from Guanajuato, Mexico, and a ♀ co-type (N. 2781), from Bolivia, presented by Prof. L. G. Neumann. Aragão (1911, pp. 159 and 162) records the occurrence of the species on *Tapirus americanus*, at Baurú and Avanhandava, São Paulo, and Palmeiras, Acre, **Brazil**, S. America.

3. AMBLYOMMA OBLONGOGUTTATUM Koch, 1844.

Figs. 9 and 10.

Synon., Lit. and Iconogr.:

Amblyomma oblongoguttatum Koch, C. L., 1844, p. 228, brief description of the ♀: 1847, p. 83, specific description of the ♀; Tab. XV, Fig. 55, ♀ dorsum (coloured). 1901, Neumann, L. G., p. 296, notes synonymy of *Amb. oblongoguttatum* and *Amb. vittatum*. 1911, Neumann, L. G., p. 77, brief description of ♀: Aragão, H. de B., pp. 177–178, specific description of the ♂; Pl. XII, Figs. 14 and 15, ♂ dorsum and venter.

Amblyomma vittatum Neumann, L. G., 1899, pp. 213–214, specific description of ♀.

Amblyomma darlingi Nuttall, G. H. F., 1912, pp. 50–55, specific description of ♂, ♀, nymph and larva; Figs. 1–4, ♂ and ♀ dorsum and venter, spiracle and tarsus IV, nymphal scutum, capitulum, coxae, spiracle and tarsus IV; dorsum, capitulum, coxae and tarsus IV of larva. Figs. 1 and 2 herein reproduced.

Male (Fig. 9). Diagnosis: A very small tick with a superficial resemblance to *Amb. cajennense*; scutum ornate, with maroon-brown spots and stripes on a pale ground; marginal groove continuous; punctations fine; eyes pale and flat; festoons long, very sharply defined, with ventral scutes, the posterior margins of which are slightly salient; hypostome dentition 3 | 3; coxa I with two moderately long, equal spurs; coxae II and III each with a single, broad spur; coxa IV with a single, moderately long spur.

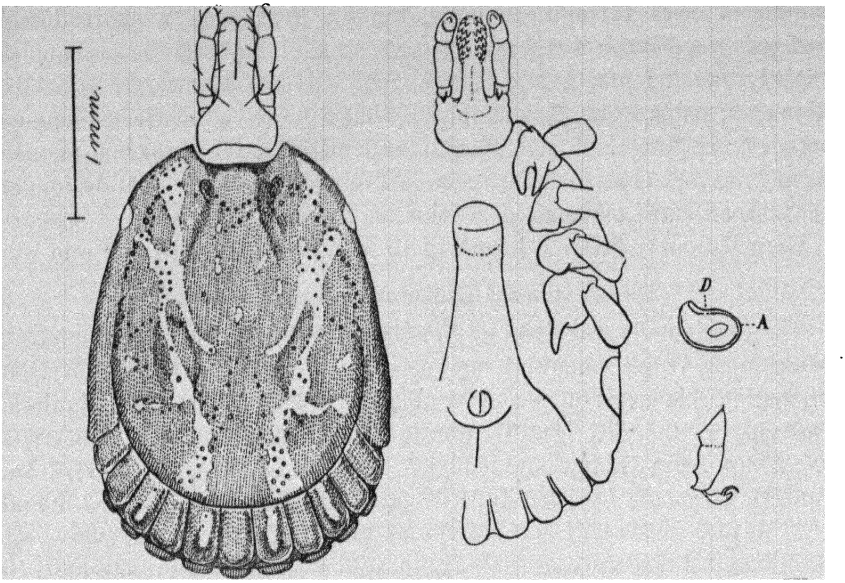


Fig. 9. *Amblyomma oblongoguttatum* ♂. Dorsum and venter, spiracle, tarsus IV. (N. 1285, Nuttall, 1912, Fig. 1.)

DESCRIPTION. *Body*: *L.* 1·8–2·6 mm., *W.* 1·4–1·7 mm., contour oval, narrower in front, lateral margins sub-rectilinear. *Scutum*: convex, smooth and shining; ornate, with maroon-brown spots and stripes on a pale ground; postero-median stripe broad, fused anteriorly with a falciform stripe and limiting spots to form a Y-shaped figure; postero-accessory stripes short, sub-triangular, sometimes fused at their apices with the antero-accessory stripes; lateral spots more or less conjoined; frontal spot often fused with the cervical stripe and the ocular spot; a median longitudinal stripe usually present between the cervical stripes, sometimes extending posteriorly to fuse with the falciform stripe; marginal ridge with or without a narrow pale stripe; festoons 3 and 5 each with an elongate pale spot, the rest dark-coloured; cervical grooves in the form of short oval pits; marginal groove continuous; eyes pale and flat; scapular angles moderately pointed; punctations fine, limited almost entirely to the pale areas; festoons long, very sharply defined. *Venter*: paler than dorsum, finely punctate and with scattered fine hairs; genital aperture opposite coxa II; spiracles small, short, comma-shaped; festoons with ventral scutes slightly salient at the posterior margin. *Capitulum*: *L.* 0·6–0·8 mm.; basis rectangular, postero-lateral angles rounded, slightly salient, lateral margins slightly convex; palps

slender, article 2 about twice as long as article 3; hypostome spatulate, dentition 3 | 3. *Legs* of medium length, slender, maroon-brown; coxa I with two moderately long, sub-parallel, equal spurs (the external spur sometimes slightly the longer); a single, short, broad, rounded spur on each of coxae II and III; a single, moderately long spur on coxa IV; tarsi gradually attenuated; pulvilli relatively large.

Female (Fig. 10). Diagnosis: A very small tick; scutum triangular-cordiform, posterior angle rather narrow; ornate with extensive maroon-brown markings on a pale ground; cervical grooves in the form of small, deep, oval pits, followed by shallow, divergent depressions; eyes large, pale and flat; punctations small, very scanty in the postero-lateral and median fields; basis capituli nearly three times as broad as long, postero-lateral angles slightly salient, posterior margin slightly concave, lateral margins convex; porose areas small, circular, widely-separated; hypostome dentition 3 | 3; coxa I with two, moderately long, sub-equal spurs; a single, short, broad spur on each of coxae II–IV.

Descriptions. *Body*: *L.* 2·9 mm., *W.* 2·3 mm., dorsum reddish-brown, wrinkled and punctate; marginal groove continuous; festoons well-

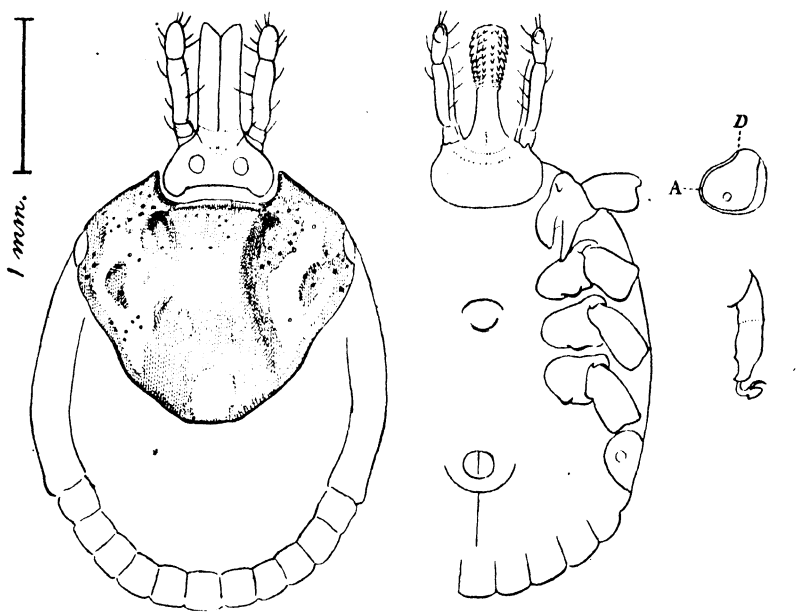


Fig. 10. *Amblyomma oblongoguttatum* ♀. Dorsum and venter, spiracle, tarsus IV. (N. 1285, Nuttall, 1912, Fig. 2.)

defined. *Scutum*: 1·7 × 1·7 mm.; smooth and shining; ornate, with extensive maroon-brown markings on a pale ground; frontal spot often fused with the ocular spot; posterior ends of the cervical stripes fused with the limiting spots; median field usually dark-coloured, with the exception of a pale spot at the posterior angle; cervical grooves in the form of small oval pits, continued posteriorly by shallow, divergent depressions; punctations small, very sparse in the postero-lateral and median fields; eyes large, pale and flat. *Venter*: similar in colour to the dorsum; genital aperture opposite the interspace between coxae II and III; spiracles small, sub-triangular with rounded angles. *Capitulum*: *L.* 1·2 mm.; basis nearly three times as broad as long, postero-lateral angles rounded and slightly salient, posterior margin slightly concave, lateral margins convex, porose areas small, circular, widely separated; palps slender, article 2 two-and-a-half times as long as article 3; hypostome spatulate, dentition 3 | 3. *Legs*: similar to those of the ♂, excepting coxa IV; coxa I with two, moderately long, sub-equal spurs, the external slightly the longer and more pointed; coxae II and III each with a single short, broad spur continued mesially as a fine salient ridge; coxa IV with a single, short, blunt, triangular spur; tarsi gradually attenuated; pulvilli relatively large.

Geographical Distribution and Hosts.

Koch's type, a ♀, came from Pará, **Brazil,** Sieber coll. (Berlin Mus.). Neumann (1899, p. 214) records a ♂ from **Bolivia** (*Amb. vittatum*) (Berlin Mus.). Aragão (1911, p. 36) records the distribution in Brazil: ♂s and ♀s, off *Dasypus* sp., State of Pará; ♂, off *Tapirus americanus*, Territorio do Acre; ♂, from the State of Matto Grosso; and ♂s and ♀s, off *Tapirus americanus*, State of Espirito Santo. I have examined specimens in the Cambridge collection: ♂ and ♀, off *Tapirus americanus*, State of Espirito Santo, Brazil, Dr H. de B. Aragão donor (N. 1896); also the types of *Amb. darlingi*, ♂s, ♀s, nymphs and larvae, off *deer* (*Odocoileus* sp.), Corozal (N. 1285), and nymphs, off the neck and head of a *turkey buzzard* (*Catharista atratus*), Empire, Canal Zone, **Panama,** Central America (N. 1287); also a ♀ submitted for determination by the Imperial Bureau of Entomology, off *Dicotyles torquatus*, **British Guiana,** 1. XII. 1918, G. E. Bodkin coll. (I.B.E. 1066).

4. AMBLYOMMA PARVUM Aragão, 1908.

Lit. and Inconogr.: Aragão, H. de B., 22. III. 1908, pp. 18–19, specific description of ♂; 1911, pp. 172–175, specific description of ♂ and ♀; Pl. XI, Figs. 10–12, ♂ dorsum and venter, ♀ dorsum.

Male. Diagnosis: A small tick, scutum inornate, marginal groove continuous; venter hairy; palps short and thick, article 1 with a ventral, retrograde spine; coxa I with two unequal spurs of which the external reaches coxa II, coxae II–IV each with a single short blunt spur; a minute spur on each trochanter.

DESCRIPTION. *Body*: *L.* 2·34 mm., including the capitulum, *W.* 1·32 mm., contour oval, narrow. *Scutum*: convex, glossy, colour dark maroon-brown, paler in middle part; cervical grooves short and deep, comma-shaped; eyes small, shining, pale yellow; marginal groove represented by a series of deep punctations of medium size, commencing at the level of the second pair of legs and becoming more clearly defined in the posterior half of the scutum where it limits the festoons; festoons longer than broad, the length increasing as the median line is approached; punctations fine and discrete, numerous at the borders and on the festoons. *Venter*: paler than the dorsum, with many superficial punctations and fine yellow hairs; genital aperture opposite coxa II; festoons well-defined, each furnished with a ventral scute, which is produced posteriorly into a salient edge (as in *A. incisum* and *brasiliense*); spiracles narrow, comma-shaped. *Capitulum*: short (*L.* 0·51 mm.), basis capituli twice as broad as long, lateral margins slightly convex, postero-lateral angles salient; palps very short and stout, article 2 a little longer than article 3, article 1 with a stout ventral retrograde process; hypostome spatulate, dentition 3 | 3. *Legs*: medium, paler in colour than the dorsum, covered with long, fine hairs; coxa I with two widely-separated spurs, of which the internal is very short and continues the postero-internal angle of the coxa; the external spur long, situated at the middle of the posterior border, attains the succeeding coxa; coxae II–IV each with a single short spur; trochanters I–IV each provided with a minute spur at the external third of the posterior border; tarsi not abruptly attenuated; pulvillus one-third length of claws.

Female. Diagnosis: A small tick, scutum sub-triangular, inornate, punctations fine, evenly distributed; coxa I with two unequal spurs of which the internal is small; hypostome dentition 3 | 3.

DESCRIPTION. *Body*: *L.* 3·52 mm., including the capitulum, *W.* 1·83 mm. (unfed), contour elliptical, colour dark maroon-brown, dorsum glabrous, marginal groove present. *Scutum*: *L.* 1·4 mm., *W.* 1·50 mm., sub-triangular, margins rounded in front of eyes, postero-lateral margins slightly convex, posterior angle moderately broad, surface shining, punctations numerous, fine and discrete; eyes large and flat, very distinct. *Venter*: paler in colour than the dorsum, punctate, scattered with few short pale hairs; genital aperture opposite interspace between coxae II and III; spiracles triangular. *Capitulum*: relatively long (1·18 mm.), basis capituli pentagonal, postero-lateral angles salient; porose areas small, oval, divergent; palps club-shaped, article 1 with a small tubercle on the ventral side; article 2 twice as long as article 3. *Legs*: long, coxal armature resembles that of the ♂ except that the spurs are relatively shorter.

Description based on 1 dried ♂ from Formoza, State of Bahia, **Brazil,** Dr Pinto Peixoto coll.; 1 ♀, off *horse*, Feira de Santa Anna, State of Bahia, Brazil, Dr Figueiredo de Vasconcellos coll.; 1 ♂ from bank of R. Guaporé, Matto Grosso, Brazil, Sr Cesar Diego coll.; 3 ♂s and 4 ♀s from manes of *horses*, Lassance, State of Minas, Brazil, Dr H. de B. Aragão coll.

5. AMBLYOMMA PARVITARSUM Neumann, 1901.

Fig. 11.

Lit. and Iconogr.: 1901, Neumann, L. G., pp. 295–296, description of ♀; Figs. 10 and 11, ♀ scutum and capitulum, tarsus IV: 1911, Neumann, L. G., pp. 82–83, brief description of ♀.

Male: unknown[1].

Female (Fig. 11). Diagnosis: A medium-sized tick; scutum ornate, postero-lateral margins concave, posterior angle broad; eyes small, dark-coloured, hemispherical, sub-orbited; coxa I with two unequal spurs, coxae II and III each with a single small tuberosity, a single long spur on coxa IV; protarsi II–IV each with a pair of stout spines at the distal extremity of the flexor surface; tarsi diminutive, spurs obsolete, pulvilli absent.

[1] Neumann (1911, pp. 82–83) gives a very brief description of the ♂ in the following words: "Palpes courts. Écusson dorsal blanc avec 2 taches brunes submédianes. Hanches IV avec une longue épine." I am not aware that the ♂ has been more fully described and have no knowledge of where the type is reposited.

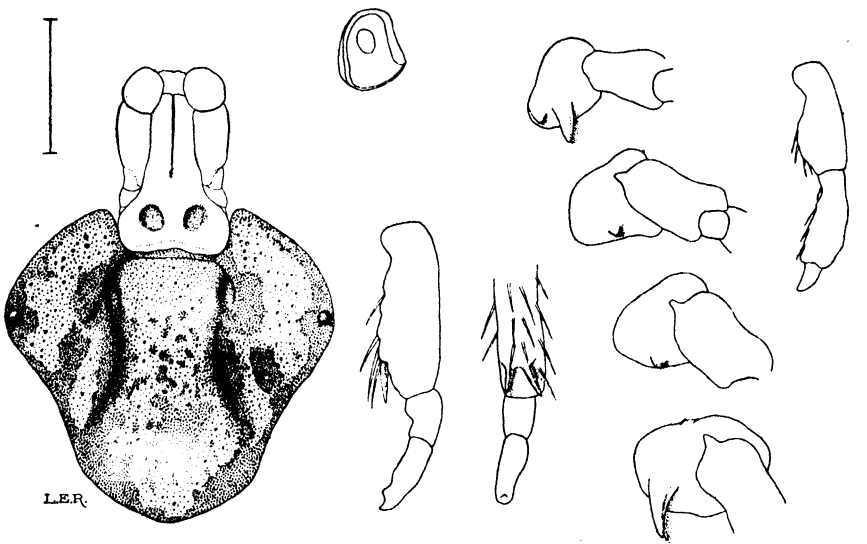


Fig. 11. *Amblyomma parvitarsum* ♀. Scutum, capitulum, coxae I–IV, spiracle, tarsus I, tarsus IV from posterior and ventral aspects, showing protarsal spines. (Type, Hamburg Mus.)

Description. *Body*: *L.* 16·4 mm., *W.* 13·7 mm. (a gorged female in which oviposition probably had commenced); dorsum earthy-brown, smooth and glabrous, with fine scattered punctations; marginal groove and festoons indistinguishable; other grooves normal. *Scutum*: 2·3 × 2·5 mm., polygonal, postero-lateral margins concave, posterior angle wide; ornate, with a dark marginal band extending from the scapular angles to the posterior angle; cervical stripes extending posteriorly to the limiting spots; frontal spots fused with the dark marginal band; cervical grooves narrow and deep anteriorly; broad, shallow and divergent posteriorly where they extend to the posterior third of the scutum; punctations very fine, coarser in the antero-lateral fields; eyes small, dark-coloured, glistening, hemispherical, sub-orbited. *Venter*: with few scattered hairs on posterior part, otherwise like dorsum; spiracles small, short, comma-shaped. *Capitulum*: *L.* 1·4 mm., basis rectangular, lateral margins convex, posterior margin slightly concave, postero-lateral angles non-salient; porose areas moderately large, oval, divergent, interval equal to diameter; palps rather short, club-shaped, article 2 twice as long as article 3; hypostome dentition 3 | 3. *Legs*: moderately stout, maroon-brown with narrow yellowish annulations at the distal extremities of the femur, tibia and protarsus; coxa I with two unequal spurs of which the

external is the longer; a single small tubercle-like spur on each of coxae II and III; a single, long, pointed spur on coxa IV; protarsi II–IV each with a pair of stout spines at the distal extremity of the flexor surface; tarsi diminutive, tarsal spurs obsolete; pulvilli absent (no trace or scar to indicate that they may have been accidentally lost).

Description based on a single ♀ (type), from **Bolivia,** S. America, 29. v. 1897, Rolle coll., Hamburg Museum. Neumann (1901, p. 296) provisionally places another ♀ (unfed), from **Patagonia** (Paris Museum), in this species, but the differences which he notes make the determination doubtful—"Corps plat, long de 3 mm 5, large de 2 mm 8. Yeux plus nettement orbités. Face dorsale chagrinée et ponctuée, à nombreux poils courts; un sillon marginal et des festons. Face ventrale ponctuée, à poils semblables. Pattes à quatrième et cinquième articles non renflés. Tarses pourvus de caroncules petites, couvrant seulement la base des ongles." In his brief description (1911, p. 83) Neumann gives *Lama vicugna* as the host, and **Bolivia** and **Chili** as the geographical distribution.

6. AMBLYOMMA MACULATUM Koch, 1844.

Figs. 12 and 13.

Synon., Lit. and Iconogr.:

Amblyomma maculatum Koch, C. L., 1844, p. 227, description of ♂: 1847, pp. 76–77, description of ♂; Tab. XIV, Fig. 49, ♂ dorsum (coloured). **1899,** Neumann, L. G., pp. 249–252, specific description of ♂, ♀ and nymph; Fig. 54, ♂ coxae and tarsus IV. **1901,** Neumann, L. G., p. 305, record of further specimens and correction of previous description. **1905,** Lahille, F., pp. 152–154, notes on geographical distribution in the Argentine Republic, hosts and biology; reproduces Neumann's specific description (pp. 36–38); Pl. IX, Figs. 1–8, larva and nymph, dorsum, venter and capitulum (coloured); Pl. X, Figs. 1–10, ♂ dorsum, venter and tarsus IV, ♀ dorsum, venter, scutum, tarsus IV, spiracle and oviposition. **1907,** Hunter, W. D., and Hooker, W. A., pp. 62–64, notes on geographical distribution, hosts and biology; Fig. 11, ♀ capitulum; Fig. 12, ♂ and ♀ coxae[1]; Fig. 13, ♀ scutum[1]. **1908,** Banks, N., pp. 39–40, description of ♂ and ♀; Pl. VI, Fig. 5, ♂, tarsus IV and coxae I and IV; Fig. 7, ♂, tarsus I and spiracle; Fig. 9, ♀ spiracle; Fig. 10, ♀ capitulum: Hooker, W. A., pp. 48–49, brief notes on biology. **1909,** Dönitz, W., pp. 446–447; observations concerning the scutal ornamentation; Fig. 6, ♂ dorsum. **1911,** Neumann, L. G., p. 70. **1912,** Bishopp, F. C., p. 37, notes on host relationship of nymphs: Hooker, W. A., Bishopp, F. C., and Wood, H. P., pp. 135–142, brief description of all stages, host relationship, geographical distribution and biology, Pl. X, Figs. 6–10, photomicrographs of larva, nymph, ♂ and ♀; Text-fig. 10, map showing distribution in the U.S. America.

Amblyomma tigrinum Koch, C. L., 1844, p. 227, description of ♂: 1847, pp. 77–78; description of ♂; Tab. XIV, Fig. 50, ♂ dorsum (coloured).

[1] Herein reproduced, p. 43.

Amblyomma rubripes Koch, C. L., 1844, p. 228, description of ♀: 1847, p. 81; description of ♀; Tab. XIV, Fig. 53, ♀ dorsum (coloured).

Amblyomma ovatum Koch, C. L., 1844, p. 228, description of ♂: 1847, p. 82; description of ♂; Tab. XV, Fig. 54, ♂ dorsum (coloured).

Amblyomma triste Koch, C. L., 1844, p. 229, description of ♀: 1847, pp. 87–88; description of ♀; Tab. XVI, Fig. 59, ♀ dorsum (coloured).

Amblyomma complanatum Berlese, A., 1888, p. 191, description of the ♂; Tab. XIII, Fig. 7, ♂ dorsum.

Male (Fig. 12). Diagnosis: A small to medium-sized tick; scutum elongate oval or pyriform; ornate, with light reddish-brown markings on a pale ground; marginal groove commencing in the scapular fields anterior to the eyes, continuous; coxa I with a long, pointed spur and a minute tubercle at the postero-internal angle; a single, short, blunt, spur on each of coxae II and III; a long, pointed spur on coxa IV; protarsi II–IV each with a pair of projecting spines at the distal extremity.

DESCRIPTION. *Body*: *L.* 3·4–5·0 mm., *W.* 2·25–3·0 mm.; contour elongate oval or pyriform, narrower in front, often slightly concave

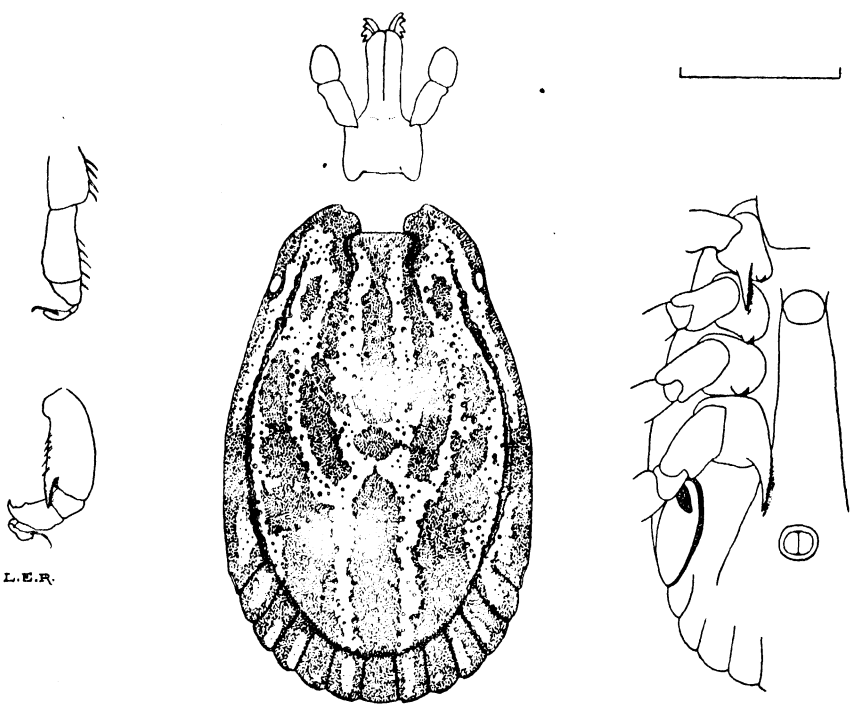


Fig. 12. *Amblyomma maculatum* ♂. Scutum, capitulum, venter, tarsi I and IV. (C. 4.)

about the level of the eyes. *Scutum*: ornate, with light reddish-brown markings on a pale yellowish ground; postero-median stripe thick, extending almost to the middle of the scutum; postero-accessory stripes thick, parallel to the postero-median stripe, fused anteriorly with the 3rd lateral spot; lateral spots large, more or less conjoined; antero-accessory stripes slightly divergent; falciform stripe represented by a small transverse spot in the centre of the scutum; cervical stripes long, often extending posteriorly to fuse with the limiting spots which lie adjacent to the inner side of the anterior extremities of the antero-accessory stripes; frontal spots present; a pale stripe on the marginal ridge, extending from the scapular angle to the external festoon, sometimes interrupted about the middle of the lateral margin; a median longitudinal dark stripe extending from the cervical emargination to the falciform stripe; median festoon dark-coloured; 4th festoon with a small pale spot at the postero-internal angle; the other festoons each with a pale longitudinal stripe; cervical grooves short, deep and curved; marginal groove deep and narrow, commencing in the scapular fields anterior to the eyes, continuous; punctations numerous, rather small, almost limited to the pale areas; eyes of medium size, pale and flat. *Venter*: dull yellow, glabrous; genital aperture opposite coxa II; spiracles large, broad oval; festoons with reddish-brown non-salient ventral scutes. *Capitulum*: *L.* 0·8–1·2 mm.; basis rectangular, postero-lateral angles slightly salient; palps short, article 2 barely one-and-a-half times as long as article 3; hypostome dentition 3 | 3. *Legs*: stout, reddish-yellow; coxa I with the external spur long and pointed, the internal spur represented by a minute tubercle at the postero-internal angle; a single, short, blunt spur on each of coxae II and III; a long pointed spur on coxa IV; protarsi II–IV with a pair of stout projecting spines at the distal extremity of the ventral surface; tarsi small, attenuated in talus.

Female (Fig. 13). Diagnosis: A small to medium-sized tick; scutum longer than broad, postero-lateral margins often slightly concave; ornate with reddish-brown markings on a pale yellowish ground; hypostome dentition 3 | 3; porose areas large, oval and divergent; coxa I with a long pointed spur and a minute tubercle at the postero-internal margin; coxae II–IV each with a single very small spur; protarsi II–IV each with a pair of stout spines on the ventral side of the distal extremity.

Description. *Body*: *L.* 3·7 mm., *W.* 2·4 mm. (gorged examples may attain dimensions of 18 × 13 mm.); contour oval, slightly narrower in

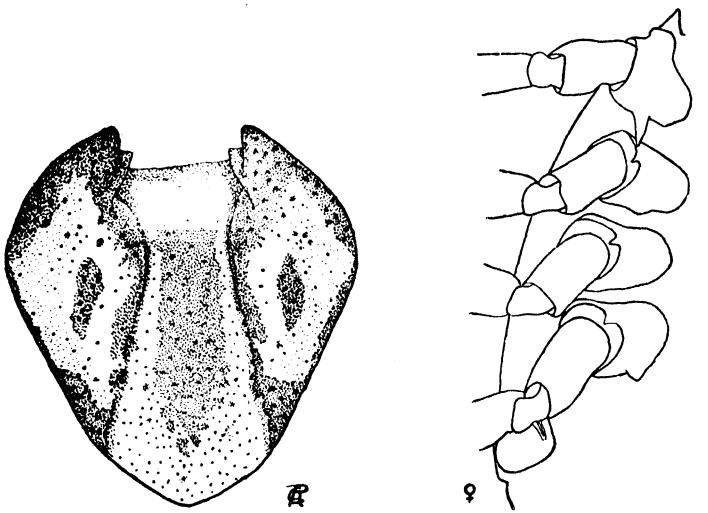


Fig. 13. *Amblyomma maculatum* ♀. Scutum, coxae. (From Hunter and Hooker, 1907, Figs. 12 and 13.)

front; dorsum reddish-brown, almost glabrous; marginal groove continuous; festoons well-defined. *Scutum*: 1·8–2·2 × 1·6–2·0 mm., sub-triangular, posterior angle rather narrow and rounded, postero-lateral margins usually slightly concave; ornate, with reddish-brown markings on a pale ground; scapular fields dark-coloured; a narrow, dark border extending from the ocular spot to the small limiting spot; cervical stripes short, usually not reaching the limiting spots posteriorly; frontal spot represented by two fine linear stripes between the ocular spot and the cervical stripe; cervical grooves deep anteriorly, long S-shaped, extending to the posterior third of the scutum; punctations numerous, fine, absent on the margins; eyes medium, pale and flat. *Venter*: similar to dorsum; genital aperture opposite the posterior border of coxa II; spiracles broad comma-shaped with a marked dorsal prolongation. *Capitulum*: *L.* 1·0–1·2 mm.; basis sub-triangular, postero-lateral angles non-salient, large, porose areas oval, divergent; palps rather short, constricted proximally, article 2 one-and-one-third times as long as article 3; hypostome dentition 3 | 3. *Legs*: rather long and slender; coxa I with the external spur long and pointed, the internal spur represented by a minute tubercle at the postero-internal angle; a single, small, triangular spur on each of coxae II–IV; protarsi II–IV each with a pair of prominent spines at the distal extremity of the ventral surface; tarsi small, attenuated gradually.

Geographical Distribution and Hosts.

The type came from Carolina, **U.S. America**; *Amb. tigrinum* and *rubripes* from **Brazil**; *Amb. ovatum* and *triste* from Montevideo, **Uruguay**; Berlese's *Amb. complanatum* came from Rio Apa, Brazil. Neumann (1899, p. 252) records a ♀, from **Peru** (Berlin Mus.): ♂s, ♀s and nymphs, from **Paraguay**, Böhls coll. (Poppe collection); ♂s, ♀s and nymphs, from Texas, California and Tennessee, **U.S. America** (Marx coll., Smithsonian Inst., Washington, and Bur. of Animal Industry, U.S. Dept. of Agric., Washington), and ♂s and ♀, off *Cervus campestris*, Buenos Ayres, **Argentine Republic** (C. Berg coll.). Neumann (1911, p. 70) adds **Mexico, Ecuador, Chili** and **Patagonia** to the list of countries in which this species is found and includes *Podinema teguixin* (L.), and *Hydrochoerus hydrochoeris* (L.) in his list of hosts. Lahille (1905, pp. 152–153) reports that the species is common in the **Argentine Republic** and that he has received specimens from the Chaco de Mendoza, Salta, Santiago del Estero, the province of Buenos Ayres, Entre Rios, Corrientes, Rio Negro and Chubut. The common host is the dog, but it is often found on horses, cattle and deer. In Rio Negro it has been taken on *Canis azarae* and *Canis griseus*. Newstead (1909, p. 445) reports that ♂s and ♀s were captured by Mr H. Jackson, at Waltham, Manchester, **Jamaica, West Indies**, in January, 1909. Aragão (1911, pp. 159 and 162) records the species from Avaré and Bello Horizonte, Minas Geraes, **Brazil**; adult ticks from *dogs*, and nymphs off *Nothura maculosa* (?) and *Rhynchotus rufescens* Temm. The Cambridge collection contains ♂s and ♀, off *cattle*, Victoria, **Texas,** X. 1906, W. D. Hunter coll. (N. 382, N. 710); ♀, off *dog*, Avaré, State of San Paulo, **Brazil,** IV. 1908, Dr H. de B. Aragão donor (N. 1270); and (?), off *cattle*, Ambalema, Rio Magdalena, **Colombia**, S. America, 1919, Dr H. Gadow donor (N. 994). W. F. Cooper's collection contains a ♂, host not specified, from San Bernardino, **Paraguay**, S. America, II. 1909, Dr Karl Fiebrig coll. (C. 4). Hooker, Bishopp and Wood (1912, p. 136) state that the distribution in the U.S. of America ranges along the Gulf Coast, from Carolina to Texas, but suggest that the isolated examples recorded from California and Tennessee have been transported inland on cattle. They list as hosts: dogs, cattle, horses, sheep, goats, man, wolf, fox and rabbit, also birds—meadow-lark (*Sturnella magna*), quail, red-winged blackbird (*Agelaius phoeniceus*). Birds probably act as hosts for the larva and are undoubtedly common hosts of the nymph.

7. AMBLYOMMA AMERICANUM (Linnaeus, 1758).

Figs. 14 and 15.

Synon., Lit. and Iconogr.:

Acarus americanus Linnaeus, 1758, Ed. 10, p. 615: 1794, Fabricius, p. 428.
Acarus nigua de Geer, 1778, VII, p. 154.
Ixodes nigua (de Geer) Latreille, 1804, pp. 52–53.
Rhynchoprion americanum Hermann, J. F., 1804, p. 71.
Ixodes americanus Fabricius, 1805, pp. 355–356.
Amblyomma americanum Koch, C. L., 1844, p. 229, 1847, Heft 4, pp. 90–91, Tab. XVII, Figs. 62–63, ♂ and ♀ dorsum, coloured. **1899**, Neumann, L. G., pp. 209–211. **1901**, Neumann, L. G., p. 296, Salmon, D. E. and Stiles, C. W., pp. 475–478, Pls. XCVI–XCVIII, Figs. 236–257, ♂ dorsum and venter, ♀ dorsum and venter, coloured; ♀ scutum and capitulum, spiracle, ♂ tarsi. **1908**, Banks, N., pp. 40–41, Pl. VI, Figs. 1–3, ♂ dorsum, spiracle and coxa I; scutum and capitulum, hypostome, spiracle and tarsus I of nymph. **1911**, Neumann, L. G., p. 69. Maver, M. B., records the transmission of Rocky Mountain Spotted Fever. Hunter, W. D. and Bishopp, F. C. **1912**, Hooker, W. A., Bishopp, F. C. and Wood, H. P., pp. 142–151, specific description, host relationship, geographical distribution, life history and bionomics; Pl. XI, 10 Figs. from photomicrographs, showing all stages, larva to adult; Text-fig. 11 is a map showing geographical distribution in N. America.
Ixodes unipunctata Packard, A. S., 1869, pp. 66–67, Pl. XIII, Fig. 11, ♀ dorsum.
Amblyomma foreli Stoll, O., 1886–1893, p. 21, Tab. XII, Figs. 3–3 *b*, Tab. XIV, Figs. 3–3 *d*, ♀ tarsus, digit of chelicera, spiracle, genital and anal apertures.

Male (Fig. 14). Diagnosis: A very small tick with a shining reddish-brown scutum marked with two pale symmetrical spots near the hinder margin of the body; usually a pale stripe at each side and a short oblique pale stripe within and behind the eyes; marginal groove present, commencing some distance behind the eyes, continuous; punctations numerous, moderately small. Coxa I with two stout unequal spurs, a short broad plate-like spur on coxae II and III, a long, pointed spur on coxa IV.

DESCRIPTION. *Body*: *L.* 2·2–2·6 mm., *W.* 1·7–2·5 mm., contour oval, broadest behind middle. *Scutum*: reddish-brown, glabrous, with numerous evenly-distributed small punctations, coarser towards margin of the body and in the scapular angles; ornamentation consisting of (1) two curved pale symmetrical spots at the posterior part within and close to the marginal groove, the limbs of which are continued on to the 3rd and 5th festoons, giving each entire spot a horse-shoe form; (2) a small pale spot on some of the festoons; (3) a lateral stripe contouring the internal margin of the marginal groove, commencing at the first festoon and extending forwards nearly to the commencement of the marginal groove;

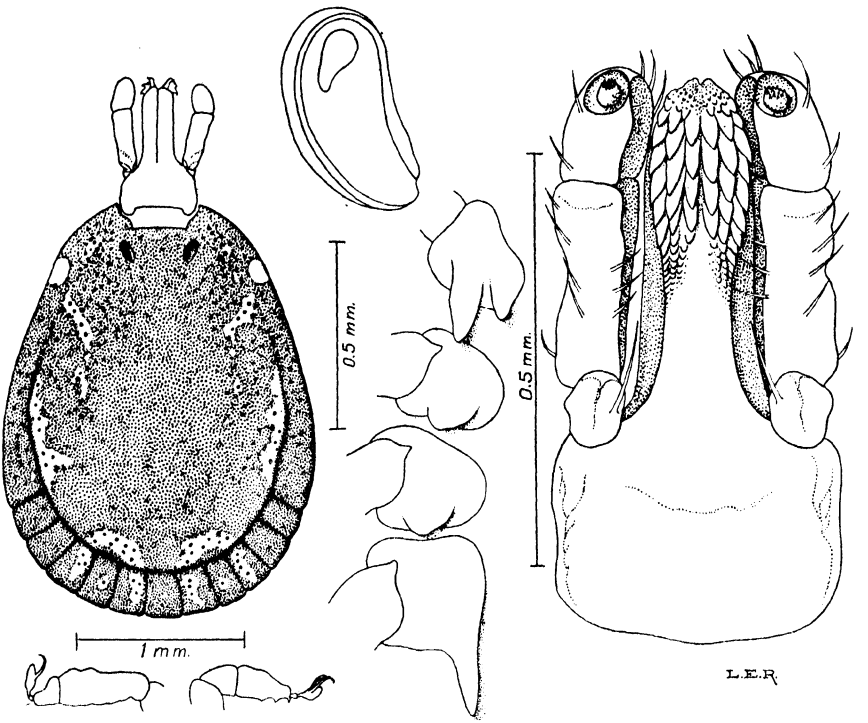


Fig. 14. *Amblyomma americanum* ♂. Dorsum, capitulum from ventral aspect, spiracle, coxae I–IV, tarsi I and IV. (N. 139.)

(4) an oblique short pale stripe behind and internal to the eyes; (5) indistinct small irregular pale patches in the scapular angles; (2)–(5) often indistinct or absent: marginal groove deeply incised, continuous, commencing some little distance behind the eyes: cervical grooves in the form of a pair of obliquely disposed oval pits continued posteriorly by very shallow depressions; eyes large, pale and flat. *Capitulum* (*L.* 0·8–0·96 mm.): basis capituli rectangular, twice as broad as long, posterior angles slightly salient and rounded, palps long and slender, article 2 twice as long as article 3; hypostome dentition 3 | 3. *Venter*: dull yellow; spiracles large, broadly comma-shaped. *Legs*: with fine long hairs; coxa I with two unequal stout spurs, the external one of which is the longer and more pointed; a broad short plate-like spur on coxae II and III; a long pointed spur on coxa IV; tarsi tapering moderately abruptly; pulvilli large.

Female (Fig. 15). Diagnosis: Scutum triangular, posterior angle broad; punctations numerous, small, a little coarser and more crowded

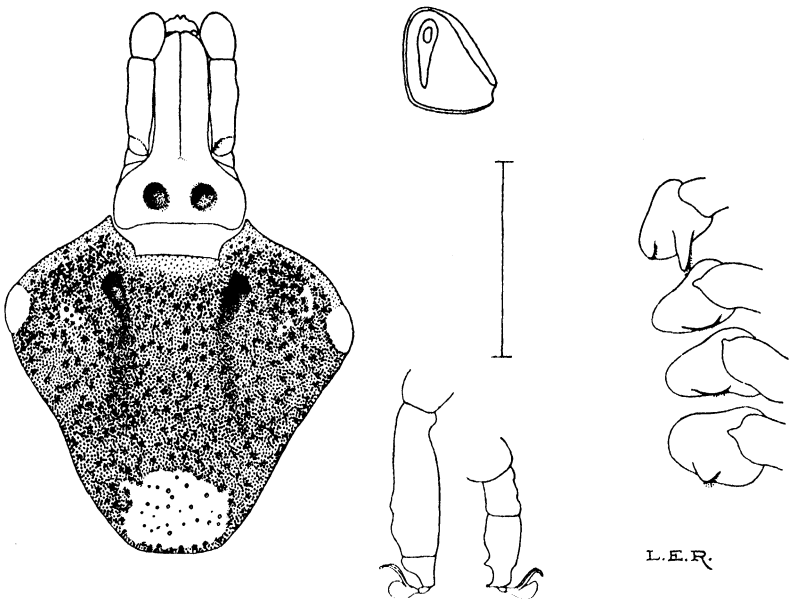


Fig. 15. *Amblyomma americanum* ♀. Scutum, capitulum, spiracle, coxae I–IV, tarsi I and IV. (N. 139.)

in the scapular angles, evenly distributed elsewhere; cervical grooves in the form of oblique oval pits, from which shallow depressions extend backwards to the posterior third of the scutum; a large pale spot in the posterior angle of the scutum; legs with long fine hairs, coxa I with two unequal spurs of which the external is long and pointed, a single broad plate-like spur on coxae II and III; a short triangular spur on coxa IV.

DESCRIPTION. *Body*: *L.* 3 mm., *W.* 2·5 mm. (unfed), gorged specimens may attain a length of 12 mm. and a breadth of 8 mm., contour oval, slightly more elongate than the male; dorsum dark-brown, coarsely punctate, glabrous, marginal groove clearly defined, continuous. *Scutum*: triangular, posterior angle broad and truncated, scapular angles pointed; colour reddish-brown, with a large pale spot in the posterior angle, and occasionally indistinct pale marking in the scapular fields; punctations coarser than in ♂; cervical grooves in the form of oblique oval pits each continued posteriorly by a shallow depression; eyes large, pale and flat. *Venter*: earthy yellowish-brown, coarsely punctate; few short fine hairs on marginal portions; genital orifice situated at level of interspace between coxae II and III; spiracles large, broadly triangular with

rounded angles. *Capitulum* (*L.* 1–1·5 mm.): resembles that of the ♂; porose areas small, broadly oval, interval slightly greater than diameter, divergent anteriorly. *Legs*: long and slender, with long fine hairs; coxa I with two spurs, the external one of which is long and pointed, a broad short plate-like spur on coxae II and III, a short triangular spur on coxa IV; tarsi long, moderately abruptly attenuated; pulvilli large.

Geographical Distribution and Hosts.

Hunter, Bishopp and Wood (1912) report the species as having been collected in nearly all the states of the **U.S. of America** bordering on the Atlantic Ocean and the Gulf of Mexico, and from several inland states, including Michigan, Kentucky, Missouri, Arkansas and Oklahoma. It is said to be abundant in Texas and Louisiana. Fitch (1872) recorded its occurrence in New York State, where it was formerly common, but relates that he had seen only one specimen from this part, and that had been collected forty years before (*ca.* 1830). Specimens in the Cambridge collection are derived from Missouri, Montana and Texas. This collection also contains a specimen (N. 545) which is recorded as having been found on the ground at Paquil, Luzon, Philippine Is. Neumann (1911) extends the range of the species to **Guatemala** (*A. foreli* Stoll?), **Brazil** and **Guiana**. Ribaga, C., (1902) records nymphs from Tucuman, Argentina, but his determination of the species is very questionable.

Amblyomma americanum shows a wide range in its choice of a host, apparently attaching itself to any mammal with which it comes into contact. Hunter, Bishopp and Wood (1912) give the following list of hosts: dogs, cattle, man, horse, deer, goat, peccary, pig, mule, skunk, sheep, wolf, fox, squirrel, badger, domestic cat, wild turkey and chaparral cock. Neumann (1911) mentions *Felis pardalis* as a host of this species.

8. AMBLYOMMA CAJENNENSE (Fabricius, 1787).

Figs. 16 and 17.

Synon., Lit. and Iconogr.:

Acarus cajennensis Fabricius, J. C., 1787, p. 372.
Ixodes cajennensis Fabricius, J. C., 1794, p. 427.
Ixodes crenatus Say, 1821, II, p. 76.
Amblyomma cajennense Koch, C. L., 1844, pp. 226–227.
Amblyomma tenellum Koch, C. L., 1844, p. 227.
Amblyomma mixtum Koch, C. L., 1844, p. 227.
Ixodes herrerae Dugès, A., 1887. (1884 ?), p. 487.
Amblyomma sculptum Berlese, A., 1888, p. 192; Tab. XIII, Fig. 8, ♂ dorsum.

Amblyomma parviscutatum Neumann, L. G., 1899, pp. 208–209.

Amblyomma versicolor Nuttall and Warburton, 1908, p. 407; Fig. 27, ♂ dorsum and coxae; Fig. 28, ♀ dorsum; Fig. 29, ♂ and ♀ spiracles.

1805, Fabricius, J. C., *Ixodes cajennensis*, p. 354. **1847**, Koch, C. L., Heft IV, pp. 73–74, Tab. XIII, Fig. 45, ♂ dorsum; Fig. 46, ♀ dorsum (coloured); pp. 74–76 (*A. mixtum*), Tab. XIII, Fig. 47, ♂ dorsum; Fig. 48, ♀ dorsum (coloured); pp. 78–79 (*A. tenellum*), Tab. XIV, Fig. 51, ♂ dorsum (coloured). **1886–1893**, Stoll, O., p. 19 (*A. mixtum* Koch), description and figs.; Pl. XII, Figs. 1–1*i*, ♀ dorsum, unfed and gorged, genital aperture, anal aperture, digit of chelicera, spiracle, hypostome, palp and tarsi; Figs. 2–2 *b*, ♂ dorsum, genital aperture and anal aperture. **1899**, Neumann, L. G., pp. 205–208; detailed description of ♂, ♀ and nymph; Fig. 51, ♂ coxae. **1905**, Lahille, F., pp. 33, 38 and 154; description taken from Neumann, 1899; Pl. XII, Fig. 1, ♂ dorsum; Fig. 2, ♂ venter (coloured); Neumann, L. G., p. 231, degrades *A. parviscutatum* to a variety of *A. cajennense*—*A. cajennense parviscutatum*. **1907**, Hunter, W. D., and Hooker, W. A., pp. 60–62, Fig. 9, capitulum, ventral aspect, Fig. 10, ♂ and ♀ coxae; notes on geographical distribution, host relationship and biology. **1909**, Newstead, R., pp. 440–443, description, biology, hosts and geographical distribution; Pl. XIII, Fig. 1, *a–g*, photomicrographs of life-stages, larva to adult, natural size; Rohr, C. J., pp. 110–117, biology; pp. 155–157, specific description (after Neumann, L. G., 1899): Pl. I, Fig. 2, photomicrograph of ♂ capitulum; Fig. 6, tarsus I with Haller's organ; Fig. 10, ♀ palp; Fig. 11, posterior part of venter of ♀: Pl. IV, Figs. 35–38, photomicrographs of ♂ dorsum and venter, ♀ dorsum and venter. **1911**, Neumann, L. G., pp. 68–69; Fig. 29, ♂ dorsum; Fig. 30, ♂ venter; p. 69, *A. cajennense parviscutatum*. **1912**, Hunter, W. D., Bishopp, F. C., and Wood, H. P., pp. 151–158, Pl. XII, Figs. 1–7; photomicrographs of larva, nymph, ♂ and ♀; brief descriptions of all stages, host relationship, geographical distribution and biology, Text-fig. 12, map showing distribution in N. and Central America.

Male (Fig. 16). Diagnosis: A small to medium-sized tick with characteristic ornamentation on the scutum, formed by reddish-brown spots and stripes on a pale background; marginal groove continuous, cervical groove short and deep, sigmoid; legs pale coloured, coxa I with two stout spurs, of which the external is the longer and more pointed; a sharp edged salient ridge on coxae II and III; a long, stout, pointed spur on coxa IV.

DESCRIPTION. *Body*: *L.* 3·9–4·9 mm., *W.* 2·3–3·0 mm., contour oval, broadest behind middle. *Scutum*: convex, glabrous, scapular angles pointed; marginal groove present, commencing a short distance behind the eyes, deeply incised, continuous; ornamentation very characteristic; cervical spots and stripes present; ocular spot small; frontal spot large and irregular; 1st and 2nd lateral spots usually conjoined; 3rd lateral spot often separated from the 2nd, horizontally disposed; limiting spots and antero-accessory stripes conjoined; falciform stripe absent; postero-median and accessory stripes short and broad; a narrow pale stripe on the marginal ridge, extending from the pale area behind the eyes almost

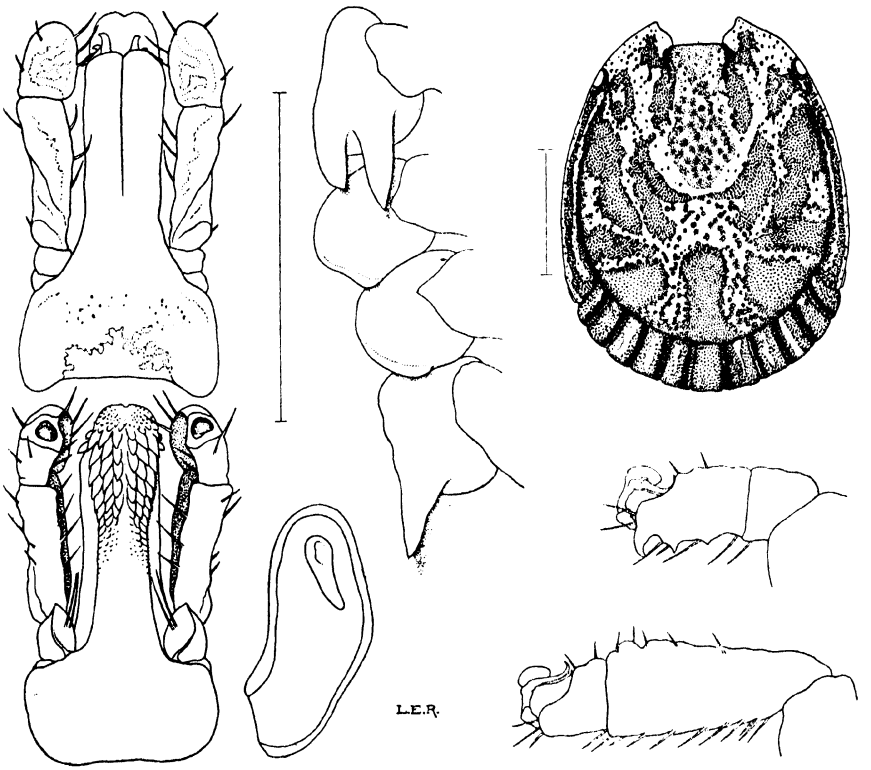


Fig. 16. *Amblyomma cajennense* ♂. Scutum, capitulum, from dorsal and ventral aspects, coxae I–IV, spiracle, tarsi I and IV. (C. 36.)

to the external festoon; irregular pale spots or stripes on the 3rd–5th festoons, 1st, 2nd and median festoons usually dark-coloured: the lateral spots, postero-median and accessory stripes are distinctly raised above the surrounding surface; the median area, extending from between the cervical grooves to the centre of the scutum, is generally dark-coloured; cervical grooves short, deep, sigmoid; punctations of medium size, numerous, absent from the dark raised areas; festoons well-defined, longer than broad. *Venter*: dull yellow, glabrous; festoons with strongly-chitinised scutes, the free posterior margins of which are slightly salient; genital aperture situated at the level of the posterior margin of coxa II; spiracles relatively large, elongate, broadly comma-shaped. *Capitulum* (*L.* 1·1–1·5 mm.): basis capituli twice as broad as long with irregular pale markings, posterior angles barely salient; palps long and slender, with pale enamelling on the dorsal side, article 2 twice as long as article 3;

hypostome dentition 3 | 3. *Legs*: rather short and stout, pale in colour, hairy; coxa I with a pair of stout spurs of which the external is the longer and more pointed; a sharp-edged salient ridge on coxae II and III; coxa IV bears a single long stout pointed spur; tarsi abruptly attenuated.

Female (Fig. 17). Diagnosis: Scutum triangular, rounded anteriorly, posterior angle of moderate breadth, ornamented with reddish-brown markings on a pale ground; cervical grooves short, deep, sigmoid; punctations numerous, medium in size, evenly distributed; coxa I with two unequal pointed spurs; coxae II and III with a sharp-edged salient ridge; coxa IV with a single short rounded blunt spur, barely longer than broad; festoons each bearing a small tubercle on the ventral side at the postero-internal angle.

DESCRIPTION. *Body*: *L.* 3·3 mm., *W.* 2·6 mm., contour oval, broadest about the middle; marginal groove well-defined, continuous; festoons clearly defined. *Scutum*: triangular, a little broader than long (1·9 × 2·1 mm.); margins from scapular angles to eyes rounded, postero-lateral margins slightly convex, posterior angle moderately broad; ornate, with reddish-brown markings on a pale ground; cervical spots and stripes present; frontal spot large, often fused with the ocular and limiting spots; median part of the scutum from between the cervical grooves often with an irregular darkish patch extending backwards almost to the posterior angle; cervical grooves short, deep, sigmoid; punctations moderately coarse, crowded and evenly distributed; eyes of medium size, pale and flat. *Venter*: festoons clearly defined, each furnished with a small, pale-coloured, rounded tubercle at the postero-internal angle; in unfed females, these tubercles are visible from the dorsal aspect; genital orifice opposite the interspace between coxae II and III; spiracles large, broadly comma-shaped. *Legs*: similar to those of the male; spurs on coxa I relatively weaker, well-separated; spur on coxa IV barely longer than broad, blunt. *Capitulum*: *L.* 1·2–1·5 mm.; basis capituli twice as broad as long, posterior angles not salient, sides slightly convex; porose areas small, circular, well-separated; otherwise the capitulum resembles that of the male.

Geographical Distribution and Hosts.

The principal distribution of this species comprises those states of the **U.S. of America** bordering on the Gulf of Mexico, **Central America**, the **West Indies, South America**, particularly along the Atlantic seaboard as far south as Buenos Aires, and the Paraguay River basin. Koch

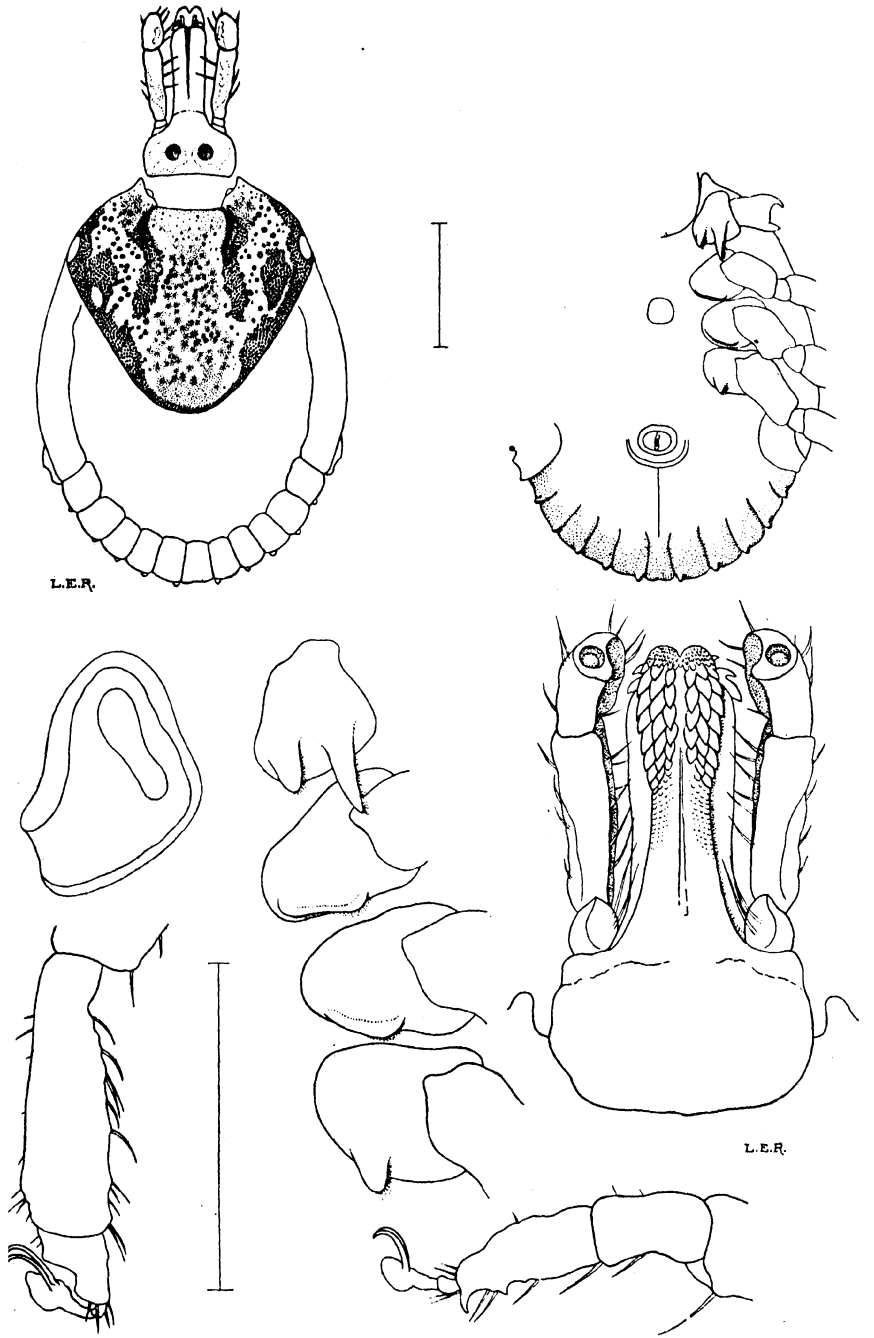


Fig. 17. *Amblyomma cajennense* ♀. Dorsum, venter, capitulum from ventral aspect, spiracle, coxae I–IV, tarsi I and IV. (C. 36.)

(1844, p. 227) gives **Brazil** and Cayenne as the fatherland of *A. cajennense* and **Mexico** (*A. mixtum* and *tenellum*). Stoll (1888–1893, p. 19) remarks that the species (*A. mixtum*) is the commonest of all the Ixodidae of Central America and records its collection in **Guatemala, Nicaragua** and **Costa Rica.** Berlese's specimen (*A. sculptum*) came from Matto Grosso, **Brazil.** Neumann (1899, p. 208) records specimens from **Mexico, Brazil, Costa Rica, Colombia, Guiana, Panama, Honduras, Jamaica, Cuba, Trinidad, Vera Cruz, Yucatan, Nicaragua, Venezuela** and **Paraguay**; in a later record (1911, p. 68) he adds the **Argentine Republic.** Banks, N. (1908, p. 42), reports that the species is abundant in southern **Texas**; he has also seen specimens from **Florida, Arizona** and **California** (San Diego Co.). Hunter, Bishopp and Wood (1912, p. 152) include **Bermuda** in their list. Ribaga (1902, p. 507) records specimens from Cuyaha, **Brazil.** Aragão, H. de B. (1911, pp. 158 and 161), gives a detailed description of the distribution in **Brazil,** his list includes the following states: Distrito Federal, Rio, Minas Geraes, S. Paulo, Bahia, Sergipe, Pernambuco, Mararanhão, Piauhy, Pará and Matto Grosso. The Cambridge collection contains specimens from **Texas,** U.S.A. (N. 381, N. 706); **Mexico** (N. 212, N. 374, N. 375, N. 376, N. 377, N. 577, N. 648 and N. 1180 *a*); **Panama** (N. 1284, N. 1505, N. 2000, N. 2178, N. 2179, N. 2180, N. 2182, N. 2183, N. 2184 *a*); **Jamaica, West Indies** (N. 457, N. 707, N. 1496, N. 1864, N. 1865, N. 1911, N. 1975, N. 1992 *a*, C. 36, C. 36 *a*, C. 202, C. 207, C. 256, C. 267); **Brazil** (N. 222, N. 1266, N. 1973, N. 1974 *a*); **Paraguay** (N. 2219 *a*, N. 2222, N. 2224).

Amblyomma cajennense readily attaches itself to a large variety of hosts, including man and his domestic stock—horses, cattle, sheep, goats, dogs and pigs. Stoll (1886–1893, p. 21) calls attention to the annoyance caused to man by this tick in Guatemala. The larvae, which at certain seasons swarm in the grass in thousands, are distinguished by the inhabitants under the name of "mostacilla" (derived from Sp. *mostaza* = mustard). Newstead (1909, p. 442) records it in Jamaica as the greatest pest to man in the Island, attacking him in all its stages, from larva to adult. He also notes several authentic records of its occurrence on the tongues of young calves. In addition to some of the foregoing, Neumann (1899, p. 208) includes in his list of hosts: *Hydrochoerus capybara* Erxl., Brazilian anteater (? *Myrmecophaga jubata* L.); and (1911, p. 68) *Tamandua tridactyla* (L.), and *Bufo marinus* (L.). Aragão (1911, pp. 158 and 161) adds the following names of hosts: *Cervus* sp., *Dicotyles* sp., *Canis azarae* Wied., *Lepus cuniculus domesticus* L., *Tapirus*

americanus L., *Myrmecophaga jubata* L., *Nasua socialis* Wied., *Dasypus* sp. Specimens in the Cambridge collection were found on a peccary (N. 557) and a large opossum (N. 648), in Mexico.

9. AMBLYOMMA TRIGUTTATUM Koch, 1844.

Figs. 18–21.

Lit. and Iconogr.: Koch, C. L., 1844, p. 225, short description of ♀; 1847, p. 60, Tab. IX, Fig. 33; ♀ dorsum: Neumann, L. G., 1899, pp. 215–217, specific description of ♂ and ♀; 1911, p. 83, brief description of ♂ and ♀.

Male (Fig. 18). Diagnosis: A small tick; scutum ornate, punctations very numerous, confluent in places; marginal groove narrow and deep anteriorly, very wide and shallow posteriorly, continuous, with fine longitudinal rugosities which extend also to the inner border of the marginal ridge; eyes slightly convex, separations of festoons short, not reaching the marginal groove; capitulum short, palps thick and club-shaped; coxa I with two unequal spurs; a single short, triangular spur on each of the other coxae.

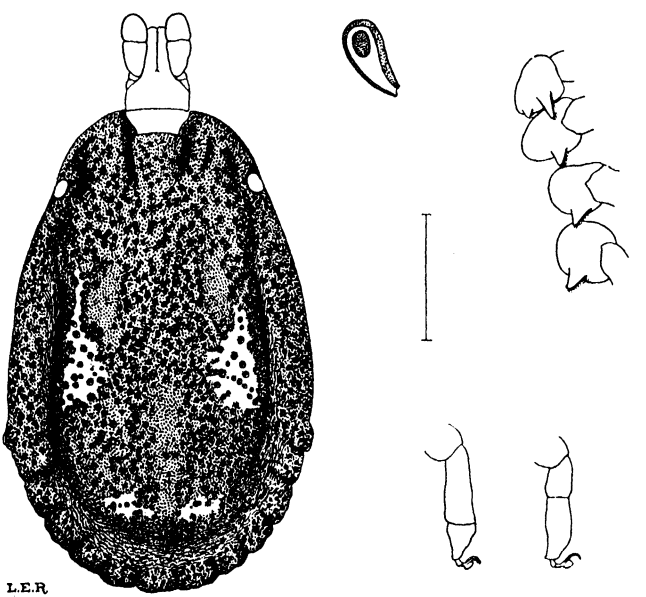


Fig. 18. *Amblyomma triguttatum* ♂. Scutum, capitulum, spiracle, coxae I–IV, tarsi I and IV. (N. 272.)

DESCRIPTION. *Body*: *L.* 3·9 mm., *W.* 2·5 mm., contour elongate oval, narrow anteriorly. *Scutum*: convex, ornate, dark reddish-brown, with an irregular elongate, pale patch in each lateral field of the scutum, extending anteriorly in some examples as far as the scapular field and terminating posteriorly a short distance in front of the external festoon; a pair of small, symmetrically disposed pale spots at the posterior part of the scutum opposite the 5th festoons; cervical grooves deep, short and linear; marginal groove continuous, commencing a short distance behind the eye in a series of contiguous punctations, narrow and deep anteriorly, broad and shallow in its posterior portion; with fine longitudinal rugosities which extend to the internal border of the marginal ridge; punctations very numerous, coarse, confluent in places, absent from those parts which correspond in position to the postero-median and antero-accessory stripes and from the marginal groove; eyes of medium size, slightly convex, glistening; festoons short, separations not reaching the marginal groove. *Venter*: pale-brown; genital aperture opposite coxa II; spiracles narrow, comma-shaped. *Capitulum*: short, *L.* 0·80 mm., basis rectangular, postero-lateral angles sharp but not salient; palps short, thick and club-shaped, article 2 barely one-and-a-half times as long as article 3; hypostome dentition 4 | 4. *Legs*: relatively long, reddish-brown; coxa I with two, well-separated, unequal spurs, the external spur tapering and twice as long as broad; a single triangular spur on each of coxae II–IV; tarsi moderately long, tapering gradually at distal extremity; tarsal spurs weak.

Female (Fig. 19). Diagnosis: A medium-sized tick; scutum cordiform, colour reddish-brown, with a pale spot in the posterior angle and at times in the antero-lateral fields; punctations coarse and deep, not so numerous as in the ♂; eyes flat, situated about middle of length of the scutum; porose areas large, circular, with a double pit-like depression in the interval and a deep, curving groove between each porose area and the lateral border of the basis capituli; coxa I with two, sub-equal, moderately stout spurs; a single, triangular spur on each of coxae II–IV.

DESCRIPTION. *Body*: *L.* 5 mm., *W.* 3·5 mm., contour oval; dorsum reddish-brown, deeply punctate, marginal grooves and festoons indistinct; numerous coarse, short, flattened, whitish hairs. *Scutum*: cordiform, 1·9 × 2·3 mm., posterior angle very wide, antero-lateral margins bulging, postero-lateral margins slightly convex; colour reddish-brown, with a pale spot at the posterior angle and sometimes a pale spot in

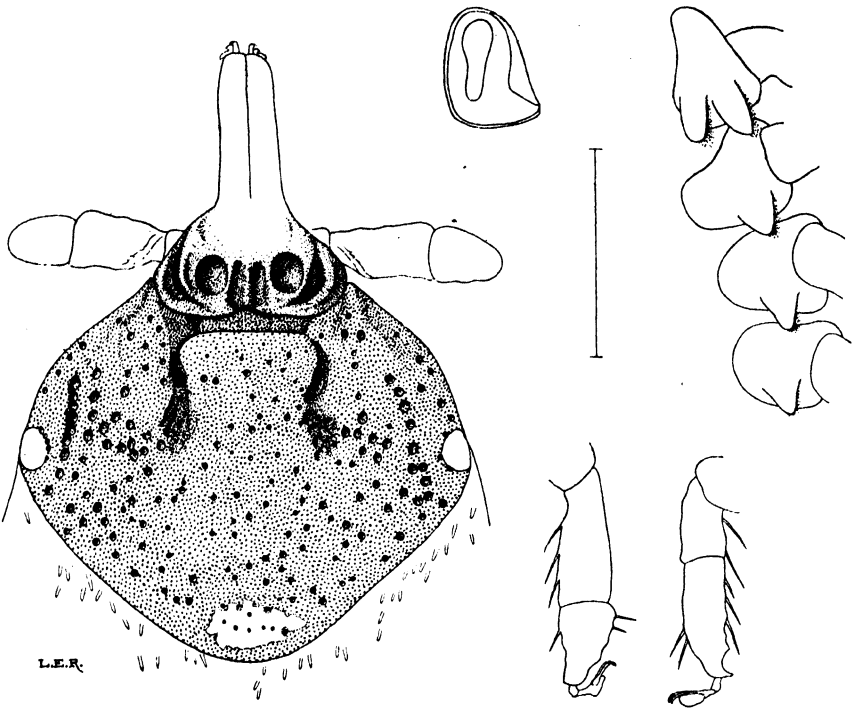


Fig. 19. *Amblyomma triguttatum* ♀. Scutum, capitulum, spiracle, coxae I–IV, tarsi I and IV. (N. 272.)

each antero-lateral field; cervical grooves narrow, deep and curved anteriorly, shallow and divergent posteriorly; punctations moderately numerous and coarse in the lateral fields, where a short linear series forms a kind of lateral groove opposite the eyes; smaller punctations in the median field; eyes flat and pale, situated about the middle of the length of the scutum. *Venter*: similar to dorsum, punctations and hairs limited to posterior portion; genital aperture opposite coxa II; spiracles broadly triangular with rounded angles. *Capitulum*: *L.* 1·3 mm., basis broad and triangular, lateral margins very convex, posterior margin with a shallow central notch, postero-lateral angles non-salient; porose areas large, almost circular, interval one-and-a-half times diameter, with a double pit-like depression; a deep curving depression between each porose area and the lateral border of the basis capituli; palps relatively longer and narrower than those of the ♂, article 2 barely one-and-a-half times as long as article 3; article 3 tapering towards its tip; hypostome stouter than that of the ♂, dentition 4 | 4. *Legs*: relatively longer than

in the ♂; coxa I with two, stout, sub-equal spurs, the external spur pointed; coxae II–IV each with a triangular spur.

Geographical Distribution and Hosts.

Koch's description relates to a single ♀. Neumann's description is based on 1 ♂ and 1 ♀, host not specified, from **Australia** (E. Simon coll.); 3 gorged ♀s, two of which were found on an ox in **Queensland, Australia,** and the third on a horse, origin not indicated (Dept. of Agriculture, Washington, U.S.A.). Later (1901, p. 298), Neumann records the species as occurring on *Bos taurus*, N. S. Wales, and on *kangaroos* (Bureau of Agriculture, N. S. Wales coll.). He also notes that it is found on *Ornithorhynchus* (Berlin Museum). A gorged ♀, from **Queensland, Australia,** in the Berlin Museum measures 20 mm. (not including capitulum) × 16 mm. ♀s and ♂s sent to Cambridge for determination came off *kangaroo*, Herberton District, **N. Queensland, Australia,** Dr Edinger coll. (Berlin Mus. Jr. No. 364/1903; N. 272). The Cambridge collection also contains ♀s, off *Equus caballus*, Albert R., Burketown, **Queensland, Australia,** v. 1896, presented by Prof. R. Tanner Hewlett (N. 340). Specimens in the Cambridge collection (N. 546, N. 551, N. 552 and N. 553), ♂s and ♀s, off kangaroo, Barrow Island, **N. W. Australia,** XI. 1900, C. J. T. Tanney coll., and a ♀ in W. F. Cooper's collection, off *Equus caballus*, **Central Queensland, Australia,** VI. 1908, H. Tryon coll. (C. 264), show some variation from the type in the matters of size and ornamentation. The pale ornamentation of the ♂ scutum (Fig. 20) is far more extensive; the postero-median and antero-accessory stripes stand out clearly on the pale ground; the postero-accessory stripes are represented by dark patches flattened alongside the marginal groove, and the three lateral spots are confused in a dark elongate stripe running along the internal border of the marginal groove; in the anterior part the outline of a pseudo-scutum is clearly defined. The ♀ also shows a more extensively ornate scutum than the type (see Fig. 21), and the central depression and curved lateral grooves of the basis capituli are not so well-developed.

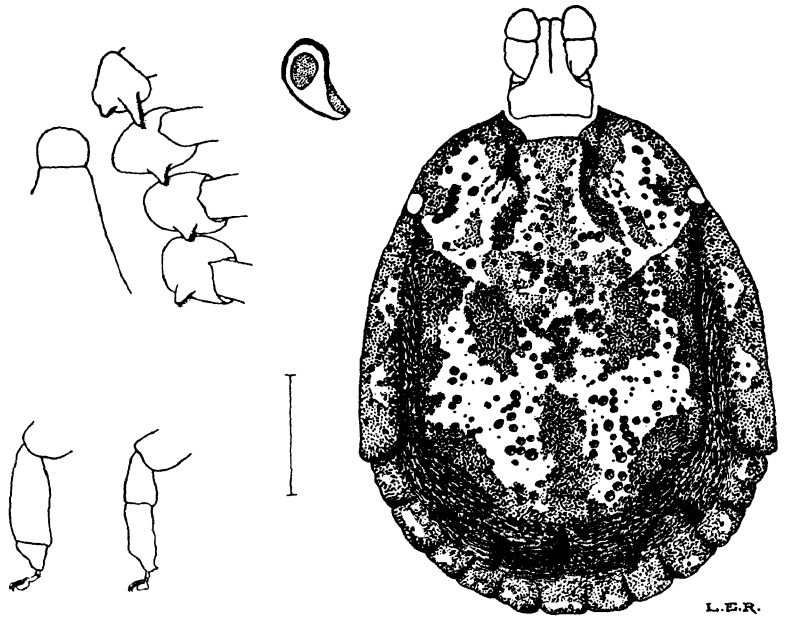


Fig. 20. *Amblyomma triguttatum* var. ♂. Scutum, capitulum, spiracle, coxae I–IV, tarsi I and IV. (N. 552.)

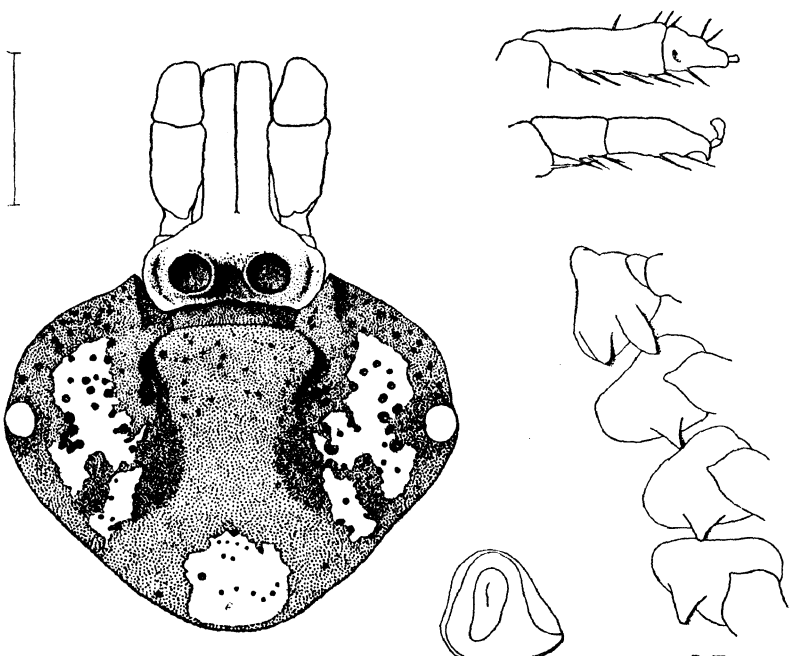


Fig. 21. *Amblyomma triguttatum* var. ♀. Scutum, capitulum, spiracle, coxae I–IV, tarsi I and IV. (C. 264.)

10. AMBLYOMMA GEAYI Neumann, 1899.

Figs. 22 and 23.

Synon. and Lit.:

Amblyomma geayi Neumann, L. G., 1899, pp. 223–224, specific description of ♂: 1901, p. 299, specific description of ♀: 1911, p. 71, brief description of ♂ and ♀.

Amblyomma v-notatum Nuttall, G. H. F., 1910, pp. 412–413, specific description of ♀; Fig. 5, ♀ capitulum and scutum, capitulum in profile, capitulum from ventral aspect, with coxae, spiracle, tarsus IV and anal groove.

Male (Fig. 22). Diagnosis: A moderately large species; scutum broad oval, very narrow anteriorly, antero-lateral margins almost straight; ornate; marginal groove continuous, commencing a short distance anterior to the middle of the length of the body; festoons large and well-defined; basis capituli trapezoidal; hypostome dentition 3 | 3; coxa I with two, short, flat, sub-equal spurs; a single, more pointed spur on each of coxae II–IV; ventral plaques large.

DESCRIPTION. *Body*: *L.* 6·0 mm., *W.* 4·7 mm., contour broad oval, very narrow anteriorly; antero-lateral margins sub-rectilinear; posterior

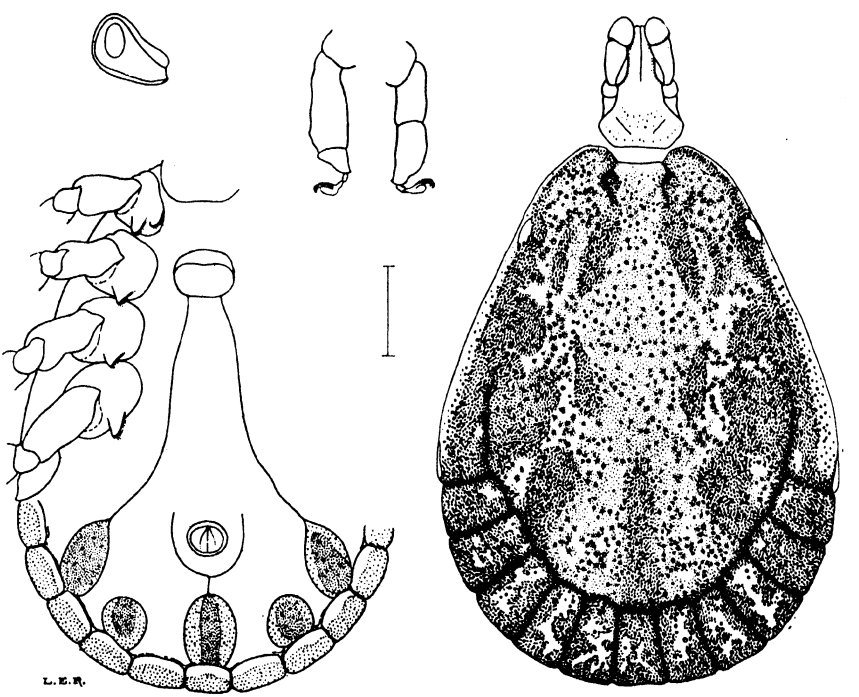


Fig. 22. *Amblyomma geayi* ♂. Scutum, capitulum, venter, spiracle, tarsi I and IV. (N. 3125.)

margin rounded. *Scutum*: convex, ornate, with irregular pale marbling extending from the scapular angles to the external festoon and also on the festoons; postero-median and postero-accessory stripes short and broad; 2nd and 3rd lateral spots conjoined and all three lateral spots fused with the dark marginal coloration; antero-accessory stripes almost parallel; frontal spot elongate; cervical grooves in the form of small, oval pits; marginal groove continuous, commencing a short distance anterior to the middle of the length of the body, more widely separated from the margin of the scutum behind than in front; punctations numerous, unequal, moderately coarse in places; eyes relatively small, pale and flat. *Venter*: earthy-yellow; genital aperture opposite coxa II; spiracles small, comma-shaped, obliquely placed; ventral plaques exceptionally large, the external and median plaques oval, the intermediate plaques smaller and almost circular; festoons long. *Capitulum*: *L.* 1·4 mm., basis trapezoidal, postero-lateral angles non-salient; palps club-shaped, article 2 one-and-a-half times as long as article 3; hypostome dentition 3 | 3. *Legs*: long and stout; coxa I with two, short, flat, sub-equal spurs; coxae II–IV each with a single, short, triangular spur, longest on coxa IV; tarsi attenuated in talus.

Female (Fig. 23). Diagnosis: A moderately large tick; scutum cordiform, ornate, with an irregular V-shaped pale patch in the posterior angle; punctations numerous; eyes situated a short distance in front of the middle; basis capituli trapezoidal; hypostome dentition 3 | 3; coxa I with two, short, flat, sub-equal spurs; a single, short, blunt spur on each of coxae II–IV.

Description. *Body*: *L.* 5·1 mm., *W.* 4·0 mm., contour broadly oval, widest at posterior third; dorsum earthy-brown, rugose, coarsely punctate, glabrous; marginal groove continuous, deep and well-defined. *Scutum*: cordiform, 3 × 3 mm., postero-lateral margins very convex, posterior angle narrow; chestnut-brown, polished; ornate, with an irregular pale V-shaped patch at the posterior angle and small pale spots in the lateral fields; cervical grooves deep anteriorly, shallow and divergent posteriorly; punctations numerous, unequal, coarse in places; eyes pale and flat. *Venter*: like dorsum, punctations finer, confined to posterior half; genital aperture opposite posterior margin of coxa II; spiracles large, triangular with rounded angles; dorsal process long. *Capitulum*: *L.* 1·9 mm., basis trapezoidal, postero-dorsal border continued as a salient ridge round the lateral margins to the ventral surface; porose areas of medium size, pyriform, slightly divergent, interval greater than diameter; palps long,

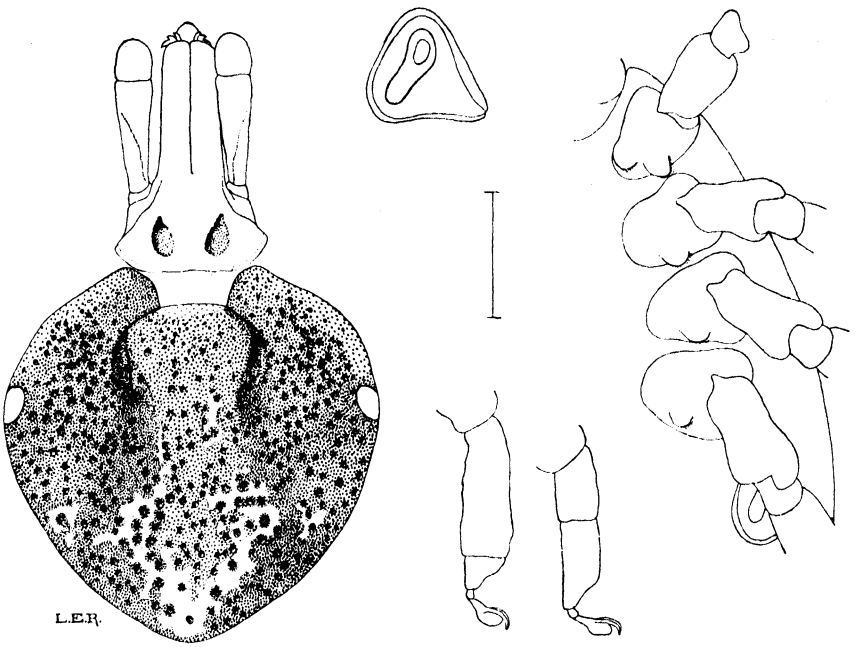


Fig. 23. *Amblyomma geayi* ♀. Scutum, capitulum, coxae I–IV, spiracle, tarsi I and IV. (N. 3215.)

slender, club-shaped, article 2 three times as long as article 3; hypostome long, tip sub-acute, dentition 3 | 3. *Legs*: long and stout; coxa I with two, short, flat, sub-equal spurs, of which the internal is the longer and more pointed; a single, short, blunt spur on each of coxae II–IV; tarsi attenuated in talus.

Geographical Distribution and Hosts.

Neumann's original description of the ♂ (1899, p. 224) is based on a specimen from Pará, **Brazil**, Göldi coll., and two ♂s from Darien, **Colombia, South America,** Geay coll. (Paris Mus.); his later description (1901, p. 299), records ♂s and ♀s, from Pará, **Brazil**, Schulz coll. (Berlin Mus.); and 1 ♂ off a tortoise in the Zoological Gardens, Amsterdam (Oudemans coll.). The Cambridge collection contains ♀s, off *Bradypus tridactylus*, Manaos, **Brazil**, VII. 1910, T. P. Beddoes coll. (N. 1149, types of *Amb. v-notatum* Nuttall); ♀, off "Mpouri," **British Guiana**, 1909, Dr K. S. Wise coll. (N. 1651); and ♂s and ♀s, off *Bradypus tridactylus*, Manaos, **Brazil**, T. P. Beddoes coll. (N. 3125). Aragão (1911, pp. 159 and 162) records examples, off *Bradypus tridactylus*, Marajó and R. Tapajoz, State of Pará, **Brazil.**

11. AMBLYOMMA BISPINOSUM Neumann, 1906.

Fig. 24.

Lit.: Neumann, L. G., 1906, p. 204, specific description of ♀; 1911, p. 77.

Male: unknown.

Female (Fig. 24). Diagnosis: A moderately large species; dorsum striated, punctate, glabrous; scutum triangular-cordiform, posterior angle broad; ornate; punctations small, numerous, evenly distributed; coxa I with two sub-equal spurs, twice as long as broad; a single short spur on each of coxae II–IV.

DESCRIPTION. *Body*: *L.* 6·5 mm., *W.* 4·5 mm., contour elliptical; marginal groove present, festoons well-defined. *Scutum*: 2·5 × 3·1 mm., triangular cordiform, posterior angle wide; ornamentation consisting of a dark marginal coloration expanded at the limiting spots, ocular spots

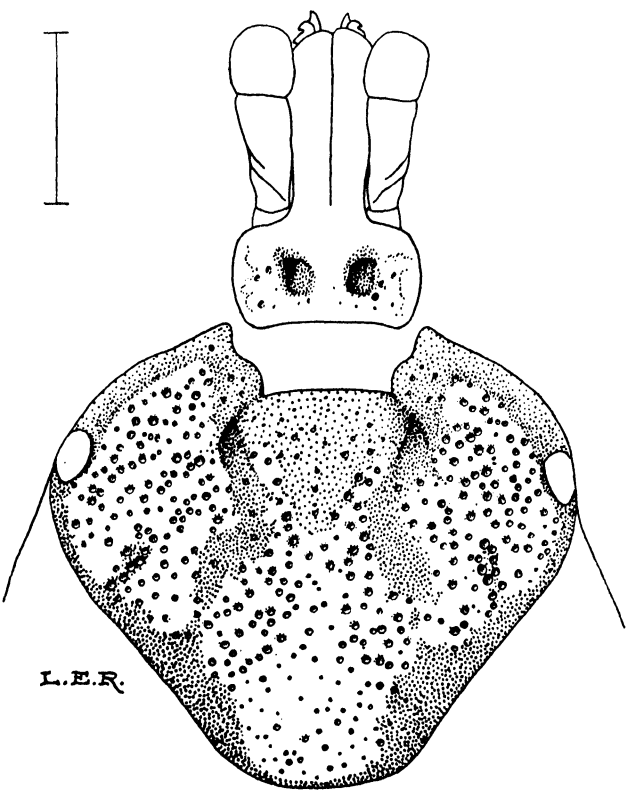


Fig. 24. *Amblyomma bispinosum* ♀. Scutum, capitulum. (Type, British Mus.)

insignificant, cervical stripes approaching each other towards the middle of their course, almost or quite reaching the limiting spots; frontal spot small, barely detached from the marginal coloration; punctations numerous, small, evenly distributed; cervical grooves short, deep, sigmoid; eyes large, pale and flat. *Venter*: glabrous, striated; spiracles large, sub-triangular. *Capitulum*: long (1·7 mm.), basis rectangular, twice as broad as long, lateral margins slightly convex, postero-lateral angles broad and barely salient; porose areas small, pyriform, divergent anteriorly; interval slightly greater than the diameter; palps long and stout, club-shaped, article 2 twice as long as article 3; hypostome long, slightly spatulate, dentition 3 | 3. *Legs*: long and stout; coxa I with two sub-equal spurs twice as long as broad; a flattened spur, broader than long on each of coxae II and III; a single spur, as long as broad, on coxa IV; tarsi long, attenuated in talus.

Description based on a ♀ (type) from **Venezuela** (British Museum); host unknown.

12. AMBLYOMMA LOCULOSUM Neumann, 1907.

Fig. 25.

Lit.: Neumann, L. G., XII, 1907, pp. 193–196, specific description of ♂ and ♀.

Male. Diagnosis: A small to medium-sized tick; scutum very convex, ornate; marginal groove continuous; punctations numerous, confluent in places; eyes large and flat; hypostome dentition 3 | 3; coxa I with two short, flat, sub-equal spurs; a single short, broad spur on each of coxae II–IV; larger and more pointed on coxa IV.

DESCRIPTION. *Body*: *L.* 4–5·5 mm., *W.* 3·5–5 mm., contour a short oval, broadest at the posterior third. *Scutum*: very convex; ornate, with a dark-coloured, narrow, marginal stripe, of irregular width, extending completely round the contour, extending over the separations of the festoons and the marginal groove; anteriorly, a pair of symmetrically disposed dark spots at the level of the commencement of the marginal grooves; behind these, two smaller, successive spots; within the latter, an elongated spot on each side; between these a transverse stripe; postero-median stripe narrow, extending as far as the posterior third of the body length; postero-accessory stripes directed towards the centre of the scutum; cervical grooves short, clearly defined; marginal groove deep, commencing behind the eyes, continuous; festoons well-defined,

rectangular, longer than broad; punctations very numerous, unequal, confluent in places; a few short hairs at the periphery; eyes large and flat. *Venter*: dark-brown, with numerous short hairs; integument striated and folded; festoons distinct; spiracles broadly comma-shaped. *Capitulum*: *L.* 1·0–1·3 mm., narrow; base rectangular, postero-lateral angles slightly salient, flattened; palps flat, with long whitish hairs, article 2 at least twice as long as article 3; hypostome long, spatulate, dentition 3 | 3. *Legs*: long, stout, reddish-brown in colour; coxa I with two, sub-equal, flat spurs, as broad as long; a single spur, broader than long on each of coxae II and III; coxa IV with a single spur, larger and more pointed than those on coxae II and III; tarsi long, stout, abruptly attenuated.

Female (Fig. 25). Diagnosis: A medium-sized tick; scutum triangular-cordiform, ornate, cervical grooves very large, broad and deep; punctations numerous, coarse, confluent in places; dorsum and venter with numerous white spiniform hairs; porose areas large, elongate, not widely separated; coxa I with two short, blunt, rounded spurs; coxae II–IV each with a short, broad, rounded and flattened spur.

DESCRIPTION. *Body*: *L.* 6 mm., *W.* 5 mm., contour broad oval; dorsum dark-brown, scattered with numerous long, whitish, spiniform hairs; marginal groove continuous; festoons well-defined. *Scutum*: triangular-cordiform, 3·0 × 3·2 mm., postero-lateral margins convex, posterior angle narrow; ornate, with a dark marginal band extending from the ocular spots to the posterior angle; cervical stripes indefinite, extending backwards as far as the limiting spots; frontal spots indistinct; punctations numerous, large, deep, confluent in places, evenly distributed in median and lateral fields, absent from the marginal parts; cervical grooves long, deep and broad in the middle, spindle-shaped, extending beyond the middle of the scutum and continued as shallow depressions almost to the postero-lateral margin of the scutum; eyes relatively small, pale and flat. *Venter*: with large whitish hairs as on the dorsum; spiracles large, triangular with rounded angles. *Capitulum*: *L.* 1·6 mm., basis rectangular, postero-lateral angles slightly salient; porose areas large, elongate, not widely separated, interval less than diameter; palps club-shaped, article 2 two-and-a-half times as long as article 3; hypostome long, spatulate, dentition 3 | 3. *Legs*: long and stout, reddish-brown, annulated with white at the distal extremities of the femur, tibia and protarsus; coxa I with two, sub-equal, short, rounded spurs; a single

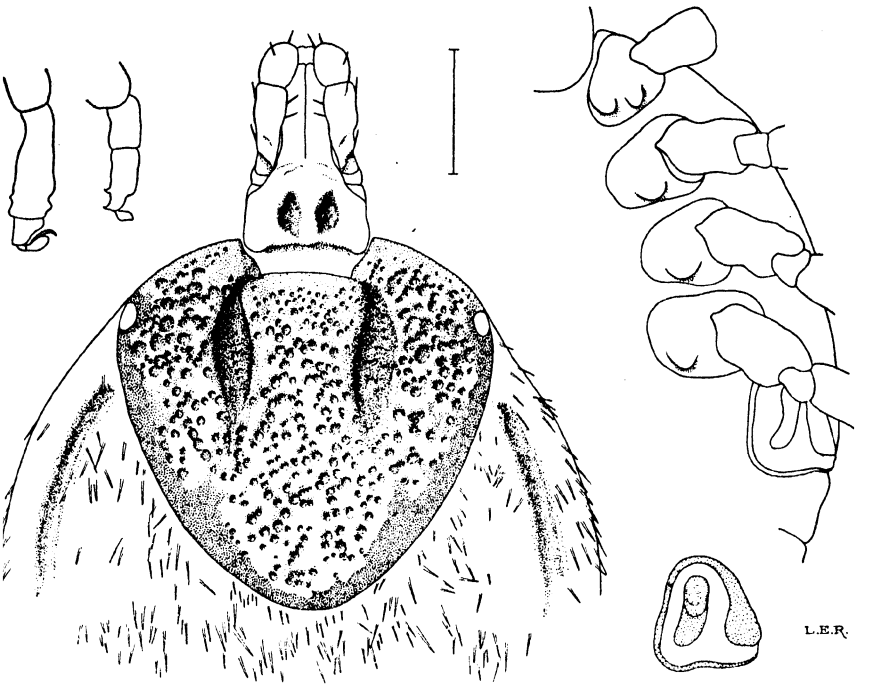


Fig. 25. *Amblyomma loculosum* ♀. Anterior part of dorsum with scutum, capitulum, coxae I–IV, spiracle, tarsi I and IV. (Co-type, lent by Prof. L. G. Neumann.)

broad, rounded spur on each of the remaining coxae; tarsi abruptly attenuated.

Neumann's description is based on 2 ♂s and 10 ♀s found on the ground, **Establishment Is**. (Cargados Carajos), Indian Ocean, Prof. J. Stanley Gardiner coll. Neumann observes that the hosts of this tick are probably lizards, which, with birds, are the only vertebrate animals living on the Cargados Islands.

13. AMBLYOMMA CONCOLOR Neumann, 1899.

Figs. 26 and 27.

Synon., Lit. and Iconogr.:

Ixodes auricularius Conil, P. A., 1878, pp. 99–110, specific description of ♂ and ♀; Pl. IX, 8 figs.

Amblyomma auriculare (Conil) Lahille, P., 1905, pp. 34, 145–148, description of ♂; Pl. XI, Figs. 1–7 (coloured), ♂ dorsum and venter, capitulum from ventral aspect, spiracle, digit of chelicera, tarsi I and IV.

Amblyomma concolor Neumann, L. G., 1899, p. 222, specific description of ♂ and ♀ (? nymph).

1909, Rohr, C. J., pp. 162–163, description after Neumann, 1899; p. 202, geographical distribution and hosts in Brazil. **1911**, Neumann, L. G., p. 71, short description of ♂ and ♀ (? nymph); Aragão, H. de B., pp. 159 and 162, distribution and hosts in Brazil.

Male (Fig. 26). Diagnosis: A small tick with slight ornamentation on the scutum; contour oval, narrow in front; punctations numerous, fine for the most part, coarser in the antero-lateral fields, evenly distributed; marginal groove well-defined in posterior part, continuous; palps short and thick, article 1 with a stout, flat, retrograde process on its ventral face; coxa I with two sub-equal spurs; coxae II–IV each with a short triangular spur; a small spur on the posterior border of each trochanter.

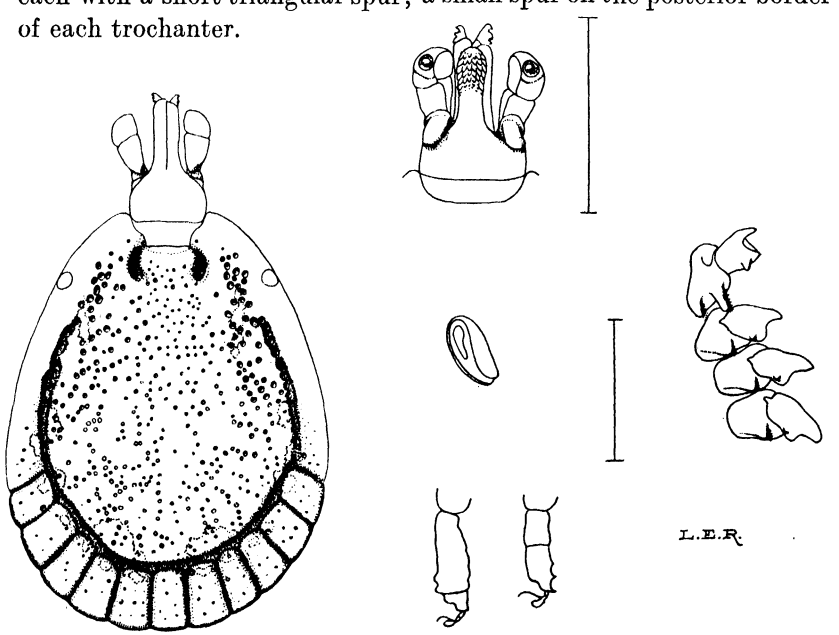


Fig. 26. *Amblyomma concolor* ♂. Scutum, capitulum from dorsal and ventral aspects, coxae I–IV, spiracle, tarsi I and IV. (N. 1264.)

DESCRIPTION. *Body*: *L.* 3 mm., *W.* 2·3 mm.; contour oval, broadest behind middle, narrow in front. *Scutum*: dark reddish-brown, convex, glossy, ornamentation feeble, sometimes indistinct in imperfectly preserved specimens; consisting of (1) a pair of small, symmetrically disposed pale spots at the posterior end of the scutum, immediately in front of the marginal groove, (2) small indistinct pale spots in the lateral fields, adjacent to the marginal groove at the level of and anterior to the external festoon, (3) an irregular longitudinal pale spot in the antero-lateral field, between and posterior to the eyes and the cervical grooves, (4) small indistinct pale spots on the festoons, excepting the median, and on the marginal ridge; marginal groove wide and deep in the posterior part, continuous, commencing some distance behind the eyes as a linear series of contiguous punctations; cervical grooves deep, curved; punctations numerous, small, evenly distributed, coarser in the antero-lateral fields; eyes moderately large, flat and pale. *Venter*: paler than dorsum, with few fine short hairs; genital aperture opposite coxa II; spiracles narrow, comma-shaped. *Capitulum*: *L.* 0·75 mm., basis capituli rectangular, lateral margins slightly convex, postero-lateral angles not salient; palps short, thick; article 1 with a stout flat retrograde spur on its ventral face; article 2 barely one-and-a-half times the length of article 3; contracted proximally, with a short conical prolongation on the dorsal side; hypostome dentition 3 | 3. *Legs*: short, moderately stout; coxa I with two widely-separated sub-equal spurs; coxae II–IV each with a single triangular plate-like spur; tarsi abruptly attenuated; trochanters each with a small spur at the external third of the posterior border, diminishing in size on the successive legs.

Female (Fig. 27). Diagnosis: A small species with a cordiform scutum indistinctly ornate; an irregular longitudinal pale spot in each lateral field; punctations moderately fine, coarser in lateral fields where confluent punctations form a depression indicating a lateral groove; eyes large; palps club-shaped; hypostome dentition 3 | 3; coxa I with two sub-equal spurs; coxae II–IV each with a triangular, plate-like spur.

DESCRIPTION. *Body*: *L.* 4·3 mm., *W.* 2·2 mm., contour broadly elliptical; dorsum earthy yellowish-brown; marginal groove present, indistinct posteriorly. *Scutum*: cordiform, 1·7 × 1·9 mm.; colour chestnut brown; an irregular longitudinal pale spot in each lateral field, punctations numerous, small, evenly distributed; coarser punctations in the lateral fields where they become confluent and form a short depression indicating

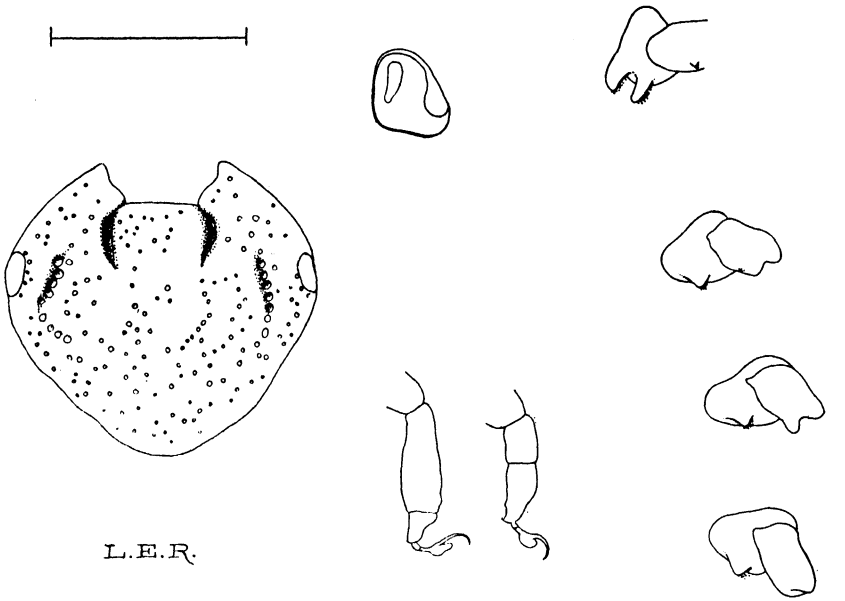


Fig. 27. *Amblyomma concolor* ♀ (? nymph). Scutum, spiracle, coxae I–IV, tarsi I and IV. (Co-type presented by Prof. L. G. Neumann to the Cambridge Coll. N. 2872.)

a lateral groove; cervical grooves narrow and curved; eyes large, flat and pale. *Venter*: paler than dorsum, smooth and glabrous; genital aperture situated opposite coxa II; spiracles small, triangular. *Capitulum*: relatively longer than that of the ♂; basis broad, lateral margins slightly convex, postero-lateral angles non-salient; porose areas medium, oval, divergent, well-separated; palps club-shaped, article 2 nearly twice as long as article 3; a flattened retrograde spur on the ventral face of article 1. *Legs*: as in ♂.

Geographical Distribution and Hosts.

Description based on a ♂ and ♀ in the Cambridge collection (N. 1264), off *Dasypus* sp., Reimanso, State of Bahia, **Brazil**, 21. I. 1908; the gift of Dr H. de B. Aragão. A female (?) co-type in the same collection (N. 2872) is immature, and appears to be a nymph; the capitulum is missing. Neumann's description of the ♀ would apply to this nymphal form and the question arises as to whether or not the females described by Neumann are nymphs. Lahille (1905) recognised that a close resemblance existed between *Amb. concolor* N. and *Ixodes auricularius* Conil, 1877, and identified specimens found on *Dasypus villosus* Desm.,

in the **Argentine Republic**, with Conil's species. Unfortunately, Conil's description is too imperfect to justify the re-establishment of his species; *Amb. auricularius* (Conil) Lahille must therefore fall into synonymy. Neumann described the species from examples off *Dasypus* sp., Belem, Pará, **Brazil**, Rebourgeon coll. (Coll. R. Blanchard). Aragão (1911) records *Dasypus* sp., as the host of this tick, from Formosa and Reimanso, Bahia, **Brazil**. Lahille's *Amb. auriculare* came from Ceres, Santa Fe, Argentine Republic. Neiva and Penna (1916, pp. 90 and 91) list specimens collected in the course of their expedition in Brazil. ♂s and ♀, off *Tolypeutes tricinctus*, Parnaguá, State of Piauhy, 23. VI. 1912; also from same host, Duro, State of Goyaz, VII. 1912; ♂s, ♀ and nymph, off *Dasypus novemcinctus*, State of Goyaz, no date; ♂, ♀ and nymph, off *Conepatus suffocans*, Caracol, State of Piauhy, no date; ♂s, ♀s and larvae, off *Dasypus novemcinctus*, Tigre, State of Pernambuco; ♂s, ♀s and larvae, off *Tolypeutes tricinctus*, Onça, State of Piauhy.

14. AMBLYOMMA PSEUDOCONCOLOR Aragão, 1908.

Figs. 28 and 29.

Lit. and Iconogr.: Aragão, H. de B., 22. XI. 1908, pp. 431–432; 1911, pp. 190–193; description of ♂ and ♀; Pl. XII, Figs. 25–27, ♂ dorsum and venter, ♀ dorsum.

Male (Fig. 28). Diagnosis: A small tick; contour broadly oval, narrow in front; marginal groove continuous; ornate, the dark coloration preponderating; punctations fine except a few in the anterolateral fields; capitulum short, basis rectangular; article 1 of the palp with a short, blunt retrograde spur on its ventral face; hypostome dentition 3 | 3; coxa I with two short sub-equal spurs; coxae II–IV each with a single short triangular spur, longest on coxa IV; a minute spur on each trochanter; tarsi abruptly attenuated.

DESCRIPTION. *Body*: *L.* 3·15 mm., *W.* 2·75 mm., contour broadly oval, widest just posterior to middle, narrow in front. *Scutum*: slightly convex, polished, ornate, with pale spots on a yellowish-brown ground, the ornamentation somewhat resembling that of *Amb. americanum*—a pair of symmetrically disposed pale spots at the posterior part of the scutum in front of and adjacent to the festoons; two smaller spots on each side, within and adjoining the marginal groove, sometimes conjoined and extending slightly on to the marginal ridge, the foremost spot situated about the middle of the length of the body, the hindermost

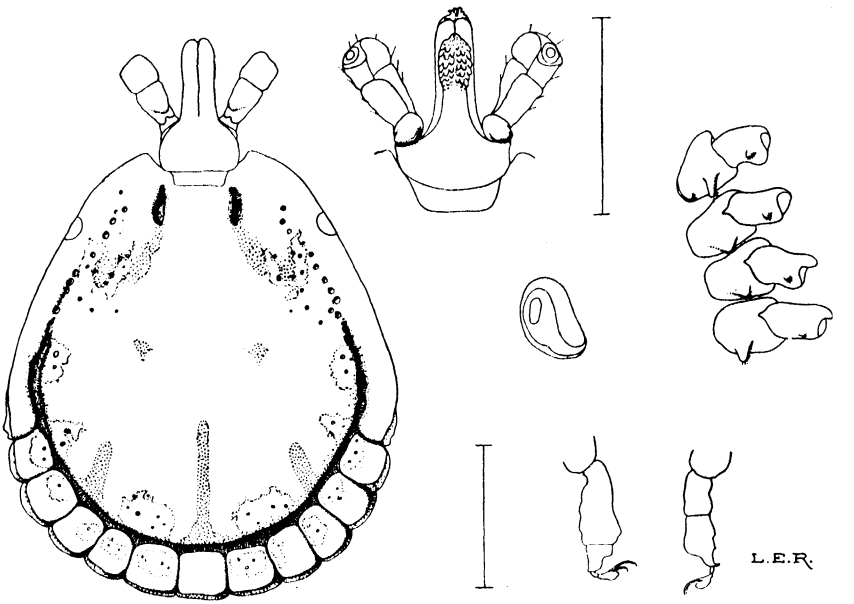


Fig. 28. *Amblyomma pseudoconcolor* ♂. Scutum, capitulum from dorsal and ventral aspects, spiracle, coxae I–IV, tarsi I and IV. (C. 5.)

opposite the external festoon; an irregular U-shaped spot in each antero-lateral field, within and posterior to the eyes, the outer limb may extend forward beyond the eyes; a small irregular pale spot on each festoon excepting the median; the postero-median, postero-accessory and cervical grooves generally visible as darker markings on the dark-coloured background; marginal groove commencing in a linear series of punctations which runs forward towards the scapular angles, deep, wide and sharply incised from a point on each side some distance behind the eyes, continuous; cervical grooves in the form of deep, elongate, longitudinally disposed pits; punctations very fine, excepting those already mentioned, and a few medium sized punctations near the margins of the body and on the festoons; festoons rectangular, clearly defined, a little longer than broad. *Venter*: pale yellow, punctate, scattered with short fine hairs; genital aperture opposite coxa II; festoons clearly defined; spiracles comma-shaped, obliquely disposed. *Capitulum*: *L.* 0·7 mm., basis rectangular, postero-lateral angles not salient; palps short, article 1 with a short, blunt, retrograde process on its ventral face; article 2 slightly longer than article 3; hypostome dentition 3 | 3. *Legs*: somewhat short; coxa I with two short, sub-equal spurs, widely separated; coxae II–IV each

with a single short triangular spur, longest on coxa IV; a minute spur on each trochanter, situated at the external third of the posterior border; tarsi abruptly attenuated.

Female (Fig. 29). Diagnosis: A moderately small species; scutum cordiform, postero-lateral margins sinuous, posterior angle broad; eyes small; cervical grooves pyriform; punctations fine, coarse in lateral fields; coxa I with two small, sub-equal spurs, widely separated; coxae II–IV each with a short triangular spur; a minute spur on the posterior border of each trochanter; tarsi abruptly attenuated.

DESCRIPTION. *Body*: *L.* 4·0 mm., *W.* 3·4 mm., contour a broad oval, almost elliptical; dorsum glabrous; marginal groove well-defined, continuous; punctation sparse. *Scutum* (2·50 × 2·15 mm.): cordiform, postero-lateral margins sinuous, posterior angle broad; ornamentation resembling that of anterior part of the scutum of the ♂; cervical grooves pyriform, deep anteriorly; punctations numerous, moderately fine in the median field; coarser punctations in the lateral fields where a trace of a lateral groove is sometimes formed by a linear series of punctations; eyes small, flat and yellow. *Venter*: paler than dorsum; genital aperture

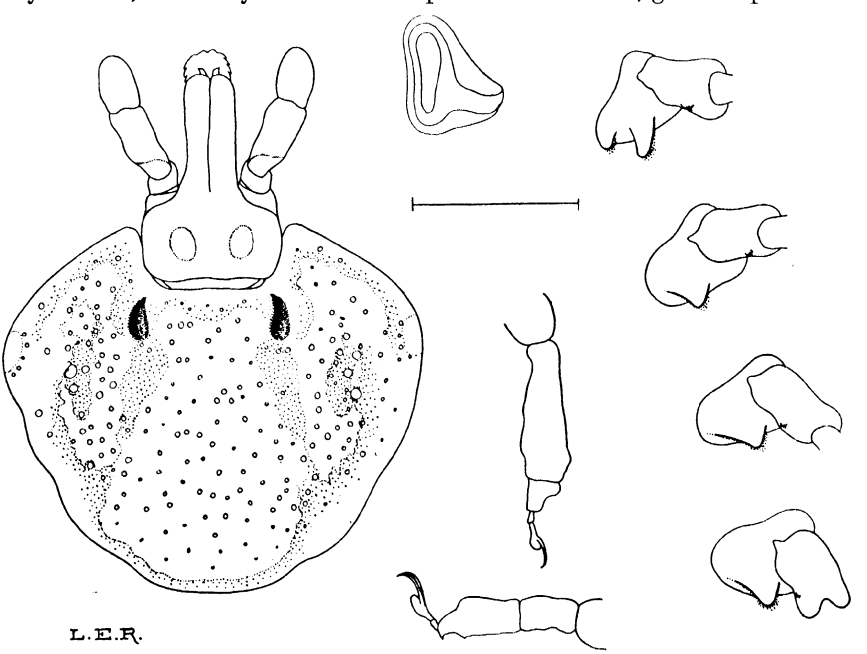


Fig. 29. *Amblyomma pseudoconcolor* ♀. Scutum, capitulum, spiracle, coxae I–IV, tarsi I and V. (C. 5.)

opposite the interspace between coxae II and III; festoons well-defined; spiracles small, triangular with rounded angles. *Capitulum*: *L.* 1·3 mm., basis rectangular, postero-lateral angles non-salient; porose areas oval, slightly divergent; palps relatively longer than those of the ♂; article 1 with a very small, blunt, retrograde spur; article 2 one-and-a-half times as long as article 3; hypostome dentition 3 | 3. *Legs*: similar to those of the ♂.

Geographical Distribution and Hosts.

Aragão (1911, pp. 18 and 21) records ♂s taken from *Dasypus* sp. (?), Avaré, Saõ Paulo, **Brazil**, and nymphs off *Nothura maculosa* (?). The Cambridge collection contains a ♂ and a ♀ from the same locality, 26. VI. 1908, the gift of Dr H. de B. Aragão (N. 820). ♂s and ♀s in the Cooper collection were collected by Dr Karl Fiebrig, at San Bernardino, **Paraguay**, 22. II. 1909, host not specified (C. 5).

15. AMBLYOMMA COOPERI Nuttall and Warburton, 1907.

Figs. 30 and 31.

Synon., Lit. and Iconogr.:

Amblyomma cooperi Nuttall, G. H. F., and Warburton, C., 1907, pp. 410–412, specific description of ♂ and ♀; Figs. 33–36, ♂ dorsum and venter, ♀ dorsum, digit of chelicera and tarsus IV (all herein reproduced).

Amblyomma lutzi Aragão, H. de B., 22. III. 1908, pp. 6–10 of reprint.

Male (Fig. 30). Diagnosis: A small tick; scutum broad oval, ornate, with characteristic brown spots and stripes on a white ground; punctations numerous, moderately coarse, confluent in places; marginal groove continuous, eyes pale and flat; capitulum short, palps thick, barely twice as long as broad; a broad, flat, retrograde spur on the ventral face of article 1; hypostome dentition 3 | 3; coxa I with two rather short, sub-equal spurs; a single, very short, broad spur on each of coxae II and III; a single, moderately long spur on coxa IV.

Description. *Body*: *L.* 3·5 mm., *W.* 2·7 mm., contour broad oval, widest at posterior third, margin concave at level of eyes. *Scutum*: ornate, with brown spots and stripes on a white ground; postero-median stripe rather narrow, barely one-third length of scutum; postero-accessory stripes short and thick, almost vertical; lateral spots distinct,

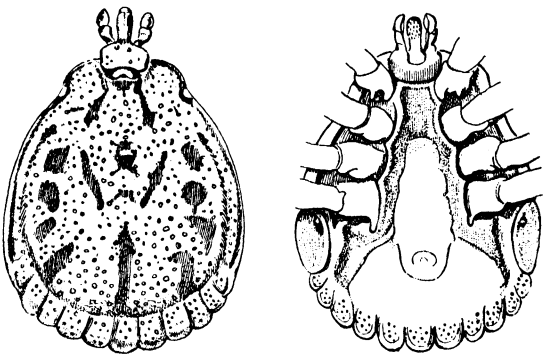


Fig. 30. *Amblyomma cooperi* ♂. Dorsum and venter. ×N. 70. From Nuttall and Warburton, 1907, Figs. 33 and 34.)

conjoined or separated; antero-accessory stripes narrow, slightly divergent anteriorly; cervical stripes narrow, divergent posteriorly; frontal spots absent; a pale stripe on the marginal ridge, extending from the pale ground behind the eye to the external festoon; festoons pale coloured; falciform stripe absent, a longitudinal dark patch sometimes present between and posterior to the cervical stripes; cervical grooves deep anteriorly, shallow and divergent posteriorly; marginal groove continuous, commencing a short distance behind the eyes, formed of confluent punctations in its anterior part, wide and rather shallow posteriorly; punctations numerous, moderately coarse, dark-coloured, confluent in places; eyes of medium size, pale and flat; festoons well-defined, separations wide. *Venter*: whitish, almost glabrous, with fine shallow punctations; genital aperture opposite coxa II; spiracles large, oval; festoons well-defined, with whitish ventral scutes, salient at the posterior margin. *Capitulum*: short, *L.* 0·85 mm., basis rectangular, postero-lateral angles slightly salient, dorsal surface with white enamelling; palps very short and thick, with white marbling on the dorsal surface, article 1 with a broad, flat retrograde spur on its ventral face, article 2 barely one-and-a-half times as long as article 3, contracted proximally, with a postero-dorsal point; hypostome short, spatulate, dentition 3 | 3. *Legs*: short, light-brown with white marbling on the dorsal surfaces of the articles; coxa I with two, rather short, sub-equal spurs; a single, very short, broad spur, continued on the mesial side into a fine salient ridge, on each of coxae II and III; a single, moderately long, pointed spur on coxa IV; tarsi short and thick, abruptly attenuated.

Female (Fig. 31). Diagnosis: A medium-sized tick; scutum triangular, posterior angle broad, postero-lateral margins sinuous, ornate, with dark reddish-brown markings on a pale yellow ground; punctations numerous, moderately coarse, confluent in places; eyes pale and flat; basis capituli rectangular; porose areas large, deep, oval, divergent; palps of medium length, club-shaped; a broad, flat, retrograde spur on the ventral face of article 1; hypostome dentition $3\frac{1}{2} \mid 3\frac{1}{2}$; coxa I with two short, stout, sub-equal spurs; a single, very short, broad spur on each of coxae II and III; a similar, but more pronounced, spur on coxa IV.

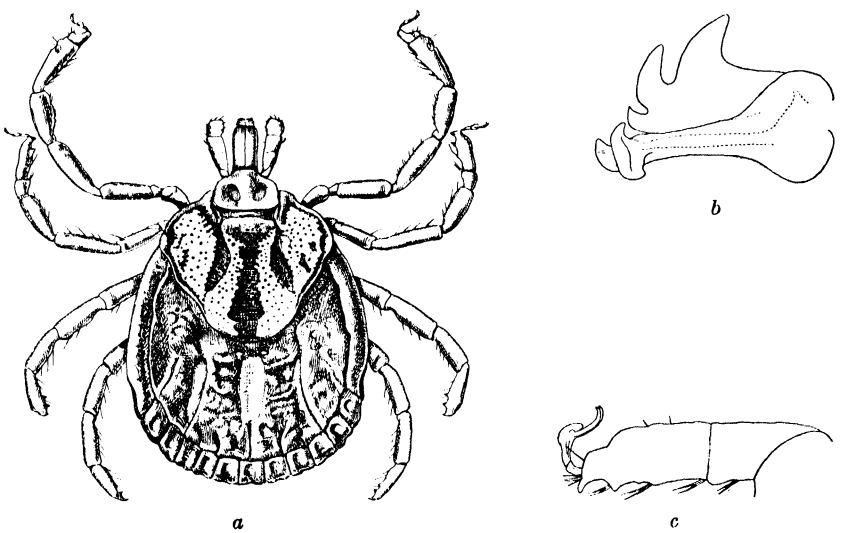


Fig. 31. *Amblyomma cooperi* ♀. Dorsum, digit of chelicera, tarsus IV. (N. 70. From Nuttall and Warburton, 1907, Figs. 35 and 36.)

Description. *Body*: *L.* 3·8 mm., *W.* 3·0 mm., contour elliptical, dorsum reddish-brown, rugose, with coarse punctations, glabrous; marginal groove indistinct posterior to the 2nd or 3rd festoon; festoons well-defined, with very coarse punctations. *Scutum*: triangular, 2·1 × 2·4 mm., posterior angle broad, postero-lateral margins slightly sinuous; ornate, with dark reddish-brown markings on a pale yellow ground; ocular spots and cervical stripes present, a narrow dark border extending backwards from the former along the postero-lateral margin; limiting spots absent, frontal spots represented by aggregations of dark-coloured punctations; a broad, longitudinal dark stripe in the median field, extending from the emargination to the posterior angle; scapular angles

pale; cervical grooves narrow, deep and curved anteriorly, shallow and divergent posteriorly; punctations numerous, moderately coarse, dark-coloured, confluent in places, finer in the posterior angle and the scapular angles; eyes of medium size, pale and flat. *Venter*: yellowish-brown, glabrous, punctate in posterior half; genital aperture opposite interspace between coxae II and III; spiracles large, oval. *Capitulum*: *L.* 1·3 mm., basis rectangular, dorsal surface pale-coloured, postero-lateral angles non-salient; porose areas moderately large, oval, divergent, interval about equal to diameter; palps of medium length, with pale enamelling on dorsal surface; article 1 with a broad, flat, retrograde spur; article 2 contracted proximally, twice as long as article 3; hypostome dentition $3\frac{1}{2} \mid 3\frac{1}{2}$. *Legs*: as in ♂, coxal spurs weaker, the spur on coxa IV being shorter than broad; tarsi longer than in ♂.

Geographical Distribution and Hosts.

The foregoing description is based on types in the Cambridge collection: ♂s and ♀s, off *Hydrochoerus capybara*, Puerto Cooper, **Paraguay, S. America,** 1904, Mr W. F. Cooper coll. (N. 70). I have also examined a ♂ specimen in the Berlin Museum collection (No. 254), no particulars as to origin.

Aragão (1911, pp. 159 and 162) records specimens from the State of Rio, Saõ Paulo, Minas Geraes and Matto Grosso, **Brazil,** and gives *Hydrochoerus capybara* as the usual host, but notes that it is also found occasionally on *Tapirus americanus*.

16. AMBLYOMMA CRENATUM Neumann, 1899.

Figs. 32 and 33.

Synon., Lit. and Iconogr.:

Amblyomma crenatum Neumann, L. G., 1899, pp. 214–215, specific description of ♀; Fig. 52, ♀ dorsum: 1901, pp. 297–298, revision of description of ♂ and ♀, and recognition of identity of *Amb. crenatum* and *Amb. subluteum*: 1911, pp. 77–78.

Amblyomma subluteum Neumann, L. G., 1899, p. 263, specific description of ♂.

Male (Fig. 32). Diagnosis: A large tick with an unusually long capitulum (3 mm.), characteristic ornamentation on the scutum, marginal groove continuous, eyes large and flat, situated far forward; hypostome dentition 3 | 3; coxa I with two large spurs; a broad, flat spur on coxae II and III; a long, stout spur on coxa IV.

Description. *Body*: *L.* 6·7 mm., *W.* 6·7 mm., contour almost circular, slightly narrowed immediately posterior to the level of the spiracles.

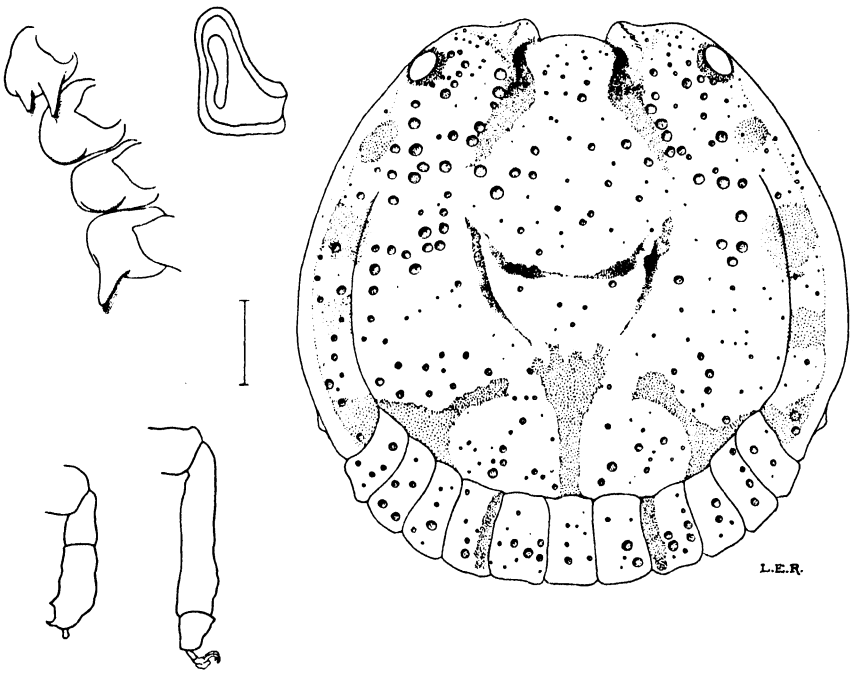


Fig. 32. *Amblyomma crenatum* ♂. Scutum, spiracle, coxae I–IV, tarsi I and IV. (E. 965.)

Scutum: slightly convex, colour dull earthy-yellow with darker brownish markings; postero-median stripe short, expanded at the anterior extremity; postero-accessory stripes long, directed towards the anterior extremity of the postero-median stripe; falciform stripe very thin, almost disappearing in its central part; antero-accessory stripes present, slender, extending backwards and inwards from the extremities of the falciform stripe towards the anterior extremity of the postero-median stripe; cervical stripes broad, divergent; ocular spot small and distinct; four dark spots on the marginal ridge, spaced equally, the hindmost immediately adjoining the external festoon; a narrow, dark stripe along the mesial border of the 4th festoon; marginal groove narrow, commencing some distance behind the eyes, continuous; large punctations interspersed with fine punctations; eyes large, pale and flat, situated far forward; festoons long. *Venter*: of same colour as dorsum; festoons well-defined; spiracles triangular with rounded angles, antero-dorsal margin concave. *Capitulum*: very long (3 mm.); basis rectangular, slightly narrower posteriorly, postero-lateral angles barely salient; palps long and slender, brownish, article 2 more than twice as

long as article 3; hypostome dentition 3 | 3. *Legs*: very long; coxa I with two large spurs, the external spur sharply pointed; a broad, flat, plate-like spur on each of coxae II and III; a moderately long, sharp spur on coxa IV; tarsi long, attenuated in talus.

Female (Fig. 33). Diagnosis: A large tick; scutum triangular, ornate, scapular angles pointed; capitulum very long (3·5 mm.); postero-internal angles of festoons salient; eyes large, pale and flat, bulging beyond the contour of the scutum.

DESCRIPTION. *Body*: *L.* 10 mm., *W.* 9 mm., broad oval, dorsum punctate, marginal groove clearly defined; festoons with postero-internal angles salient, giving the posterior margin a serrate outline. *Scutum*: large, 4·6 × 5 mm., triangular, postero-lateral margins slightly sinuous, antero-lateral margins rounded, scapular angles pointed; ornate, ocular spot represented by a narrow dark band round the eye; limiting spots broadly applied to the postero-lateral margin, a very narrow dark edging to the scutum between the ocular and limiting spots and also round the posterior angle; cervical stripes large and more or less fused with the frontal spots; coarse punctations in the antero-lateral fields, confluent in places, few coarse punctations in the posterior half of the median field; numerous fine punctations scattered over the entire surface of the scutum; cervical grooves small and deep anteriorly, bifurcating posteriorly and continued as shallow depressions towards the postero-lateral margins; eyes large, pale and flat, bulging laterally beyond the contour of the scutum. *Venter*: of same colour as dorsum, punctations finer, scattered with fine hairs; spiracles large, triangular, with broad, rounded angles. *Capitulum*: *L.* 3·5 mm., basis rectangular, slightly narrowed posteriorly, one-and-a-half times as broad as long; postero-lateral angles not salient, porose areas of medium size, oval, divergent; palps long and slender, article 2 two-and-a-half times as long as article 3; hypostome long and narrow, sides almost parallel; dentition 3 | 3 in anterior part, 4 | 4 posteriorly. *Legs*: long and stout; coxa I with two stout spurs, the external spur pointed; a broad plate-like spur on each of coxae II and III; a broad rounded spur on coxa IV; tarsi very long, attenuated abruptly.

Geographical Distribution and Hosts.

Amblyomma crenatum is an **African** species and the only known host is the *Rhinoceros*. Neumann's earlier description of the female was based on a single specimen, off *Rhinoceros*, **Cape of Good Hope** (Paris

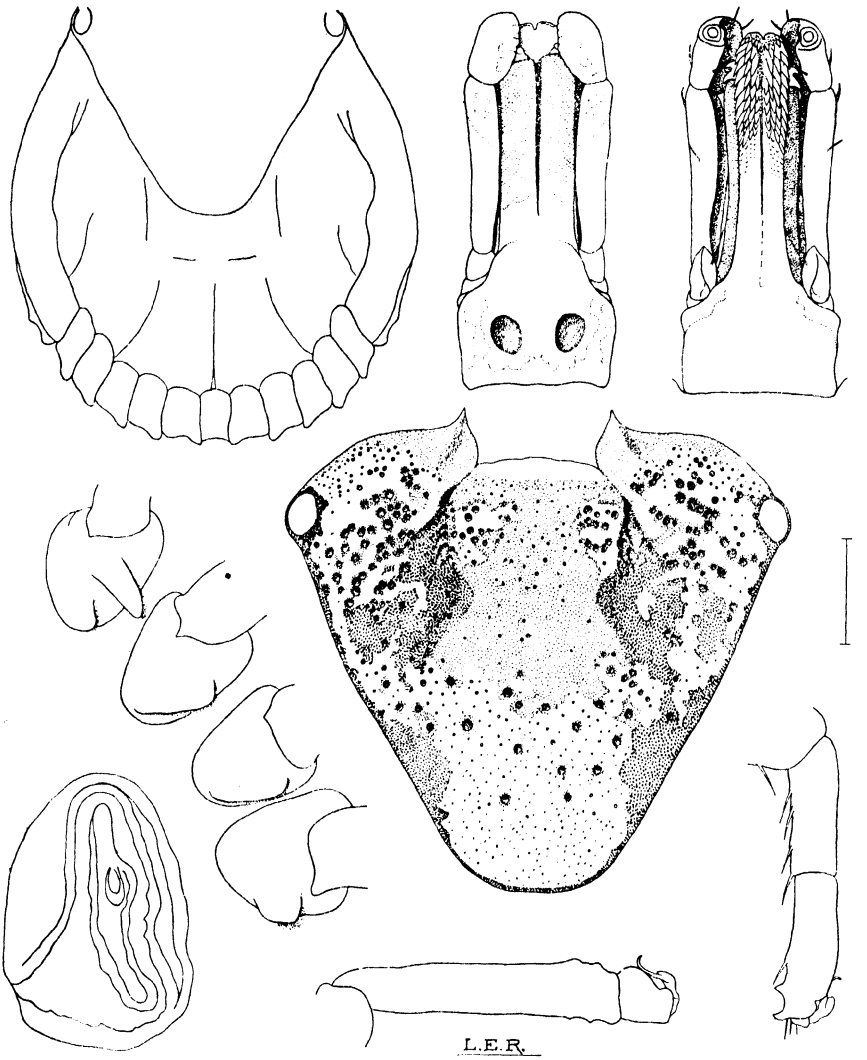


Fig. 33. *Amblyomma crenatum* ♀. Dorsum, scutum, capitulum from dorsal and ventral aspects; coxae I–IV, spiracle, tarsi I and IV. (Type, Berlin Mus.)

Mus.); his description of *Amb. subluteum* was based on two ♂s, one of unknown origin, the other off *Rhinoceros*, **Africa.** The Berlin Museum collection contains 2 ♂s and 2 ♀s, labelled as having been collected by Mösch, in Sumatra. It would seem improbable that this tick is to be found in two parts of the world so remote as Africa and Sumatra without its occurrence being recorded in intermediate parts, and the indication

of origin of the Berlin specimens is probably erroneous. The specimen in the same collection, labelled *Amb. distinctum* Karsch, recorded as having been collected in Ceylon, by Hoffmeister, is a typical female *Amb. hebraeum* Koch, a strictly African species. Fig. 32 is drawn from a ♂, submitted for determination by the Imperial Bureau of Entomology (E. 965).

17. AMBLYOMMA CLYPEOLATUM Neumann, 1899.

Figs. 34 and 35.

Synon., Lit. and Iconogr.:

Amblyomma clypeolatum Neumann, L. G., 1899, pp. 257–258, brief description of ♂; 1911, p. 83, brief description of ♂.

Amblyomma atrogenatum Nuttall and Warburton, 1908, pp. 409–410, specific description of ♂; Text-figs. 30–32, ♂ dorsum and venter, digit of chelicera, hypostome.

Amblyomma zeylanicum Neumann, L. G., 1908, p. 16, specific description of ♀; 1911, p. 89.

Male (Fig. 34). Diagnosis: A small tick; scutum broad oval, pale in colour with very limited dark ornamentation; marginal groove continuous; coxa I with two short, blunt, sub-equal spurs; a single broad flattened spur on each of coxae II–IV.

Description. *Body*: *L.* 4·1 mm., *W.* 3·5 mm., scutum broad oval, narrow anteriorly. *Scutum*: convex, pale dull yellow, alcohol preserved specimens show a golden sheen; dark-brown ornamentation limited to (1) a narrow marginal stripe extending from the scapular angles to the external festoon, expanded at the eye to form the ocular spot; (2) postero-median and postero-accessory stripes present, often indistinct; (3) antero-accessory stripes short and narrow, moderately divergent; lateral spots, cervical stripes and limiting spots absent; coarse punctations, numerous, very shallow but clearly defined, fairly evenly distributed, interspersed with very minute punctations; cervical grooves short, deep, curved; marginal groove narrow but clearly defined, continuous; festoons distinct, short, each bearing a large, pale spot with a dark margin; eyes relatively small, pale and flat. *Venter*: dirty yellow, punctate, with few scattered, short hairs; genital aperture opposite coxa II; spiracles large, broadly comma-shaped. *Capitulum*: *L.* 1·3 mm., basis triangular, lateral margins convex, posterior margin concave, postero-lateral angles barely salient, palps long, stout, club-shaped, hairy; article 2 twice as long as article 3; hypostome long, spatulate, dentition 4 | 4. *Legs*: reddish-yellow, of medium length; coxa I with two short, flat, blunt, contiguous spurs; coxae II–IV each with a broad, rounded, plate-like spur, longest on coxa IV; tarsi short, abruptly attenuated.

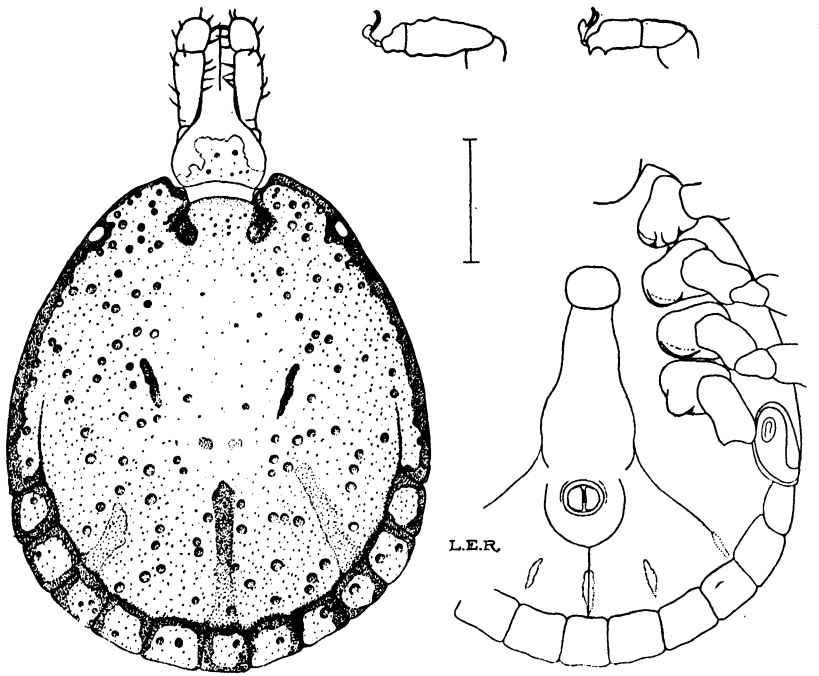


Fig. 34. *Amblyomma clypeolatum* ♂. Scutum, capitulum, venter, tarsi I and IV. (N. 3126.)

Female (Fig. 35). Diagnosis: A medium-sized tick; scutum cordiform, with irregular pale markings on a dark-brown ground; numerous, large, clearly-defined punctations interspersed with very fine punctations; cervical grooves deep, narrow, long **S**-shaped; hypostome dentition 4 | 4; coxa I with two short, blunt spurs; coxae II–IV each with a single broad, flattened spur.

Description. *Body*: *L.* 10 mm., *W.* 7 mm., contour a short oval, dorsum dark-brown, marginal groove and festoons well-defined. *Scutum*: 3·0 × 3·2 mm., cordiform, convex; colour dark-brown with irregular pale markings in the median field and in the lateral fields adjacent to the cervical grooves (alcohol-preserved specimens); large, clearly-defined, non-confluent punctations scattered over the whole surface, more numerous in the anterior half, interspersed with very fine punctations; cervical grooves deep and narrow, long **S**-shaped, extending to the posterior third of the scutum; eyes pale and flat. *Venter*: with fine punctations and fine short hairs; genital aperture opposite coxa II; spiracles large, with rounded angles, no dorsal prolongation. *Capitulum*: *L.* 1·9 mm., basis rectangular, lateral margins convex; postero-lateral

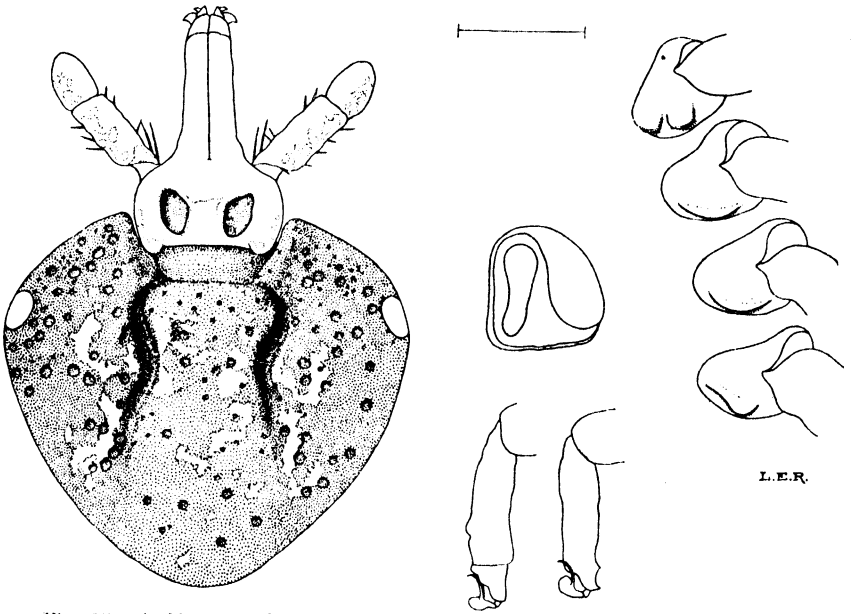


Fig. 35. *Amblyomma clypeolatum* ♀. Scutum, capitulum, spiracle, coxae I–IV, tarsi I and IV. (Indian Mus. Calcutta, 1177/17.)

angles slightly salient; porose areas large, elongate oval or "lemon"-shaped, divergent, interval a little greater than the diameter; palps stout, contracted proximally, sides almost parallel, article 2 twice as long as article 3; hypostome long, spatulate, dentition 4 | 4. *Legs*: long and strong, reddish-brown, indistinctly annulate at the distal extremities of articles 3–5; coxa I with two, broad, flat, contiguous spurs; coxae II–IV each with a very broad, flat spur, longest on coxa IV; tarsi long, abruptly attenuated.

Geographical Distribution and Hosts.

Neumann's original description was based on 6 ♂s, off a *tortoise*, with no indication of the country of origin, Steinblinck coll. (Hamburg Mus.). *Amb. atrogenatum* Nuttall and Warburton was described from 6 ♂s, off *Testudo elegans*, received from **India**, at the Zoological Society's Gardens, London, 15. VIII. 1905, and removed from the host 2. X. 1905 (N. 43). The Cambridge collection also contains ♂ and ♀, ex-Indian Mus. Calcutta (No. 1177/17, N. 3126), ♂s, off *Testudo elegans*, **Ceylon** (West Coast), T. Southwell coll. (N. 1512), ♂, off *Cinixys erosa*, origin unknown, and ♂s, off *tortoise* (?), Zoological Gardens, Budapest, Dr Kotlán donor.

18. AMBLYOMMA PAULOPUNCTATUM Neumann, 1899.

Figs. 36 and 37, Pl. VI, fig. 2.

Synon., Lit. and Iconogr.:

Amblyomma paulopunctatum Neumann, L. G., 1899, pp. 248–249, specific description of ♂.

Amblyomma sparsum var. *paulopunctatum* Neumann, L. G., 1905, p. 233, degrades *Amb. paulopunctatum* to a variety of *Amb. sparsum*.

Amblyomma trimaculatum Neumann, L. G., 1908, pp. 84–85, specific description of ♀; Figs. 5–7, ♀ scutum and capitulum, coxae I–IV, and spiracle.

Amb. sparsum Nn. = *Amb. marmoreum* Koch; *Amb. trimaculatum* Nn. ♀ is unquestionably identical in species with *Amb. paulopunctatum* Nn. ♂; by the rule of priority, therefore, the latter name must stand, while *Amb. trimaculatum* Nn. lapses into synonymy.

Male (Fig. 36). Diagnosis: A medium-sized tick; scutum broad oval, slightly narrower in front than behind; ornate, marginal groove continuous, few coarse punctations in the peripheral part, interspersed with fine punctations; eyes large, pale and flat; festoons nearly twice as long as broad; capitulum large, palps with a rounded, lateral, salient angle at base of article 2; hypostome dentition 4 | 4; coxa I with two stout spurs; a broad plate-like spur on each of coxae II and III; a moderately long, pointed spur on coxa IV.

Description. *Body*: *L.* 4·35–5·9 mm., *W.* 3·6–4·8 mm., contour broad oval, slightly narrower in front. *Scutum*: flat, smooth; general colour dark-brown, paler in central part; ornate, with a large pale patch in each antero-lateral field; a pale spot towards the postero-lateral margin, opposite to the external festoon; a pair of symmetrically disposed pale spots at the posterior end of the scutum, in front of the 4th and 5th festoons; a small elongate pale spot in the lateral part of the scutum, divided longitudinally by the marginal groove; a pale spot on each of festoons 3–5 and on the median festoon; a pair of small irregular spots between the cervical grooves; marginal groove well-defined, continuous, formed of large contiguous punctations in the part anterior to the external festoon, commencing some distance behind the eye; few large punctations scattered over the scutum, interspersed with fine punctations; cervical grooves in the form of short, deep, oval, divergent pits; eyes moderately large, pale and flat; festoons twice as long as broad, well-defined. *Venter*: dull yellowish-brown, finely punctate, with few, short, scattered hairs in the posterior part; genital aperture opposite

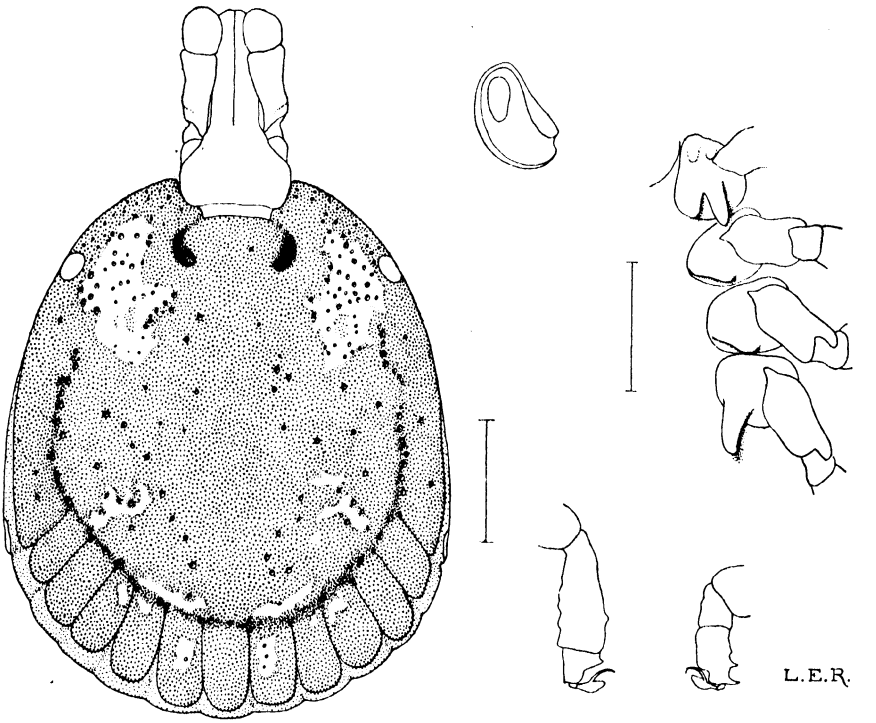


Fig. 36. *Amblyomma paulopunctatum* ♂. Scutum, capitulum, spiracle coxae I–IV, tarsi I and IV. (Type, Paris Mus.) Certain pale spots described in the text are not evident in this specimen.

coxa II; spiracles of medium size, broadly comma-shaped, obliquely placed. *Capitulum*: *L.* 1·6–1·75 mm., basis rectangular, lateral margins slightly convex, postero-lateral angles barely salient; palps stout, article 2 two-and-a-half times as long as article 3, with a lateral prominence at the base; hypostome dentition 3 | 3 or 4 | 4, internal files of teeth small. *Legs* of medium length, moderately stout, dark-brown with narrow, pale annulations at the distal extremity of each femur, tibia and protarsus; coxa I with two stout spurs, the internal spur blunt, the external spur slightly the longer and more pointed; a broad, plate-like spur on each of coxae II–III; a moderately long spur, more than twice as long as broad, on coxa IV; tarsi rather short, abruptly attenuated; pulvilli small, one-third length of claws.

Female (Fig. 37, and Pl. VI, fig. 2). Diagnosis: A moderately large tick; scutum triangular-cordiform, ornate, with three large pale spots

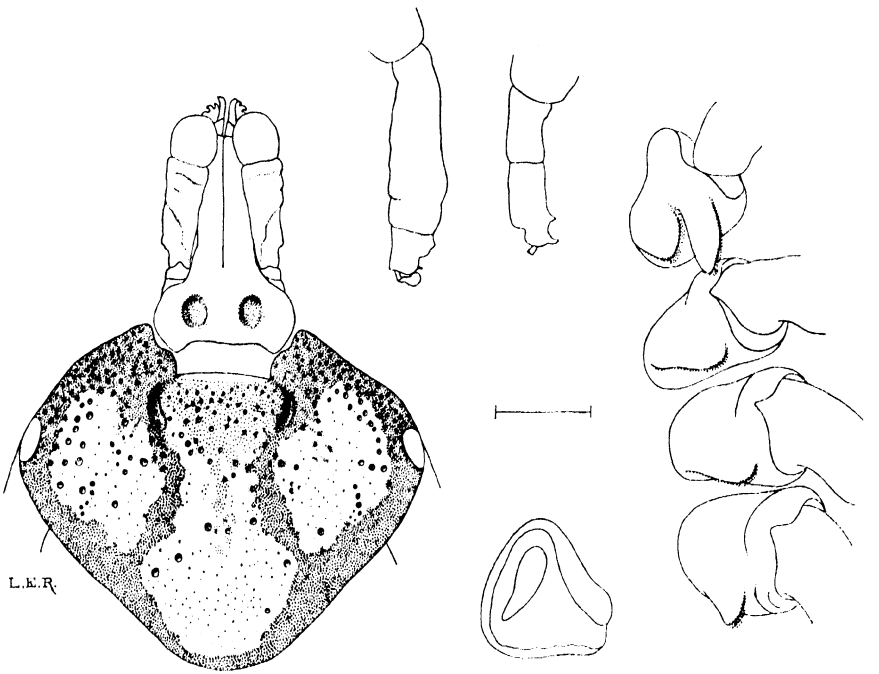


Fig. 37. *Amblyomma paulopunctatum* ♀. Scutum, capitulum, spiracle, coxae I–IV, tarsi I and IV. (N. 460 *a*.)

on a dark background; a few coarse punctations, interspersed with fine punctations; marginal groove continuous; festoons well-defined; basis capituli with convex lateral margins, postero-lateral angles slightly salient, porose areas medium, almost circular, widely-separated; hypostome dentition 4 | 4; coxa I with two stout, unequal spurs; a single broad, plate-like spur on each of coxae II–III; a short triangular spur on coxa IV, barely longer than broad.

Description. *Body*: *L.* 6·2–6·8 mm., *W.* 5·2–5·4 mm., contour broadly elliptical, dorsum dull greyish-yellow, glabrous, with scattered coarse punctations and slight rugosities and striae on the area enclosed by the marginal groove; marginal groove continuous, deeply incised; postero-median and postero-accessory grooves shallow and ill-defined; festoons very distinct. *Scutum*: 3·4 × 4·3 mm., triangular-cordiform, posterior angle medium, postero-lateral margins almost straight or slightly convex; antero-lateral margins convex; scapular processes blunt and barely salient; ornate, with a dark marginal coloration bordering the scutum from the cervical spots to the posterior angle; limiting spots broadly

applied to the postero-lateral margins; cervical stripes narrow, divergent, extending posteriorly to fuse with the limiting spots; frontal spots absent; the general effect of the dark ornamentation is to define a large lozenge-shaped patch in each lateral field, and an even larger hourglass-shaped patch occupying the median field; a few coarse punctations in the lateral and median fields, interspersed with fine punctations, the latter numerous in the scapular angles and between the cervical grooves; cervical grooves narrow and deep anteriorly, continued posteriorly by wide shallow depressions which extend to the posterior third of the scutum; eyes large, pale and flat. *Venter*: smooth, glabrous, with few scattered hairs on posterior half; colour as dorsum; genital aperture opposite interspace between coxae II and III; spiracles large, triangular with rounded angles. *Capitulum*: *L.* 2·5 mm., basis with convex lateral margins, postero-lateral angles slightly salient, porose areas of medium size, almost circular, interval slightly greater than diameter; palps long and stout, beset with whitish hairs, article 2 twice as long as article 3, with a slightly salient postero-lateral angle; hypostome long, slightly spatulate, dentition 4 | 4. *Legs*: long and stout, dark-brown with narrow pale annulations at the distal extremities of the femur, tibia and protarsus; coxa I with two stout spurs, of which the external is the longer, narrower and more pointed; coxae II and III each with a broad, plate-like spur, a single flat, triangular spur, barely longer than broad, on coxa IV; tarsi abruptly attenuated.

Geographical Distribution and Hosts.

Equatorial Africa, from the **West Coast** to **Uganda.** The ♂, upon which Neumann's original description is based came from Konakry, **French Guinea,** Maclaud coll. (Paris Museum); his description of the ♀ is based on a single example, from Robertsport, **Liberia,** Demery coll. (Mus. of Nat. Hist., Leyden). I have examined ♂s and ♀s, from **West Africa** presented to the Cambridge collection by Dr Seymour Hadwen; 1 ♀, off grass, Daro Forest, Toro, **Uganda,** x. 1911, Dr S. A. Neave coll. (I.B.E. coll., No. 460 *a*); and 1 ♀, off grass, Bewama, **Sierra Leone,** W. Africa, 13. IX. 1912, J. J. Simpson coll. (I.B.E. coll., No. 623). The host of this species has not yet been recorded.

19. AMBLYOMMA MARMOREUM Koch, 1844.

Figs. 38 and 39.

Synon., Lit. and Iconogr.:

Amblyomma marmoreum Koch, C. L., 1884,p. 224, description of ♂: 1847, pp. 54–55, description of ♂; Tab. VIII, Fig. 29, ♂ dorsum (coloured). **1899**, Neumann, L. G., pp. 266–267, description of ♂. **1901**, Neumann, L. G., pp. 309–311, description of ♂ and ♀; Fig. 13, ♂ scutum. **1907**, Dönitz, W., p. 84, brief description. **1908**, Howard, C. W., pp. 142–144, specific description of ♂ and ♀; Pl. XII, Figs. *m*, *n*, ♂, digit of chelicera, coxae I–IV; Pl. XIII, Figs. *c–k*; ♂ dorsum, ♀ dorsum, digit of chelicera of ♀, nymph and larva, scutum and capitulum of nymph, venter and dorsum of larva; King, H. H., p. 220, Pl. XXVI, figs. 1 and 2; ♂ dorsum, ♀ dorsum (coloured). **1909**, Dönitz, W., pp. 471–473, specific description of ♂ and ♀, with special reference to the ornamentation; Fig. 7, ♂ dorsum. **1910**, Dönitz, W., pp. 444–445, specific description of ♂ and ♀; Tab. XV, Fig. 3, ♂ dorsum (coloured). **1911**, Neumann, L. G., pp. 78–79, brief description of ♂ and ♀. **1916**, Paoli, G., pp. 291–292, description of ♂ and ♀; Pl. VI, Figs. 27 and 28, ♂ and ♀ scutum.

Amblyomma sparsum Neumann, L. G., 1899, pp. 247–248, description of ♂.

Amblyomma rugosum Neumann, L. G., 1899, pp. 253–254, description of ♂.

Amblyomma devium (Koch) Neumann, L. G., 1899, pp. 255–256, description of ♀ (*Hyalomma devium* Koch = *Amblyomma latum* Koch).

Male (Fig. 38). Diagnosis: A large tick; scutum with characteristic ornamentation consisting of brownish-black spots and stripes on a reddish-yellow ground; antero-accessory stripes forming a Y-shaped figure with the postero-median stripe; lateral spots small, usually isolated, marginal ridge with four more or less distinct pale spots between the eye and the external festoon; marginal groove continuous; punctations unequal, irregular, very coarse in part, interspersed with very numerous fine punctations; festoons parti-coloured; eyes pale and flat; coxa I with two, stout, flattened spurs; coxae II and III each with a broad, flat, salient ridge; coxa IV with a single stout spur.

Description. *Body*: *L.* 7·5 mm., *W.* 6·5 mm., contour broad oval, narrower in front. *Scutum*: slightly convex; ornamentation consisting of brownish-black spots and stripes on a reddish-yellow ground; postero-median stripe rather short, broadly expanded at its anterior extremity, not reaching the falciform stripe; antero-accessory stripes generally fused at their posterior extremities with the postero-accessory stripe, forming a Y-shaped figure; postero-accessory stripes long, knobbed at their anterior extremities, where they sometimes fuse with the knobbed extremity of the postero-median stripe, widely separated from the 3rd lateral spot; lateral spots small, generally isolated; falciform stripe usually fused at its lateral extremities with the antero-accessory stripes;

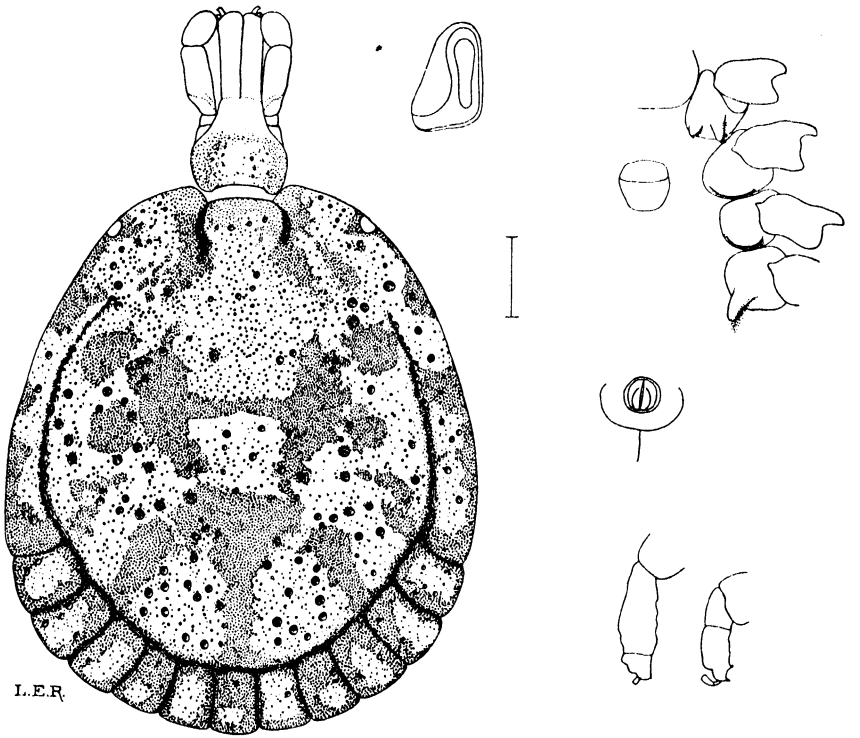


Fig. 38. *Amblyomma marmoreum* ♂. Scutum, capitulum, spiracle, coxae I–IV, tarsi I and IV. (C. 38*f*.)

cervical stripes generally short, divergent, occasionally extending backwards to fuse with the extremities of the falciform stripe; frontal spot generally present; marginal ridge with four more or less distinct pale spots between the eye and the external festoon, the first and second merging into the pale ground colour; festoons variegated, often with a pale spot on each, small or absent on the median and the fourth; cervical grooves narrow, deep and curved with the convexity external; marginal groove deep, continuous, abruptly flexed just anterior to the external festoon; punctations numerous, irregular, coarse punctations relatively few, interspersed with very numerous fine punctations; eyes relatively small, pale and flat; festoons large and very well-defined. *Venter*: greyish-yellow, festoons well-defined, with dark-brown ventral scutes; genital aperture opposite coxa II; spiracles triangular with rounded angles. *Capitulum*: relatively short, *L.* 2·2 mm., basis rectangular; lateral margins convex, postero-lateral angles barely salient; median field of dorsal surface with a pale spot; palps stout, article 2 twice as long as

article 3, compressed at its postero-dorsal extremity; hypostome dentition $3\frac{1}{2} \mid 3\frac{1}{2}$. *Legs*: thick and strong, maroon-brown with narrow pale annulations at the extremities of the articles, trochanters I and II often with a distinct small pale spot on the anterior side of their tips; coxa I with two stout spurs of which the external is the longer; a broad, flattened, salient ridge on each of coxae II and III; a single, stout, flattened spur, about twice as long as broad, on coxa IV; tarsi very abruptly attenuated; pulvilli small.

Female (Fig. 39). Diagnosis: A large tick; scutum triangular-cordiform, pale reddish-yellow with sparse brownish-black ornamentation, consisting of the cervical spots and stripes, the limiting spots and the ocular spots; frontal spots present or absent; scapular angles pointed; scattered coarse punctations interspersed with numerous fine punctations; eyes moderately large, pale and flat; capitulum of medium length, basis with a pale spot on the dorsal surface; coxa I with two stout, sub-equal, flattened spurs; a broad, flattened, salient ridge on each of coxae II and III; a short, stout, flattened spur on coxa IV.

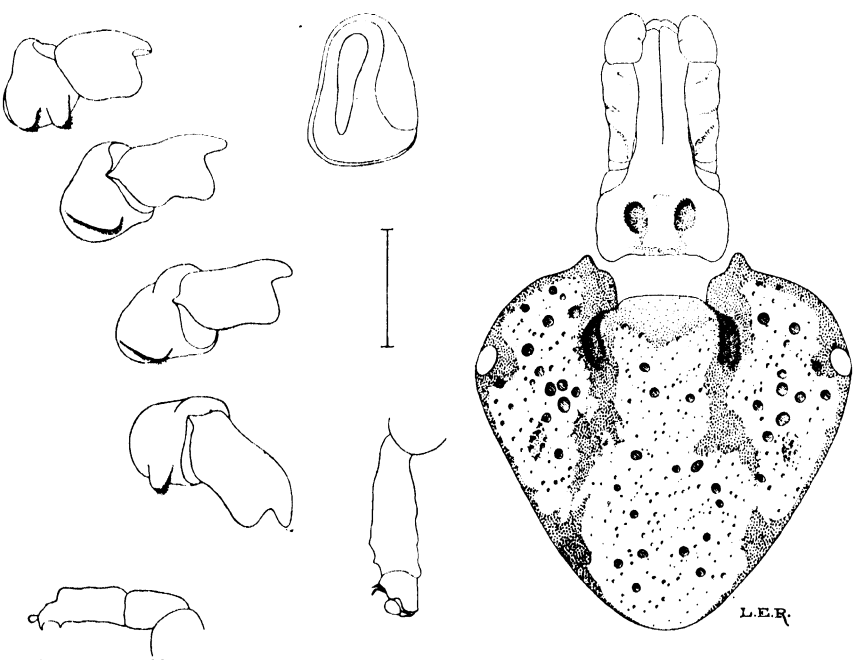


Fig. 39. *Amblyomma marmoreum* ♀. Scutum, capitulum, spiracle, coxae I–IV, tarsi I and IV. (N. 1428.)

DESCRIPTION. *Body*: *L.* 7–10 mm., *W.* 6–8·5 mm. (gorged examples may attain dimensions of 30 × 20 mm.); dorsum dark reddish-brown, rugose and deeply punctate; marginal groove and festoons well-defined. *Scutum*: triangular-cordiform, 3·2 × 3·3 mm., posterior angle narrow, scapular angles pointed; median and lateral fields extensively pale-coloured, reddish-yellow, cervical stripes divergent posteriorly, usually short, rarely extending backwards to the limiting spots; ocular and limiting spots small but distinct; frontal spots present or absent; cervical grooves short, deep and curved with the convexity external; punctations numerous; irregular, scattered coarse punctations interspersed with many fine punctations; eyes moderately large, pale and flat. *Venter*: similar in colour to dorsum; genital aperture opposite coxa II; spiracles large, triangular, with broadly rounded angles. *Capitulum*: *L.* 2 mm., basis rectangular, postero-lateral angles barely salient, lateral margins slightly convex; a pale spot on the median part of the dorsal surface; porose areas of medium size, oval and slightly divergent, interval a little greater than the diameter; palps stout, article 2 twice as long as article 3, compressed at the postero-dorsal part; hypostome dentition $3\frac{1}{2} \mid 3\frac{1}{2}$. *Legs*: stout, maroon-brown, with narrow pale annulations; coxa I with two stout, sub-equal, flattened spurs; a single broad, salient ridge on coxae II and III; a short, stout, flattened spur, barely longer than broad, on coxa IV; tarsi very abruptly attenuated.

Geographical Distribution and Hosts.

An African species found chiefly on Rhinoceros and on Chelonia of various species. Koch's specimen came from **South Africa**, host not specified. In his earlier description (1899 and 1901) Neumann records examples from Kitui, East Africa, the **Cape of Good Hope**, and off *tortoise*, **Zanzibar**, Foà coll.; and later (1911, p. 79) Cape Colony, **Mozambique**, **Tanganyika Territory**, **Congo** and **Senegal**, while he lists as hosts *Rhinoceros bicornis* L., *Genetta pardina* Geoffr., Chelonia (gen.?), *Python* sp.; his *Amb. sparsum* was found on *Testudo mauritanica*, at Oran, **Algeria**. Dönitz gives South, East and Tropical Africa as the distribution of the species. I have examined material from many parts of Africa, including the following: **Sudan**: ♂s, host not specified, Khartoum, 1908, Dr A. Balfour coll. (N. 240). **Somaliland**: ♂ and ♀, host not specified, Gueldessa, Dr Brumpt coll.; ♂ and ♀, off *tortoise*, Artaud, Dr Brumpt coll. **Uganda**: ♂s and ♀, off *tortoise*, Bussu, XII. 1909, Dr H. Bayon coll. (N. 681); ♀, off *tortoise*, Bussu, IV. 1909, Dr H. Bayon coll. (N. 744); ♂, host not specified, Bussu, X. 1909, Dr H. Bayon coll.

(N. 939 *a*); off *tortoise*, Col. Alcock coll.; ♂s, ♀s and nymphs, off *Bitis gabonica* D. and B., Bussu, x. 1909, Dr H. Bayon coll. (N. 940): ♂s, off grasses, Simba and Mtito Andei, III. and IV. 1911, Dr S. A. Neave coll. (I.B.E. 259 *a* and 264 *b*). **Kenya**: ♂, off *Rhinoceros*, Nairobi, III. 1907, Dr P. Ross coll. (N. 249): ♂s and ♀s, off *Rhinoceros*, Yatta Plains, Kitui, v. 1911 and VIII. 1910, S. W. J. Scholefield coll. (N. 1428, 1438; I.B.E. 322 and 316 *d*): ♂s, off *Bitis arietans*, Yatta Plains (N. 1747); ♂ and ♀, off *tortoise*, Kavirondo Border, Lumbwa District, III. 1912, O. M. Dobbs coll. (N. 1814); ♂s, off *Rhinoceros*, Punda Milia, 3. VIII. 1909, W. F. Cooper coll. (C. 17, 21 *a* and 28); off *Rhinoceros*, Tana R., VIII. 1909, W. F. Cooper coll. (C. 38 *f*); ♂s, off *eland*, VIII. 1909, and off *buffalo*, VIII. 1909, W. F. Cooper coll. (C. 52 and 32). **Nyasaland**: ♂s and ♀s, off *Rhinoceros*, Deer Bay, N. Nyasa, XI. 1909, Dr J. B. Davey coll. (N. 1088): ♂, off *monitor*, Wovwi R., N. Nyasa, XI. 1909, Dr J. B. Davey coll. (N. 1095). **Rhodesia**: ♂, off *Rhinoceros*, Nawalia, N.E. Rhodesia, VIII. 1911, Dr A. Kinghorn coll. (N. 1934). **South Africa**: ♂s, off *tortoise*, Macloutsie, Bechuanaland, I. 1906, Dr B. G. Brock coll. (N. 95); ♂s and ♀s, off *tortoise*, Germiston, Transvaal, 1906, Dr B. G. Brock coll. (N. 228 and 229); ♂s, off *Testudo leopardinus*, 10. I. 1912 (N. 1659 and Z.S. 19, also Z.S. 21 and 31); ♂s and ♀, off *tortoise*, Sandflats, Albany, 15. II. 1906, G. C. Woodbury coll. (C. 262).

20. AMBLYOMMA NUTTALLI Dönitz, 1909.

Figs. 40 and 41.

Lit. and Iconogr.: Dönitz, W., 1909, pp. 469–471, specific description of ♂ and ♀; Fig. 4, ♀ scutum.

Male (Fig. 40). Diagnosis: A small to medium-sized tick; smaller than, but closely resembling, *Amb. marmoreum*; scutum ornate; postero-median stripe rather short, its anterior extremity only slightly expanded, not fused with the antero-accessory stripes; postero-accessory stripes short and thick, the free extremity not even approximating to the anterior extremity of the postero-median stripe; falciform stripe usually divided in the middle; marginal groove deep and continuous; eyes small, pale and flat.

DESCRIPTION. *Body*: *L.* 4·2–5·0 mm., *W.* 3·3–4·2 mm.; contour oval, narrower in front. *Scutum*: ornate, with reddish-brown spots and stripes on a yellowish ground; postero-median stripe rather short, its anterior extremity free, only slightly expanded; postero-accessory stripes short

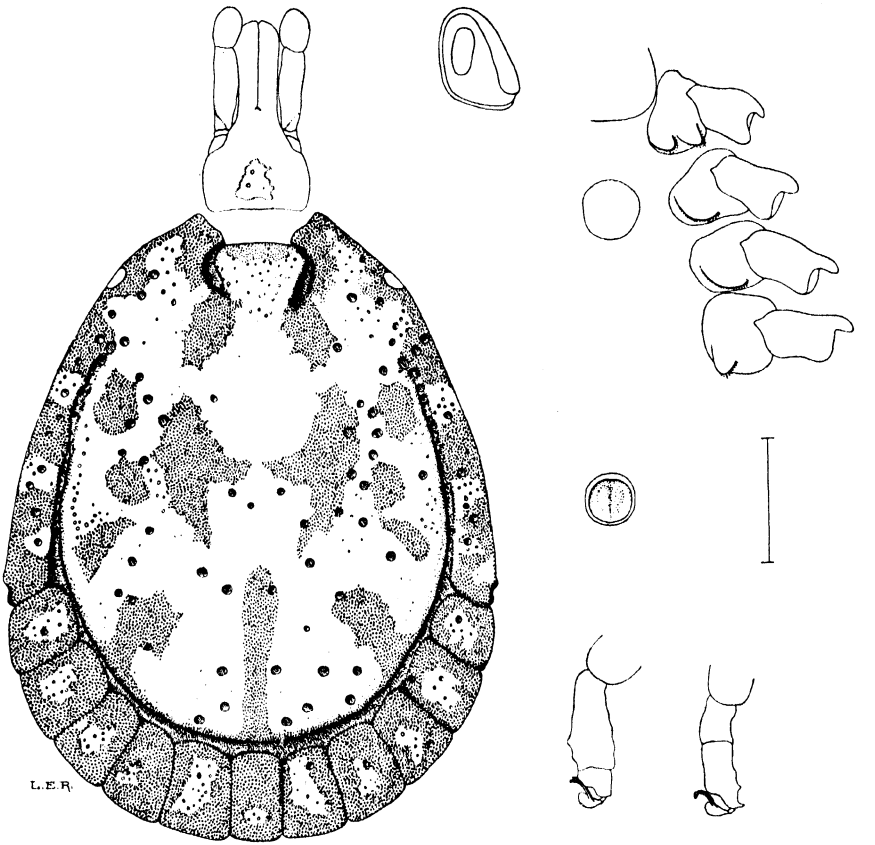


Fig. 40. *Amblyomma nuttalli* ♂. Scutum, capitulum, spiracle, coxae I–IV with part of venter, tarsi I and IV. (N. 681.)

and thick, the anterior extremities free (not, as in *Amb. marmoreum*, approximating the extremity of the postero-median stripe); lateral spots small, generally isolated, the 2nd and 3rd sometimes conjoined; falciform stripe usually divided in the middle, its extremities fused with the antero-accessory stripes; cervical stripes divergent, sometimes extended posteriorly to fuse with the lateral horns of the falciform stripe; frontal spots present or absent; marginal ridge with four pale spots between the eye and the external festoon, the first of which merges into the general pale ground; 1st, 2nd, 3rd and 5th festoons each with a large, irregular, pale spot; smaller pale spots in the 4th and median festoons; cervical grooves short, deep and curved; marginal groove deep and continuous, much more widely-separated from the margin of the scutum

posteriorly than at its commencement; few coarse punctations interspersed with few finer punctations near the periphery; eyes small, pale and flat; festoons long and well-defined. *Venter*: pale greyish-yellow, plaques and ventral scutes of festoons small and reddish-brown; genital aperture opposite coxa II; spiracles medium, sub-triangular with rounded angles. *Capitulum*: *L.* 1·6 mm., basis rectangular with a pale spot on the dorsal surface; postero-lateral angles non-salient, lateral margins slightly convex; palps relatively longer than those of *Amb. marmoreum*, article 2 at least twice as long as article 3; hypostome long, dentition 3 | 3. *Legs*: medium, articles feebly annulated; coxa I with two short, stout, sub-equal spurs; a single similar spur on coxa IV; coxae II and III each with a broad, curved, ridge-like spur; tarsi abruptly attenuated.

Female (Fig. 41). Diagnosis: A medium-sized tick closely resembling *Amb. marmoreum*; scutum large, triangular-cordiform; ornate; the pale areas less extensive than in *marmoreum*; limiting spots very large, constricting the posterior end of the pale median field to a point; frontal spots often conjoined with the dark margin; cervical grooves prolonged as fairly deep depressions along the course of the cervical stripes; few coarse punctations interspersed with fine punctations; eyes small, pale and flat.

Description. *Body*: *L.* 7·0 mm., *W.* 5·5 mm.; contour elliptical or oval; dorsum dark-brown, smooth, with few large, shallow punctations. *Scutum*: 3·2 × 3·3 mm., triangular-cordiform, posterior angle rather narrow, smooth, convex; ornate, with a dark margin extending from the scapular angles to the posterior angle; limiting spots very large, constricting the posterior part of the pale median field to a point; ocular spots large; frontal spots small, elongate, often conjoined with the dark margin; cervical stripes narrow posteriorly, where they fuse with the limiting spots; few coarse punctations interspersed with few fine punctations, the latter being almost entirely on the anterior half; cervical grooves deep and curved anteriorly, continued posteriorly as fairly deep, divergent depressions which extend for a considerable distance along the course of the cervical stripes; eyes small, pale and flat. *Venter*: similar in colour to dorsum, with small, scattered, whitish hairs; genital aperture opposite coxa II; spiracles triangular with rounded angles. *Capitulum*: *L.* 1·9 mm.; basis rectangular, median part of dorsal surface pale, postero-lateral angles rounded, barely salient; porose areas rather large, oval, divergent, interval about equal to diameter; palps stout, article 2 twice as long as article 3; hypostome dentition 3 | 3. *Legs*:

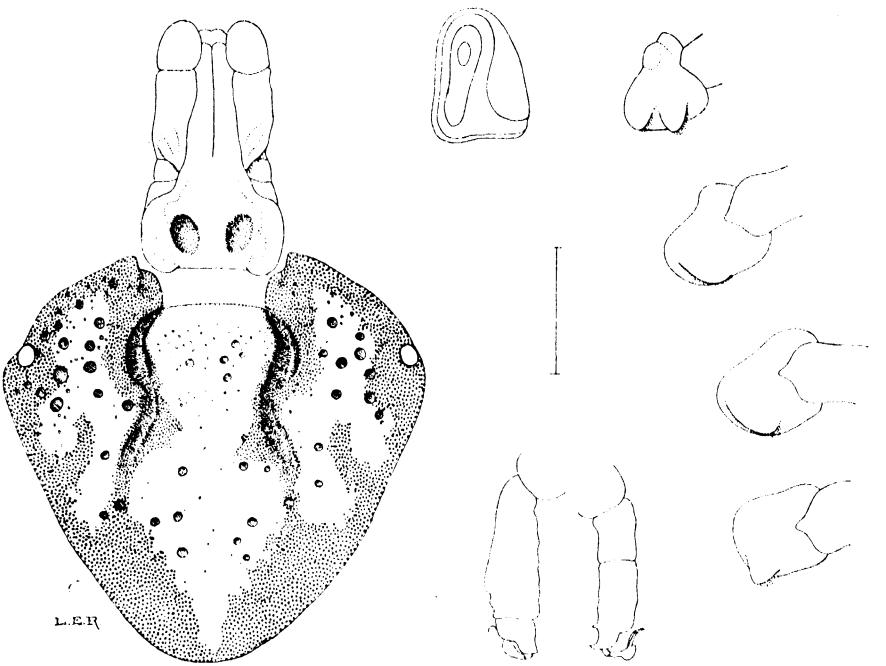


Fig. 41. *Amblyomma nuttalli* ♀. Scutum, capitulum, spiracle, coxae I–IV, tarsi I and IV. (N. 681)

medium, dark-brown, with narrow and feeble annulations at the extremities of the articles; coxal armature as in the ♂; tarsi abruptly attenuated; pulvilli small.

Geographical Distribution and Hosts.

Dönitz's description is based on 3 ♂s, from Daressalem and Bergamojo, **Tanganyika Territory**; 1 ♀, from Daressalem; 1 ♀, from Umtali, **Southern Rhodesia**; and 1 ♀, from the **Cameroons, W. Africa.** The Cambridge collection contains ♂s, off *Varanus* or *Emys*, **Tanganyika Territory,** the gift of Prof. W. Dönitz (N. 996, 997); ♂ and ♀, off *Iguana*, Offa, **Southern Nigeria,** XI. 1910, R. C. Hiscock coll. (N. 1421 and 1443); ♂s and ♀, off *tortoise*, Bussu, **Uganda,** III. 1909, H. Bayon coll. (N. 681), and ♂s and ♀s, off *hedgehog*, Accra, **Gold Coast, W. Africa,** 18. XI. 1914, Dr J. W. S. Macfie coll. (N. 3088 *e*). I have also examined a specimen found on the centre of the plastron of a tortoise, Parombo, **W. Nile Province, Uganda,** 27. VIII. 1921, Dr R. E. McConnell coll. (I.B.E. 1212).

21. AMBLYOMMA LEPIDUM Dönitz, 1909.

Figs. 42 and 43.

Lit.: Dönitz, W., 1909, pp. 460–461, specific description of the ♂. **1916**, Paoli, G., pp. 286–291, description of ♂ and ♀; Pl. VI, Figs. 24 and 25, ♂ scutum, Fig. 26, ♀ scutum.

Male (Fig. 42). Diagnosis: A small to medium-sized tick; scutum with characteristic ornamentation; postero-median stripe broad at the base, slightly knobbed at the anterior extremity, not reaching the falciform stripe; postero-accessory stripe fairly close to the 3rd lateral spot, almost vertical; lateral spots generally conjoined to form a broad bowed stripe the extremities of which are fused with the dark marginal coloration; marginal groove commencing a short distance behind the eyes, continuous; eyes small, dark-coloured, hemispherical, orbited; festoons parti-coloured.

Description. *Body*: *L.* 4·8 mm., *W.* 3·7 mm.; contour broad oval, slightly narrower in front. *Scutum*: ornate, with dark-brown or brownish-black markings on a pale ground; postero-median stripe broad at the base, slightly knobbed at the anterior extremity, not reaching the falciform stripe; postero-accessory stripes short, fairly close to the 3rd lateral spots, almost vertical; lateral spots usually conjoined to form a broad bowed lateral stripe, the extremities of which are fused with the dark marginal coloration; antero-accessory stripes fused with the extremities of the falciform stripe and usually with the 1st and 2nd lateral spots; cervical stripes broad anteriorly, tapering posteriorly, not reaching the antero-accessory stripes; frontal spots fused with the cervical stripes; festoons parti-coloured, the external, 4th and median festoons dark-coloured, the 2nd, 3rd and 5th each with a pale spot; a pale spot on the marginal ridge opposite the 2nd lateral spot; cervical grooves short, deep and curved with the convexity external; marginal groove deep, commencing a short distance behind the eyes, continuous; punctations numerous, irregular, coarse in the lateral fields, between the cervical stripes and on the marginal ridge and festoons; eyes small, dark-coloured, hemispherical, orbited. *Venter*: pale yellowish-grey; genital aperture opposite coxa II; spiracles large, triangular with rounded angles. *Capitulum*: *L.* 2 mm.; basis rectangular, postero-lateral angles broadly rounded, barely salient, lateral margins slightly convex; palps long and slender, article 2 two-and-a-half times as long as article 3; hypostome dentition 4 | 4. *Legs*: stout, dark-brown, with broad, pale annulations at the distal extremities of the articles; coxa I with two, stout, unequal spurs, the external spur

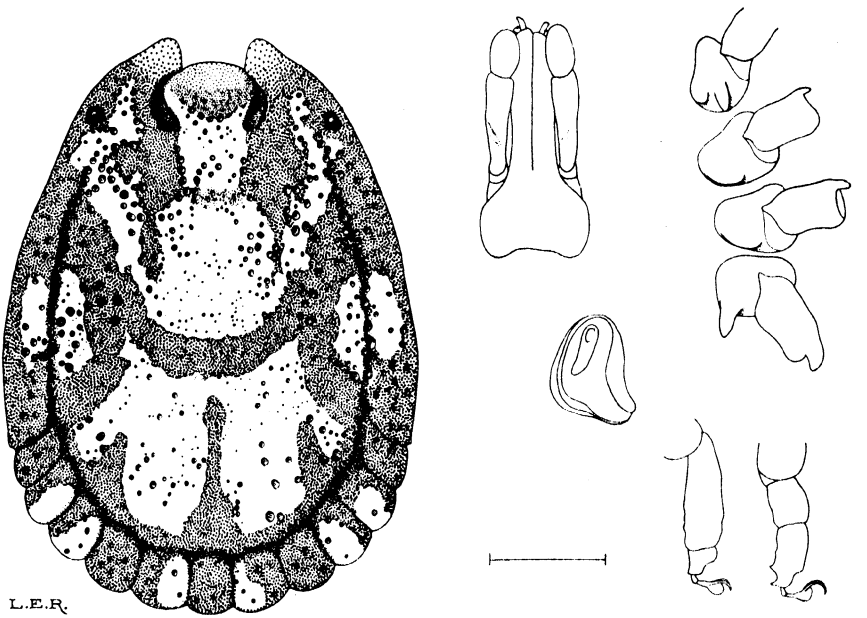


Fig. 42. *Amblyomma lepidum* ♂. Scutum, capitulum, coxae I–IV, spiracle, tarsi I and IV. (C. 397.)

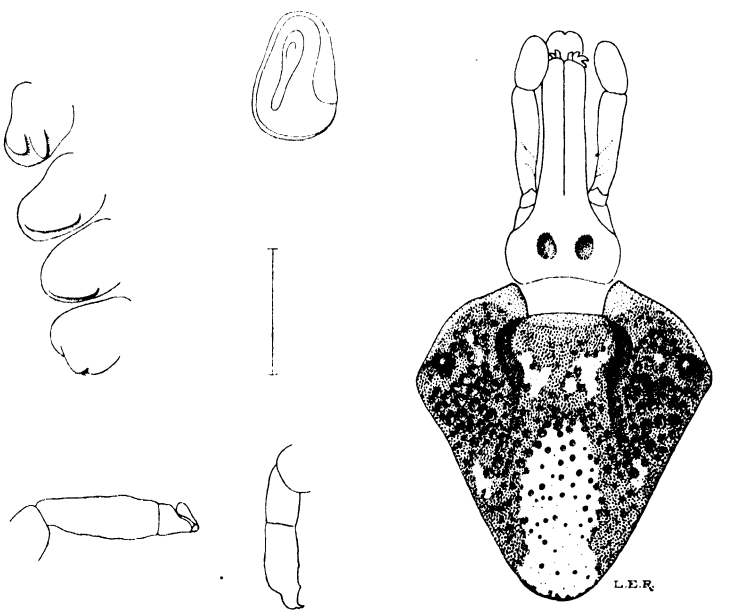


Fig. 43. *Amblyomma lepidum* ♀. Scutum, capitulum, spiracle, coxae I–IV, **tarsi I and IV.** (C. 397.)

being the longer and more pointed; a broad, curved, salient ridge on each of coxae II and III; a single, stout spur, twice as long as broad, on coxa IV; tarsi abruptly attenuated.

Female (Fig. 43). Diagnosis: A small to medium-sized tick closely resembling *Amb. variegatum*; scutum triangular, posterior angle narrow; ornate, lateral fields dark-coloured with the exception of a small pale spot near the middle of the postero-lateral border; median field with a more or less extensive pale spot in the posterior half, and two small, irregular, pale spots between the cervical grooves; punctations numerous, coarse and crowded in the lateral fields; eyes small, dark-coloured, hemispherical, orbited.

DESCRIPTION. *Body*: *L.* 4·4 mm., *W.* 3·1 mm.; contour broad oval or elliptical; dorsum dark-green or greenish-black, rugose and punctate; marginal groove continuous; festoons clearly defined. *Scutum*: 2·5–3 × 2·5–2·9 mm.; posterior angle narrow, postero-lateral margins rectilinear or slightly concave; antero-lateral margins convex; ornate, scapular border and scapular angles pale, lateral fields dark-coloured excepting a small pale spot near the middle of the postero-lateral margin; median field with a more or less extensive pale spot in the posterior half and two small, irregular, pale spots between the cervical grooves; punctations numerous, deep, coarse and crowded in the lateral fields, between the eyes and the posterior two-thirds of the cervical grooves; cervical grooves deep and curved in the anterior part, shallower and divergent posteriorly, extending almost to the postero-lateral border; eyes small, dark-coloured, hemispherical, orbited. *Venter*: similar in colour to dorsum; genital aperture opposite coxa II; spiracles large, sub-triangular with rounded angles. *Capitulum*: *L.* 2·2 mm.; basis rectangular, posterior margin slightly concave, postero-lateral angles non-salient; porose areas medium, oval, divergent, interval one-and-a-half times diameter; palps long and slender, article 2 three times as long as article 3; hypostome long, spatulate, dentition $3\frac{1}{2} \mid 3\frac{1}{2}$. *Legs*: relatively longer than in the ♂; spur on coxa IV shorter; tarsi attenuated in talus; otherwise similar to those of the ♂.

Geographical Distribution and Hosts.

Eastern Equatorial Africa from the **Sudan** to **Zanzibar.** The Cambridge collection contains examples from the following sources: **Sudan**: ♀s, off *cattle*, 1908, H. H. King coll. (N. 526); ♂s, off *cattle*, Tonga, 1909, H. H. King coll. (N. 529); ♂s and ♀s, off *cattle*, VI. 1913,

F. E. Mason coll. (N. 2210 *a*, 2204, 2204 *a* and 2204 *b*); ♂s and ♀s, off *buffalo*, Meshra el Rom, 21. VI. 1910, H. H. King coll. (N. 3075), ♂ and ♀, off *cow*, Blue Nile, VI. 1909, Dr S. Williamson donor (C. 193). Figs. 42 and 43 are drawn from examples found on a *cheetah*, Sennar Province, 27. IV. 1910, L. Gorringe coll. (C. 393). **Kenya**: ♂, off *cattle*, Kismayu, 1906, Dr P. H. Ross coll. (N. 193 *c*); ♂s and ♀s, off *goats*, Zanzibar, 1. V. 1917, W. Mansfield Aders coll. (N. 3261); ♂s, ♀s and nymphs, off *cattle*, Zanzibar, 29. IV. 1918, W. Mansfield Aders coll. (N. 3263); ♂s, off *camel*, Zanzibar, 1. V. 1918, W. Mansfield Aders coll. (N. 3272 *b*); ♂s, off *cattle*, Zanzibar, XII. 1909, Prof. W. Dönitz donor (N. 944). Specimens have been found on imported cattle at Cairo, Egypt, and East London, S. Africa.

22. AMBLYOMMA POMPOSUM Dönitz, 1909.

Figs. 44 and 45.

Synon., Lit. and Iconogr.:

Amblyomma pomposum Dönitz, W., 1909, pp. 466–469.

Amblyomma variegatum var. *nocens* Robinson, L. E., 1911, pp. 480–482, Fig. 2, ♂ dorsum, capitulum, dorsal and ventral aspects, spiracle, coxae and tarsi (herein reproduced).

Male (Fig. 44). Diagnosis: A moderately large tick; resembling *Amb. variegatum*; scutum ornate; festoons and marginal ridge uniformly dark-coloured; median field anterior to the falciform stripe yellow, green and red posterior to the falciform stripe; punctations coarse and irregular; eyes dark or pale-coloured, hemispherical and orbited.

DESCRIPTION. *Body*: *L.* 5–7 mm., *W.* 4–5 mm.; contour broad oval, narrower in front. *Scutum*: ornate, with black or dark-brown markings on a pale ground, the latter yellow anterior to the falciform stripe and red (centrally) and green (laterally) posterior to the falciform stripe; postero-median stripe tapering from the base to a fine extremity which does not reach the falciform stripe; postero-accessory stripes thick, directed towards the centre of the scutum; lateral spots conjoined in the form of a lateral bowed stripe, the extremities of which fuse with the dark marginal coloration (enclosing a small red area); falciform stripe fused at its extremities with the antero-accessory stripes; the latter often fused with the 1st and 2nd lateral spots; posterior ends of the cervical stripes fused with the free extremities of the antero-accessory stripes; frontal spots fused with the cervical stripes; marginal ridge and festoons uniformly dark-coloured; cervical grooves short and deep; marginal

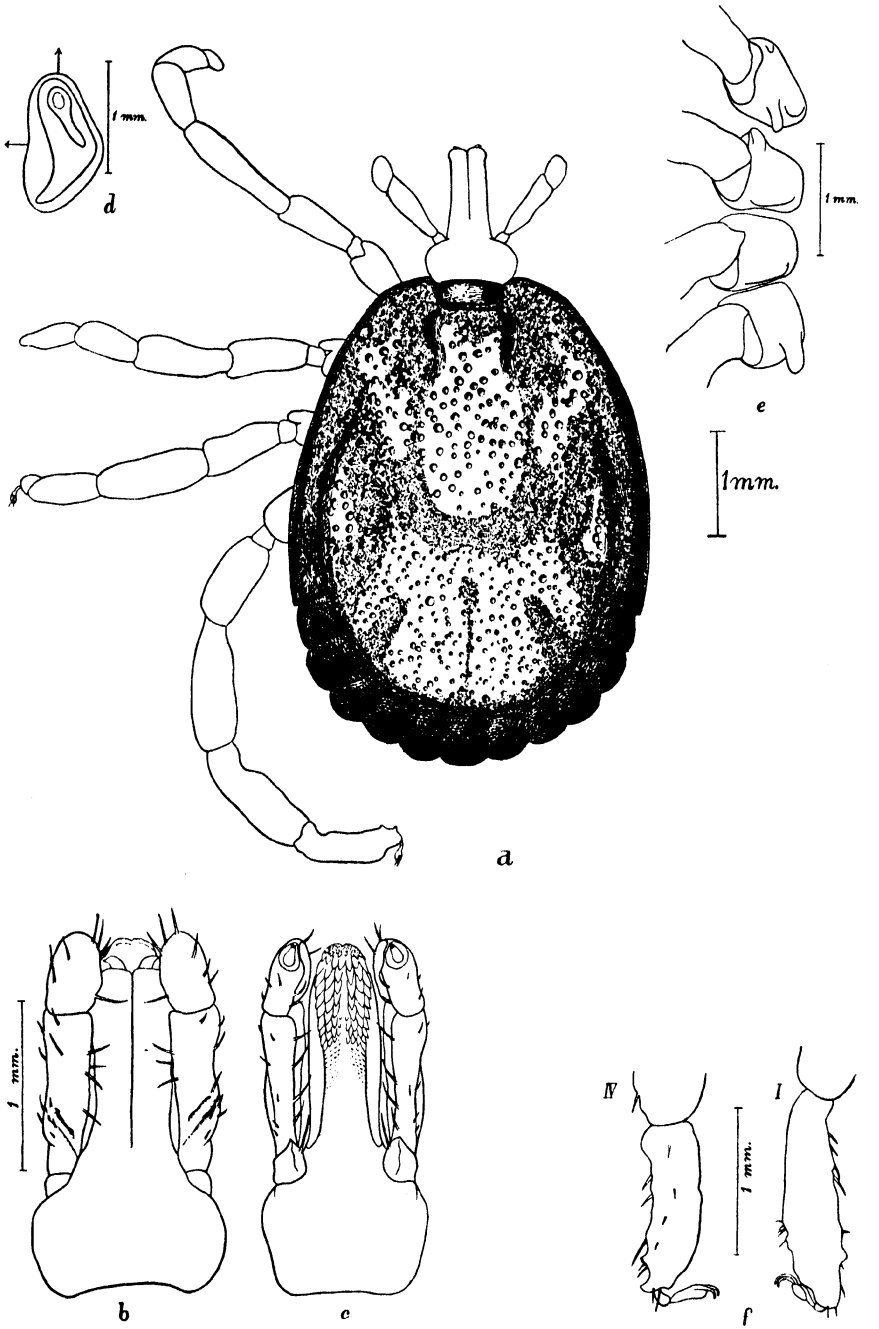


Fig. 44. *Amblyomma pomposum* ♂. Dorsum, capitulum from dorsal and ventral aspects, spiracle, tarsi I and IV, coxae I–IV. (C. 371. Reproduced from Robinson, 1911.)

groove deep, continuous; punctations numerous, coarse and irregular; eyes dark-coloured (pale in dried specimen), strongly convex and orbited. *Venter*: yellowish-grey, wrinkled and punctate; genital aperture opposite the interspace between coxae II and III; spiracles moderately large, triangular with rounded angles; festoons with brownish-black ventral scutes, slightly salient at the posterior margin. *Capitulum*: *L.* 2·5 mm.; basis with postero-lateral angles non-salient, lateral margins very convex; palps laterally compressed, article 2 twice as long as article 3; hypostome dentition $3\frac{1}{2} \mid 3\frac{1}{2}$. *Legs*: stout, dark-brown with broad yellow annulations at the extremities of the articles; coxa I with two spurs of which the external is the longer; a broad, curved, salient ridge on each of coxae II and III; a single, long, stout spur on coxa IV; tarsi attenuated in talus.

Female (Fig. 45). Diagnosis: A moderately large tick resembling *Amb. variegatum*; scutum entirely dark-coloured; punctations very numerous, coarse and confluent in places; with irregular furrow-like depressions; eyes small, pale or dark, convex and orbited.

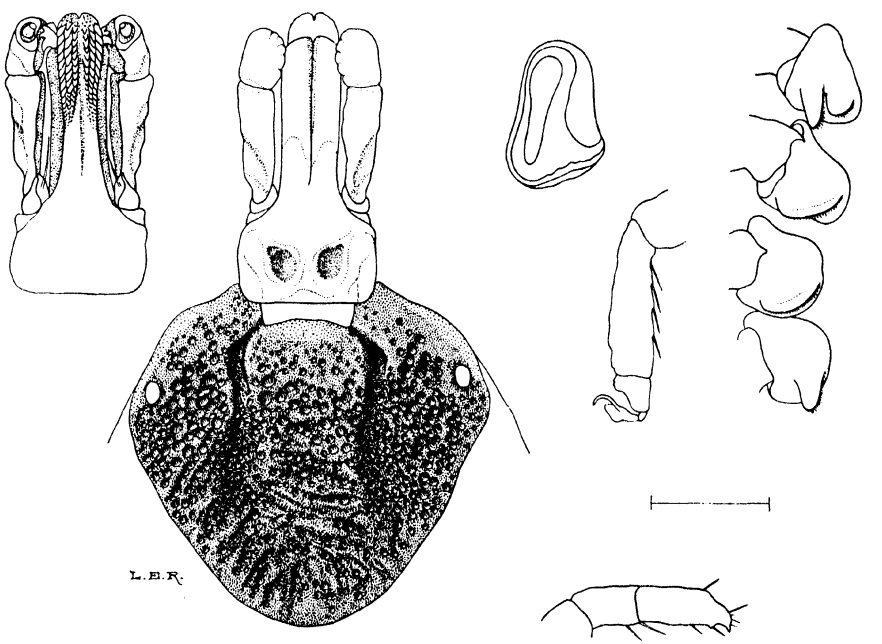


Fig. 45. *Amblyomma pomposum* ♀. Scutum, capitulum from dorsal and ventral aspects, spiracle, coxae I–IV, tarsi I and IV. (N. 755.)

DESCRIPTION. *Body*: *L.* 6·1 mm., *W.* 4·7 mm.; contour broad oval, narrower in front; dorsum greenish-black with scattered coarse punctations; marginal groove continuous; festoons distinct. *Scutum*: 2·8–3·6 × 3·1–3·8 mm.; triangular-cordiform, postero-lateral margins slightly convex; colour dark-brown (a dry pinned specimen), no trace of pale ornamentation; cervical grooves deep anteriorly, shallower and slightly divergent posteriorly where they extend almost to the postero-lateral margins of the scutum; punctations coarse and deep, confluent in places, forming series of short rows; with numerous furrow-like depressions and ridges; eyes pale, strongly convex and orbited. *Venter*: dark-green, yellowish at the anterior extremity and posterior to the anus; with coarse punctations and few small scattered hairs; genital aperture opposite the posterior margin of coxa II; spiracles triangular, with rounded angles. *Capitulum*: *L.* 2·4 mm.; basis rectangular, postero-lateral angles non-salient; porose areas rather small, oval, slightly divergent, interval about equal to diameter; palps long, article 2 twice as long as article 3; hypostome dentition 3 | 3. *Legs*: moderately long, dark reddish-brown with broad yellow annulations; coxa I with two unequal spurs; a broad, curved, salient ridge on each of coxae II and III; a short spur, barely longer than broad, on coxa IV; tarsi attenuated in talus.

Geographical Distribution and Hosts.

Dönitz's specimens came from Urunga, south end of L. Tanganyika, **East Africa,** host—striped antelope. The Cambridge collection contains examples from various parts of **Equatorial Africa–West Africa**: ♂, off *mule*, and ♂s, host not specified, Benguella, x. 1906, v. 1908, Dr F. C. Wellman coll. (N. 142 and N. 392). **Congo Free State**: ♂, off *ox*, and ♂s, off *hartebeeste*, Katanga, VII. and VIII. 1907, Dr A. Yale Massey coll. (N. 311 and N. 338). **Northern Rhodesia**: ♂s, off *eland*, IX. 1907, Dr A. Yale Massey coll. (N. 336); ♂, ♀, off *sable antelope*, *Egoceros niger*, Msofa R., Alala, **N.W. Rhodesia**, XI. 1905, Dr S. A. Neave coll. (N. 755); ♂, off *roan antelope*, 11. x. 1913 (N. 2638); ♂s, off *kudu*, 13. x. 1913 (N. 2639); both lots from Mwengwa; ♂s, off *sable antelope*, Namwala District, **N.W. Rhodesia**, 13. VIII. 1914, Scott and Cunningham colls. (N. 3029); and ♂s, off *eland*, Kafui R., Namwala District, **N.W. Rhodesia**, 18. VIII. 1914, Scott and Cunningham coll. (N. 3032). Fig. 44 is drawn from a ♂, ? off *cattle*, **Rhodesia**, Mr E. M. Jarvis coll. (C. 371). Mr Jarvis informed me that the species is found in the Umtali, Inyanga, Makoni and Melsetter districts, also in Portuguese Manica, Baruwe, and the Zambesi Company's Territory.

23. AMBLYOMMA VARIEGATUM (Fabricius, 1794).

Pl. II, figs. 1 to 4, Text-fig. 4.

Synon., Lit. and Iconogr.:

Acarus variegatus Fabricius, J. C., 1794, p. 353, No. 11, brief description of ♂.

Ixodes elegans Guérin-Méneville, M. F. E., 1829–1853, pp. 16–17, brief description of ♂; Pl. VI, Figs. 1, 1 *a*, ♂ dorsum, tarsus.

Amblyomma venustum Koch, C. L., 1844, p. 224, brief description of ♂: 1847, pp. 57–58, description of ♂; Tab. IX, Fig. 31, ♂ dorsum (coloured).

Amblyomma variegatum Gerstaecker, A., 1873, p. 465, brief description of the ♂. **1878,** Karsch, F., brief note of occurrence on Rhinoceros. **1894,** Barber, C. A., note on occurrence of *Amb. variegatum* in Antigua. **1899,** Neumann, L. G., pp. 268–271, specific description of ♂, ♀, nymph and larva; Fig. 57, ♂ dorsum. **1907,** Dönitz, W., p. 81, description of ♂ and ♀, with notes on geographical distribution and hosts; Pl. III, Fig. 15, posterior part of ♂ venter; Pl. VI, Figs. 35 and 37, ♀ capitulum, ventral aspect and dorsal aspect. **1910,** Dönitz, W., p. 443, description of ♂ and ♀, with special reference to the ornamentation; Tab. XV, Figs. 4 and 5, ♂ dorsum and ♀ scutum and capitulum (coloured). **1911,** Neumann, L. G., p. 82, description of ♂ and ♀, synonymy, geographical distribution and hosts. **1913,** Nuttall, G. H. F., p. 50, differences of coloration in living and preserved examples; Pl. VII, Figs. 1 to 4, ♂ dorsum and ♀ scutum in living and preserved specimens (herein reproduced, see Pl. II). **1915,** Nuttall, G. H. F., pp. 419–421, notes on biology, with records of raising experiments.

Male (Pl. II, figs. 1 and 2, text-fig. 4). Diagnosis: A medium-sized tick; scutum ornate, with brownish-black markings on a pale coppery-red ground; falciform stripe usually isolated; postero-median stripe very narrow; postero-accessory stripes thick and short, directed towards the centre of the scutum; coarse punctations situated towards the periphery, not numerous; festoons all dark-coloured; eyes small, dark-coloured, hemispherical, orbited.

DESCRIPTION. *Body*: *L.* 4–5 mm., *W.* 3·7–4·5 mm., contour oval, slightly narrower in front. *Scutum*: convex; ornate, with dark brownish-black markings on a pale coppery-red ground, edged with a narrow greenish border (in preserved specimens, the dark markings tend to become brownish, and the pale ground and eyes to assume a yellowish colour); postero-median stripe very narrow, usually tapering to a fine point at the anterior extremity; postero-accessory stripes short and thick, directed towards the centre of the scutum; falciform stripe usually isolated, sometimes fused at its extremities with the 1st and 2nd lateral spots; lateral spots conjoined with each other and with the dark marginal coloration, usually forming a large, solid, lateral patch of dark colour; cervical spots large; cervical stripes short and tapering

posteriorly, rarely continued backwards as fine stripes which fuse with the lateral horns of the falciform stripe; frontal spots fused with the cervical spots; all the festoons and the marginal ridge uniformly dark-coloured; cervical grooves deep; marginal groove continuous; punctations fairly regular, fine on the posterior part of the body, with scattered coarser punctations, variable on the anterior part of the body, fine or coarse; eyes small, dark-coloured in living examples (tending to become yellowish in preserved specimens), hemispherical, brilliant, orbited. *Venter*: greenish-grey, plaques and ventral scutes of the festoons brownish; genital aperture opposite coxa II; spiracles triangular with rounded angles. *Capitulum*: *L.* 2 mm., basis rectangular, posterior margin slightly concave, lateral margins convex; palps long and fairly stout, article 2 about twice as long as article 3; hypostome long, spatulate, dentition $3\frac{1}{2} \mid 3\frac{1}{2}$. *Legs*: stout, reddish-brown, articles with broad, pale annulations at their distal extremities; coxa I with two unequal spurs; a broad, flat, salient ridge on each of coxae II and III; coxa IV with a single, stout, blunt spur, twice as long as broad; tarsi abruptly attenuated.

Female (Pl. II, figs. 3 and 4). Diagnosis: A moderately large tick; scutum triangular; ornate, median field more or less extensively pale-coloured, lateral fields dark-coloured, with the exception of a small pale spot between the limiting spot and the eye; punctations numerous, coarse and confluent in places; eyes brilliant, hemispherical, orbited, colour as in the ♂.

Description. *Body*: *L.* 5 mm., *W.* 4·7 mm. (gorged examples may attain dimensions of 25 × 18 mm.); dorsum dark-green to greenish-black; marginal groove continuous. *Scutum*: 3 × 3 mm., triangular; postero-lateral margins almost rectilinear, antero-lateral margins convex; posterior angle fairly narrow, scapular angles projecting and pointed; ornate, with median field more or less extensively pale (according to Dönitz the scutum tends to become darker as engorgement proceeds); lateral fields dark-coloured with a single, small, pale spot between the limiting spot and the eye; cervical grooves deep and curved with the convexity external, shallow and divergent posteriorly, extending nearly to the postero-lateral margin; punctations numerous, coarse, confluent in places, more especially in the lateral fields; eyes small, brilliant, hemispherical, orbited, colour as in the ♂. *Venter*: dark-green, glabrous; genital aperture opposite coxa II; spiracles large, triangular, with rounded angles. *Capitulum*: *L.* 2 mm., basis rectangular, lateral margins convex; porose areas large, broad oval, interval rather less than diameter;

otherwise as in the ♂. *Legs*: long and stout; coxae similar to those of the ♂, except that the spur on coxa IV is quite short.

Geographical Distribution and Hosts.

Tropical Africa, ranging from **Abyssinia** and **Somaliland** to **Portuguese East Africa**; introduced into **Madagascar, Mauritius** and the **West Indies.** Principally found on cattle, also on sheep, zebra, rhinoceros, and rarely on man.

The type came from **Africa**; the habitat of Guérin-Méneville's *Ixodes elegans* is given as **Senegal** and **Egypt**; Koch's *Amb. venustum* from **Senegal.** Neumann (1899, p. 271) records numerous lots of specimens (Paris Mus., Simon, Oudemans and Neumann colls.) from **Abyssinia, Zambesi R., Zanzibar, Senegal, Congo, Angola, Ivory Coast, Sierra Leone, R. Niger, Mauritius** and **Reunion**; off *Bos taurus* L., *Ovis aries* L., *Equus zebra* L., *Rhinoceros africanus* Cuv., *Homo sapiens* L., *Bitis arietans* Gray, and *Limicolaria adansoni* Pfr. He notes that the species has become naturalised in the **West Indies (Guadeloupe)**, and that a gorged ♀ was collected by Pöhl in **Guatemala, Central America.** Specimens in Dr Brumpt's collection comprise ♀s, off *cattle*, Harar, **Abyssinia**, a ♂ and ♀, off *cattle*, Djibouti, **Somaliland,** and a ♂ and ♀, off *cow*, from **Dahomey.** The Cambridge collection contains an abundance of material derived from the following sources: **Senegal, Gambia, Guinea, Sierra Leone, Gold Coast, Nigeria, Belgian Congo, Uganda, Kenya, Nyasaland, Northern Rhodesia, Tanganyika Territory, Portuguese East Africa** and **South-West Africa**; also examples, off *cattle*, from **Madagascar, Mauritius,** and the **West Indies (Antigua).** In addition to the foregoing, I have examined numerous specimens sent for determination by the Imperial Bureau of Entomology, from Opelifa, **West Africa, Sierra Leone, Gold Coast, Nigeria, Uganda, British East Africa** and **Nyasaland.** The recorded hosts comprise cattle, sheep, horse, donkey, dog, cat, goat, hartebeeste, camel, zebra, elephant, buffalo, water-buck, eland, congoni, rhinoceros, wart-hog, Jackson's hartebeeste, sable antelope, reed-buck and bush-buck.

24. AMBLYOMMA HEBRAEUM Koch, 1844.

Pl. I, figs. 1, 2 and 4, Pl. III, figs. 1 and 2, Text-fig. 3.

Synon., Lit. and Iconogr.:

Amblyomma hebraeum Koch, C. L., 1844, p. 225, brief description of ♂. **1847,** pp. 63–64, specific description of ♂; Tab. X, Fig. 36, ♂ dorsum (coloured). **1899,** Neumann, L. G., p. 266, short description, indicating differences between *Amb. hebraeum* and *Amb. eburneum*; Lounsbury, C. P., biology, etc. **1900,** Lounsbury, C. P. (v. 1900), pp. 682–687, Tick-Heartwater experiments; (1900 *d*), pp. 336–340, life-history. **1901,** Neumann, L. G., p. 309, notes that *Amb. hassalli* is but a synonym of *Amb. hebraeum*; p. 311, Neumann degrades *Amb. annulipes* to a synonym: Lounsbury, C. P., pp. 728–743, 1 Fig., life-history and habits. **1904,** Lounsbury, C. P., pp. 175–186, *Amb. hebraeum* and Heartwater. **1905,** Neumann, L. G., p. 233, note on *Amb. hebraeum* and allied forms. **1907,** Dönitz, W., pp. 82–83, short description. **1908,** Howard, C. W., pp. 136–139, specific description (after Neumann), Pl. XII, Figs. *a–h*, ♀ dorsum, ♂ capitulum from dorsal aspect, ♂ and ♀ cheliceral digits; scutum and capitulum of nymph, dorsal and ventral surface of larva, and coxae of ♂. **1909,** Dönitz, W., pp. 455–456, specific description of ♂ and ♀, with special reference to ornamentation; Figs. 2 and 5, ♂ dorsum, ♀ scutum. **1910,** Dönitz, W., pp. 441–442, description of ♂ and ♀, notes on biology; Pl. XV, Figs. 6 and 7, ♂ dorsum, ♀ scutum (coloured). **1911,** Neumann, L. G., p. 79, brief description of ♂ and ♀. **1915,** Nuttall, G. H. F., pp. 409–419, biology, detailed account of raising experiments in Cambridge. Robinson, L. E., pp. 10–16, variability in size. **1916,** Nuttall, G. H. F., p. 337, brief description, chiefly relating to coloration; p. 347, notes on biology. **1920,** Nuttall, G. H. F., pp. 1, 2 and 5, notes on coloration in the living example; Pl. I, Figs. 1 and 4, ♂ scutum; Fig. 3, ♀ scutum, all coloured (herein reproduced, see Pl. I).

Amblyomma annulipes Koch, C. L., 1844, p. 230, specific description of ♂ and ♀: 1847, Koch, C. L., pp. 91–93, specific description of ♂ and ♀; Tab. XVII, Figs. 64–65, ♂ and ♀ dorsum (coloured). **1899,** Neumann, L. G., p. 267, note associating *Amb. annulipes* with *Amb. hebraeum*, and brief description of ♂ and ♀. **1901,** Neumann, L. G., p. 311, degrades *Amb. annulipes* to a synonym of *Amb. hebraeum*.

Ixodes poortmani Lucas, H., 1850, p. 41. **1861,** Belval, Th., pp. 97–101, description of ♂ and ♀, coloured Fig. of ♂ dorsum and outline nat. size.

Amblyomma distinctum Karsch, F., 1879, p. 534, specific description of ♀.

Amblyomma hassalli Marx and Neumann, 1899, Neumann, L. G., pp. 271–272, specific description of ♂ and ♀.

Male (Pl. I, figs. 1 and 4; Pl. III, fig. 1, text-fig. 3). Diagnosis: A medium-sized tick; scutum with characteristic ornamentation consisting of fine black or dark-brown stripes and spots on a pale greenish-white ground; postero-median stripe narrow, knobbed at the anterior extremity, rarely reaching the falciform stripe; postero-accessory stripes short, well-separated from the 3rd lateral spots; festoons all pale excepting the external, forming a continuous pale border to the posterior margin; eyes small, pale, almost circular, slightly convex.

Description. *Body*: *L.* 4·2–5·7 mm., *W.* 3·5–4·9 mm., contour oval, widest just posterior to middle. *Scutum*: smooth, convex; ornate, with

fine black or dark-brown spots or stripes on a greenish-white ground; postero-median stripe narrow, knobbed at the anterior extremity, rarely reaching the falciform stripe; postero-accessory stripes short, well-separated from the 3rd lateral spots, directed towards the knobbed extremity of the postero-median stripe; falciform stripe usually isolated, central portion sometimes undeveloped; lateral spots more or less separate, or fused to form a continuous bowed stripe in the lateral field; cervical stripes narrow, tapering posteriorly where they sometimes extend to the lateral horns of the falciform stripe; frontal spot small, separate or connected by a narrow bridge with the cervical spot; marginal ridge pale-coloured opposite the 1st and 2nd lateral spots; cervical grooves short, deep anteriorly; marginal groove continuous, very shallow in its anterior part, narrow; punctations for the most part fine, few coarser punctations in the scapular angles and on the peripheral parts of the scutum; festoons pale, excepting only the external festoon, forming a continuous pale border round the posterior margin; eyes small, pale, almost circular, slightly convex. *Venter*: dull greenish-yellow, glabrous; festoons with dark-brown scutes, obsolete on the external festoon; ventral plaques very distinct; genital aperture opposite coxa II; spiracles moderately large, triangular, with rounded angles. *Capitulum*: *L.* 2·0 mm., narrow; basis rectangular, lateral margins convex, postero-lateral angles broadly rounded and very slightly salient; palps long and slender, contracted at base; article 2 nearly three times as long as article 3; hypostome long, spatulate, dentition $3\frac{1}{2} \mid 3\frac{1}{2}$. *Legs*: moderately stout, dark-brown, with narrow yellowish annulations at the distal extremities of the articles; coxa I with two unequal spurs; a salient ridge on each of coxae II and III; a short, stout spur, little longer than broad, on coxa IV; tarsi short, abruptly attenuated.

Female (Pl. I, fig. 2; Pl. III, fig. 2). Diagnosis: A medium-sized tick; scutum triangular, ornate with extensive pale coloration; cervical stripe extending posteriorly to the limiting spot and usually connected with the small frontal spot by a narrow bridge; scapular fields dark-coloured; punctations fine generally, coarser and crowded in the scapular fields; eyes pale, almost circular, slightly convex.

Description. *Body*: *L.* 5 mm., *W.* 4 mm. (unfed), gorged females may attain a length of 20 mm. or more; dorsum dark-coloured, greenish-brown or -black; punctate and striate. *Scutum*: 3·0 × 2·9 mm., triangular, postero-lateral margins slightly convex, posterior angle narrow and rounded; ornate, with extensive pale coloration; cervical stripes

extending posteriorly to the limiting spots; frontal spots small, generally connected with the cervical stripes by a narrow bridge; scapular angles dark-coloured from the eyes forwards; cervical grooves deep anteriorly, very shallow behind, where they extend to the posterior third of the scutum; punctations fine on the posterior half of the scutum, coarser and more crowded in the antero-lateral and scapular fields; eyes pale, almost circular, slightly bulging. *Venter*: as dorsum; genital aperture opposite interspace between coxae II and III; spiracles broadly triangular, with rounded angles. *Capitulum*: *L.* 2 mm., basis rectangular, lateral margins convex, postero-lateral angles very slightly salient; palps slender, article 2 two-and-a-half times as long as article 3, slightly curved; hypostome long, slightly spatulate, dentition $3\frac{1}{2} \mid 3\frac{1}{2}$. *Legs*: more slender than those of the male, pale annulations on legs III and IV much more extensive; spur on coxa IV smaller.

Geographical Distribution and Hosts.

The centre of distribution is **S. Africa,** particularly the south-eastern regions, extending northwards through **Portuguese East Africa** to **Tanganyika Territory.** Dönitz (1907, p. 83) reports specimens, off *elephant,* from the Cameroons, but records of the occurrence of this species from parts of Africa other than those mentioned previously must be looked upon with suspicion. It must be remembered, however, that specimens may be found on imported cattle in parts far removed from the normal habitat. Neumann (1899, p. 266) notes that Lucas's specimens (*Ixodes poortmani*) were found on *Cynhyena picta,* Cape of Good Hope, and that Belval's specimens were off *Boselaphus oreas,* Mts. of the Moon. In his description of *Amb. hassalli,* Neumann records (1899, p. 272) a male, off an *African buffalo,* labelled *Amb. hassalli* by G. Marx; a ♀, from the neighbourhood of the R. Tana, East Africa (Smithsonian Inst.); ♂s and ♀s from Port Natal, Lippert coll. (Hamburg Mus.); a ♀ from Port Elizabeth (E. Simon coll.); and a ♂ from Delagoa Bay, Oberthür coll. (Paris Mus.). Later (1901, p. 309) Neumann notes that Schillings found specimens on *Camelopardalis giraffa* and on *Rhinoceros lucerius.* Karsch's specimen (*Amb. distinctum*) is labelled from Ceylon, Hoffmeister coll. (Berlin Mus.). If the record is correct, the presence of the species in Ceylon may be looked upon as being accidental. Dönitz (1909, p. 456) states that South Africa is the fatherland, but that *Amb. hebraeum* is also recorded from the Congo basin and from German East Africa, and lists as hosts: cattle and other domestic animals, rhinoceros and (1910, p. 442) civet cat. The Cambridge collection contains several

lots from **Portuguese East Africa,** comprising ♂s, ♀s and nymphs, off *cattle*, Bilene, III. 1913 (N. 2288, 2289, 2290, 2291 *a*, 2292); off *ox*, Guija, IV. 1913 (N. 2293, 2295, 2296); off *donkey* and *cattle*, Marlana, II. 1913 (N. 2298 *a*, 2300, 2302); off *horse*, *cattle*, *sheep* and *dog*, Namahacha, II. 1913 (N. 2304 *b*, 2308 *b*, 2309 *a*, 2310 *a*, 2311 *a*, 2312 *a*, 2313 *a*, 2316 *a*); Chief Veterinary Surgeon coll.: off *sheep* and *horse*, Namahacha, 25. IX. 1913 (N. 2418 *b*, 2419 *b*); off *cow*, Moamba, 8. VIII. 1913 (N. 2421 *a*); off *ox*, Namahacha, 31. VII. 1910 (N. 2424); off *cow*, Infulene (N. 2429); off *goat*, Incomati, 15. VIII. 1913 (N. 2432); off *cattle*, Incomati (N. 2433–2436); off *sheep* and *goats*, Incomati (N. 2437 *a*, 2439); also ♂s, from Delagoa Bay, C. F. M. Symmerton coll.; off *goats*, Lourenço Marques, 20. VIII. 1913 (N. 2439). Specimens from **South Africa:** off *ox*, Germiston, Transvaal, 6. IV. 1906, B. G. Brock coll. (N. 26); off *horse*, Germiston, Transvaal, I. 1907, B. G. Brock coll. (N. 232); from Pretoria, V. and VI. 1908, the gift of Sir Arnold Theiler (N. 418, 419, 420, 450); from Gonubie Park, East London, IV. 1905 (N. 1354–1357), 1906 (N. 1475, 1476), IX. 1912 (N. 1925), V. 1913 (N. 2154), Dr S. Williamson coll.; off *goat*, Cape Colony, VII. 1908, C. P. Lounsbury coll. (N. 964); III. 1906, 20. VII. 1912, no other data, C. P. Lounsbury coll. (N. 1350, 1932); off *Cephalopus* sp., East London, XII. 1908, W. F. Cooper coll. (C. 309).

25. AMBLYOMMA COHAERENS Dönitz, 1909.

Fig. 46.

Synon. and Lit.:

Amblyomma cohaerens Dönitz, W., 1909, pp. 465–466, specific description of ♂, with special reference to the ornamentation.

Amblyomma anceps Dönitz, W., 1909, p. 466, description of ♂.

Male. Diagnosis: A medium-sized tick; scutum with characteristic ornamentation, consisting of dark-brown or blackish spots and stripes on a pale ground; falciform present or absent, postero-median stripe rarely reaching the falciform stripe; postero-accessory stripes short, broad and triangular, closely adjacent to the 3rd lateral spots with which they are often fused at the base; cervical spots large; cervical stripes long, their posterior ends incurved and fused with the lateral horns of the falciform stripe when this is present; lateral spots conjoined to form a broad, bowed, lateral stripe, the ends of which are fused with the dark marginal coloration; festoons parti-coloured; punctations fine; eyes pale, slightly convex.

DESCRIPTION. *Body*: *L.* 5·0–6·0 mm., *W.* 4·1–4·7 mm., contour broad oval, a little narrower in front than behind. *Scutum*: smooth, convex;

with ornamentation consisting of dark-brown or blackish spots and stripes on a pale ground; falciform stripe present or absent; postero-median stripe rather narrow; anterior extremity very slightly knobbed if at all; rarely fused with the falciform stripe; postero-accessory stripes short, broad, triangular, closely adjacent to the 3rd lateral spots with which they are more or less fused at the base; lateral spots conjoined to form a broad, bowed, lateral band, the ends of which are fused with the marginal coloration; cervical spots very large; cervical stripes apparently very long and incurved at their posterior extremities; this appearance is due to the fact that the antero-accessory stripes are fused end on to the cervical stripes; external and median festoons dark-coloured, 2nd, 3rd and 5th festoons pale, 4th festoon pale in posterior half; cervical grooves in the form of elongate, comma-shaped pits; marginal groove continuous, very shallow in the part anterior to the middle; eyes of medium size, pale and slightly convex. *Venter*: pale yellowish-brown, smooth and glabrous; genital aperture opposite coxa II; spiracles triangular with rounded angles; festoons well-defined, with dark-brown ventral scutes; plaques small. *Capitulum*: *L.* 2·0–2·3 mm.; basis sub-trapezoidal, postero-lateral angles non-salient; palps long, sides almost parallel, article 2 contracted at proximal end, two-and-a-half times as long as article 3; hypostome long, spatulate, dentition $3\frac{1}{2} \mid 3\frac{1}{2}$. *Legs*: stout, dark maroon-brown with pale-yellow annulations at the distal extremities of the larger articles; coxa I with two unequal spurs, the external spur moderately long and pointed, the internal spur short and blunt; a broad, curved, salient ridge on each of coxae II and III, a short, blunt spur, slightly longer than broad on coxa IV; tarsi small, attenuated in talus.

In one lot of specimens (N. 1551) collected in Kenya by Col. R. J. Stordy, the ♂s show a marked variation from the type: they are smaller (*L.* 3·47–4·20 mm., *W.* 2·72–3·20 mm.); the dark markings are light reddish-brown; the postero-median stripe is fused at its anterior end with the falciform stripe in every case (6 examples); otherwise typical.

Female (Fig. 46). Diagnosis: A medium-sized tick; scutum triangular, smooth; median field pale-coloured; lateral fields mostly dark-coloured; punctations very fine; eyes moderately large, pale, slightly convex. Distinguishable with difficulty from the ♀ of *Amb. splendidum*.

Description. *Body*: *L.* 4·9 mm., *W.* 4·0 mm., contour oval, slightly narrower in front than behind; dorsum dark-green, with scattered coarse

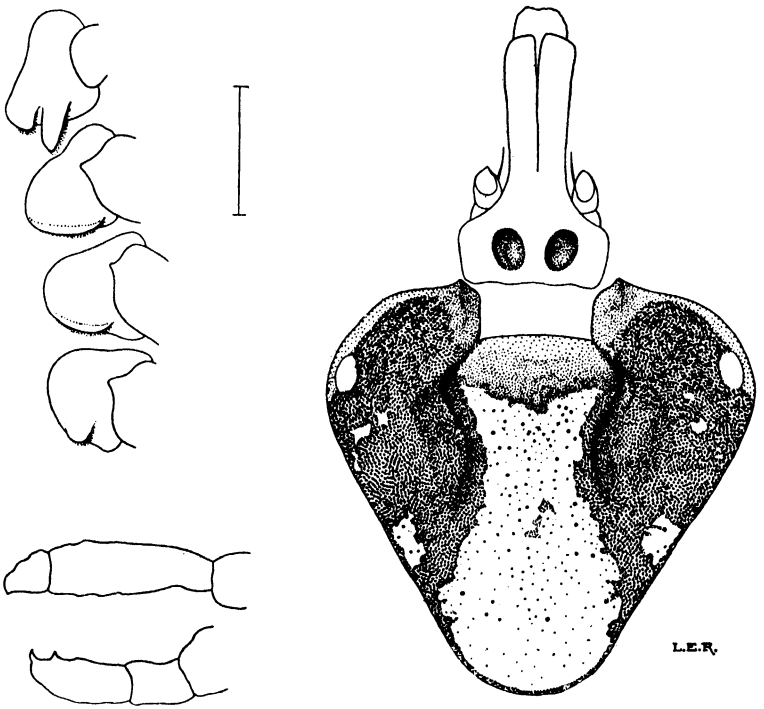


Fig. 46. *Amblyomma cohaerens* ♀. Scutum, capitulum (palps incomplete), coxae I–IV, tarsi I and IV. (N. 773.)

punctations on posterior half; marginal groove well-defined, continuous. *Scutum*: 2·8 × 2·9 mm.; convex, smooth; triangular, antero-lateral margins convex, scapular angles obtusely pointed, postero-lateral margins almost straight, slightly sinuous; posterior angle moderately narrow; ornate, median field pale-coloured, excepting the part between the cervical grooves; lateral fields dark-coloured with or without a small pale spot in the posterior part; cervical grooves short and deep, continued towards the posterior border by very shallow, ill-defined depressions; punctations very fine, coarser but still small in the scapular angles; eyes moderately large, almost circular, pale, slightly convex. *Venter*: colour as dorsum, almost glabrous, punctations on posterior half; genital aperture opposite coxa II, spiracles triangular with rounded angles. *Capitulum*: *L.* 2·2 mm., porose areas large, oval, divergent, interval about equal to diameter. *Legs*: stout, maroon-brown with pale annulations; coxae as in the ♂, spur on coxa IV shorter; tarsi attenuated in talus.

Geographical Distribution and Hosts.

Eastern Equatorial Africa, chiefly on *buffalo.* Dönitz's description is based on 2 ♂s, host not specified, from East Africa; his description of *Amb. anceps* is based on 3 ♂s, from L. Tanganyika. The Cambridge collection contains examples from various parts of E. Africa.

Uganda: ♂ and ♀, found on earth where *buffalo* had been lying, Toro, XII. 1910, Dr R. van Someren coll. (N. 1290); ♂s and ♀s, Bugoma Forest, Umgoro, VIII.–IX. 1910, Dr C. H. Marshall coll. (N. 1291); ♂, off *buffalo*, 1911, Dr D. G. H. Carpenter coll. (N. 1549); 2 ♂s, off *buffalo*, Lake Albert, VII. 1905, Dr Christy coll. (N. 1607); off *grasses*, N.W. Ankole, X. 1911, Dr S. A. Neave coll. (N. 1715); ♂s and ♀s, off *buffalo*, Katwe, II. 1912, R. Fyffe coll. (N. 1813); ♂s and ♀s, off *buffalo*, shot near Mchera R., Ankole, VIII. 1912, Dr R. E. McConnell coll. (N. 2020); ♂s and ♀s, off *buffalo*, Chagwe, 10. XI. 1913, E. H. Brogan coll. (N. 2716); specimens off *buffalo*, Buddu, 25. XII. 1913, F. A. Knowles coll. (N. 3014); ♂s and ♀s, off *elephant*, Chagwe, 24. VII. 1915, C. C. Gowdey coll. (N. 3211). I have also examined specimens sent for determination by the Imperial Bureau of Entomology: ♂, off *buffalo*, Ishasha R., 1911, Dr C. H. Marshall coll. (I.B.E. 358); ♂s and ♀s off *buffalo*, L. Edward, Ankole, 1911, E. Brogan coll. (I.B.E. 428); off *grasses*, Malisa-Jinja Road, VII. 1911, Dr S. A. Neave coll. (I.B.E. 477); ♂s and ♀s, off *buffalo*, F. A. Knowles coll. (I.B.E. 610 *a*); ♂s and ♀s, off *buffalo*, Mchera R., Ankole, 22. VIII. 1912, Dr R. E. McConnell coll. (I.B.E. 613).

Kenya: ♂s and ♀s, host not specified, 1911, Col. R. J. Stordy coll. (N. 1551); ♂, off *bullock*, Chukwani, IV. 1912, J. G. Parham coll. (N. 1781 *e*).

Belgian Congo: ♂s, ♀s and nymph, off *buffalo*, Semliki Plains, south shore of L. Albert, XI. 1911, Dr S. A. Neave coll. (N. 1582, 1583, 1584); ♂s and ♀s, off *buffalo*, 1913, Dr Yale Massey coll. (N. 2397); examples off *buffalo*, from Beni, 31. V. 1914, F. Harker coll. (N. 2902, 2906 *b*), and Mpenga, Gomba, 19. XII. 1912, F. A. Knowles coll. (N. 3015).

26. AMBLYOMMA INTEGRUM Karsch, 1879.

Figs. 47 and 48.

Synon., Lit. and Iconogr.:

Amblyomma integrum Karsch, F., 1879, p. 534, brief and insufficient description of the ♀. **1909**, Dönitz, W., pp. 473–477, specific description of the ♂ and ♀; Figs. 3 and 15, ♀ scutum, ♂ dorsum. **1911**, Neumann, L. G., p. 84, brief description of the ♀.

Amblyomma prolongatum Neumann, L. G., 1906, pp. 208–209, specific description of the ♂; Fig. 10, ♂ dorsum (herein reproduced). 1909, Dönitz, W., p. 473, degrades to a synonym of *Amb. integrum*. 1911, Neumann, L. G., p. 84, brief description of the ♂.

Male (Fig. 47). Diagnosis: A medium-sized tick; scutum broad oval; ornate, with dark-brown spots and stripes on a pale ground; postero-median stripe fused anteriorly with the prominent falciform stripe; postero-accessory stripes slightly curved, almost horizontal; lateral spots indistinct; antero-accessory stripes fused with the lateral extremities of the falciform stripe and often with the 1st lateral spot; a small limiting spot sometimes present on the inner side of the anterior extremities of the antero-accessory stripes; punctations numerous, coarse and irregular; marginal groove continuous, eyes pale and flat; hypostome dentition 3 | 3; festoons with ventral scutes more or less salient at the posterior margin; coxa I with two stout spurs; a broad, flat, ridge-like spur on coxae II and III; a stout spur, longer than broad, on coxa IV.

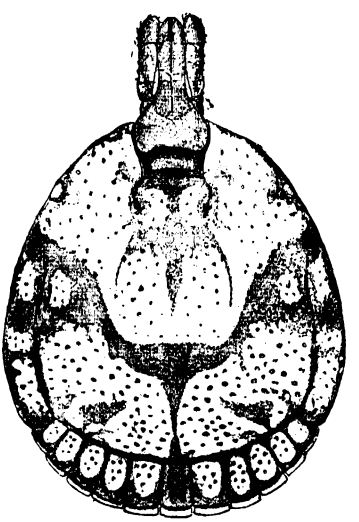


Fig. 47. *Amblyomma integrum* ♂. Dorsum (from Neumann, L. G., 1906, Fig. 10).

DESCRIPTION. *Body*: *L.* 5·1 mm., *W.* 4·5 mm.; contour broad oval, narrower in front. *Scutum*: convex; ornate, with dark reddish-brown markings on a pale ground; postero-median stripe narrow posteriorly, expanded at its anterior extremity where it fuses with the prominent falciform stripe; postero-accessory stripes small, slightly curved, almost horizontal; lateral spots indistinct, confused with the antero-accessory stripes and the dark marginal coloration; antero-accessory stripes fused with the lateral extremities of the falciform stripe; small limiting spots often present within and adjacent to the anterior extremities of the antero-accessory stripes; frontal spots small, fused with the ocular spots; cervical stripes often confused with a median longitudinal dark patch extending from the cervical emargination almost to the centre of the scutum; marginal ridge with four pale spots between the eye and the external festoon, the first of which merges into the general pale ground; 1st, 2nd, 3rd and 5th festoons pale; 4th and median festoons dark-coloured or with a small pale spot; cervical grooves short, deep and curved; marginal groove continuous, shallow and indistinct in its anterior part, deep and well-defined posteriorly; punctations very numerous, coarse, confluent in places; eyes pale and flat. *Venter*: earthy-yellow, with scattered whitish hairs; plaques and proximal part of ventral scutes of festoons dark-brown; genital aperture opposite the posterior margin of coxa II; spiracles broadly comma-shaped; festoons with ventral scutes more or less salient at the posterior border, the projecting portions translucent, not notched at the free extremity and as wide as the corresponding festoon. *Capitulum*: *L.* 1·8 mm., basis rectangular, postero-lateral angles slightly salient, lateral margins slightly convex, dorsal surface with pale enamelling; palps moderately long, article 2 laterally compressed, with pale enamelling at the proximal end and along the interno-dorsal margin, more than twice as long as article 3; hypostome long, sub-spatulate, dentition 3 | 3. *Legs*: medium, dark reddish-brown with narrow, pale annulations, and longitudinal pale stripes on the dorsal surface of the articles; coxa I with two spurs, the internal short and blunt, the external longer and pointed; coxae II and III each with a broad, curved, salient ridge; coxa IV with a blunt spur twice as long as broad; tarsi attenuated in talus.

Female (Fig. 48). Diagnosis: A medium-sized tick; scutum triangular, posterior angle narrow and truncated; ornate, with small dark markings on an extensive pale-yellow ground; limiting spots small; frontal spots indistinguishably fused with the ocular spots; cervical stripes short, narrow and divergent; cervical spots rather

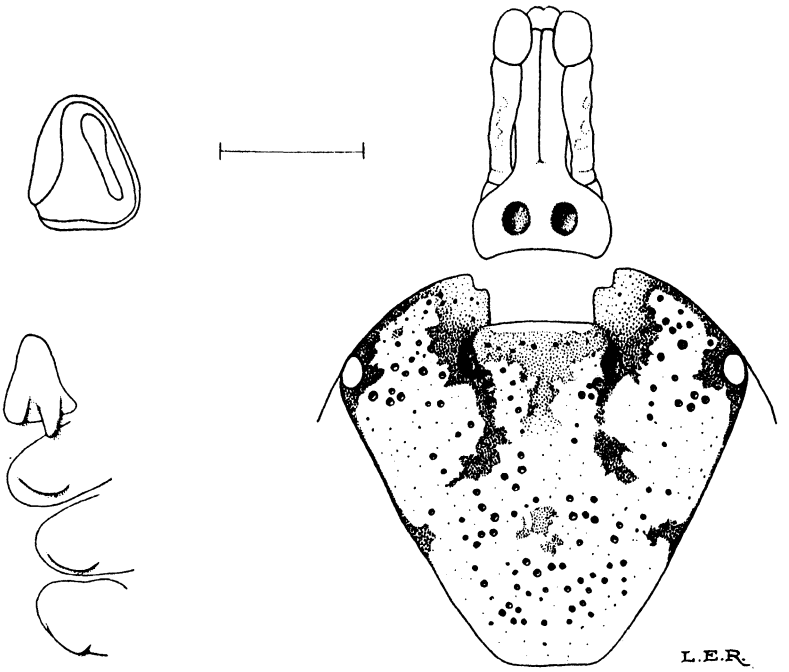


Fig. 48. *Amblyomma integrum* ♀. Scutum, capitulum, spiracle, coxae I–IV. (Type, Berlin Mus.)

large; punctations moderately large, numerous, irregular; eyes large, pale and flat; porose areas large, oval, interval equal to diameter; hypostome dentition 3 | 3; coxa I with two unequal spurs; a single, short, blunt spur on coxa IV; coxae II and III each with a broad salient ridge.

DESCRIPTION. *Body*: *L.* 4·25 mm., *W.* 3·7 mm., contour broadly oval, very slightly narrower in front; dorsum dark-brown, wrinkled; marginal groove and festoons present. *Scutum*: 2·8 × 2·9 mm., triangular; posterior angle narrow, truncated; postero-lateral margins almost rectilinear; ornate, with dark reddish-brown markings on a pale-yellow ground; limiting spots small; frontal spots indistinguishably fused with the ocular spots; cervical stripes short, narrow and divergent, terminating posteriorly about the middle of the scutum; cervical spots rather large; small, irregular median spots sometimes present between the cervical grooves and in the centre of the scutum; cervical grooves short, deep and curved; punctations numerous, irregular, moderately large; eyes large, pale and flat. *Venter*: genital aperture opposite coxa II; spiracles

large, triangular with rounded angles. *Capitulum*: *L.* 1·7 mm., postero-lateral angles of basis non-salient; porose areas large, oval, parallel, interval equal to diameter; in other respects similar to that of the ♂. *Legs*: similar to those of the ♂; spur on coxa IV very short.

Geographical Distribution and Hosts.

The type came from **Ceylon,** Hoffmeister coll. (Berlin Mus.). Neumann's description of *Amb. prolongatum* is based on a ♂, from Kandy, Ceylon (British Mus.). The Cambridge collection contains the following: **Ceylon**: ♀s, off *cattle*, Naranpitiya, XII. 1906, Col. B. Skinner coll. (N. 182); ♂s, off *hare*, Borlasgama, XII. 1906, Col. B. Skinner coll. (N. 184); (?) off *cattle*, Matara, 1906, E. E. Green coll. (N. 518); ♂, host not specified, Iala, II. 1899, T. Bainbridge Fletcher coll. (N. 811); ♂s, off *domesticated buffalo*, Talawa, XI. 1910, E. E. Green coll. (N. 1228); ♀s, off *wild buffalo*, Hambantota, XI. 1910, E. E. Green coll. (N. 1229); ♀s, off *man*, II. 1913, J. S. Fryer coll. (N. 2001); ♂s, off *pig*, 29. III. 1915 (Indian Mus., Calcutta, and N. 3326); ♂, from Anuradhapura, II. 1904, A. Rutherford coll. (I.B.E. 878). **India**: ♂s, from *nettle hedge*, Gopkuda, S. Lake Chilka, 1907, Dr N. Annandale coll. (N. 825); ♂s, off *calves*, Guindy, Saidapet, S. India, IX. 1909, Capt. W. S. Patton coll. (N. 835); ♂s and ♀s, off *buffalo*, Angul, Bengal, VII. 1909, J. L. Bose coll. (N. 1221); and ♂s and ♀, found under stones and on bushes in jungle, Puri Distr., Orissa, Bengal, 1–3. VIII. 1914, F. H. Gravely coll. (N. 3069).

27. AMBLYOMMA DUBITATUM Neumann, 1899.

Fig. 49.

Lit.: Neumann, L. G., 1899, pp. 234–235, specific description of ♀. 1911, p. 80, brief description of ♀.

Male: unknown.

Female (Fig. 49). Diagnosis: A medium-sized tick; scutum triangular-cordiform, ornate, punctations numerous; capitulum medium; porose areas almost circular, interval slightly less than diameter; coxa I with two short, sub-equal spurs; a short, broad, plate-like spur on coxae II and III; a small, blunt spur on coxa IV.

DESCRIPTION. *Body*: *L.* 10 mm., *W.* 8 mm. (gorged), colour dark-brown, dorsum glabrous. *Scutum*: 2·15 × 2·5 mm., triangular-cordiform; postero-lateral margins convex; posterior angle rather narrow; ornate,

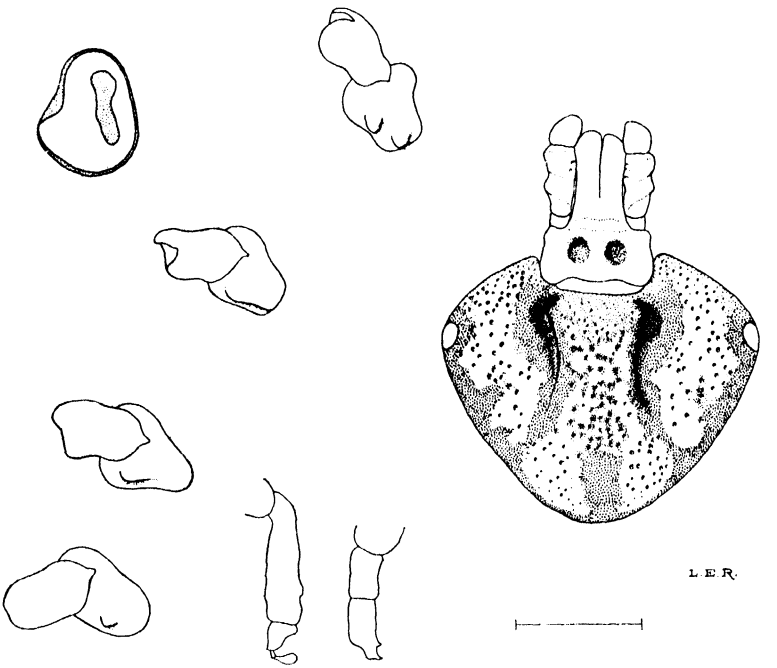


Fig. 49. *Amblyomma dubitatum* ♀. Scutum, capitulum, coxae I–IV, spiracle, tarsi I and IV. (Type, Toulouse.)

with a dark marginal stripe extending from the ocular spot to the limiting spot, continued as a very narrow band round the posterior angle; cervical spots large; cervical stripe extending posteriorly to reach the limiting spot; frontal spot small, fused with the dark marginal coloration; a dark median patch at the posterior angle may be attributed to defective preservation of the specimen; cervical grooves long, deep anteriorly, shallow and divergent posteriorly; punctations numerous, of medium size, almost absent from the dark-coloured markings, areolate in the median field; eyes rather small, pale and flat. *Venter*: as dorsum; spiracles broadly triangular, angles rounded. *Capitulum*: *L.* 1·3 mm., basis rectangular, postero-lateral angles rounded, very slightly salient; porose areas almost circular, interval slightly less than diameter; palps stout, article 2 two-and-a-half times as long as article 3, with an oblique dorsal ridge, slightly salient laterally, and terminating in a point at the posterior end of the dorso-internal margin; hypostome dentition 3 | 3. *Legs* of medium length, weak; coxa I with two short, flat, equal spurs;

a short, blunt, flat, plate-like spur on each of coxae II and III; a small, blunt spur on coxa IV; tarsi relatively long, attenuated in talus.

Description based on 1 ♀ (type), host not specified, reported to have come from **Southern Spain** (E. Simon coll., Toulouse, Cat. No. 843). Neumann (1899, p. 235) remarks that a ♀, brought from the **Congo** by M. Greshoff (Oudemans coll.) closely resembles *Amb. dubitatum*. The differences which he notes are well within the limits of normal specific variation.

28. AMBLYOMMA EBURNEUM Gerstaecker, 1873.

Figs. 50 and 51.

Lit. and Iconogr.: Gerstaecker, A., 1873, pp. 465–466, brief specific description of ♂ and ♀; Pl. XVIII, Fig. 1, ♂ dorsum (coloured). **1899**, Neumann, L. G., pp. 264–266, specific description of ♂ and ♀. **1905**, Neumann, L. G., p. 234; Dönitz, W., p. 133, brief note only. **1907**, Dönitz, W., p. 83, brief description of the ♂. **1909**, Dönitz, W., pp. 456–458, specific description of ♂ and ♀, with special reference to the ornamentation. **1910**, Dönitz, W., pp. 443–444, specific description of ♂ and ♀. **1911**, Neumann, L. G., p. 79, brief description of ♂ and ♀.

Male (Fig. 50). Diagnosis: A moderately large tick, with characteristic ornamentation on the scutum; scutum glossy, yellowish-white with dark-brown stripes and spots; postero-median stripe much expanded at its anterior extremity and fused with the falciform stripe; postero-accessory stripes extending from the 3rd festoon to fuse with the knob-like extremity of the postero-median stripe; marginal groove shallow and continuous; punctations fine; eyes almost circular, pale, slightly convex; festoons parti-coloured.

Description. *Body*: *L.* 5·5–6·7 mm., *W.* 4·8–6·0 mm., contour broad oval, widest just posterior to middle. *Scutum*: convex, glossy; ornate, with dark-brown stripes and spots on a yellowish-white ground; postero-median stripe much expanded at its anterior extremity where it fuses with the falciform stripe to form a large triangular central spot, the anterior angles of which are continued forwards and outwards in the direction of the eyes by a stripe which represents the fused antero-accessory stripes and limiting spots; postero-accessory stripes extending from the 3rd festoon and fusing with the postero-median stripe at the apex of the central triangle; 1st lateral spot fused with the dark marginal coloration; 3rd lateral spot in the form of a narrow stripe, generally separated from the 2nd lateral spot, running parallel to the postero-

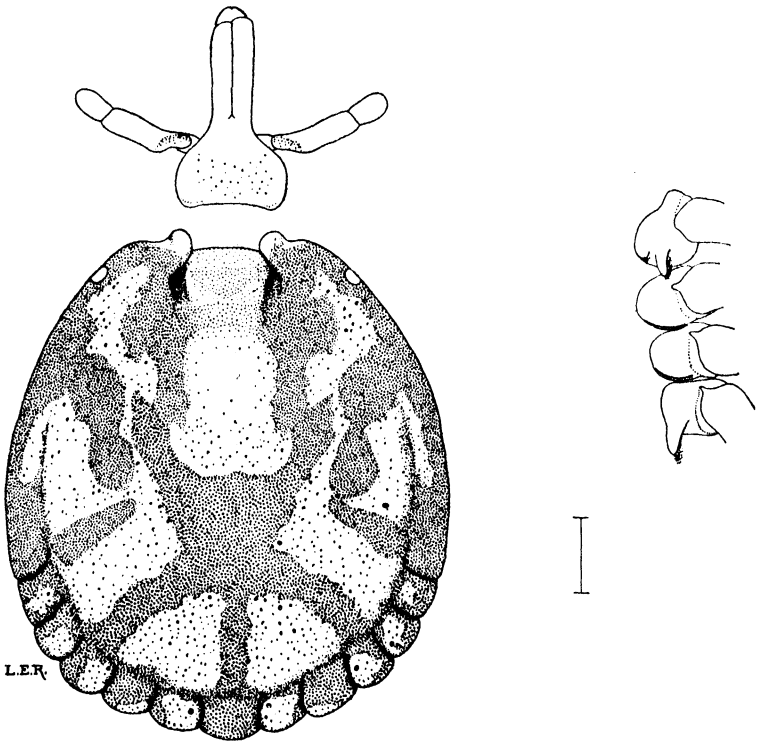


Fig. 50. *Amblyomma eburneum* ♂. Scutum, capitulum, coxae I–IV. (N. 947.)

accessory stripe and directed towards the centre of the scutum; frontal spot fused with the cervical spot; cervical stripes extending to the limiting spots posteriorly; a small, light-brown triangular spot between the cervical grooves; cervical grooves deep anteriorly, short; punctations fine and superficial; marginal groove continuous, commencing some distance behind the eyes; eyes almost circular, pale, slightly convex; festoons parti-coloured; median festoon dark, a very small pale spot at the postero-internal angle of the 4th festoon, the rest with pale spots. *Venter*: greenish-white; genital aperture opposite coxa II; spiracles large, triangular with rounded angles; festoons with brownish ventral scutes, in front of which the five plaques stand out conspicuously on the pale background. *Capitulum*: *L.* 2·7 mm., basis rectangular, lateral margins convex, postero-lateral angles non-salient; hypostome dentition 4 | 4. *Legs*: with pale annulations barely one-third the length of the respective article; coxa I with two unequal spurs, the internal

spur short and blunt, the external spur longer and more pointed; a broad, flat, plate-like spur on each of coxae II and III; a moderately long spur on coxa IV; tarsi short, tapering abruptly; pulvilli barely half the length of claws.

Female (Fig. 51). Diagnosis: A large tick; scutum triangular, smooth and shining; punctations fine; pale ornamentation limited to a large spot in the posterior angle, and small indefinite pale spots in the lateral fields and between the cervical grooves, the latter spots often absent; eyes almost circular, slightly convex, pale.

DESCRIPTION. *Body*: *L.* 6–11 mm., *W.* 6–9 mm., contour elliptical or oblong. *Scutum*: triangular, posterior angle rather narrow, postero-lateral margins almost straight; ornamentation consisting of a large, pale spot in the posterior angle, and small pale spots in the lateral fields and between the cervical grooves, these small spots sometimes missing; cervical grooves deep anteriorly, shallow behind where they extend to

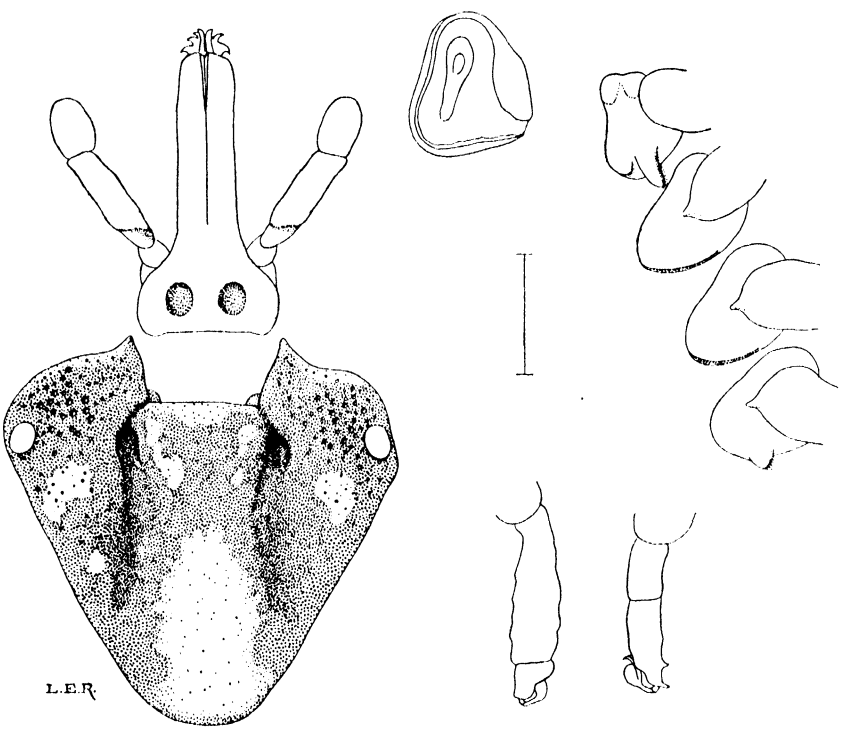


Fig. 51. *Amblyomma eburneum* ♀. Scutum, capitulum, spiracle, coxae I–IV, tarsi I and IV. (N. 312 *b*.)

the posterior third of the scutum; punctations fine, slightly coarser in the scapular fields; eyes almost circular, pale, slightly convex. *Venter*: brownish-green, finely punctate; genital aperture opposite coxa II; spiracles large, triangular with rounded angles. *Capitulum*: as in ♂, *L.* 2·5 mm., porose areas large, broadly oval, interval equal to diameter. *Legs*: as in ♂, coxal armature weaker; spur on coxa IV not longer than broad; tarsi relatively longer.

Geographical Distribution and Hosts.

East Africa. Gerstaecker's ♂ specimens came from Aruscha, XI. 1862, and 2 ♀s, off *Varanus saurus* Laur., from the Buru Mts, **Zanzibar**, Dr Kersten coll. Neumann records ♂s and ♀s from the coast of East Africa (1899, p. 266), and lists as hosts (1911, p. 79) *Felis leo* L., *Bubalus caffer* Sparm., and *Giraffa schillingsi* Mtsch. Dönitz (1905, p. 133) records specimens from Zanzibar, Saadini and Kundoa-Irangi, East Africa, also from Cairo, Egypt (doubtless imported on cattle). The Cambridge collection contains ♂s from Kumi Bukedi, East Africa, VIII. 1909, E. G. Morris coll. (N. 874 *c*); ♂s and ♀s, off *cattle*, Muengembo German East Africa (N. 947), the gift of Prof. W. Dönitz; and ♂s and ♀s, host not specified, Amani, **Tanganyika Territory**, presented by the Kaiserl. Biol. Inst., Amani (N. 3001).

29. AMBLYOMMA GEMMA Dönitz, 1909.

Pl. I, figs. 3 and 5, Pl. IV, fig. 3, Text-fig. 52.

Lit.: Dönitz, W., 1909, pp. 458–459, specific description of the ♂ and ♀, with special reference to the ornamentation. 1916, Paoli, G., pp. 286–291, description of ♂ and ♀ under the name *A. eburneum*; Pl. VI, Figs. 22 and 23, ♂ and ♀ scutum. 1920, Nuttall, G. H. F., pp. 1, 2, 4 and 5, notes on coloration in the living example; Pl. I, Figs. 3 and 5, scutum of ♀ and ♂, in colour (herein reproduced, see Pl. I).

Male (Pl. I, fig. 5; Pl. IV, fig. 3). Diagnosis: A medium-sized tick, closely resembling *Amb. hebraeum*: scutum with characteristic ornamentation; postero-median stripe extending anteriorly to fuse with the falciform stripe; cervical stripes broad anteriorly, tapering and fused posteriorly with the lateral horns of the falciform stripe; postero-accessory stripes short, widely-separated from the 3rd lateral spots, directed towards the anterior extremity of the postero-median stripe; lateral spots isolated or more or less conjoined; festoons particoloured, external and median festoons dark-coloured, 4th festoon with a small, pale spot at the postero-internal angle, 2nd, 3rd and 5th

festoons pale-coloured; marginal groove continuous; punctations fine; eyes of medium size, pale, almost circular, slightly bulging.

DESCRIPTION. *Body*: *L.* 5·5 mm., *W.* 4·9 mm., contour broad oval, narrower in front. *Scutum*: smooth, convex; ornate, with fine black or brownish-black markings on a pale ground; postero-median stripe knobbed at the anterior extremity where it touches or fuses with the falciform stripe; postero-accessory stripes short, widely-separated from the 3rd lateral spot, directed towards the anterior extremity of the postero-median stripe; lateral spots small, isolated or more or less conjoined; antero-accessory stripes indistinguishably fused with the lateral horns of the falciform stripe; cervical stripes broad anteriorly, tapering posteriorly, their hinder extremities generally extending to the horns of the falciform stripe; frontal spots usually fused with the cervical stripes, often fragmentary; marginal ridge dark-coloured except for an incursion of the pale ground opposite the lateral spots; festoons parti-coloured, 1st and median festoons dark-coloured, 2nd, 3rd and 5th festoons pale-coloured; 4th festoon with a small pale spot at the postero-internal angle; cervical grooves short and deep; marginal groove commencing about the level of the 2nd lateral spot, continuous; punctations for the most part very fine, few larger, but still small, punctations on the peripheral parts of the scutum. *Venter*: pale yellowish-grey; plaques and the ventral scutes of the festoons reddish-brown; spiracles medium, triangular, with rounded angles. *Capitulum*: *L.* 2 mm., basis rectangular, posterior margin slightly concave; palps long, hairy, article 2 twice as long as article 3; hypostome dentition $3\frac{1}{2} \mid 3\frac{1}{2}$. *Legs*: moderately stout, maroon-brown with broad, pale annulations at the distal extremities of the articles attaining half the length of the article on the dorsal side of tibia and protarsus of the hinder legs; coxa I with two unequal spurs, the external spur pointed and attaining the anterior margin of coxa II, the internal spur short and blunt; a broad, curved ridge-like spur on coxae II and III; a single stout spur, twice as long as broad, on coxa IV; tarsi small, abruptly attenuated.

Female (Fig. 52 and Pl. I, fig. 3). Diagnosis: A medium-sized tick closely resembling *Amb. hebraeum*; scutum triangular-cordiform, postero-lateral angles convex; ocular spot large; frontal spot isolated, or connected by a narrow bridge with the cervical stripe; the latter extending posteriorly to fuse with the limiting spot; scapular angles pale; punctations numerous, medium, coarse in the antero-lateral fields; eyes circular, pale, slightly convex.

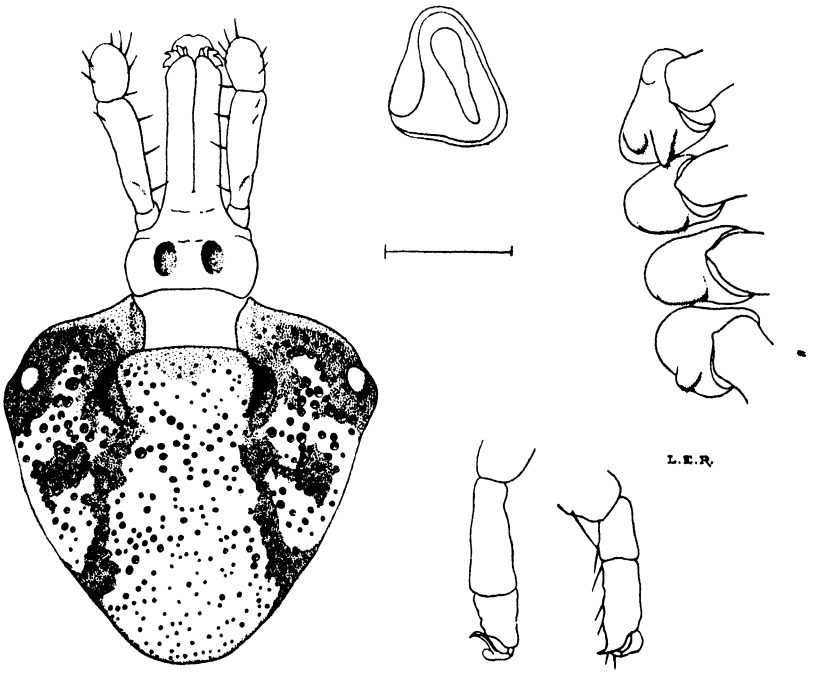


Fig. 52. *Amblyomma gemma* ♀. Scutum, capitulum, coxae I–IV, spiracle, tarsi I and IV. (N. 1432.)

DESCRIPTION. *Body*: *L.* 5–5·5 mm., *W.* 4–4·5 mm. (unfed); contour broadly elliptical; dorsum dark-green to greenish-brown or greenish-black, smooth, finely punctate. *Scutum*: 3 × 3 mm., triangular-cordiform, posterior angle medium, postero-lateral margins slightly convex; ornate, with dark markings on an extensive pale ground; ocular spots large, frontal spot isolated or connected by a narrow bridge with the cervical stripe; cervical stripes narrow, extending to fuse posteriorly with the small limiting spots; the scapular fields dark-coloured, broken by a narrow forward extension of the pale ground between the eye and the cervical spot; scapular angles pale; cervical grooves short and deep, continued posteriorly by shallow, divergent depressions; punctations fairly numerous, medium, coarse and confluent in places in the antero-lateral fields; eyes circular, pale and slightly convex. *Venter*: colour as dorsum; genital aperture opposite coxa II; spiracles triangular, with rounded angles. *Capitulum*: *L.* 2 mm., basis rectangular, posterior margin slightly concave, lateral margins convex; porose areas fairly

large, oval, interval about equal to diameter; palps long, rather slender, article 2 more than twice the length of article 3; hypostome dentition $3\frac{1}{2} \mid 3\frac{1}{2}$. *Legs*: more slender than those of the ♂, with very broad, pale annulations at the distal extremities of the articles; coxal armature as in the ♂, except that the spur on coxa IV is shorter; tarsi medium, abruptly attenuated.

Geographical Distribution and Hosts.

Dönitz's original description of the species is based on ♂s and ♀s, off *giraffe*, Mkatta-Steppe, **Tanganyika Territory.** I have examined specimens from various parts of East Tropical Africa, as follows: **Somaliland;** ♂, off *Phacocherus aethiopicus africanus*, Sagak, VII. 1901, Dr Brumpt's collection. **Uganda:** ♂s and ♀, host not specified, from 6 miles east of Palango Station (3700 ft.), Nile Province, X. 1912, R. Paske Smith coll. (N. 1724). **Kenya:** ♂s, off *giraffe*, Col. Alcock donor (N. 960); ♂s and ♀, off *Oryx callotis*, Mowa R. (60 miles south-east of Kitui), V. 1911, S. W. J. Scholefield coll. (N. 1432); off *cattle*, Mkokotoni, IV. 1912, J. G. Parham coll. (N. 1758 and 1794 *c*); off *bullock*, Bu-bu-bu, IV. 1912, J. G. Parham coll. (N. 1785 *b*, 1789 *a*); ♂s and ♀s, off *eland*, Makindu, Dr J. O. Shircore coll. (N. 3215 *e*); ♂s, off *rhinoceros*, Tana R., VIII. 1909; ♂s and ♀s, off *eland*, 16. VIII. 1909, W. F. Cooper coll. (C. 380, 55 and 61); ♂s, collected in desert country, Col. R. J. Stordy (I.B.E. 419 *a*); ♂s and ♀s, off *ponies* and *mules*, Marsabit, X.–XI. 1911, Capt. C. A. Neave coll. (I.B.E. 491 *a*); ♂s and ♀, off *ox*, Voi, I. 1912, R. Edmondson coll. (I.B.E. 505). **Tanganyika Territory:** ♂s and ♀, off *giraffe*, Ngomberenga, Mkatta-Steppe, W. Dönitz donor (N. 965); ♂s, off *cattle*, Iringa (?), Dr W. Bartels coll. (N. 2586); (?) off *eland*, Shembekuli, 13. v. 1913 (N. 2604 *b*); off *gnu*, Marangeek, Bezirk Wilhelmsthal (N. 2603 *a*); ♂s and ♀s, off *eland*, Sanitätsdienststelle, Wilhelmsthal, 13. v. 1913 (N. 2599).

30. AMBLYOMMA SPLENDIDUM Giebel, 1877.

Pl. II, figs. 5 and 6, Pl. IV, fig. 2.

Synon., Lit. and Iconogr.:

Amblyomma splendidum Giebel, C. G., 1877, pp. 293–295, description of ♂ and ♀. **1899**, Neumann, L. G., pp. 273–274, description of ♂ and ♀. **1905**, Neumann, L. G., p. 233–234, degrades to *Amb. hebraeum* var. *splendidum*. **1907**, Dönitz, W., pp. 83–84, brief description of ♂ and ♀. **1909**, pp. 461–462, description of ♂ and ♀, with special reference to the ornamentation. **1910**, p. 444, description of ♂ and ♀. **1911**, Neumann, L. G., p. 80, brief description of ♂ and ♀ under the name *Amb hebraeum splendidum* (Giebel). **1913**, Nuttall, G. H. F., pp. 49–51, notes on coloration in living and dead examples; Pl. VII, Figs. 5 and 6, ♂ scutum, in colour (herein reproduced, see Pl. II).

Amblyomma quantini Martin, J., 1895, p. 267, description of ♂ and ♀; Pl. XIV, Figs. 1–11, ♂ dorsum, venter, capitulum, hypostome, digit of chelicera of ♂ and ♀, tarsus IV, spiracle, ♀ venter and dorsum.

Male (Pl. II, figs. 5 and 6; Pl. IV, fig. 2). Diagnosis: A moderately large West African tick; scutum ornate, with thick, black markings on a pale, brilliantly-coloured ground; a vermilion-red spot on the centre of the scutum surrounding the foveae; falciform stripe absent; otherwise closely resembling *Amb. cohaerens*.

Description. *Body*: *L.* 6–7 mm., *W.* 4·5–5 mm.; contour broad oval, narrower in front, sometimes almost elliptical. *Scutum*: brilliantly ornate, with thick black markings on a pale but variously-coloured ground; postero-median stripe rather short and thick, not expanded at the anterior extremity; postero-accessory stripes short and thick, situated close to, but separated from, the 3rd lateral spots; lateral spots conjoined to form a broad lateral bowed stripe the extremities of which fuse with the dark marginal coloration, enclosing a lateral patch of the pale ground; antero-accessory stripes slightly divergent, sometimes more or less fused with the 2nd and 1st lateral spots; falciform stripe absent; cervical and frontal spots fused to form a single large spot; cervical stripes extending posteriorly to fuse with the anterior extremities of the antero-accessory stripes; festoons parti-coloured, the external and median festoons dark-coloured, the 4th festoon with a smaller pale spot than the 2nd, 3rd and 5th; a vermilion-red spot on the centre of the scutum, surrounding the foveae; cervical grooves short and deep; marginal groove continuous; punctations very fine and superficial, a few larger punctations near the lateral margins and on the festoons; eyes medium, slightly convex, pale (darker in the living specimens). *Venter*: greyish-yellow, smooth, with scattered fine hairs; genital aperture opposite the

interspace between coxae II and III; spiracles medium, triangular with rounded angles; festoons and plaques dark-brown, the former with slightly salient posterior margins, the latter small. *Capitulum*: *L.* 2 mm.; basis sub-triangular, postero-lateral angles rounded and barely salient; lateral margins convex; palps long and slender, article 2 three times as long as article 3; hypostome long, sub-spatulate, dentition $3\frac{1}{2} \mid 3\frac{1}{2}$. *Legs*: stout, dark-brown with broad, yellow annulations; coxa I with two stout spurs, of which the external is the longer and more pointed; a broad, curved, salient ridge on coxae II and III; a single stout spur, about twice as long as broad, on coxa IV; tarsi small, rather abruptly attenuated.

Female. Diagnosis: A moderately large tick closely resembling *Amb. cohaerens*; scutum triangular; ornate, with an extensive, pale, median field; lateral fields dark-coloured, excepting a small pale spot near the middle of the postero-lateral margin; punctations exceedingly fine, largest in the scapular fields; eyes medium, pale and slightly convex.

Description. *Body*: *L.* 5–6 mm., *W.* 4·2–5 mm.; contour broad oval or elliptical; dorsum smooth, glabrous, greenish-black with few scattered punctations; marginal groove continuous; festoons well-defined. *Scutum*: 2·35 × 2·4 mm., triangular, posterior angle rather narrow, postero-lateral margins almost rectilinear; ornate, with an extensive pale coloration of the median field; lateral fields dark-coloured, excepting a small, pale spot near the middle of the postero-lateral border; cervical grooves short, deep anteriorly, continued posteriorly by very shallow, divergent depressions; punctations very fine, largest in the scapular fields; eyes medium, pale and slightly convex. *Venter*: similar in colour to dorsum, with scattered small whitish hairs; genital aperture opposite the interspace between coxae II and III; spiracles large, triangular, with rounded angles. *Legs*: longer and more slender than in the ♂; dark-brown with broad, yellow annulations; coxa I with two spurs, of which the external is the longer and more pointed; a broad, curved, salient ridge on coxae II and III; a short spur, about as long as broad, on coxa IV; tarsi longer than in the ♂, abruptly attenuated; pulvilli small.

Geographical Distribution and Hosts.

A **West African** species. The type came from **Gabun**, off *Bos brachyceros*. Neumann records a ♀, found by Quantin on a skin of *Bos brachyceros*, in the Paris Museum, from the **Congo**; ♂s, ♀s and nymph, off a *boar*, **Gabun**, Hans Petersen coll. (Hamburg Mus.); ♂ and ♀, from the

Congo, Ferrière coll. (Paris Mus.); 4 ♂s and 5 ♀s, from South Africa (?) (Oudemans coll.). The Cambridge collection contains the following: **Sierra Leone:** ♀s, off *grasses*, Yiraia, VI. 1912, J. J. Simpson coll. (N. 1898); ♂s and ♀, off *cattle*, Madina, V. 1913, Dr J. Y. Wood coll. (N. 2259 *a*); ♂s, off *cattle*, Koinadugu, III.–IV. 1913, Dr J. Y. Wood coll. (N. 2262); ♂s and ♀s, off *cattle*, Firawa, Kabunga and Kulakunko (N. 2333, 2505 *b*, 2506 *b*, 3034 *a*). **Gold Coast:** ♂s, off *bush-cow*, Yeji, 12. II. 1913, Dr J. J. Simpson coll. (I.B.E. 666). **Lagos:** ♂s and ♀s, off *buffalo*, Ikiti Country, 1907, Capt. W. H. Best coll. (N. 194 and 196). **Nigeria:** ♂ and ♀, off *buffalo*, Tagi, **N. Nigeria,** 27. IV. 1913, Dr G. F. Petrie (N. 2900). **Congo Free State:** ♂s and ♀s, off *buffalo*, Tshumbiri, 1909 (N. 1610); ♂s and ♀s, host ?, Kisantu, Rev. P. Renard coll. **French Congo:** ♂, off *cattle*, Ngomo (N. 1697). **Portuguese Congo:** ♂s and ♀s, off *buffalo*, 1911, Dr M. Gamble coll. (N. 1578); ♂s and ♀s, off *buffalo*, 1912, Dr M. Gamble coll. (N. 1947); ♂s and ♀s, off ?, W. Larsen coll. (N. 2742); ♂s and ♀s, off *buffalo*, Fukian, San Salvador, 1. I. 1913, Dr M. Gamble coll. (N. 2649); ♂ and ♀, off *pig*, 1913, Dr Mercier Gamble coll. (I.B.E. 737 *a*); ♂s and ♀s, off *buffalo*, 1913, Dr Mercier Gamble coll. (I.B.E. 738); ♂s and ♀s, off *buffalo*, 1909, Dr Mercier Gamble coll. (I.B.E. 794).

31. AMBLYOMMA ASTRION Dönitz, 1909.

Lit. and Iconogr.: Dönitz, W., 1909, pp. 463–465, specific description of the ♂; Fig. 13, ♂ dorsum.

Male. Diagnosis: A medium-sized tick, closely resembling *Amb. splendidum*; with characteristic dark-coloured ornamentation on a pale ground; postero-median stripe with a very broad, triangular base, the apex tapering into a very fine, short stripe; postero-accessory stripes in the form of broad triangles, the anterior sides of which are fused with the 3rd lateral spots; falciform stripe absent; lateral spots conjoined, forming a strongly-bowed lateral stripe, the extremities of which are fused with the dark marginal coloration; festoons parti-coloured; eyes pale and almost flat.

DESCRIPTION. *Body*: *L.* 5 mm., *W.* 4·3 mm., contour broad oval, narrowing anteriorly. *Scutum*: with characteristic dark-coloured, slightly raised spots and stripes on a pale ground; postero-median stripe in the form of a broad triangle, the base of which occupies the anterior margin of the three median festoons; postero-accessory stripes also broadly

triangular, their bases extending along the anterior margins of the four external festoons, their anterior sides almost completely fused with the 3rd lateral spots; falciform stripe absent; lateral spots conjoined to form a strongly-bowed lateral stripe, the extremities of which are fused with the dark marginal coloration; antero-accessory stripes narrow, parallel, fused anteriorly with the posterior extremities of the cervical stripes; festoons parti-coloured, median and external festoons dark-coloured, 2nd, 3rd and 5th festoons completely pale, 4th festoon pale in the posterior part only; marginal groove shallow at its commencement opposite the 2nd lateral spot, continuous; punctations exceptionally fine, with a few scattered larger punctations; eyes pale and moderately flat. *Legs*: broadly annulated.

Female: unknown.

Dönitz' description based on a single ♂, off *buffalo*, Loanda, **W. Africa** (Berlin Mus.).

32. AMBLYOMMA FURCULA Dönitz, 1909.

Figs. 53 and 54.

Lit.: Dönitz, W., 1909, pp. 478–482, specific description of ♂ and ♀.

Male (Fig. 53). Diagnosis: A very small tick; scutum narrow oval, ornate; marginal groove interrupted opposite the 5th festoon; capitulum very short; coxa I with two unequal spurs, the external long and pointed, the internal very short; a very small, short spur on each of coxae II and III; a very long, sharp spur on coxa IV.

Description. *Body*: *L.* 2·7 mm., *W.* 1·7 mm., contour elongate oval, narrow anteriorly. *Scutum*: ornate, with reddish-brown stripes and spots on a pale ground; postero-median stripe broad, extending nearly to the middle of the scutum; postero-accessory stripes short, broad, vertical; lateral spots fused; antero-accessory stripes slightly divergent anteriorly; frontal spots represented by small aggregations of dark-coloured punctations or completely absent; cervical stripes narrow; marginal ridge with a continuous, but irregular, pale stripe extending from the eye to the external festoon; cervical grooves short, deep, crescentic with the convexity internal; marginal groove narrow and deep, interrupted opposite the 5th festoons; punctations numerous, moderately coarse in the antero-lateral fields and in the posterior half of the scutum; festoons well-defined, longer than broad; the median festoon, and often the 4th, dark-coloured, the 1st–3rd each with a pale spot, the 5th with an

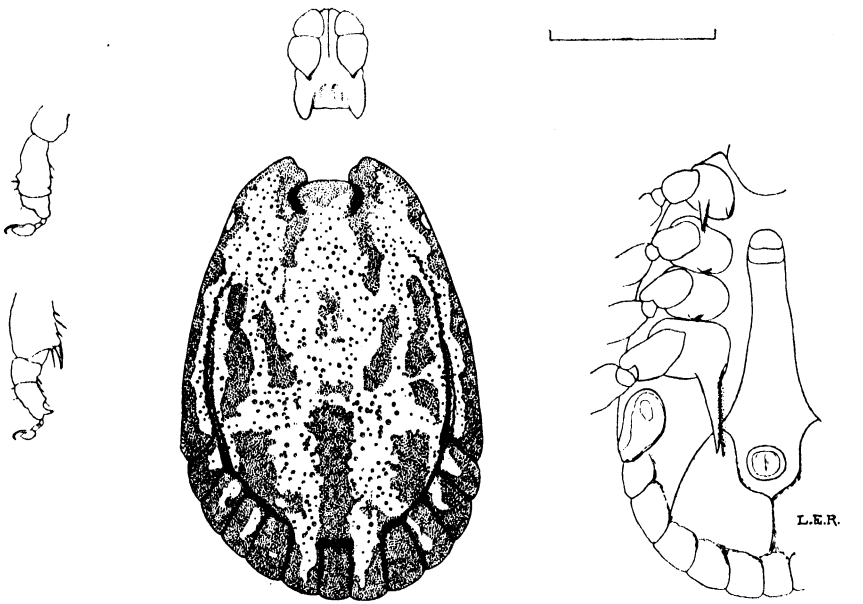


Fig. 53. *Amblyomma furcula* ♂. Scutum, capitulum, venter, tarsi I and IV (N. 946.)

encroachment of the pale field of the scutum; eyes small, pale and flat. *Venter*: genital aperture opposite coxa II; spiracles of medium size, broad comma-shaped; festoons short, well-defined, delimited anteriorly by a fine groove. *Capitulum*: *L.* 0·6 mm., basis rectangular, lateral margins slightly convex, postero-lateral angles produced backwards as a pair of stout cornua; palps very short and thick; article 2 barely longer than article 3, compressed proximally, dorsal surface continued posteriorly as a short, pointed process; hypostome dentition 3 | 3. *Legs*: of medium size, with pale annulations at the distal extremities of the larger articles; coxa I with two widely-separated, unequal spurs, the external long and pointed, the internal very short; a single small spur on each of coxae II and III; a very long pointed spur on coxa IV; protarsi II–IV each with a stout spine at the distal extremity of the ventral surface; tarsi small, short, tapering gradually at extremity.

Female (Fig. 54). Diagnosis: A small tick; scutum triangular, postero-lateral margins straight or slightly concave, posterior angle broad; ornate, with extensive pale coloration in the median and lateral fields; eyes large, pale and flat, bulging laterally beyond the contour of the scutum; capitulum short, basis rectangular, postero-

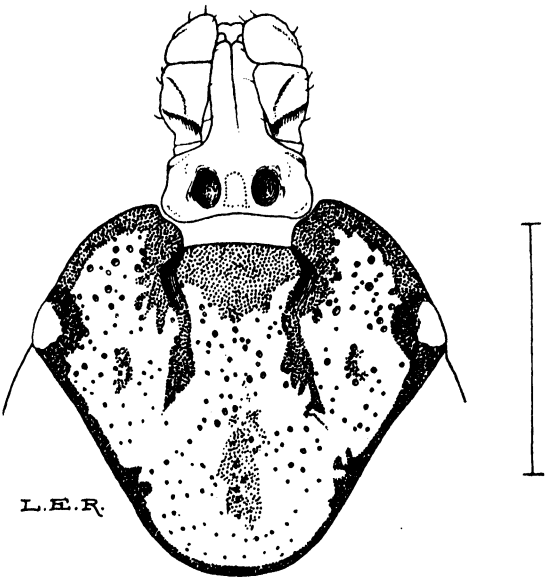


Fig. 54. *Amblyomma furcula* ♀. Scutum, capitulum. (N. 946.)

lateral angles non-salient, porose areas small, almost circular, interval greater than diameter; coxa I with two unequal spurs, the external spur long and pointed; a single small spur on each of coxae II–IV, longest on coxa IV.

Description. *Body*: *L.* 3·2 mm., *W.* 2·1 mm., contour oval; dorsum earthy-brown, rugose, scattered with short, coarse, whitish hairs; marginal groove incomplete. *Scutum*: 1·5 × 1·7 mm., triangular; antero-lateral margins convex, postero-lateral margins rectilinear or slightly concave; posterior angles broad, ornate, with extensive pale coloration in the median and lateral fields; a narrow, dark, marginal band commencing at the scapular angles and extending round the posterior angle; limiting spots very small; cervical stripe short and narrow; frontal spots represented by small aggregations of dark-coloured punctations; cervical grooves short, deep, crescentic with the convexity external; punctations numerous, small, coarser in the antero-lateral fields; eyes large, pale and flat, bulging laterally beyond the contour of the scutum. *Venter*: paler than dorsum, with whitish hairs on posterior two-thirds; genital aperture opposite interspace between coxae II and III; spiracles broad comma-shaped. *Capitulum*: *L.* 0·7 mm., basis rectangular, postero-lateral angles non-salient; porose areas of medium size, almost circular, interval

greater than diameter; palps short and thick, article 1 compressed proximally, with an oblique, dorsal, salient ridge terminating in a point at the postero-internal angle, one-and-a-half times as long as article 3; hypostome dentition 3 | 3. *Legs*: of medium size, pale-coloured, narrowly annulated and striped with white on the dorsal surface; coxae I–III as in the ♂; coxa IV with a short spur of variable length; tarsi as in the ♂.

Geographical Distribution and Hosts.

Dönitz described the species from ♂s and ♀, found free, **Argentine Republic,** Dr A. Richter coll. The Cambridge collection contains a ♂, ♀s and nymphs, host not specified, Salta, Argentine Republic, S. America, presented by Dr W. Dönitz, XII. 1909 (N. 946).

33. AMBLYOMMA BRASILIENSE Aragão, 1908.

Figs. 55 and 56.

Lit. and Iconogr.: Aragão, H. de B., 22. III. 1908, pp. 11–17; 1911, pp. 181–186, Pl. XII, Figs. 19–21, ♂ dorsum and venter, ♀ dorsum.

Male (Fig. 55). Diagnosis: A small tick with characteristic ornamentation on the scutum; marginal groove incomplete; capitulum short; festoons with ventral rectangular and rounded or triangular prolongations; coxa I with two unequal spurs; coxae II and III each with a short, blunt spur and a small internal tubercle; coxa IV with a long, pointed spur and a small internal tubercle; tarsi abruptly attenuated.

DESCRIPTION. *Body*: *L.* 4·42 mm. (including capitulum), *W.* 2·81 mm., contour elongate oval. *Scutum*: flat, ornate, with characteristic dark-brown markings on a pale ground—postero-median stripe attains about one-third the length of the body; postero-accessory stripes small, triangular, isolated; the three lateral spots conjoined in the form of a broad, longitudinal stripe close to the marginal groove; antero-accessory stripes narrow, oblique, forming a Y-shaped figure with the postero-median stripe; cervical stripes narrow, not reaching the antero-accessory stripes; a narrow, dark stripe on the marginal ridge, extending from the ocular spot to the external festoon; cervical grooves small, deep anteriorly, comma-shaped; eyes pale and flat; marginal groove commencing some distance behind the eyes in a series of large punctations, broad, deep in its hinder portion and terminating at the external festoon, a shallow

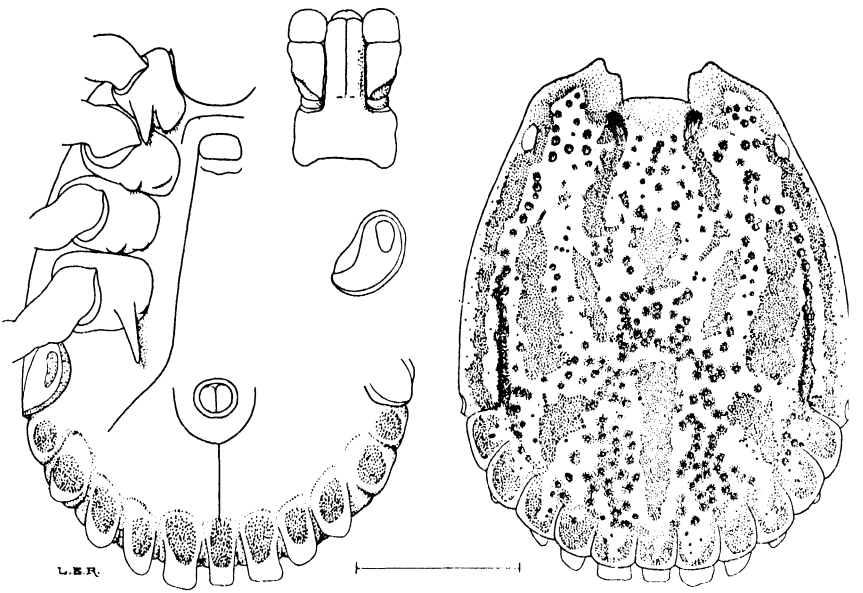


Fig. 55. *Amblyomma brasiliense* ♂. Scutum, capitulum, venter, spiracle. (N. 832.)

extension limiting the two last festoons is usually found; punctations numerous, large, superficial, interspersed with finer punctations; the large punctations, especially in the centre and hinder part of the scutum, each with a dark-coloured areola. *Venter*: dark-brown with scattered short hairs and fine punctations; genital aperture opposite coxa II; spiracle broadly comma-shaped; festoons each bearing a ventral, dark-coloured, chitinous scute which is prolonged posteriorly as a thin, translucent, salient plate, visible from the dorsal aspect; the median projections longer and more or less rectangular in outline; the outer short and barely salient and more rounded or triangular. *Capitulum*: short (0·8 mm.), basis rectangular salient, with postero-lateral angles; hypostome spatulate, short, dentition 3 | 3; palps with pale enamelling on the dorsal side, article 2 one-and-a-half times as long as article 3. *Legs*: long, stout, maroon-brown in colour; coxa I with two sub-equal, contiguous, parallel spurs, of which the external is the longer and more pointed; two short, blunt spurs on coxae II and III, of which the internal is reduced to a mere tubercle; coxa IV with a long, pointed spur and a small tubercle at the postero-internal angle; tarsi abruptly attenuated; pulvillus half length of claws.

Female (Fig. 56). Diagnosis: A small tick, ornate; palps short and stout; porose areas small, circular, widely-separated; coxa I with two unequal spurs; coxae II–IV each with a small, blunt, triangular spur and a small tubercle at the postero-internal angle; a small tubercle on the posterior margin of festoons 1–5.

DESCRIPTION. *Body*: *L.* 4·81 mm. (including capitulum), *W.* 3·04 mm., contour elliptical; dorsum glabrous, few superficial punctations; marginal groove distinct, continuous. *Scutum*: sub-triangular (1·8 × 2·0 mm.); margin bulging in front of eyes; postero-lateral margins slightly convex; posterior angle broad and rounded; ornate—a dark-coloured border extending from the scapular angles to the posterior angle; frontal and limiting spots represented by small projections of the dark margin;

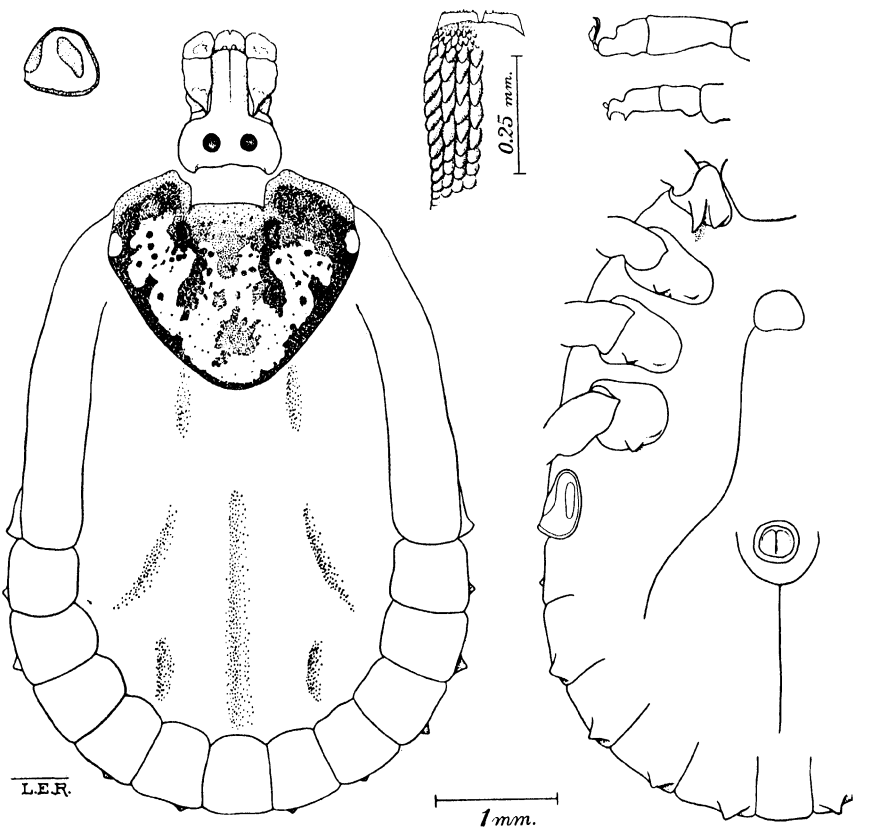


Fig. 56. *Amblyomma brasiliense* ♀. Dorsum, capitulum, hypostome, spiracle, tarsi I and IV. (N. 832.)

cervical stripes extending to the posterior third of the scutum, not reaching the limiting spots; cervical grooves sigmoid, deep anteriorly, broad and shallow behind, extending to the posterior third of the scutum; punctations medium in size, moderately deep, numerous in the scapular fields, fine and sparse in the median field; eyes flat and yellowish. *Venter*: glabrous, punctations fine; genital aperture situated opposite the posterior border of coxa II; festoons well-defined, each, with the exception of the median festoon, furnished with a small chitinous tubercle at the postero-internal angle (as in *Amb. cajennense* ♀); spiracles triangular, with broadly rounded angles. *Capitulum*: *L.* 1·05 mm.; basis rectangular, lateral margins convex, postero-lateral angles salient; porose areas small, circular, widely-separated; palps short, with pale enamelling on the dorsal surface, article 2 barely twice as long as article 3; hypostome dentition 4 | 4. *Legs*: stout, similar to those of the ♂; coxae I–III with armature resembling that of the male; coxa IV with a short spur scarcely longer than broad, and a minute internal tubercle.

Geographical Distribution and Hosts.

A **Brazilian** species. Original description based on 2 ♂s, off *Dicotyles torquatus*; Taubaté, State of S. Paulo, XII. 1906, Dr Urbano Figueira coll.; 3 ♂s and 5 ♀s, off *Dicotyles torquatus*; 1 ♂ and 2 ♀s raised from nymphs, off *Coeloginys paca*; 4 ♂s, 2 ♀s (with nymphs), off *Dicotyles torquatus*, Piraúba, State of Minas, 10. II. 1908, Dr P. Salgado coll.; 1 ♀, off *Cervus campestris*, Baurú, State of São Paulo, 15. XI. 1907, Dr Castro Goyanna coll.; 3 ♂s and 1 ♀ (with nymphs), off *Dicotyles torquatus*, Descoberto, State of Minas, I. 1908, Dr Rubens de Campos coll.; Aragão (1908, p. 17) also records the finding of nymphs of this species on *Coeloginys paca*, and on *Penelopes superciliaris*, Xerém, State of Rio, VIII.–X. 1907, Dr. A. Neiva coll.; nymphs, off *Dasyprocta aguty*, Descoberta, State of Minas, I. 1908, Dr Rubens de Campos coll. Aragão (1911, pp. 158, 161) gives the following geographical distribution in Brazil: Magé, Xerém (State of Rio); banks of the R. Tieté, Taubaté, Avanhandava (São Paulo); Descoberto, Piraúba, Itabira, R. Tambaquary, Alfenas (State of Minas Geraes). The Cambridge collection contains ♂ and ♀ (N. 823, pinned specimens), off *Dicotyles torquatus*, Itabira, State of Minas, Brazil, 8. IV. 1908, the gift of Dr H. de B. Aragão; ♂ and ♀, off *Dicotyles torquatus*, Matto Dentro, Brazil, VII. 1908, Dr H. de B. Aragão coll.

34. AMBLYOMMA SCALPTURATUM Neumann, 1906.

Fig. 57.

Lit.: Neumann, L. G., 1906, pp. 203–204, specific description of ♀; 1911, p. 77, brief description of ♀.

Male: unknown.

Female (Fig. 57). Diagnosis: A medium-sized tick; scutum cordiform, posterior angle narrow; ornate, punctations numerous, evenly distributed, large and deep in the lateral fields; cervical grooves short and deep; eyes large, pale and flat; hypostome dentition 4 | 4; coxa I with two strong spurs, the internal spur broad and flat, the external spur more pointed; a single very short spur on each of coxae II–IV, with a fine salient ridge occupying the position of the internal spur.

DESCRIPTION. *Body*: *L.* 6·0 mm., *W.* 3·4 mm., contour oval; dorsum reddish-brown, striated, punctate and glabrous; marginal groove and festoons distinct. *Scutum*: cordiform, 2·5 × 3·1 mm.; lateral margins convex, posterior angle narrow; colour maroon-brown, with a small, pale spot at the posterior angle, and small, irregular, indistinct, pale spots distributed over the entire surface; cervical grooves short, deep and divergent; punctations numerous, deep, evenly distributed, coarse

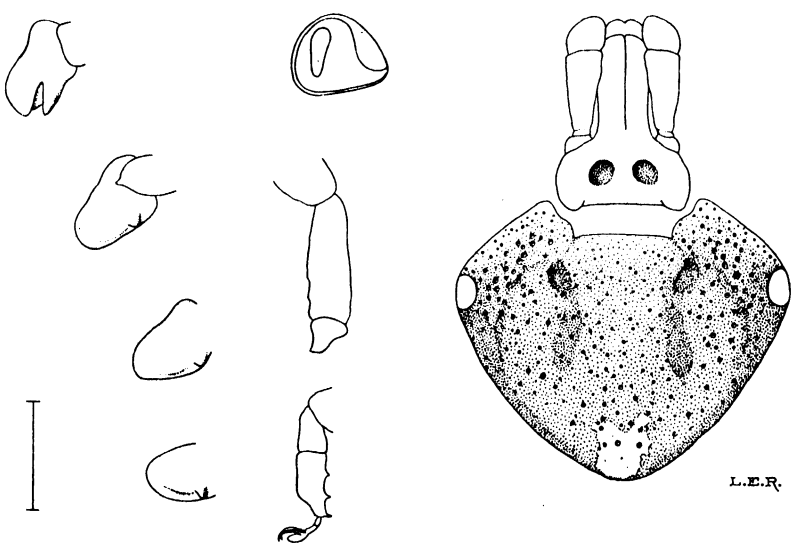


Fig. 57. *Amblyomma scalpturatum* ♀. Scutum, capitulum, spiracle, coxae I–IV, tarsi I and IV. (Type, off *Tapirus*, Bolivia, British Mus.)

in the lateral fields; eyes large, pale and flat. *Venter*: as dorsum; spiracles large, broadly triangular with very rounded angles. *Capitulum*: *L.* 1·7 mm., basis rectangular, lateral margins slightly convex, postero-lateral angles broad and slightly salient; porose areas oval, convergent, interval equal to diameter; palps club-shaped, article 2 nearly two-and-a-half times as long as article 3; hypostome dentition 4 | 4. *Legs*: long and stout; coxa I with two stout, contiguous spurs, the internal spur broad and flat, the external spur tapering and pointed; coxae II–IV each with a small short spur at the external third of the posterior margin, and a fine salient ridge extending from the spur to the postero-internal angle of the coxa, occupying the position of the missing internal spur; tarsi attenuated in talus.

Description based on 1 ♀ (dry), host not specified, Ega, **Brazil**; and one gorged ♀, measuring 10 × 6 mm., off *Tapirus* sp., **Bolivia** (British Museum).

35. AMBLYOMMA AUSTRALIENSE Neumann, 1905.

Figs. 58 and 59.

Lit.: Neumann, L. G., 1905, *Arch. de Parasitol.* IX, 227–228, specific description of ♂, ♀ and nymph; Neumann, L. G., 1911, p. 85.

Male (Fig. 58). Diagnosis: A small, inornate species; marginal groove interrupted behind eyes and terminating posteriorly at the external festoon; scapular angle terminating in a deflected point; coxa I with two sub-equal spurs; coxae II and III each with a short, blunt spur; coxa IV with a single, stout spur of moderate length.

Description. *Body*: *L.* 3·6 mm., *W.* 2·8 mm., oval, broadest in posterior half. *Scutum*: inornate, dirty-brown, flat; marginal groove deep, well-defined, incomplete, commencing at the level of the eye, behind which its course is completely interrupted for a short interval and terminating posteriorly at the external festoon; cervical grooves deep, straight and parallel; postero-median and accessory grooves indistinct; punctations fine and superficial, practically limited to the posterior half; eyes large, pale, flat and indistinct; scapular angles terminating in deflexed conical points; festoons well-defined, the five median festoons short, the remainder longer than broad. *Venter*: yellowish-brown, almost glabrous, festoons well-defined; genital orifice opposite coxa II; spiracles large, comma-shaped. *Capitulum*: relatively large (1·1 mm.),

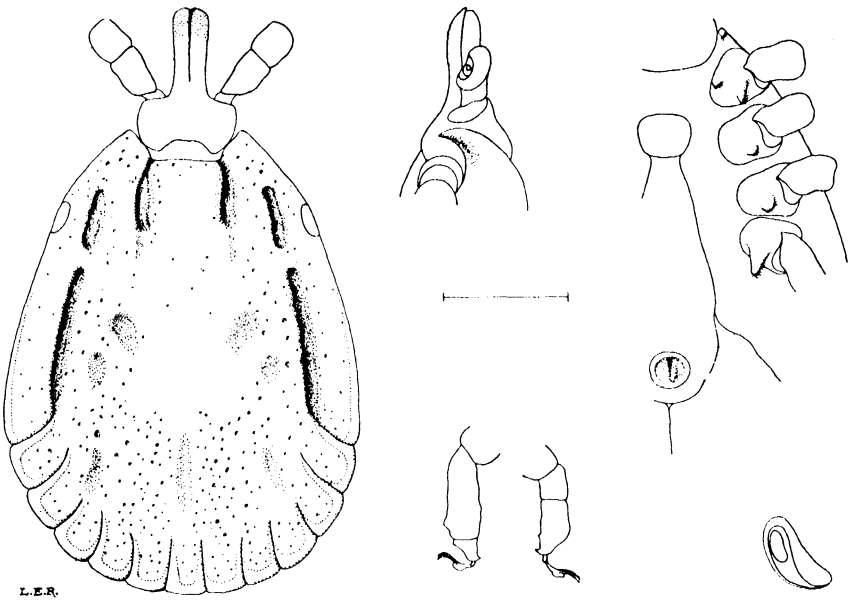


Fig. 58. *Amblyomma australiense* ♂. Scutum, capitulum from dorsal and lateral aspects (showing deflected scapular angle of scutum), venter, spiracle, tarsi I and IV. (N. 547.)

basis capituli broad, with convex lateral margins, posterior margin concave, postero-lateral angles salient; palps stout, clavate, article 2 slightly humped dorsally, one-and-a-half times as long as article 3, a small retrograde process on the ventral surface of article 1; hypostome dentition 4 | 4, tip emarginate. *Legs*: stout, sienna-brown; coxa I with two short, sub-equal spurs, the external of which is the longer; a single, short spur on each of the other coxae, longest on coxae IV; tarsi short, attenuated in talus.

Female (Fig. 59). Diagnosis: A small tick; scutum inornate, broadly cordiform, antero-lateral margins unusually extensive; short, lateral grooves formed by confluent punctations; scapular angles terminating in deflected points.

Description. *Body*: *L.* 4·4 mm., *W.* 3·4 mm., contour oval, narrowing anteriorly, earthy-brown, punctate with striate rugosities on median portion, and slightly mamillated in the region of the marginal groove which is wide, shallow and ill-defined and terminates posteriorly at the 3rd festoon; postero-median and accessory grooves well-defined; festoons as in male. *Scutum*: broadly cordiform (2·1 × 2·6 mm.) with very wide

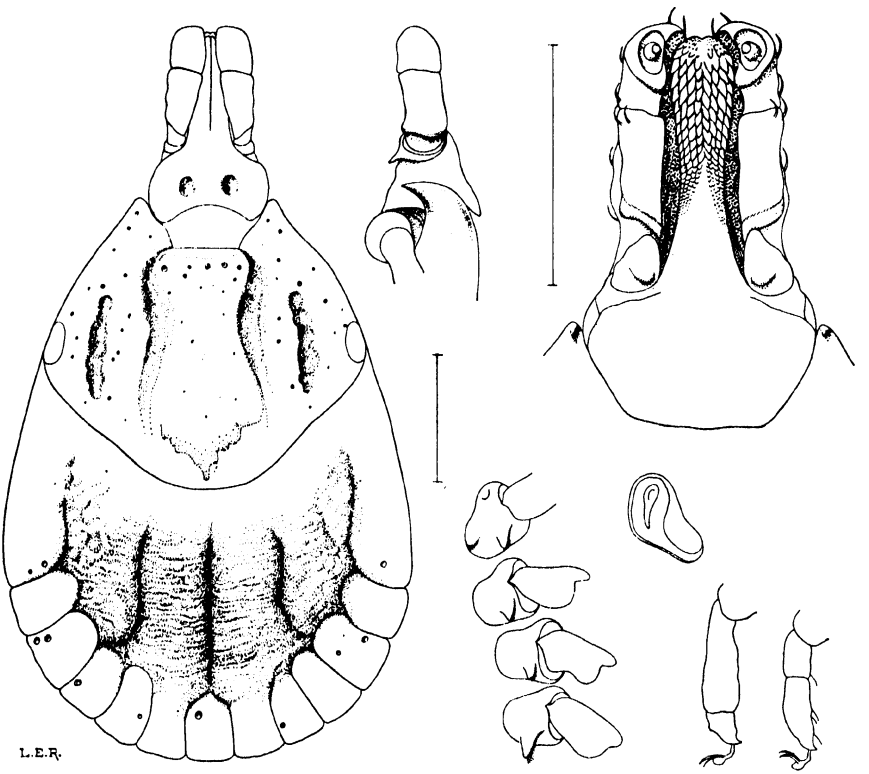


Fig 59. *Amblyomma australiense* ♀. Dorsum, capitulum from dorsal, lateral and ventral aspects (note deflected scapular angle of scutum), spiracle, coxae I–IV, tarsi I and IV. (N. 547.)

posterior angle, chestnut-brown towards margins, paler in median portion; eyes large, flat and pale, situated opposite middle of length of scutum; scapular angles as in male; in each lateral field a short, deep clearly-defined depression formed of large, confluent punctations, corresponding to the anterior detached portion of the marginal groove of the male; punctations exceedingly fine and few in number; cervical grooves deep anteriorly, almost straight, parallel, extending to the posterior third of the scutum. *Venter*: as in the ♂; genital orifice opposite interspace between coxae II and III; spiracles comma-shaped with a pronounced curved tail running outwards and backwards. *Capitulum*: long (1·55 mm.), porose areas small, circular, deep, interval greatly exceeding diameter; otherwise as in the ♂. *Legs*: as in the ♂, tarsi somewhat longer.

Geographical Distribution and Hosts.

Description based on 1 ♂ and 1 ♀ (N. 547), off *Echidna aculeata*, from Mt Anderson, **W. Australia**, C. J. T. Tunney coll. (N. 547). Neumann's specimens 9 ♂s, 1 ♀ and 2 nymphs, off *Echidna aculeata*, came from **W. Australia**, 1900, G. Shaw coll. (Coll. N. C. Rothschild). The Cambridge collection also contains a ♂ (N. 1206), off an *iguana* (? *Varanus* sp.), Port Darwin, **Northern Territory, Australia**, VI. 1910, the gift of Col. Alcock.

36. AMBLYOMMA LONGIROSTRE Koch, 1844.

Figs. 60 and 61.

Synon., Lit. and Iconogr.:

Haemalastor longirostris Koch, C. L., 1844, p. 223, brief description of the ♀; 1847 p. 49, description of the ♀; Tab. VII, Fig. 25, ♀ dorsum (coloured). 1899, Neumann, L. G., p. 179, description of the ♀.

Haemalastor crassitarsus Karsch, F., 1880, p. 141.

Hyalomma crassitarsus (Karsch) Neumann, L. G., 1899, pp. 293–294, description of the ♂; Figs. 62–63, ♂ dorsum and venter, extremity of tarsus II.

Hyalomma longirostre (Koch) Neumann, L. G., 1901, p. 315; Figs. 15–18, ♀ dorsum, hypostome, tip of hypostome and digit of chelicera.

Amblyomma giganteum Neumann, L. G., 1899, pp. 259–260, description of ♀.

Amblyomma avicola Neumann, L. G., 1899, p. 260, description of nymph.

Amblyomma longirostre (Koch) Neumann, L. G., 1905, p. 231; 1911, pp. 71–72.

Male (Fig. 60). Diagnosis: A large tick; scutum elongate; indistinctly ornate, dark-coloured, with irregular, pale streaks and spots in the scapular, lateral and posterior fields; marginal groove terminating posteriorly at the 3rd festoon; punctations numerous, deep, equal; eyes pale and flat; hypostome dentition 3 | 3; coxa I with two small, unequal spurs; a single, short, triangular, pointed spur on each of coxae II–IV; ventral plaques exceptionally large.

Description. *Body*: *L.* 6·3–7 mm., *W.* 3·9–4 mm.; contour elongate oval, narrow in front. *Scutum*: convex, dark reddish-brown, with a series of irregular pale streaks and spots extending from the scapular fields to a point a little anterior to the external festoon; small irregular pale spots anterior to the seven median festoons, on the festoons themselves, particularly the external and the 3rd, and on the marginal ridge; cervical grooves in the form of small broad-oval pits; marginal groove commencing as a series of contiguous punctations a short distance behind the eyes, deep and narrow posterior to the middle of the body,

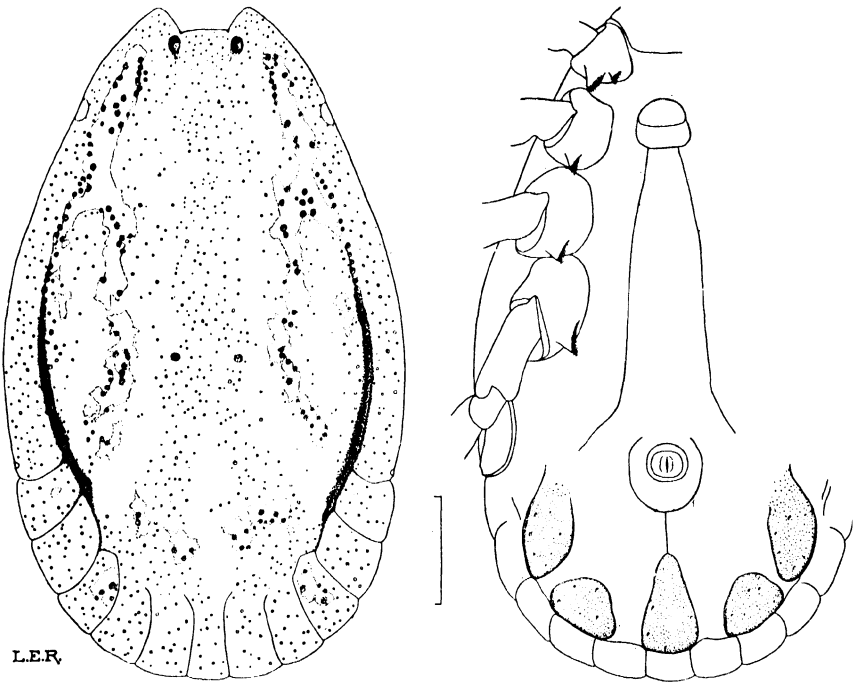


Fig. 60. *Amblyomma longirostre* ♂. Scutum, venter. (Type (*Hyalomma crassitarsus*, Nn.) Berlin Mus.)

terminating posteriorly at the 3rd festoon; punctations very numerous, deep, rather small, coarser upon the pale markings in the lateral fields and along the course of the marginal groove; eyes pale and flat; festoons long, clearly-defined, separations narrow. *Venter*: yellowish-brown, glabrous, wrinkled; genital aperture opposite coxa II; spiracles large, comma-shaped; ventral plaques exceptionally large, dark-brown, the median and lateral plaques elongate, the intermediate plaques short; festoons delimited by a narrow, deep, marginal groove. *Capitulum*: *L.* 1·8 mm., long and narrow; basis broadly hexagonal, postero-lateral angles non-salient; palps long, narrow, club-shaped, article 2 twice as long as article 3; hypostome narrow, spatulate, dentition 3 | 3. *Legs*: very long, coxae increasing in size successively, coxa IV being exceptionally large; coxa I with two unequal, short spurs, the internal spur very small, the external spur triangular and pointed; a single, small, triangular, pointed spur on each of coxae II–IV; tarsi long, attenuated gradually.

Female (Fig. 61). Diagnosis: A large tick; scutum elongate oval, almost lozenge-shaped; indistinctly ornate with an irregular, longitudinal, pale patch in the median field; punctations numerous, medium, regular in distribution; eyes small, pale and flat; basis capituli triangular; porose areas small, widely-separated; hypostome very long, lanceolate, tapering from the middle to a pointed anterior extremity, dentition 3 | 3; coxa I with two short spurs, a single small triangular spur on each of coxae II–IV.

DESCRIPTION. *Body*: *L.* 6 mm., *W.* 4 mm. (gorged examples may attain dimensions of 25 × 19 mm.); contour elongate oval, narrow in front; dorsum dark reddish-brown, coarsely and irregularly punctate; marginal groove continuous; festoons well-defined. *Scutum*: elongate, oval, almost lozenge-shaped, 4 × 3 mm.; indistinctly ornate, dark-brown, with an irregular longitudinal pale patch in the median field; cervical

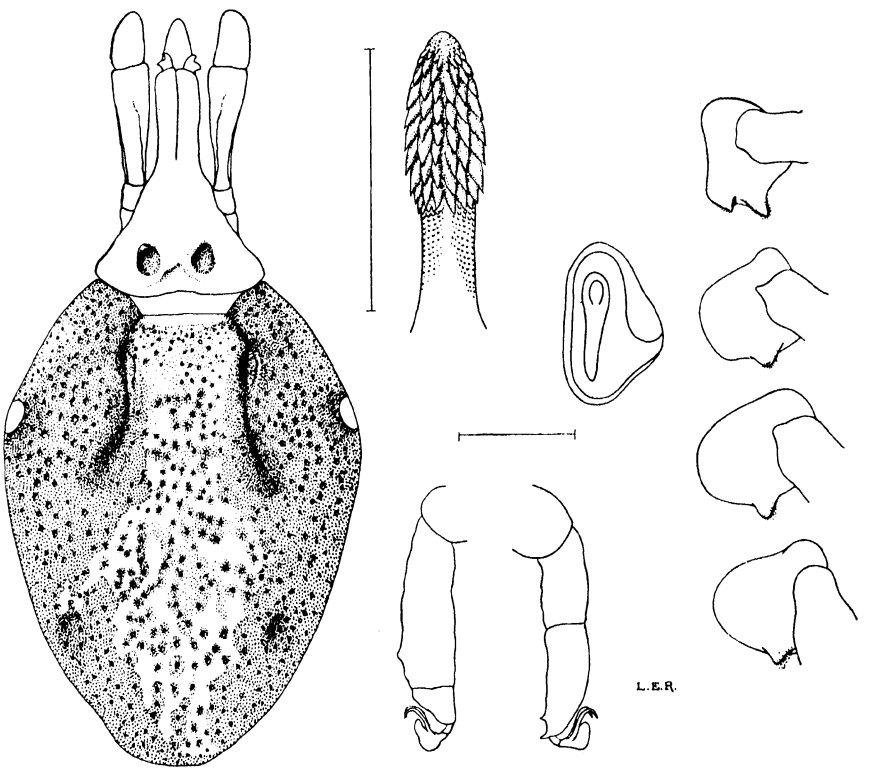


Fig. 61. *Amblyomma longirostre* ♀. Scutum, capitulum, hypostome, spiracle, coxae I–IV, tarsi I and IV. (Berlin Mus. N. 7709.)

grooves deep and narrow anteriorly, shallow and divergent posteriorly; punctations numerous, medium, regular in distribution; eyes relatively small, pale and flat. *Venter*: yellowish-brown, almost glabrous; genital aperture opposite the posterior border of coxa II; spiracles triangular with rounded angles. *Capitulum*: *L.* 2·2 mm.; basis triangular, postero-lateral angles flattened; porose areas small, widely-separated; palps long and narrow, article 2 constricted proximally, nearly two-and-a-half times as long as article 3; hypostome very long, lanceolate, tapering from the middle to the pointed anterior extremity, dentition 3 | 3. *Legs*: very long, especially the last pair; coxa I with two small, unequal spurs; a single, short, triangular spur on each of coxae II–IV; tarsi long, attenuated in talus.

Geographical Distribution and Hosts.

The type came from Brazil; Karsch's specimen from Caracas, **Venezuela, S. America** (Berlin Mus.). Neumann records the following: ♂s, off *Cercolabes villosus*, **Brazil,** Göldi coll.; a gorged ♀, from **Trinidad**, Rollin coll. (Paris Mus., type of *Amb. giganteum*); nymph, off *gobe-mouche*, **Trinidad** (labelled *A. avicola*, by G. Marx, Smithsonian Inst., Washington); ♂ and ♀s, off *porcupine*, Santa Cruz de Rio Grande de Sul, **Brazil**, Stiegelmayr coll. (Hamburg Mus.); ♀, from Caracas, **Venezuela**, Gollmer coll. (Berlin Mus.). The Cambridge collection contains a ♂, off *Coendu simonsi*, Charuplaya, **Bolivia, S. America,** P. O. Simons coll. (N. 560).

37. AMBLYOMMA CUNEATUM Neumann, 1899.

Figs. 62 and 63.

Lit.: Neumann, L. G., 1899, pp. 233–234, description of ♂; 1901, pp. 301–302, description of ♀; 1911, p. 80, short description of ♂ and ♀.

Male (Fig. 62). Diagnosis: A small tick; scutum ovate, very broad at posterior third, narrow in front, inornate; marginal groove incomplete, formed of contiguous punctations; capitulum broad; palps short and club-shaped; hypostome dentition 3 | 3; coxa I with two short, sub-equal, flat spurs; coxae II–IV each with a single short spur.

Description. *Body*: *L.* 4·2 mm., *W.* 3·7 mm., contour oval, very broad at posterior third, narrow in front, antero-lateral margins almost straight. *Scutum*: colour dark-brown, inornate, slightly convex, glossy; cervical grooves short, deep, oval, divergent; marginal grooves incom-

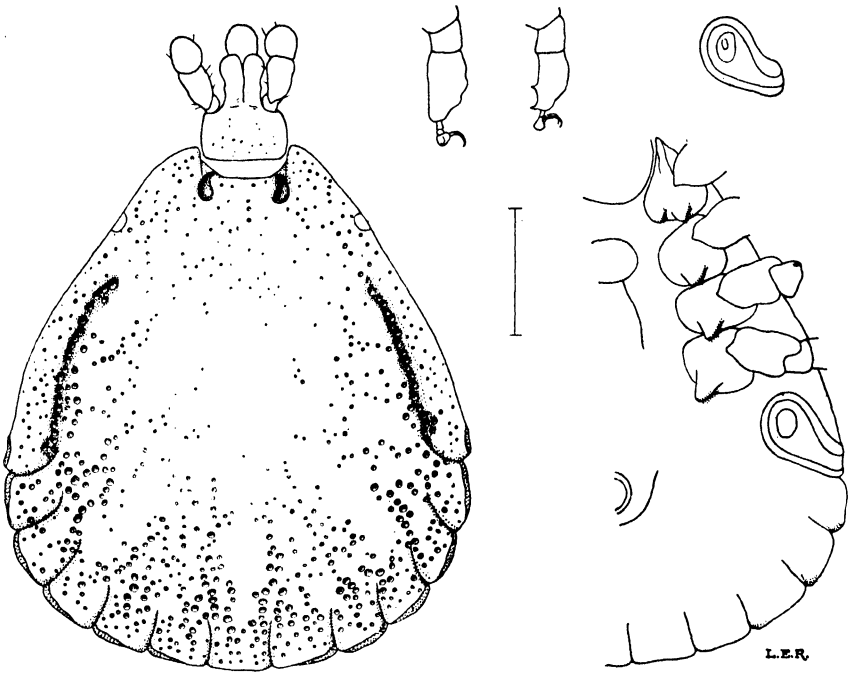


Fig. 62. *Amblyomma cuneatum* ♂. Scutum, capitulum, venter, tarsi I and IV, spiracle. (Berlin Mus. (Jr. No. 1037/1913).)

plete, formed of contiguous, coarse punctations, commencing some distance behind the eyes and terminating posteriorly at the external festoon; punctations large and deep in the posterior half of the scutum and along the marginal grooves, small elsewhere; festoons distinct, separations wide; eyes pale and flat. *Venter*: greyish-brown, finely punctate, almost glabrous; genital aperture opposite coxa II; spiracles moderately large, comma-shaped, very oblique. *Capitulum*: *L.* 1·1 mm., relatively short and broad; basis rectangular, lateral margins slightly convex, postero-lateral angles non-salient; palps short, thick, club-shaped, article 2 one-and-a-half times as long as article 3; hypostome dentition 3 | 3. *Legs*: of medium length, dark-brown, stout; coxa I with two short, sub-equal, blunt spurs; a single short, blunt spur on each of coxae II–IV, longest on coxa IV; tarsi short, tapering gradually at distal extremity; pulvilli very small.

Female (Fig. 63). Diagnosis: A small tick; body broadly oval, narrow in front; marginal groove continuous, scutum cordiform, reddish-brown, inornate; punctations numerous, medium in size,

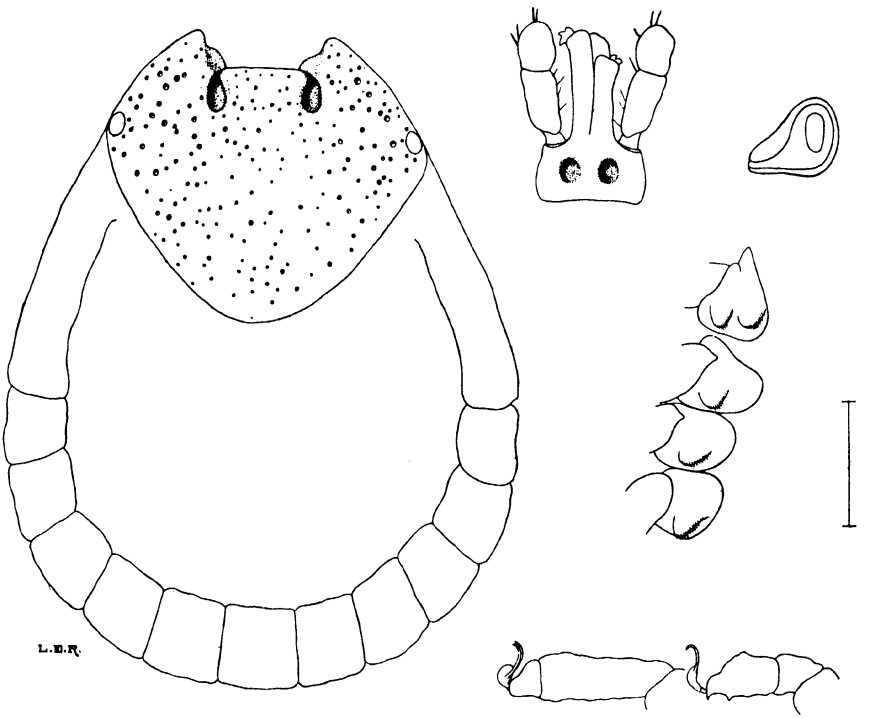


Fig. 63. *Amblyomma cuneatum* ♀. Scutum, capitulum, spiracle, coxae I–IV, tarsi I and IV. (Berlin Mus. (Jr. No. 1037/1913).)

regularly distributed; porose areas small, circular, interval equal to diameter; hypostome dentition 3 | 3; coxa I with two short, blunt, sub-equal spurs; tarsi attenuated in talus.

Description. *Body*: *L.* 4·5 mm., *W.* 3·5 mm. (gorged examples attain dimensions of 11 × 8 mm.), contour oval, broadest at posterior third, narrow in front; dorsum dark-brown with few fine punctations and few short hairs; marginal groove and festoons well-defined. *Scutum*: triangular-cordiform, 2·3 × 2·8 mm., colour reddish-brown, inornate; cervical grooves short and deep; punctations numerous, medium in size, evenly distributed; eyes flat and indistinct. *Venter*: like dorsum; genital aperture opposite interspace between coxae I and II; spiracles broad, comma-shaped, very oblique. *Capitulum*: *L.* 1·3 mm., broad, but relatively longer than that of the ♂; basis rectangular, postero-lateral angles non-salient; porose areas small, circular, interval equal to diameter; palps short and thick, not so club-shaped as those of the ♂, article 2 one-and-a-half times as long as article 3; hypostome longer

than in the ♂, dentition 3 | 3. *Legs*: of medium length, stout, dark-brown in colour; coxa I with two short, rounded, sub-equal spurs; a single, short, blunt spur on coxae II–IV, longest on coxa IV; tarsi longer than in ♂, attenuated in talus.

Geographical Distribution and Hosts.

West Africa and the **Lower Congo, Uganda.** Neumann (1899, p. 234) based his earliest description on 2 ♂s, host not specified, from the **Congo,** Pobeguin coll. (Paris Mus.); his later description (1901, p. 302) records a ♂ and ♀ from Togo, host not specified, Baumann coll., 2 ♂s and 2 ♀s from the **Cameroons,** host not specified, Zenker coll. (Berlin Mus.). The ♀ (Fig. 63) was included in a collection of tick material sent to Cambridge from the Zool. Museum, Berlin, for determination; it was labelled "Seychelles, A. Merian coll. (Jr. No. 1037/1913)." The Cambridge collection contains a ♂, off *Hylochoerus*, Congo Expedition, 1913, American Mus. Nat. Hist. coll. "672," Dr S. Hadwen donor (N. 3491); ♂s, ♀s and nymphs, off *Pangolin*, Avakubi, **West Africa,** Dr Christy (N. 3379); ♂ and ♀, off "Schuppentier," Lolodorf, Kamerun, Lt. Jacob coll., Prof. Ziemann donor (N. 3401).

38. AMBLYOMMA LIMBATUM Neumann, 1899.

Figs. 64 and 65.

Lit.: Neumann, L. G., 1899, pp. 231–232, specific description of ♂ and ♀; 1911, p. 86.

Male (Fig. 64). Diagnosis: A small tick; scutum oval, almost elliptical, reddish-brown in colour, glossy; few coarse punctations in scapular and lateral fields; ornate, with an irregular pale spot in each scapular angle, irregular pale stripes in the lateral and marginal regions, and a pair of symmetrically disposed spots at the posterior margin anterior to the festoons; marginal groove obsolete, represented by a short, narrow depression and a series of large punctations; cervical grooves deep, narrow and curved; coxa I with two small, well-separated spurs; a single triangular spur on each of the other coxae, largest on coxa IV.

DESCRIPTION. *Body*: *L.* 3·2 mm., *W.* 2·4 mm., contour oval, almost elliptical, little wider behind than in front. *Scutum*: convex marginally, flattened in the central part; glossy; colour reddish-brown; ornate, with (1) a pale irregular spot in each scapular angle, contracted opposite the

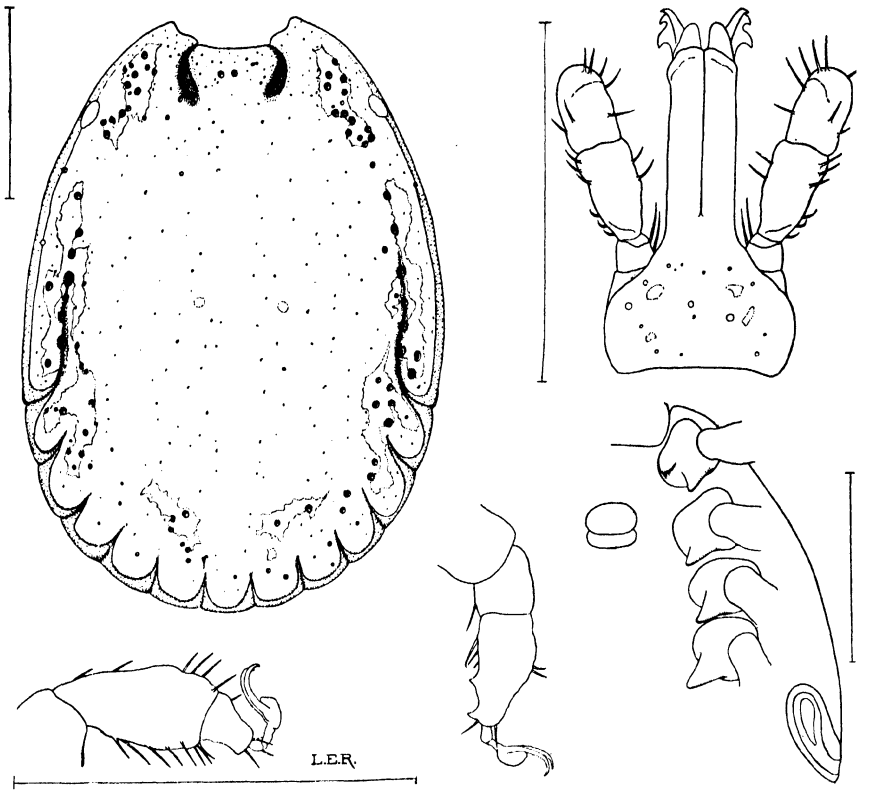


Fig. 64. *Amblyomma limbatum* ♂. Scutum, capitulum, coxae I–IV, tarsi I and IV. (Prof. L. Harrison's coll.)

eyes; (2) an irregular and interrupted pale, longitudinal stripe extending from a short distance behind the eye along the inner edge of the marginal ridge almost to the external festoon and eroded on its external side by two marginal spots; (3) an irregular, longitudinal stripe commencing at the anterior end of the obsolete marginal groove, interrupted at the middle of its length and dividing posteriorly into two extensions which encroach on the external and the second festoon; (4) a pair of symmetrically disposed oblique spots at the posterior end anterior to the festoons; few coarse punctations in the scapular fields and the marginal parts, very fine punctations sparsely scattered over the rest of the scutum; cervical grooves short, deep, narrow, and curved, with the convexity external; marginal grooves obsolete, consisting of a very narrow depression extending forwards for a short distance anterior to the external festoon and continued as far as the anterior third of the

scutum by a series of large, discrete punctations; eyes pale and flat; festoons well-defined. *Venter*: genital aperture opposite coxa II, spiracles narrow, comma-shaped. *Capitulum*: *L.* 0·90 mm., basis rectangular, dorsal surface with pale marbling, lateral margins slightly convex, postero-lateral angles non-salient; palps short, thick, article 2 less than one-and-a-half times as long as article 3; hypostome dentition 4 | 4. *Legs*: of medium length; coxa I with two well-separated, divergent spurs of which the external is the longer; a single, short, triangular spur on each of the other coxae, increasing in size from coxa II to coxa IV; tarsi short, attenuated gradually.

Description based on a ♂, off *carpet snake*, Koolpinyah, Northern Territory, Australia, 22. II. 1913, G. F. Hill coll. (Harrison's coll.).

Female (Fig. 65). Diagnosis: A small tick; scutum cordiform, colour reddish-brown; ornate, with a pale spot in each scapular field, a small, pale spot external to the cervical groove, and a small, pale spot at the posterior angle; cervical grooves deep, narrow and curved anteriorly; capitulum relatively long, porose areas small and widely separated; coxa I with two unequal divergent spurs, a single triangular spur on each of the remaining coxae.

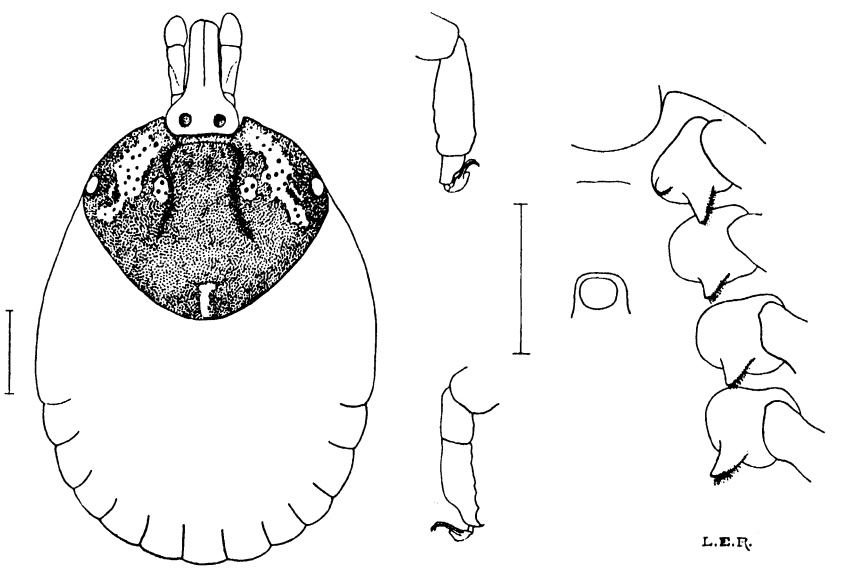


Fig. 65. *Amblyomma limbatum* ♀. Dorsum, capitulum, coxae I–IV, tarsi I and IV. (Type, Berlin Mus.)

DESCRIPTION. *Body*: *L.* 5·5 mm., *W.* 4·1 mm., oval; dorsum reddish-brown, marginal groove absent, festoons distinct. *Scutum*: 2·5 × 3 mm., cordiform, posterior angle broad; colour reddish-brown; ornate, with a large, pale patch in each scapular angle, contracted opposite the eye; a small pale spot adjoining and external to the cervical groove, and a small, pale spot at the posterior angle; cervical grooves deep, narrow and curved anteriorly, shallow and divergent posteriorly, extending a little beyond the middle of the scutum; a few moderately coarse punctations in the antero-lateral fields, very fine elsewhere. *Venter*: similar in colour to dorsum; punctate; festoons distinct; genital aperture opposite posterior margin of coxa II; spiracles comma-shaped. *Capitulum*: *L.* 0·8 mm., basis rectangular, lateral margins slightly convex, postero-lateral angles non-salient; porose areas small, circular, widely separated, interval nearly twice diameter; palps club-shaped, article 2 one-and-a-half times the length of article 3; hypostome sub-spatulate, dentition 4 | 4. *Legs*: moderately long, slender; coxa I with two well-separated, divergent spurs, the internal spur short, the external spur longer, triangular and pointed; a single, pointed, triangular spur on each of the remaining coxae, increasing slightly in size from before backwards; tarsi tapering gradually.

Geographical Distribution and Hosts.

Neumann's specimens comprised ♂s from King Island and ♀s from Adelaide, **S. Australia** (Berlin Mus.), host not specified; Prof. L. Harrison's collection includes a ♂, off *carpet snake*, Koolpinyah, **Northern Territory, Australia.**

39. AMBLYOMMA POSTOCULATUM Neumann, 1899.

Fig. 66.

Lit.: Neumann, L. G., 1899, pp. 232–233, description of ♀; 1911, p. 84, brief description of ♀.

Male: unknown.

Female (Fig. 66). Diagnosis: A small tick, closely resembling *Amb. limbatum*; scutum triangular; ornate, lateral fields pale, median field (discoloured by defective preservation in the type specimen) probably pale; ocular and frontal spots present; cervical stripes extending almost to the posterior margin where they fuse with the ? limiting spots; punctations irregular, fairly numerous; dorsum

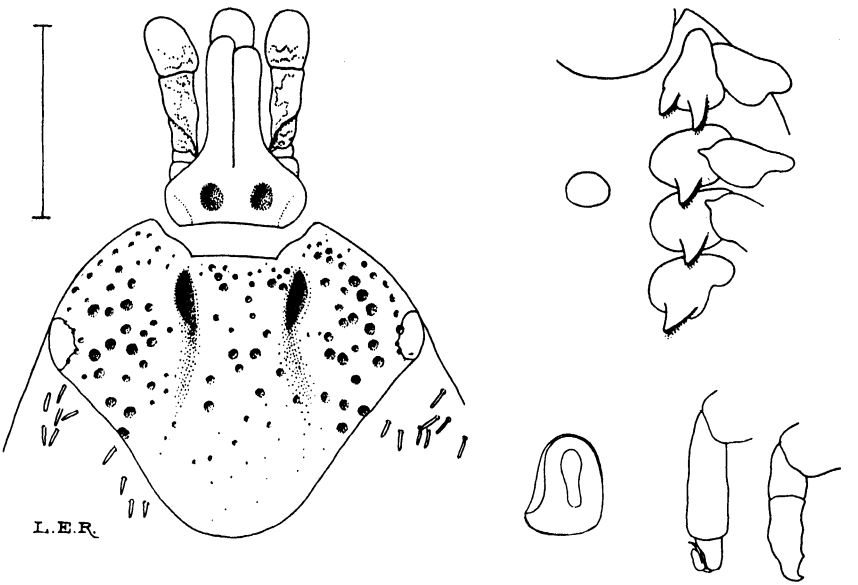


Fig. 66. *Amblyomma postoculatum* ♀. Scutum, capitulum, coxae I–IV, spiracle, tarsi I and IV. (Type, Paris Mus.)

thickly beset with large, flattened, whitish hairs; coxa I with two unequal spurs, the external spur moderately long; a single, stout, triangular spur on each of coxae II–IV; tarsi gradually attenuated.

DESCRIPTION. *Body*: *L.* 3·5 mm., *W.* 2·8 mm., contour elliptical; dorsum dark earthy-brown, thickly beset with long, flattened, whitish hairs; marginal groove absent; festoons present. *Scutum*: 1·5 × 1·9 mm., triangular, posterior angle narrow, postero-lateral margins almost rectilinear; ornate, lateral fields pale, ocular and frontal spots present; median field probably pale (in the type specimen irregular pale spots are visible at the anterior and posterior parts when the specimen is examined in alcohol but there is considerable discoloration due to defective preservation); cervical stripes extending nearly to the posterior margin where they fuse with the ? limiting spots (the latter, if present, are obscured by discoloration); cervical grooves short and deep, continued posteriorly by shallow, indistinct and divergent depressions; punctations fairly numerous, coarse in the lateral fields and the anterior half of the median field; eyes large, slightly convex, pale, situated about the anterior third of the scutum. *Venter*: similar in colour to dorsum, with few large, flattened, whitish hairs on the posterior part; genital

aperture opposite the interspace between coxae II and III; spiracles relatively large, broad, comma-shaped. *Capitulum*: *L.* 1·1 mm., basis rectangular, lateral margins convex, postero-lateral angles non-salient; porose areas medium, oval, shallow, interval rather greater than diameter; palps laterally compressed, with pale marbling on the dorsal surface; article 2 barely twice as long as article 3; hypostome spatulate, dentition 3 | 3. *Legs*: medium, earthy-brown, narrowly annulated with white at the extremities of the articles; coxa I with two, unequal, pointed, widely-separated spurs, the external spur reaching the succeeding coxa; a triangular, pointed spur on each of coxae II–IV; tarsi long, attenuated gradually; pulvilli small.

Description based on the type, a ♀, host not specified, from King Island, **Australia** (Paris Mus.).

40. AMBLYOMMA MORELIAE (L. Koch, 1867).

Figs. 67 and 68.

Lit. and Synon.: *Ixodes moreliae* L. Koch, 1867, pp. 241–242. *Amblyomma moreliae* Neumann, L. G., 1899, p. 258; 1901, pp. 308–309; 1911, p. 85.

Male (Fig. 67). Diagnosis: A small tick; scutum with irregular pale spots in scapular fields and on marginal ridge; marginal groove present, extending from a little distance behind the eyes to the external festoon; punctations few, limited to scapular fields and marginal parts of scutum and the festoons; coxa I with two short, triangular spurs; a single similar spur on coxae II–IV.

Description. *Body*: *L.* 3·5 mm., *W.* 2·9 mm., contour oval. *Scutum*: dark-brown, glossy, with few punctations in scapular fields, the lateral fields and festoons; an irregular pale spot in each scapular angle, two or three smaller and less distinct pale spots on the marginal ridge; marginal groove deeply incised, extending from some little distance behind the eyes to the external festoon; cervical grooves short, deep, curved; eyes flat and pale. *Capitulum*: (*L.* 1 mm.) basis capituli rectangular, postero-lateral angles barely salient; palps club-shaped, article 2 less than one-and-a-half times the length of article 3; hypostome dentition 4 | 4. *Venter*: earthy-yellow, glabrous; spiracle comma-shaped. *Legs*: coxa I with two short, sub-equal, triangular, pointed spurs; a single similar spur on each of coxae II–IV; tarsi attenuated in talus.

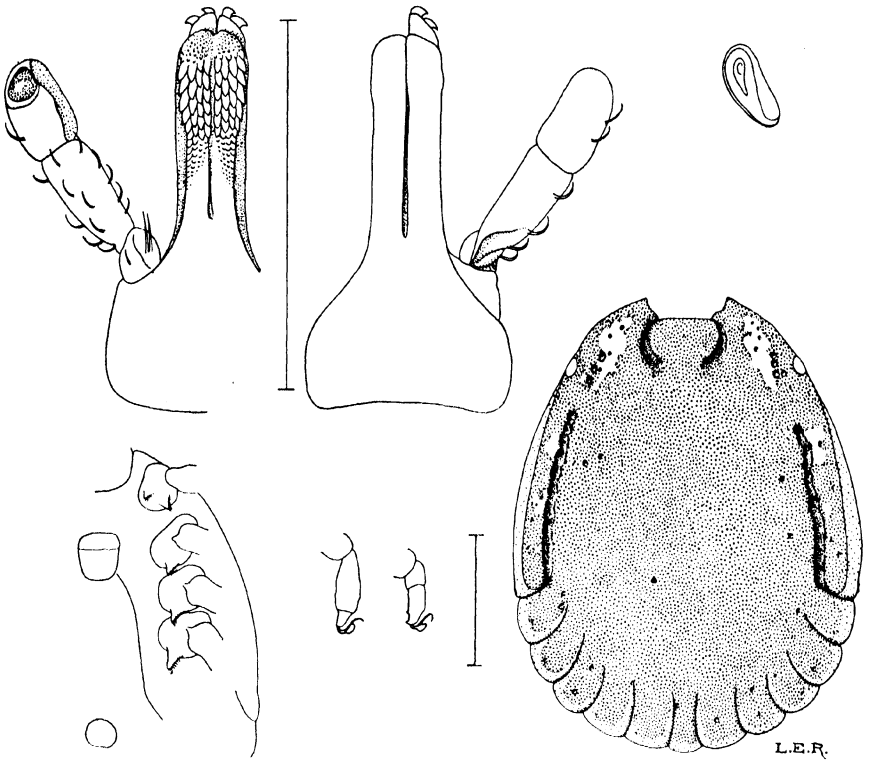


Fig. 67. *Amblyomma moreliae* ♂. Scutum, capitulum from dorsal and ventral aspects, spiracle, coxae I–IV, tarsi I and IV. (Type, Hamburg Mus.)

Female (Fig. 68). Diagnosis: scutum cordiform, posterior angle broad; cervical grooves short, curved, terminating in a shallow depression formed of contiguous punctations; an irregular pale spot in each scapular field; punctations as in ♂, a short row of contiguous coarse punctations often forming a row opposite the eyes along the margin of the pale spot.

DESCRIPTION. *Body*: *L.* 3·9 mm., *W.* 3·2 mm. (unfed), oval, broadest posterior to middle; dorsum, colour earthy yellowish-brown, glabrous; marginal groove absent, other grooves and festoons normal. *Scutum*: cordiform, broader than long, 1·9 × 2·1 mm., variable in contour, sometimes approaching a triangular form; posterior angle broad; colour reddish-brown, darker round eyes and behind the cervical grooves; an irregular pale spot in each scapular field; punctations as in ♂, a short row of contiguous, coarse punctations often present opposite the eyes

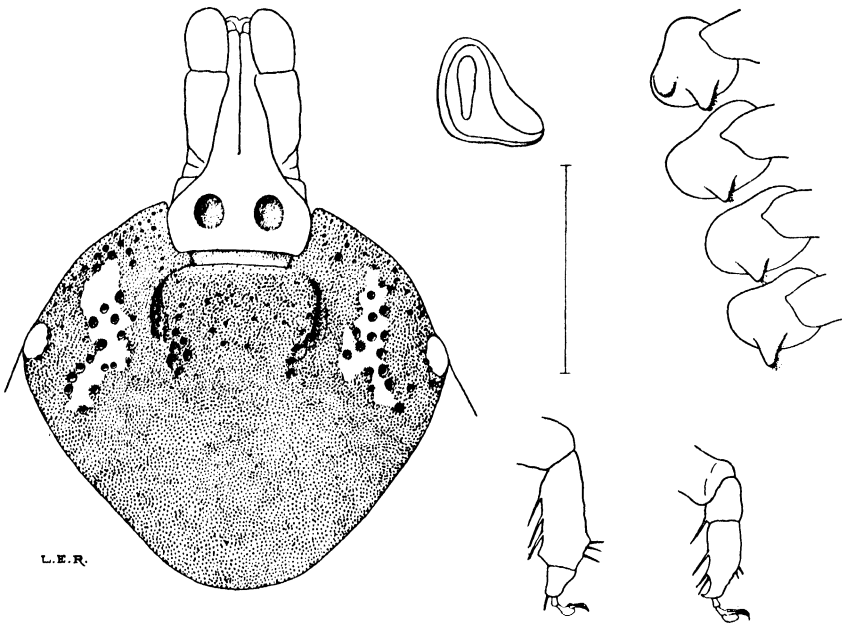


Fig 68. *Amblyomma moreliae* ♀. Scutum, capitulum, spiracle, coxae I–IV, tarsi I and IV. (N. 2690 *b*.)

along the external margin of the pale spot; cervical grooves short, deep and curved, often terminating posteriorly in a depression formed of contiguous punctations (this deep portion is succeeded by an indefinite shallow portion which does not extend to the posterior margin of the scutum); eyes moderately large, flat and pale, situated a little anterior to the middle of the length of the scutum. *Capitulum*: (*L.* 1·2 mm.) basis capituli rectangular, posterior margin straight; porose areas relatively large, interval equal to diameter; palps and hypostome as in ♂. *Venter*: paler in colour than dorsum, with few scattered, fine hairs; spiracle subtriangular, with rounded angles. *Legs*: as in ♂.

Description of ♂ based on the types in the Zoological Museum, Hamburg (2 specimens, labelled Mus. Godeffroy, No. 2277), off *Morelia argus* var. *fasciolata*, from Brisbane, **Queensland**, **Australia**; ♀ described from a specimen collected by Dr Bancroft, on *Varanus varius*, Eidsvold, Queensland, Australia (N. 2690 *b*).

41. AMBLYOMMA LATUM Koch, 1844.

Figs. 69 and 70.

Synon., Lit. and Iconogr.:

Hyalomma latum Koch, C. L., 1844, p. 221, specific description of the ♂; 1847, pp. 39–40, Tab. IV, Fig. 14, ♂ dorsum.

Hyalomma devium Koch, C. L., 1844, p. 222, specific description of the ♀; 1847, pp. 47–48, Tab. VI, Fig. 24, dorsum of ♀.

Amblyomma latum (Koch)[1] Neumann, L. G., 1899, p. 233, specific description of the ♂; 1909, Dönitz, W., p. 469 (footnote); 1910, Dönitz, W., pp. 445–447, description of ♂ and ♀.

Amblyomma sylvaticum (De Geer) Neumann, L. G., 1899, pp. 274–275, specific description of ♂, ♀ and nymph; 1911, p. 83.

Neumann (1899, pp. 274–275) identified a male tick, labelled "*latum* Koch. Kap" (Zool. Mus., Berlin) with *Acarus sylvaticus* de Geer (1778, VII, pp. 162–163). De Geer's description applies to a female tick, found on a terrestrial tortoise at the Cape of Good Hope, by M. Sparrman. The short description reads as follows:

"Mitte des buissons. 3. *Mitte ovale, à corcelet jaune rayé et ponctué de noir, et à corps roux.*

Acarus (sylvaticus) *ovatus, thorace flavo fasciis punctisque nigris, abdomine rufo.*" From this nothing can be inferred. In the following more detailed description De Geer continues: "La tête et le corcelet sont d'un jaune pâle un peu blancheâtre; ...Le corcelet est presque circulaire et bien distingué du ventre par une incision, ayant en dessus deux rayes ondées longitudinales noires et une raye semblable de chaque côté qui en est bordé; entre ces dernières rayes et celles du milieu on voit de chaque côté une petite tache noire, et le fond jaune de cette partie est parsemée de points noirs." This description is suggestive, but, unfortunately, applies equally to other species of *Amblyomma* occurring in South Africa. As Dönitz has commented (1909, p. 469, footnote), De Geer's illustration (Pl. 38, Fig. 7) is not helpful. The fact that the species has been found on tortoises at the Cape of Good Hope (2 ♂s of *Amb. sylvaticum*, Paris Mus.) lends some support to Neumann's decision. The matter is very doubtful, however, and I have preferred to follow the same course as Dönitz, in relegating De Geer's *Acarus sylvaticus* to the limbo of the forgotten.

Male (Fig. 69). Diagnosis: A small tick; scutum elliptical, dark-coloured with pale markings on the marginal ridge and outermost festoons; eyes small, hemispherical, deeply orbited; marginal groove represented by a series of contiguous punctations; coxae I–IV each with two short, rounded spurs.

DESCRIPTION. *Body*: *L.* 4·3 mm., *W.* 3·4 mm., contour elliptical. *Scutum*: convex, dark-brown with ornamentation in the form of an interrupted pale band on the marginal ridge, commencing some distance behind the eye and extending posteriorly to the external festoon;

[1] According to Neumann, 1901, pp. 291–292, *Amblyomma latum* Koch, 1844, p. 231, No. 43, = *Aponomma latum*.

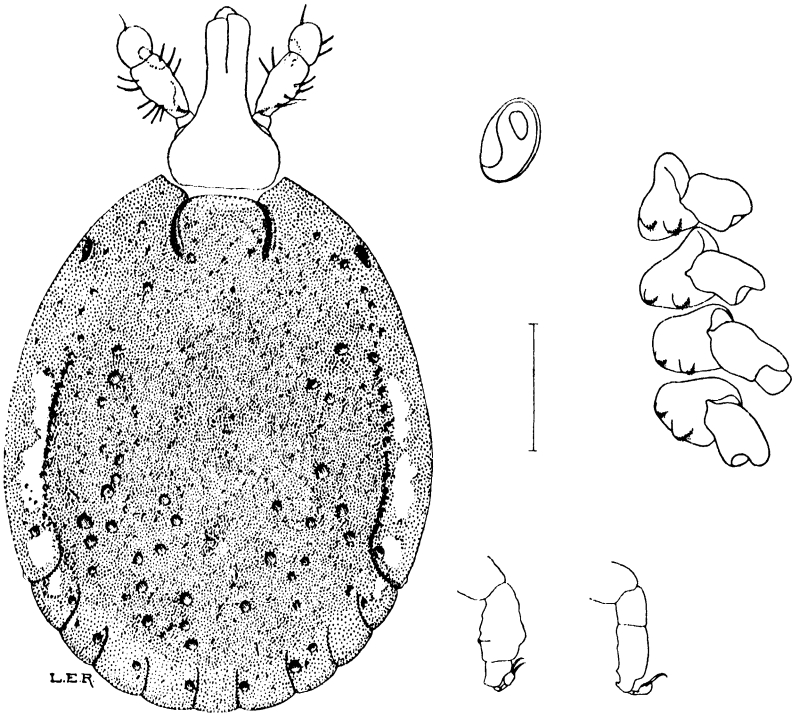


Fig. 69. *Amblyomma latum* ♂. Scutum, capitulum, spiracle, coxae I–IV, tarsi I and IV. (Type of "sylvaticum" (De Geer) Neumann.)

marginal groove formed by a series of contiguous punctations, commencing at the anterior third of the body length and terminating posteriorly at the second festoon; a small, pale spot on the external and sometimes on the second festoon also; cervical grooves moderately long, deep, narrow and curved with the convexity external; very coarse punctations scattered over the lateral and posterior parts of the scutum, interspersed with very fine punctations; eyes very small, dark-coloured, hemispherical and deeply orbited; festoons clearly defined, intervals narrow. *Venter*: paler than the dorsum; genital aperture opposite coxa II; spiracles relatively small, oval. *Capitulum*: *L.* 1·4 mm., basis subtriangular, lateral margins slightly convex, postero-lateral angles nonsalient; palps moderately long, with pale enamelling along the inner margin of the dorsal surface and beset with long, whitish hairs; article 2 twice as long as article 3; hypostome very spatulate, teeth limited to distal third, dentition 4 | 4. *Legs*: with long, pale hairs, medium in length, dark-brown in colour with a pale longitudinal streak on the

dorsal side of the articles; coxae I–IV each bearing a pair of short, rounded spurs.

Female (Fig. 70). Diagnosis: A medium-sized tick; scutum cordiform, ornate, punctations dark-coloured, numerous, coarse in the antero-lateral fields; cervical grooves moderately long, narrow and curved; eyes dark-coloured, hemispherical and orbited; marginal groove terminating posteriorly at the second festoon; palps with a pale stripe along the internal margin of the dorsal surface of articles 2 and 3; hypostome dentition 4 | 4; legs with a pale, longitudinal stripe on the dorsal surface of the articles; coxae each with two short, rounded, sub-equal spurs.

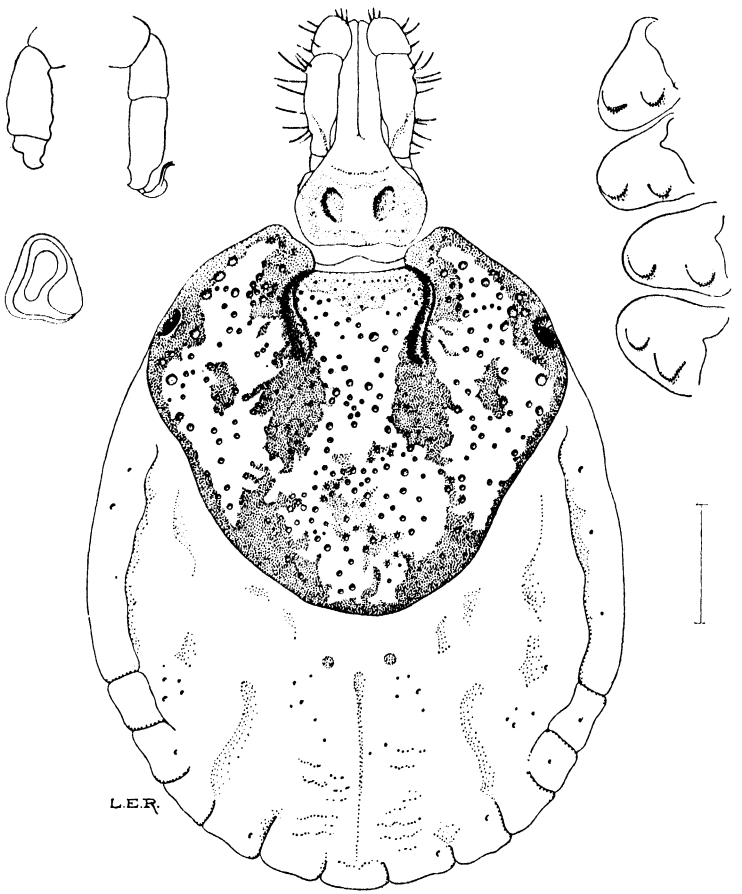


Fig. 70. *Amblyomma latum* ♀. Dorsum, capitulum, coxae I–IV, spiracle, tarsi I and IV. (Type of "devium" Koch, Berlin Mus.)

DESCRIPTION. *Body*: *L.* 5·5 mm., *W.* 4·5 mm., contour broad oval; dorsum reddish-brown, hairy on lateral margins above the legs, practically glabrous elsewhere; marginal groove terminating posteriorly at the second festoon. *Scutum*: 3·3 × 3·5 mm., cordiform, postero-lateral margins sinuous, posterior angle broad; pale-yellow with black ornamentation; cervical stripes large, expanded; ocular spots large, connected by a dark band round the antero-lateral margin with the cervical spots, and by a very narrow, dark band along the postero-lateral margins with the limiting spots; frontal spots small; cervical grooves moderately long, deep and curved in an elongated **S**-shape; few coarse, dark-coloured punctations in the antero-lateral fields, medium in size elsewhere; eyes dark-coloured, hemispherical, deeply orbited. *Venter*: dark earthy-brown, almost glabrous; genital aperture opposite posterior margin of coxa II; spiracles small, sub-triangular with rounded angles. *Capitulum*: moderately long (1·8 mm.), basis triangular, lateral margins convex, postero-lateral angles non-salient; porose areas narrow oval, divergent, interval nearly twice diameter; a pale patch occupying the whole central area of the dorsal face; palps long with a pale stripe along the dorso-internal margins of articles 2 and 3, and with long, stiff, whitish hairs, article 2 nearly three times as long as article 3, contracted in the postero-dorsal portion; hypostome long, spatulate, teeth covering distal third, dentition 4 | 4. *Legs*: of medium length, hairy, dark-brown with a longitudinal pale streak on the dorsal surface and a narrow, pale annulation at the distal extremities of the articles; coxae each bearing two short, rounded spurs, of which the external is slightly the larger; tarsi attenuated abruptly.

Description of the ♂ based on one of Neumann's types, a ♂ from the Cape of Good Hope, **S. Africa**; no other particulars.

Description of the ♀ based on a specimen from the Berlin Museum (No. 1022), labelled "*Amblyomma devium* Koch type."

Neumann's descriptions are based on 3 ♂s and 4 ♀s, from Cafraria, Delalande coll.; 2 ♂s, off a *tortoise*, Cape of Good Hope; 2 nymphs and 1 ♀, origin unknown (Paris Mus.); 1 ♂ labelled "*latum*, Koch, Kap" (Berlin Mus.); and 1 gorged ♀, off a *Virginian deer*, in the Zoological Gardens, Hamburg (Hamburg Mus.).

42. AMBLYOMMA ALBOPICTUM Neumann, 1899.

Fig. 71.

Synon. and Lit.:

Ixodes variegatus Lucas, H., 1852, pp. lxxxviii–lxxxix.
Amblyomma albopictum Neumann, L. G., 1899, p. 244; 1911, p. 73.

Male (Fig. 71). Diagnosis: A small species; contour broadly oval; scutum ornate, with dark chestnut-brown markings on a pale ground; marginal groove absent; punctations numerous, small; cervical grooves short and deep; capitulum of medium length, basis rectangular, postero-lateral angles non-salient; hypostome dentition 3 | 3; coxae I–IV each with a single, short, triangular spur.

DESCRIPTION. *Body*: *L.* 3·75 mm., *W.* 3·2 mm., contour broadly oval, widest behind middle. *Scutum*: slightly convex; marginal grooves absent; cervical grooves short, deep and pyriform; festoons longer than broad, clearly defined, intervals narrow; punctations small, coarser

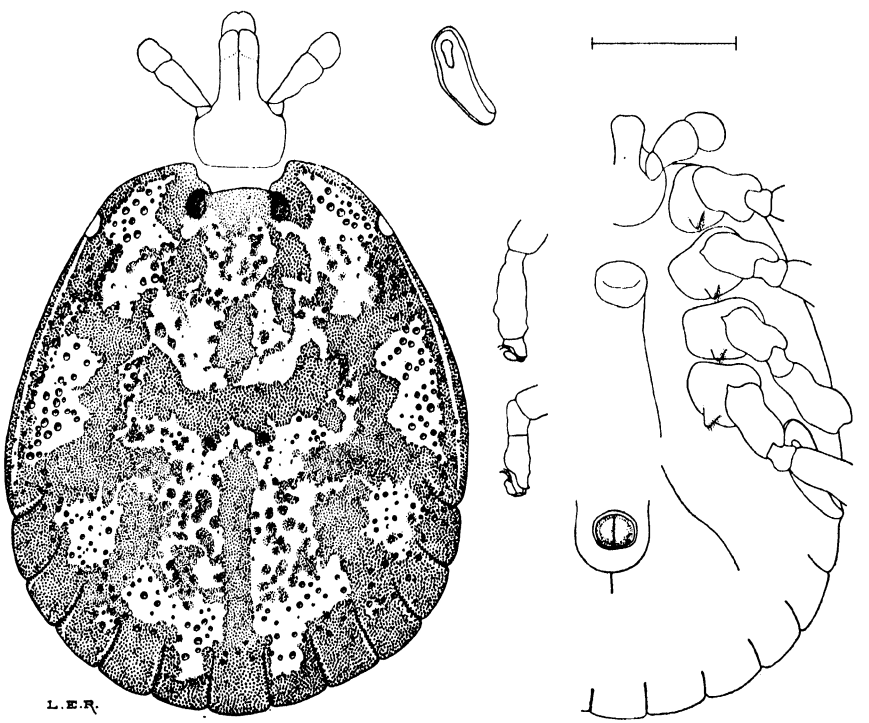


Fig. 71. *Amblyomma albopictum* ♂. Scutum, capitulum, venter, spiracle, tarsi I and IV. (N. 2866.)

towards margins; areolate punctations in anterior and posterior median fields; ornamentation consisting of dark chestnut-brown markings on a pale ground; postero-median stripe long, extending almost to the centre of the scutum; postero-accessory stripes directed towards the centre of the scutum; the three lateral spots conjoined with each other and with the dark marginal coloration; falciform stripe with extremities turned forward; limiting spots small, more or less confluent with the first lateral spot; cervical stripes irregular, more or less detached from the cervical spots; an irregular longitudinal dark patch in the anterior field immediately in front of the falciform stripe; marginal ridge dark-coloured with a narrow, pale stripe running from the eye to the external festoon; festoons dark-coloured excepting the pair adjacent to the median, upon which an extension of the pale ground encroaches, and the antepenultimate festoon which bears a small, pale spot on its anterior part. *Venter*: earthy-yellow, glabrous, with few punctations in its posterior part; genital aperture opposite coxa II; spiracles very narrow, comma-shaped. *Capitulum*: *L.* 1·05 mm., basis rectangular, postero-lateral angles non-salient; palps narrow, club-shaped, article 2 twice as long as article 3, tapering to a point at its postero-dorsal extremity; hypostome large, spatulate, dentition 3 | 3. *Legs*: of medium length, dark-brown; coxae I–IV each with a short, triangular spur, slightly larger on coxae I and IV; tarsi attenuated in talus; pulvilli half length of claws.

Female: unknown.

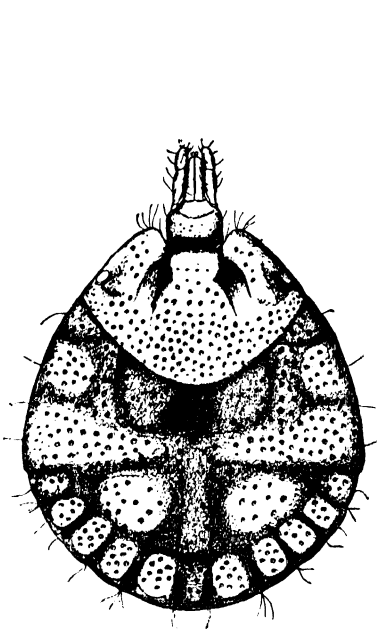
Description based on 1 ♂, a co-type presented to the Cambridge collection by Prof. L. G. Neumann, off *Cyclura harlani*, **Guiana** (?) (N. 2866). Neumann (1899) records ♂s from **Cuba**, Gundlach coll. (Mus. de Paris), and a ♂ from **Brazil**, Göldi coll., off *Cercolabes villosus*. Lucas's specimens were found on *Cyclura harlani*, in Havana.

43. AMBLYOMMA HIRTUM Neumann, 1906.

Figs. 72 and 73.

Lit. and Iconogr.: Neumann, L. G., 1906, pp. 201–203, specific description of ♂ and ♀; Figs. 6–7, ♂ and ♀ dorsum (herein reproduced): 1911, p. 74, brief description of ♂ and ♀.

Male (Fig. 72). Diagnosis: A very small tick; scutum broad oval, widest about middle of length; punctations numerous; long, whitish hairs, often in tufts of two or three, round the periphery and especially



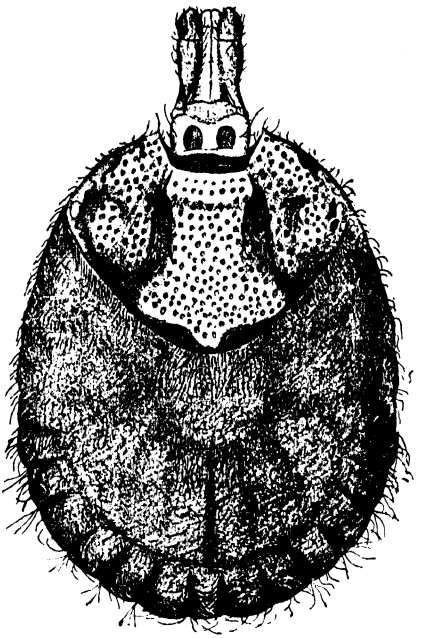


Fig. 72. *Amblyomma hirtum* ♂. Dorsum (from Neumann, 1906, Fig. 6).
Fig. 73. *Amblyomma hirtum* ♀. Dorsum (from Neumann, 1906, Fig. 7).

round the posterior margin; a well-defined pseudoscutum; marginal groove absent; hypostome dentition 3 | 3; coxae I–IV each with two very small, widely-separated spurs.

DESCRIPTION. *Body*: *L.* 2·7 mm., *W.* 2·0 mm., contour short oval, broadest about middle of length. *Scutum*: convex, general colour yellowish-white, with pale-brown markings; postero-median stripe, postero-accessory stripes, and lateral spots slightly elevated; a clearly defined pseudoscutum; long, whitish hairs often in tufts of twos and threes, at the periphery and especially round the posterior border; cervical groove deep and broad, convergent; marginal groove absent, punctations numerous, deep, sub-equal, dark-coloured, scattered over the whole of the pale areas; festoons clearly-defined; eyes flat, pale, bordered by punctations on their internal margins. *Venter*: yellowish, hairy, with deep punctations on the posterior fourth; festoons clearly defined; genital aperture opposite coxa II; spiracles broadly comma-shaped. *Capitulum*: *L.* 0·55 mm., basis rectangular, lateral margins slightly convex, postero-lateral angles non-salient; palps short, beset with long hairs, article 2 one-and-a-half times as long as article 3;

hypostome short, spatulate, dentition 3 | 3. *Legs*: of medium length, with long hairs; coxae I–IV each with two very small, triangular, widely-separated spurs; tarsi terminating in talus.

Female (Fig. 73). Diagnosis: A small tick; scutum triangular-cordiform, indistinctly ornate; dorsum shagreened, hairy; long hairs in scattered tufts round the margins, especially in the posterior portion; porose areas large, oval; hypostome dentition 3 | 3; coxae I–IV each with two very small, widely-separated spurs.

DESCRIPTION. *Body*: *L.* 3·6 mm., *W.* 2·3 mm., contour broad oval, widest about middle of length; dorsum shagreened, covered with whitish hairs, the peripheral hairs on the posterior border very long and tufted in places. *Scutum*: broadly cordiform, 1·3 × 1·7 mm.; postero-lateral margins slightly convex, posterior angle wide; indistinctly ornate, with a yellowish-white patina on the median field and in the antero-lateral fields; cervical grooves wide and deep, diverging posteriorly; punctations numerous, deep, sub-equal, evenly distributed over the entire scutum; eyes pale and flat. *Venter*: very hairy, punctate; genital aperture opposite coxa II; spiracles broad comma-shaped. *Capitulum*: *L.* 0·90 mm., basis rectangular, postero-lateral angles non-salient; porose areas large, oval, interval slightly less than diameter; palps club-shaped, article 2 twice as long as article 3; hypostome dentition 3 | 3. *Legs*: relatively longer than in the ♂, very hairy; coxae I–IV each with two very small, widely-separated spurs; tarsi attenuated in talus.

Geographical Distribution and Hosts.

The **Galapagos Is.**, S. Pacific Ocean, and **St Paul Is.**; hosts, birds (?). Neumann's description is based on 2 ♂s and 5 ♀s, host not specified, from the Galapagos Is.; and 3 ♀s, from St Paul Is. (British Mus.). He notes that in two of the ♀s from the Galapagos Is., and 2 ♀s from St Paul Is., the hairs are much less numerous than in the others, and the pale markings of the scutum but slightly apparent. The Cambridge collection contains 1 ♂ (N. 397), mounted in balsam, off "bird No. 125," Galapagos Is., presented by the Hon. N. C. Rothschild.

44. AMBLYOMMA PILOSUM Neumann, 1899.

Fig. 74.

Lit.: Neumann, L. G., 1899, p. 209, short description of ♀: 1911, p. 70.

Male: unknown.

Female (Fig. 74). Diagnosis: A small tick; dorsum and venter with long, scattered, whitish hairs, few short, stiff hairs on scapular angles and on the scutum between the cervical grooves; scutum triangular, posterior angle wide; punctations large and numerous; ornate; capitulum long, hypostome dentition 3 | 3; coxae each with two short, blunt spurs.

DESCRIPTION. *Body*: *L.* 6·6 mm., *W.* 5·0 mm. (a gorged specimen); dorsum dark-brown, with long, scattered, whitish hairs. *Scutum*: triangular, 1·95 × 2·0 mm., posterior angle broad; ornate, with a dark marginal band extending from the cervical spots and scapular angles to the ocular spots and then continued as a narrower dark edging along the postero-lateral margins to the posterior angle; limiting spots absent; frontal spots large, bridging the gap between the cervical stripe and the marginal coloration; cervical grooves short, deep and curved anteriorly,

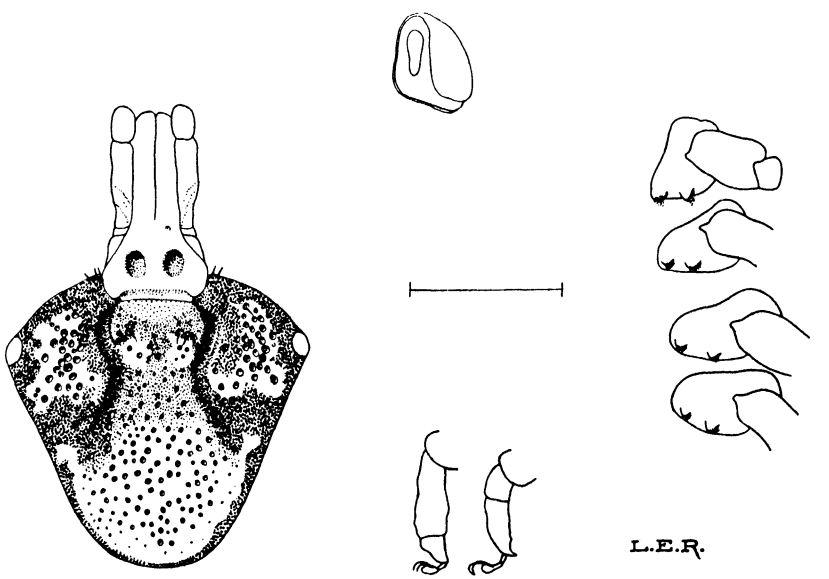


Fig. 74. *Amblyomma pilosum* ♀. Scutum, capitulum, spiracle, coxae I–IV, tarsi I and IV. (N. 711.)

shallow and divergent posteriorly; punctations numerous, large, coarse and confluent in the antero-lateral fields; a few short stiff hairs projecting from the scapular angles and between the cervical grooves; some of the punctations in the median and lateral fields also bear each a single, very short, stiff hair; eyes of medium size, flat and pale. *Venter*: of same colour as dorsum, with few scattered whitish hairs in the posterior half; genital aperture small, situated opposite the interspace between coxae II and III; spiracles triangular comma-shaped, frame very wide on dorsal side. *Capitulum*: relatively long, 1·2 mm., basis rectangular, posterior margin ill-defined, postero-lateral angles slightly salient, lateral margins convex; porose areas moderately large, oval, slightly divergent, interval equal to diameter; palps long and slender, article 2 three times as long as article 3; hypostome long, sides almost parallel, dentition 3 | 3. *Legs*: small, reddish-brown; coxae I–IV each with two, widely-separated, short, blunt spurs; tarsi gradually tapering.

Description based on a ♀ in the Cambridge collection (N. 711), host not specified, **Galapagos Is.**, Pacific Ocean, the gift of the Department of Agriculture, United States of America. Neumann's description is based on a female from the Galapagos Is. (Smithsonian Institution, Marx coll.).

45. AMBLYOMMA TESTUDINIS (Conil, 1877).

Fig. 75.

Synon., Lit. and Iconogr.:

Ixodes testudinis Conil, P. A., 1877, pp. 25–37, a lengthy, specific description of the ♂ and ♀, full of useless details; Pl. I, Figs. 1–2, ♀ dorsum and venter; Pl. II, Figs. 1–5, ♂ dorsum and venter, spiracle, chelicerae and anus; Pl. III, Figs. 1–7, coxae, leg, cervical emargination ♀ and ♂, ♀ capitulum, ♂ capitulum, ventral aspect and in profile.

Amblyomma argentinae Neumann, L. G., 1905, pp. 226–227, specific description of the ♂, ♀ and nymph; 1911, p. 74, brief description of ♂ and ♀.

Amblyomma testudinis (Conil) Lahille, F., 1905, pp. 148–152, revision of Conil's description, descriptive notes concerning larva, nymph, ♂ and ♀; Pl. XII, Figs. 3–7, ♂ dorsum, venter, spiracle and tarsus II (coloured); Text-fig. 23, ♂ and ♀ coxae. 1911, Neumann, L. G., p. 93, brief description of ♂ and ♀.

Male (Fig. 75). Diagnosis: A medium-sized tick; scutum convex, golden-yellow with small brown markings; punctations numerous, deep, coarse and areolate, interspersed with fine punctations; marginal groove absent; hypostome dentition 3 | 3; coxae I–IV each with two small, flat spurs.

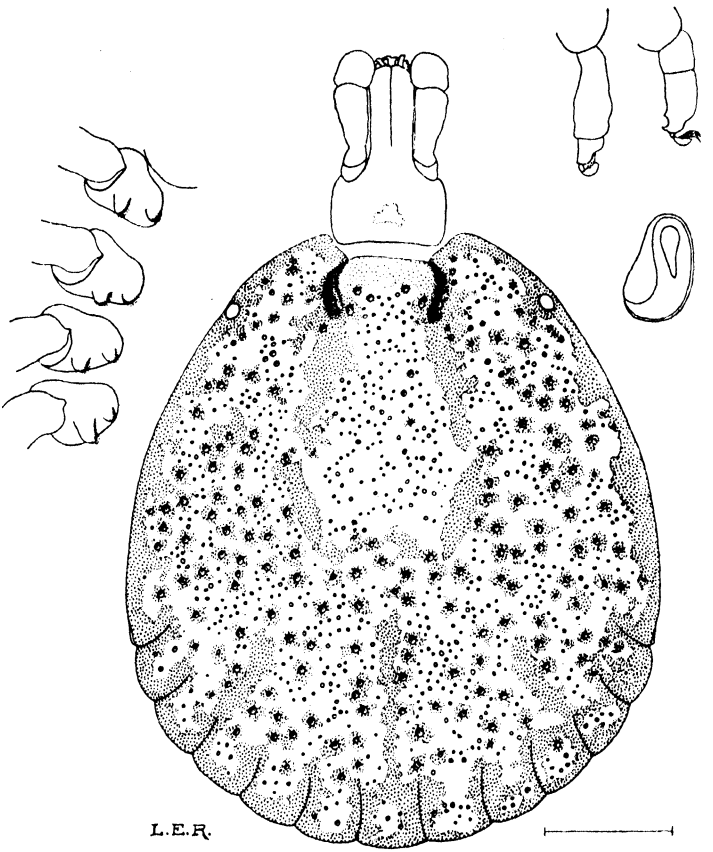


Fig 75. *Amblyomma testudinis* ♂. Scutum, capitulum, coxae I–IV, spiracle, tarsi I and IV. (Berlin Mus. No. 237.)

DESCRIPTION. *Body*: *L.* 5·0 mm., *W.* 4·2 mm.; contour broad oval, narrower in front, lateral margins convex. *Scutum*: convex; ornate, pale golden-yellow with small brownish spots and stripes; postero-median and accessory stripes narrow; lateral spots indistinct or absent; cervical stripes and antero-accessory stripes present; falciform stripe fragmentary; a narrow, dark border extending from the scapular angles to the external festoons with four shallow, irregular incursions of the pale ground between the eye and the external festoon; festoons with irregular pale spots or extensions of the pale ground; cervical grooves short, deep and curved; marginal groove absent; numerous, coarse, deep, areolate punctations, absent from the antero-median field, the extreme lateral

margins and the festoons, interspersed with very fine punctations; eyes small, pale and flat. *Venter*: yellowish, with few punctations and hairs; genital aperture opposite coxa II; spiracles elongate ovoid. *Capitulum*: *L.* 1·5 mm.; basis rectangular, postero-lateral angles non-salient; palps stout, club-shaped, article 2 constricted proximally, twice as long as article 3; hypostome spatulate, dentition 3 | 3. *Legs*: stout; coxae I–IV each with two short, blunt, well-separated spurs, the external spur on coxa IV slightly larger than the rest; tarsi abruptly attenuated; pulvilli small.

Female. Diagnosis: A medium-sized tick; scutum cordiform, pale golden-yellow with brownish markings; eyes pale and flat; hypostome dentition 3 | 3; coxae I–IV each with two short, blunt spurs.

Description. *Body*: *L.* 5 mm., *W.* 4 mm. (according to Neumann gorged examples may attain dimensions of 12 × 9·5 mm.); dorsum dark-brown, marginal groove continuous, festoons well-defined. *Scutum*: cordiform, 3 × 2·5 mm., posterior angle narrow, postero-lateral margins slightly convex; ornate, with brown markings on a pale golden-yellow ground; cervical stripes extending posteriorly to fuse with the limiting spots; frontal spots small; a narrow dark border extending from the scapular angle to the ocular spot; few coarse areolate punctations interspersed with many fine punctations; cervical grooves longer than in the ♂; eyes small, pale and flat. *Venter*: genital aperture opposite coxa II; spiracles comma-shaped. *Capitulum*: *L.* 1·5 mm.; porose areas medium, oval, divergent, interval equal to the larger diameter; otherwise as in the ♂. *Legs*: as in the ♂.

Geographical Distribution and Hosts.

The type was found on a tortoise, *Testudo sulcata* Müll., in the **Argentine Republic, S. America,** by W. Wegenbergh. Neumann's description is based on ♂s, ♀ and nymph, from the Argentine Republic, sent to him for determination by Prof. F Lahille; also a ♀, host not specified, from Buenos Aires, Argentine Republic (Lignières coll.). Fig. 75 is drawn from an example in the Berlin Museum (No. 237), no particulars as to host or origin.

46. AMBLYOMMA DISSIMILE Koch, 1844.

Figs. 76 and 77.

Synon., Lit. and Iconogr.:

Amblyomma dissimile Koch, C. L., 1844, p. 225, brief description of ♂ and ♀. **1847,** Koch, C. L., pp. 64–66, description of ♂ and ♀; Tab. XI, Figs. 37, 38, ♂ and ♀ dorsum (coloured). **1899,** Neumann, L. G., pp. 227–230, specific description of ♂, ♀ and nymph; Fig. 53, digit of nymphal chelicera. **1909,** Newstead, R., short description of ♀ and nymph, notes on biology, geographical distribution and hosts; Pl. XIII, figure of toad (*Bufo marinus*) with replete ♀ attached: Rohr, C. J., pp. 164–166, description of ♂, ♀ and nymph after Neumann. **1911,** Neumann, L. G., p. 72, short description of ♂ and ♀, geographical distribution, hosts and synonymy (the inclusion of *Amb. cooperi* in the latter is an error). **1912,** Hooker, W. A., Bishopp, F. C., and Wood, H. P., pp. 130–135, specific description, host relationship, geographical distribution, life-history; Pl. X, Figs. 1–5, photomicrographs of larva, nymph, ♂ and ♀ gorged and unfed.

Amblyomma irroratum Koch, C. L., 1844, p. 225, brief description of ♂. 1847, pp. 66–67, description of ♂; Pl. XI, Fig. 39, ♂ dorsum (coloured). 1901, Neumann, L. G., pp. 300–301, degrades to a synonym of *Amb. dissimile* (I have examined Koch's type, and agree with Neumann).

Amblyomma adspersum Koch, C. L., 1844, p. 226, brief description of ♂ and ♀, 1847, Koch, C. L., pp. 71–72, description of ♂ and ♀; Tab. XII, Figs. 43, 44, ♂ and ♀ dorsum (coloured). 1880, Bertkau, P., p. 109, reports 2 ♀s, off *Boa constrictor*, Barbacena, Brazil, and notes that Koch's specimen came from Colombia, off same host. 1899, Neumann, L. G., p. 227, degrades to a synonym of *Amb. dissimile* (I have examined Koch's type and agree with Neumann).

Ixodes humanus Koch, C. L., 1844, p. 233, brief description of ♀ (? nymph). 1847, Koch, C. L., pp. 104–105; Pl. XXI, Fig. 78, dorsum (coloured); degraded by Neumann (1899, p. 227) to a synonym of *Amb. dissimile.*

Ixodes pulchellus Lucas, H., 1846, p. 61; Pl. I, Figs. 4, 4 *a–d*, ♂ and ♀ dorsum (coloured), ♂ capitulum: 1849, p. 582 (Secretary's abstract of paper read Oct. 10th). Degraded by Neumann (1899, p. 227) to a synonym of *Amb. dissimile.*

Ixodes boarum Stoll, O., 1886–1893, p. 18, description of ♀; Pl. XIII, Figs. 1–1 *e*, ♀ dorsum, venter, capitulum, tarsus and spiracle; Pl. XIV, Fig. 4, anus. Degraded by Neumann (1899, p. 227) to a synonym of *Amb. dissimile.*

Ixodes flavidus Koch, C. L., 1844, p. 233; 1847, pp. 103–104; Pl. XXI, Fig. 77. This species (a nymph) Neumann degrades to a synonym of *Amb. dissimile* (1899, p. 227).

Amblyomma infumatum Koch, C. L., 1844, p. 228, brief description of ♀; 1847, p. 84, specific description of ♀; Tab. XV, Fig. 56, ♀ dorsum (coloured). I have examined the type and degrade *Amb. infumatum* to a synonym of *Amb. dissimile.* 1880, Bertkau, P., pp. 109–110, records the occurrence of ♂s and ♀s on *Hydrochoerus capybara*, near Chapeo de Uvas, S. America.

Male (Fig. 76). Diagnosis: A small to medium-sized tick; scutum with variable but characteristic ornamentation; postero-median, postero-accessory and falciform stripes, lateral spots, cervical stripes

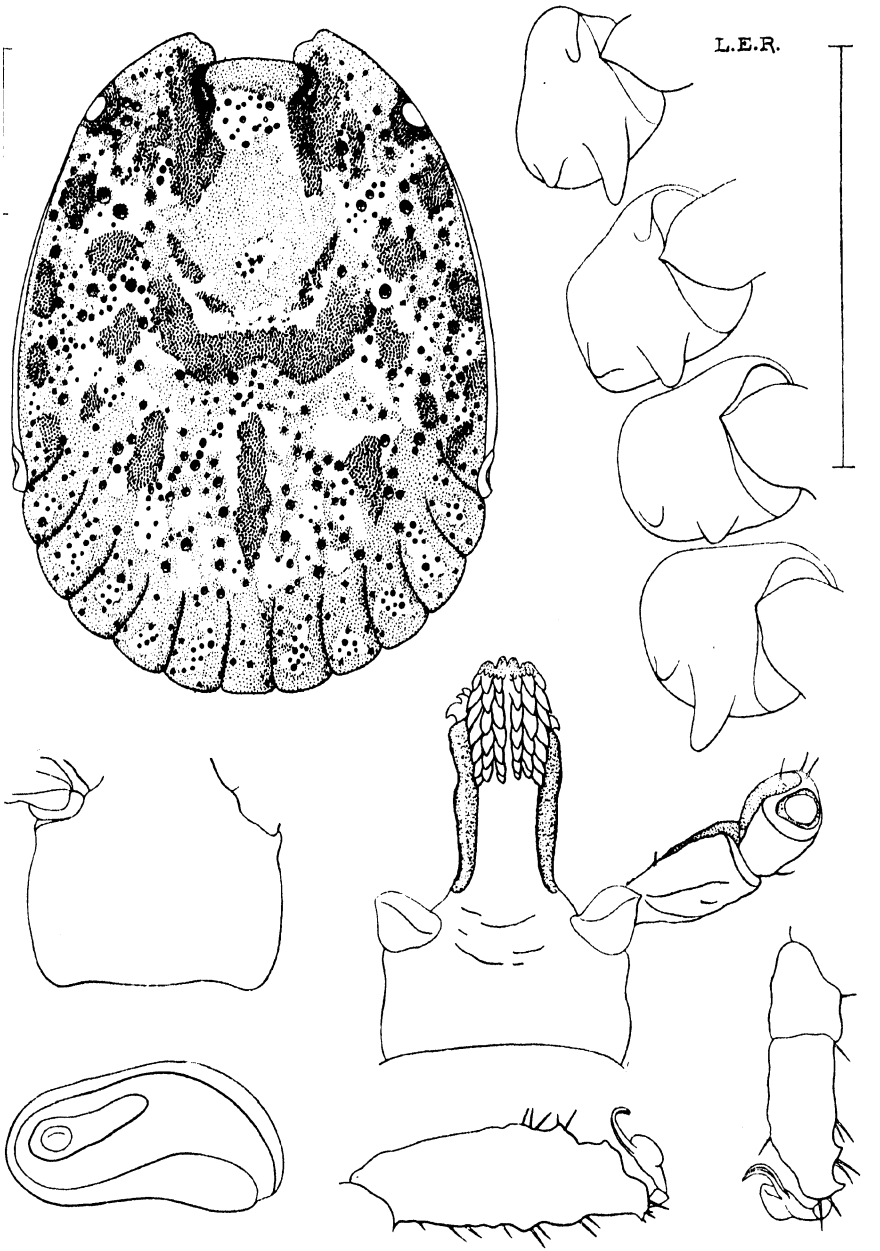


Fig. 76. *Amblyomma dissimile* ♂. Scutum, coxae I–IV, capitulum from ventral aspect, basis capituli from dorsal aspect, spiracle, tarsi I and IV. (N. 1883 (scutum) and Z.S. 16.)

and frontal spots usually distinguishable; four successive dark spots on the marginal ridge between the ocular spot and the external festoons; marginal groove absent; punctations unequal, coarse towards the periphery; eyes pale and flat; hypostome dentition 3 | 3; coxae each with two spurs, the external spur on coxae I and IV longer than broad, the internal spurs small.

DESCRIPTION. *Body*: *L.* 4·1–5 mm., *W.* 3·2–4 mm., contour broad oval, slightly narrower in front, slightly convex. *Scutum*: ornate, with reddish-brown spots and stripes on a pale-yellowish ground; postero-median stripe narrow, not reaching the falciform stripe; postero-accessory stripes short; falciform stripe broad, sometimes divided in the middle; antero-accessory stripes fused with the extremities of the falciform stripe; limiting spots often present; lateral spots small, irregular, often obscured among the dark areolate punctations; marginal ridge with four dark spots, separated by incursions of the general pale ground colour; festoons each with a more or less extensive irregular pale spot; cervical grooves short and deep, sigmoid; marginal groove absent; numerous, irregular, coarse, dark-coloured, areolate punctations in the peripheral parts and the posterior half of the scutum, interspersed with fine punctations; eyes small, pale and flat. *Venter*: dirty yellow, with fine punctations and scattered short hairs; genital aperture opposite coxa II; spiracles narrow, elongate, comma-shaped. *Capitulum*: *L.* 1–1·2 mm., basis rectangular, rather long in relation to its breadth, postero-lateral angles barely salient; palps medium, article 2 one-and-a-half times as long as article 3; hypostome dentition 3 | 3. *Legs*: medium, dark-brown; coxa I with two unequal spurs, the external twice as broad as long, the internal small; coxae II and III each with two small spurs, the external of which is the larger; coxa IV with a moderately long external spur and a minute internal spur; tarsi attenuated in talus.

Female (Fig. 77). Diagnosis: A medium-sized tick; scutum sub-triangular; ornate, with indistinct pale spots in the scapular fields and at the posterior angle; punctations few, large, mostly in the antero-lateral fields, with some interspersed fine punctations; eyes large, pale and flat; basis capituli rectangular, postero-lateral angles non-salient; porose areas large, oval, divergent, interval about equal to diameter; hypostome dentition 3 | 3; coxa I with two short, sub-equal spurs; two spurs on each of coxae II–IV, the internal spurs decreasing in size on the successive coxae.

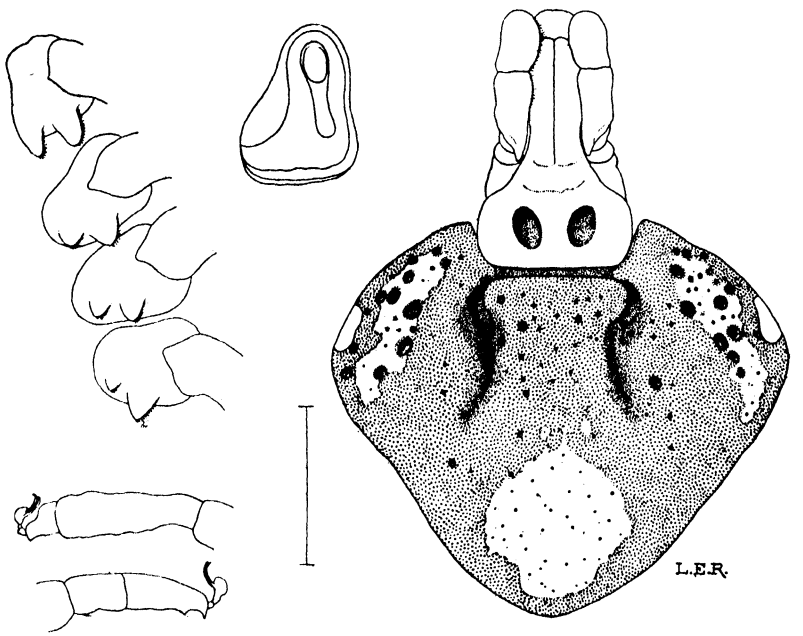


Fig. 77. *Amblyomma dissimile* ♀. Scutum, capitulum, coxae I–IV, spiracle, tarsi I and IV. (N. 1883.)

DESCRIPTION. *Body*: *L.* 5 mm., *W.* 4 mm. (a gorged example in the Cambridge collection attains dimensions of 15 × 10 mm.); dorsum reddish-brown, contour oval or elliptical, glabrous. *Scutum*: sub-triangular, 2·45 × 2·85 mm., posterior angle narrow; slightly convex, polished; ornate, with an elongate, irregular pale spot in each scapular field, and a large pale spot at the posterior angle, the pale spots sometimes indistinct; cervical grooves long, deep, S-shaped; punctations few and large in the antero-lateral fields, interspersed with fine punctations; eyes large, pale and flat. *Venter*: like dorsum; genital aperture opposite coxa II; spiracles large, triangular with rounded angles. *Capitulum*: *L.* 1·6 mm., basis rectangular, postero-lateral angles non-salient, lateral margins slightly convex; porose areas large, oval, slightly divergent, interval about equal to diameter; palps clavate, article 2 about one-and-a-half times as long as article 3, laterally compressed at the postero-dorsal extremity; hypostome slightly spatulate, dentition 3 | 3. *Legs*: of medium length, slender, dark-brown; coxa I with two short, blunt, sub-equal spurs; two spurs on each of coxae II–IV, the internal spurs small and decreasing in size on the successive articles, very small on coxa IV; tarsus I abruptly attenuated; tarsi II–IV gradually attenuated.

Geographical Distribution and Hosts.

Central America to the **Argentine Republic, S. America.** Hosts: Reptilia and Batrachia. Koch's type came from Mexico, *Amb. irroratum* and *Amb. infumatum* from Brazil, *Amb. adspersum* from Colombia, *Ix. flavidus* and *Ix. humanus* from Brazil; in no case is the host specified. Lucas's *Ix. pulchellus* was found on *Spilotes variabilis*; *Ix. boarum* Stoll, came from Guatemala. Neumann (1899, p. 230) records examples from Nicaragua, Barbadoes and the Philippine Is. (Marx coll., Smithsonian Inst., Washington); from Mexico, Colombia, Brazil and Venezuela (Hamburg Mus.); New Grenada, Honduras and Darien (Paris Mus.); Panama and Paraguay (Blanchard and Poppe colls.): (1911, p. 72) he lists hosts: *Hydrochoerus hydrochoeris* (L.) (*H. capybara* Erxl.), *Iguana rhinolopha* Wgm., *I. tuberculata* Laur., *Crotalus terrificus* Wgm., *Lachesis mutus* (L.), *Trigonocephalus jararaca* Schl., *Scytale coronatum* D. B., *Leptodeira annulata* Fitz., *Spilotes variabilis* Wagl., *Xenodon severus* Boie, *Epicrates cenchrys* Wagl., *Boa constrictor* L., *B. imperator* Daud., *Bufo marinus* (L.) (*B. agua* Latr.). The Cambridge collection contains the following: **Mexico**; ♂s and ♀, off large *snake*, Frontera, v. 1900, gift of the Hon. N. C. Rothschild (N. 568); ♂s, off *Iguana tuberculata*, vi. 1912 (N. 1726). **Guatemala**: ♂ and ♀, host not specified, 1909, Dr L. O. Howard donor (N. 709). **Panama**: ♂s and ♀s, off *snake*, i. 1896, Prof. V. L. Kellogg donor (N. 289); ♂s and ♀, off *Iguana*, Ancon, Canal Zone, i. 1911, Dr S. T. Darling coll. (N. 1283); ♂, ♀, nymph and larva, off *Oxybelis acuminatus*, iv. 1913, Dr S. T. Darling coll. (N. 2176 and 2185). **West Indies**: ♂, off *lizard*, 1907, H. A. Ballon (N. 1599); ♀s, off *toad*, St Lucia, vi. 1912, Dr L. Nicholls coll. (N. 2010); ♂, off *Lachesis mutus*, Trinidad, iii. 1913 (N. 2086); ♂s, ♀s and nymphs, off *Iguana*, Trinidad, iv. 1913, P. Carmody coll. (N. 2112). **British Guiana**: (?) vii. 1906 (N. 126); ♂s, off *toad*, 1905, Dr K. S. Wise coll. (N. 1597); ♂ and ♀, off *toad*, 1911, Dr K. S. Wise coll. (N. 1870); ♂ and ♀, off *Iguana*, 1912, Dr K. S. Wise coll. (N. 1883); ♂ and ♀, off "Salapenter," 1909, Dr K. S. Wise coll. (N. 1598); off *cow*, 1911, Dr K. S. Wise coll. (N. 1783). **Brazil**: ♂ and ♀, off *Iguana*, State of Pará, iv. 1908, Dr H. de B. Aragão donor (N. 1268); ♂, off *Boa constrictor*, Upper Amazon, xi. 1912, Dr O'Connell coll. (N. 1935). A ♀ (N. 1653) is recorded as being found on sheep, no indication of origin. Specimens sent to Cambridge by the Zoological Society of London for determination were taken from the following hosts: *Iguana tuberculata*, *Lachesis mutus* and *Boa constrictor* (Z.S. 16, 28, 32, 33, 35 and 37). Aragão (1911, pp. 159 and 162) records the species from Belem, Marajo and Soure, State of Pará, Brazil, and gives *Boa constrictor*, *Podocnemis* sp. and *Iguana* sp. as hosts.

47. AMBLYOMMA ROTUNDATUM C. L. Koch, 1844.

Fig. 78.

Synon., Lit. and Iconogr.:

Amblyomma rotundatum Koch, C. L., 1844, p. 229. 1847, Koch, C. L., p. 89; Tab. XVI, Fig. 61, ♀ dorsum (coloured). 1899, Neumann, L. G., p. 278, short description of the female, after Koch. 1911, Neumann, L. G., p. 91, short description.

Amblyomma agamum Aragão, H. de B., 1912, pp. 96–114, Pl. II, Figs. 1 and 2, ♀ dorsum and venter (coloured); Pl. III, Figs. 1–3, gorged ♀s on a toad, and on a snake, ♀s ovipositing: Text-fig. 1, nymph; scutum, capitulum from dorsal and ventral aspects, coxae I–IV, spiracle, and tarsi: Text-fig. 2, larva, dorsum, capitulum from ventral aspect, coxae I–III, and tarsus: Text-fig. 3, egg; detailed specific description of ♀, nymph and larva; biology; parthenogenesis.

Male: unknown.

Female (Fig. 78). Diagnosis: A small species; scutum cordiform, ornate, punctations numerous, coarser in the antero-lateral fields; cervical grooves narrow and deep anteriorly, long **S**-shaped; capitulum long, postero-lateral angles of basis non-salient; coxae I–IV each with two short, stout, rounded spurs; tarsi attenuated in talus.

Description. *Body*: *L.* 3·1 mm., *W.* 2·6 mm., oval, broadest at posterior third; dorsum smooth, glabrous, punctations fine and shallow; marginal groove distinct, continuous, other grooves indistinct; festoons well-defined. *Scutum*: 1·95 × 2·05 mm., cordiform, posterior angle somewhat narrow; convex; ornate; cervical grooves narrow, deep anteriorly, cleanly incised, curved, with the convexity external, continued posteriorly as shallow, divergent grooves which extend for a short distance beyond the middle of the scutum; punctations irregular, coarse in the antero-lateral fields and at the posterior ends of the deep part of the cervical grooves, fine punctations interspersed among the coarse, and scattered over the remainder of the scutum; eyes flat and pale, situated at the level of the anterior third of the scutum; ornamentation consisting of an irregular, pale area in each lateral field, interrupted by a dark frontal spot and dark-coloured areolate punctations; median field with an irregular shaped pale spot at the posterior angle and two similar but smaller spots in the anterior part between the cervical grooves; in living or adequately preserved specimens the ground colour of the median field might be pale. *Venter*: paler than dorsum, smooth and glabrous, festoons well-defined; genital aperture opposite coxa II; spiracles ovoid-triangular. *Capitulum*: *L.* 1·2 mm., basis with lateral margins slightly convex; postero-lateral angles non-salient; porose areas medium in size, ovoid, widely-separa ted; palps moderately long; article 1 with a keel-like

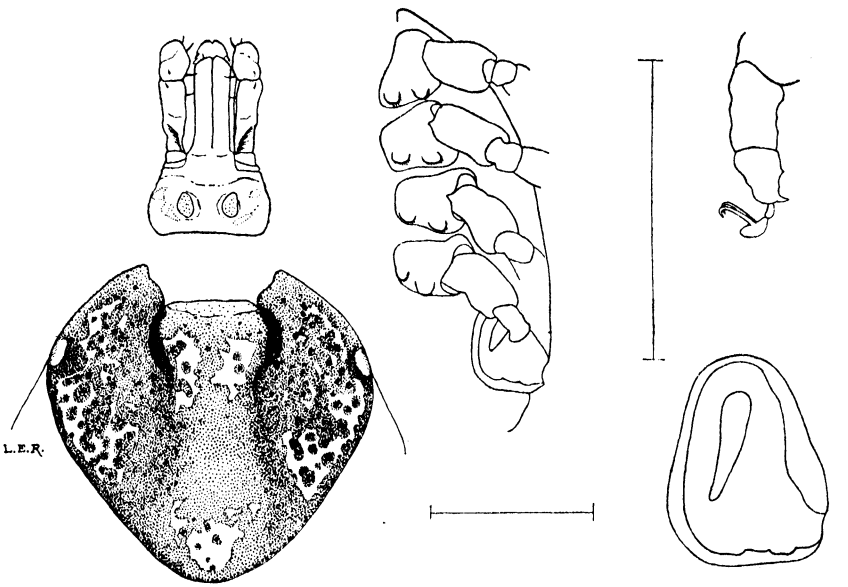


Fig. 78. *Amblyomma rotundatum* ♀. Scutum, capitulum, coxae I–IV, spiracle, tarsus IV. (Type, Berlin Mus.)

prominence on its ventral face; article 2 twice as long as article 3; hypostome dentition 3 | 3. *Legs*: coxae I–IV each bearing two short, stout, rounded, well-separated spurs; tarsi attenuated in talus.

Description based on 1 ♀ (type), a dry, pinned specimen, from Pará Brazil, Sieber coll., in the Zool. Museum, Berlin (No. 1065). Aragão (1912) gives the following dimensions for *Amb. agamum—Body*: *L.* 5·6 mm. (including capitulum?), *W.* 3·7 mm. *Scutum*: 2·0 × 2·4 mm. *Capitulum*: *L.* 1·53 mm. Gorged females may attain a length of 17 mm. and a breadth of 12·6 mm.

Geographical Distribution and Hosts.

The type, a single ♀, in the Koch collection, Zool. Museum, Berlin, is labelled Pará, **Brazil**, Sieber coll., host not specified. Aragão's original description (1912) of *Amb. agamum* is based on numerous ♀s, nymphs and larvae from the environs of Manguinhos, Rio de Janeiro, Brazil, toads (*Bufo* sp.) and snakes (*Boa constrictor*) being cited as hosts; also a ♀ from Matto Grosso, host unknown. Aragão (1918) records the species (*agamum*), off *Testudo* sp., Corrumba, State of Matto Grosso; off *Lachesis lanceolatus*, Ilha Queimada Grande, State of São Paulo. The Cambridge collection contains 1 ♀, off *Bufo* sp., Rio de Janeiro, Brazil, 12. I. 1914, the gift of Dr H. de B. Aragão (N. 2704).

48. AMBLYOMMA EXTRAOCULATUM Neumann, 1899.

Fig. 79.

Lit.: Neumann, L. G., 1899, p. 274, brief description of ♀; 1911, p. 88, brief description of ♀.

Male: unknown.

Female (Fig. 79). Diagnosis: A moderately large tick; scutum triangular, ornate; eyes large, flat, bulging laterally beyond the contour of the scutum; capitulum long, porose areas large; coxa I with two unequal spurs, the external spur twice as long as broad; two short, flat spurs on each of coxae II and III, the internal small; two spurs on coxa IV, the external nearly twice as long as broad, the internal very small.

DESCRIPTION. *Body*: *L.* 16 mm., *W.* 12 mm. (gorged), sub-rectangular; dorsum smooth, almost glabrous, few short hairs at posterior end grooves obliterated by distension. *Scutum*: triangular, 2·4 × 2·7 mm.; postero-lateral margins almost straight, posterior angle moderately

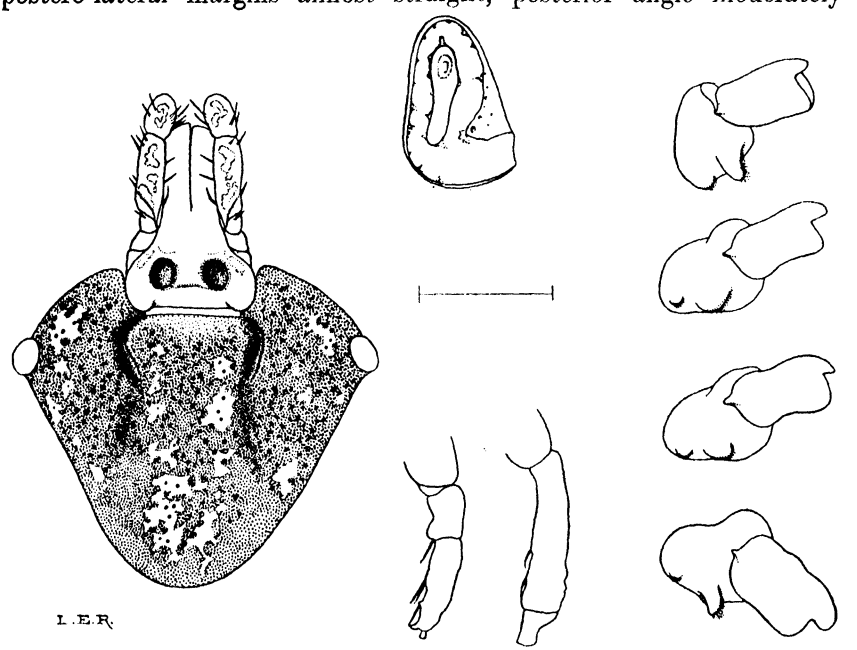


Fig. 79. *Amblyomma extraoculatum* ♀. Scutum, capitulum, spiracle, coxae I–IV, tarsi I and IV. (Type, Hamburg Mus.)

broad and rounded; colour dark-brown with irregular small, pale patches in the median and lateral fields (the ornamentation is probably obscured to some extent by defective preservation); cervical grooves deep, narrow, curved with the convexity external, continued posteriorly by shallow, divergent depressions extending to the posterior third of the scutum; punctations numerous, small, distributed evenly in the lateral fields and the anterior two-thirds of the median field; eyes large, slightly convex, their external halves bulging laterally beyond the contour of the scutum. *Venter*: like dorsum; genital aperture opposite 1st coxal interspace; spiracles triangular, with rounded angles. *Capitulum*: *L.* 1·6 mm., basis capituli rectangular, lateral margins convex, postero-lateral angles rounded and slightly salient; porose areas large, broadly oval, interval slightly greater than diameter; palps slender, with pale marbling on dorsal surface, article 2 two-and-a-half times as long as article 3; hypostome dentition 4 | 4. *Legs*: slender; coxa I with two short spurs, of which the internal is twice as broad as long; coxae II and III each with two spurs, the internal small, the external flat and rounded; coxa IV with two spurs, a moderately pointed spur at the external third of its posterior margin, twice as long as broad; and a minute spur at the postero-internal angle; tarsi long, attenuated in talus.

Description based on a single female (type), from **Singapore**; host not specified (Hamburg Mus.).

49. AMBLYOMMA PAPUANA Hirst, 1914.

Fig. 80.

Lit. and Iconogr.: Hirst, A. S., 1914, pp. 327–328, specific description of ♂ and ♀, Fig. 15, ♂ coxae.

Male. Diagnosis: A very small tick, scutum sub-circular, with indistinct ornamentation; marginal groove absent; punctations numerous and deep; eyes indistinct; coxae I–IV each furnished with two small, widely-separated, triangular spurs; a single, similar spur on each of trochanters II–IV; hypostome dentition 4 | 4; tarsi gradually attenuated at the extremity.

Description. *Body*: *L.* 2·4 mm., contour subcircular, breadth slightly greater than length, scapular angles somewhat truncated. *Scutum*: colour dark-brown, with faint traces of light-greenish markings, two patches near the posterior margin being fairly distinct (the light-coloured

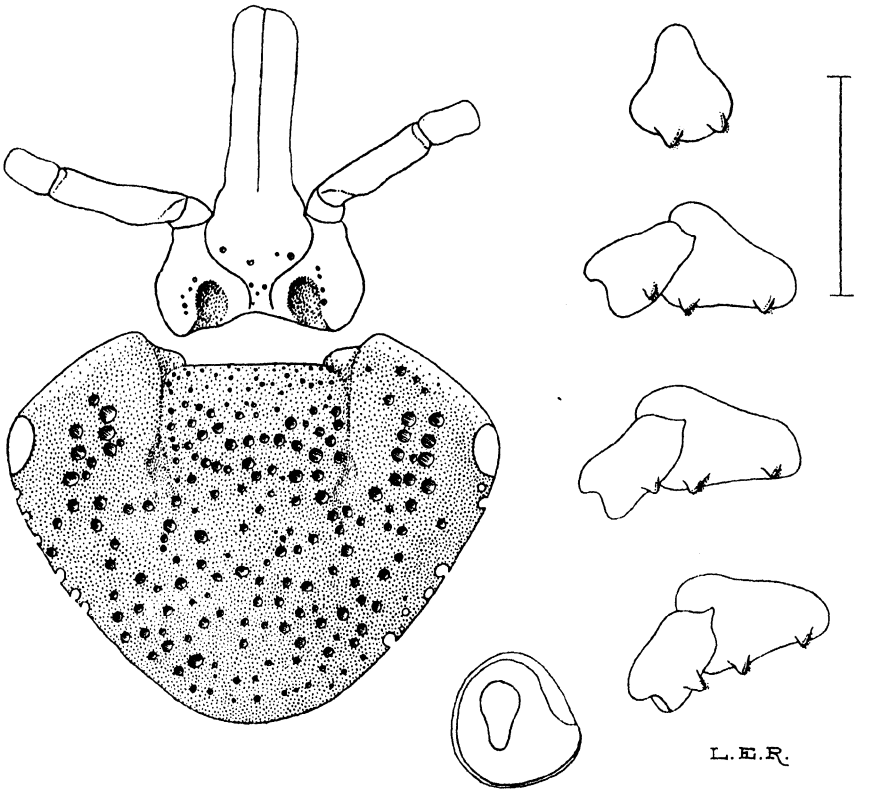


Fig. 80. *Amblyomma papuana* ♀. Scutum, capitulum, coxae and trochanters I–IV, spiracle. (Type, British Mus.)

areas may be more clearly defined, and more extensive in well-preserved examples); postero-median stripe represented by a dark, narrow, central, slightly-raised line, devoid of punctations, on either side of which is a short, shallow, oblique groove with a smooth posterior border (postero-accessory stripes?); cervical grooves short and inconspicuous; marginal groove absent; punctations numerous, deep and well-defined; eyes indistinct; festoons not visible on the dorsal surface. *Venter*: spiracle large and very wide. *Capitulum*: basis with salient postero-lateral angles; hypostome dentition 4 | 4, innermost files short and denticles weak. *Legs*: coxae I–IV each with two short, widely-separated, triangular spurs, of which the external is the larger; trochanters II–IV each with a single similar spur at the external third of the posterior margin; tarsi gradually attenuated at the free extremity.

Female (Fig. 80). Diagnosis: A small tick; scutum cordiform, inornate, dark-brown with the exception of a narrow, pale margin extending from the eye to the scapular angle; punctations numerous, coarse, fairly evenly distributed; capitular emargination broad and shallow; basis capituli rectangular, lateral margins convex, postero-lateral angles raised but barely salient, porose areas encroaching on the posterior margin; hypostome dentition 4 | 4; coxae I–IV each with a pair of small, sub-equal, widely-separated, triangular spurs; trochanters II–IV each with a single similar spur.

DESCRIPTION. *Body*: *L.* 7 mm. (partly gorged). *Scutum*: 1·8 × 2·3 mm., cordiform, posterior angle rather broad, postero-lateral margins convex, capitular emargination broad and shallow, scapular angles blunt; colour dark-brown, with a narrow, pale margin extending from the eye to the scapular angle; cervical grooves deep anteriorly, shallow and ill-defined posteriorly; punctations numerous, coarse, fairly evenly distributed, some eroding the postero-lateral contour of the scutum; eyes large, pale and flat. *Venter*: spiracles large, almost circular. *Capitulum*: *L.* 1·5 mm., basis rectangular, lateral margins convex, posterior margin slightly concave, postero-lateral angles raised but barely salient; porose areas oval, very widely-separated, interval more than twice diameter, encroaching on the posterior margin of the basis; palps narrow, sides almost parallel, article 2 nearly three times as long as article 3; hypostome dentition 4 | 4, innermost file short, with weak denticles. *Legs* (mostly missing in the specimens): coxae I–IV each with a pair of short, sub-equal, widely-separated, triangular spurs of which the external is slightly the larger; a single similar spur at the external third of the posterior border of trochanters II–IV; tarsi ?.

Hirst's description is based on 1 ♂ (with 2 nymphs), Mimika R., and 2 ♀s, Canoe Camp, Utakwa R., south **Dutch New Guinea,** XI. 1912, British Ornithologists' Union Expedition and Wollaston Expedition colls. (British Mus.).

50. AMBLYOMMA TUBERCULATUM Marx, 1893–1894.

Figs. 81 and 82.

Lit. and Iconogr.: Marx, G., 1893–1894, p. 314. 1899, Neumann, L. G., pp. 235–236, specific description of ♂ and ♀. 1911, Neumann, L. G., p. 74, brief description of ♂ and ♀. 1912, Hooker, W. A., Bishopp, F. C., and Wood, H. P., pp. 123–130, description, host relationship, geographical distribution, life-history, etc.; Pl. IX, Figs. 1–8, photomicrographs of larva, nymph gorged and unfed, ♀, ♀s attached to a tortoise, ♂ and ♀ unfed, and ♀ gorged; Text-fig. 8, map showing geographical distribution; Text-fig. 9, Gené's organ.

Male (Fig. 81). Diagnosis: A large tick; scutum broad oval, smooth and convex; ornate, with characteristic dark-brown markings on a dull yellowish-white ground; marginal groove absent; punctations for the most part very fine; eyes small, pale and flat; hypostome dentition 4 | 4; coxae I–IV each with two, short, flat, broad spurs; tarsi abruptly attenuated.

DESCRIPTION. *Body*: *L.* 6·2 mm., *W.* 5·5 mm., contour broad oval, slightly narrower in front, sides rounded. *Scutum*: smooth and convex; ornate, with dark-coloured spots and stripes on a dull yellowish-white ground; postero-median stripe moderately long, thickened anteriorly, not extending to the falciform stripe; postero-accessory stripes in the form of large, irregular, oval spots; a small additional spot immediately anterior to the 4th festoon; lateral spots large, isolated or conjoined; falciform stripe divided in the centre, its lateral extremities indistinguishably fused with the antero-accessory stripes; cervical stripes broad anteriorly, divergent, with their posterior tapering extremities almost touching, or completely fused with, the extremities of the antero-accessory stripes; frontal spots clearly defined, connected by a narrow bridge with the cervical stripes; a narrow, dark border commencing at the scapular angles and extending completely round the lateral and posterior margins of the scutum, with four wide, shallow indentations between the eye and the external festoon; cervical grooves long and rather narrow, almost straight; marginal groove absent; punctations numerous, very fine, a few large punctations near the margins; eyes small, pale and flat; festoons short, separations narrow. *Venter*: dirty-yellow, with fine, short, scattered hairs; genital aperture opposite coxa II; spiracles moderately large, broad comma-shaped. *Capitulum*: *L.* 1·9 mm., basis broad and convex, postero-lateral angles non-salient, lateral

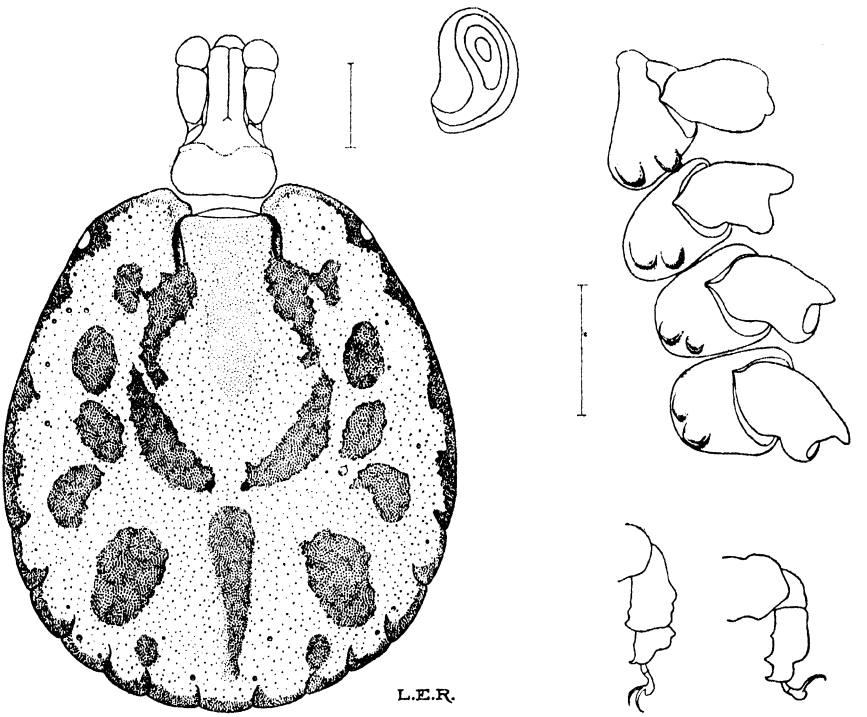


Fig. 81. *Amblyomma tuberculatum* ♂. Scutum, capitulum, spiracle, coxae I–IV, tarsi 1 and IV. (N. 3356.)

margins convex; palps rather short, stout, club-shaped, article 2 about twice as long as article 3; hypostome dentition 4 | 4. *Legs*: long and strong, maroon-brown; coxae I–IV each with two, short, flat, broad spurs, obliquely disposed on coxa IV; tarsi short, abruptly attenuated.

Female (Fig. 82). Diagnosis: A large tick; scutum broadly cordiform, posterior angle rounded and merging imperceptibly into the convex postero-lateral margins; ornate, with characteristic dark-brown markings on a yellowish-white ground; punctations very fine, numerous; a few larger punctations in the scapular angles; eyes small, pale and flat; porose areas small, oval, divergent and widely-separated; hypostome dentition 4 | 4; coxae I–IV each with two short, broad, flat spurs; tarsi abruptly attenuated.

Description. *Body*: *L.* 7 mm., *W.* 6 mm., contour broad oval, sides and posterior margin rounded; dorsum brown, with fine punctations and hairs; marginal groove present. *Scutum*: 3·5 × 4·1 mm.; very broadly

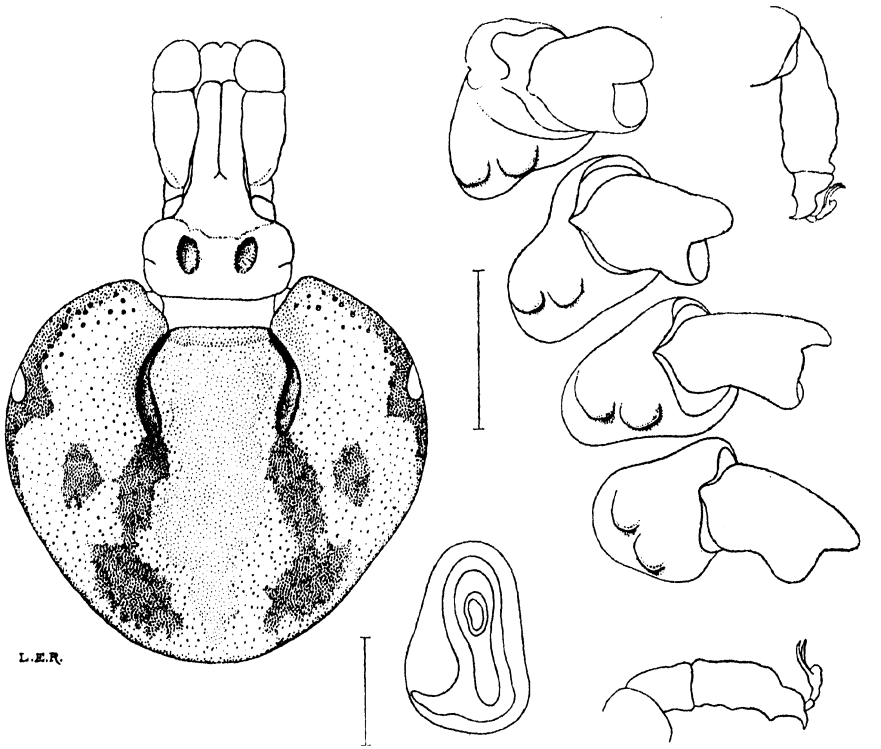


Fig. 82. *Amblyomma tuberculatum* ♀. Scutum, capitulum, coxae I–IV, spiracle, tarsi I and IV. (N. 3356.)

cordiform; posterior angle wide and rounded, merging imperceptibly into the convex lateral margins; ornate, with dark-brown markings on a yellowish-white ground; cervical stripes fusiform, merging posteriorly into the large limiting spots which may be slightly separated from the margin of the scutum; frontal spots distinct, isolated or connected by a narrow bridge with the cervical stripes; a narrow dark border extending anteriorly from the ocular spot to the scapular angle, and posteriorly for a short distance along the lateral margin; cervical grooves long, narrow, deep and curved; punctations very numerous and for the most part very fine, a few larger punctations in the scapular angles; eyes small, pale and flat. *Venter*: similar in colour to dorsum, more punctate and hairy; genital aperture opposite the posterior border of coxa II; spiracles large, triangular, with rounded angles. *Capitulum*: *L.* 2·3 mm., basis rectangular, postero-lateral angles non-salient, lateral margins convex; porose areas small, oval, divergent, widely-separated; palps

relatively longer than those of the ♂, hypostome dentition 4 | 4. *Legs*: similar to those of the ♂; tarsi relatively longer and more slender, not so abruptly attenuated.

Geographical Distribution and Hosts.

Florida, Southern Alabama and **Cuba**; the adults appear to be found exclusively on the *gopher tortoise*. The type came from Florida (Smithsonian Inst.). Neumann records a ♂, from Cuba, Grundelach coll. (Paris Mus.). Hooker, Bishopp and Wood note that the adults have been found only on the gopher tortoise and that attempts to attach them to bovines have failed. Engorged larvae have been collected in large numbers from dogs and rabbits and in smaller numbers from cattle and birds (owl and hawk). The species is commonly met with in Florida, as far north as Hawthorn and it is reported to be rather common in southern Alabama. The Cambridge collection contains a ♂ and nymph, host not specified, Crescent City, Florida, U.S. America, 1909, Dr L. O. Howard donor (N. 708); and ♂ and ♀, off *gopher tortoise*, Alabama, U.S. America (N. 3356).

51. AMBLYOMMA CRASSUM, n.sp.

Fig. 83.

Male: unknown.

Female (Fig. 83). Diagnosis: A large, stoutly-built species, with a superficial resemblance to *A. tuberculatum* Marx; marginal groove present, continuous; scutum large, triangular-cordiform, with unequal punctations, coarse in lateral fields; cervical grooves deep and curved; eyes situated at anterior quarter of length of scutum; capitulum long, palps slender, porose areas large and deep, hypostome dentition 4 | 4; coxa I with two short, broad, sub-equal spurs; two plate-like spurs on each of other coxae, conjoined by a salient sharp ridge; tarsi long, abruptly attenuated at extremity.

Description. *Body*: *L.* 8·3 mm., *W.* 6·8 mm. (unfed), contour oval, maximum width at level of spiracles; general colour of dorsum dark earthy-brown, surface glabrous, with scattered large punctations; marginal groove well-defined, continuous, commencing about the level of the posterior angle of the scutum; festoons well-defined, longer than broad. *Scutum*: 4·2 × 4·4 mm., cordiform, surface smooth and convex;

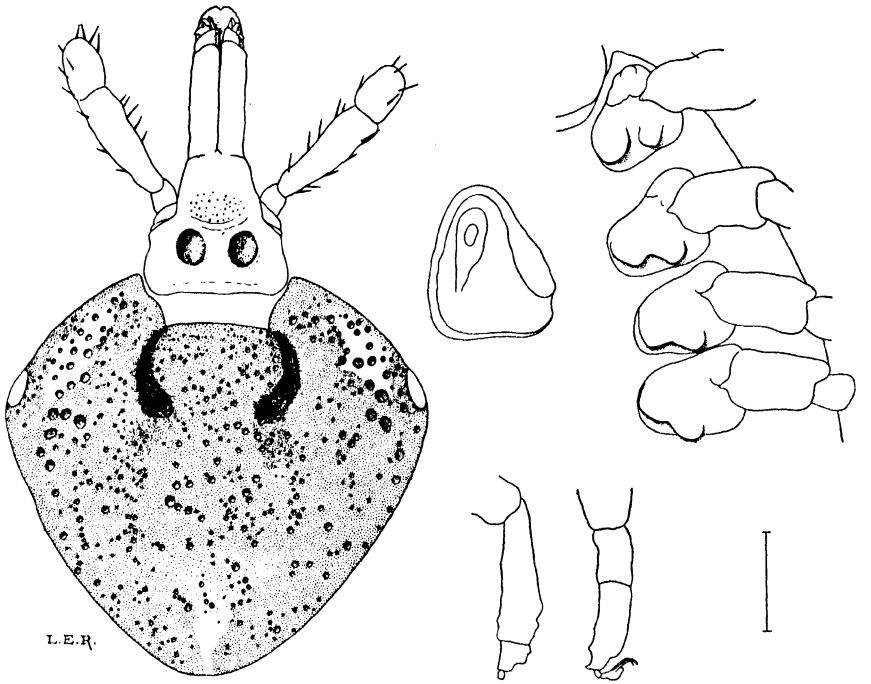


Fig. 83. *Amblyomma crassum* ♀. Scutum, capitulum, spiracle, coxae I–IV, tarsi I and IV. (I.B.E. 1198.)

ornate, colour dark maroon-brown with irregular pale spots in scapular fields and at the posterior angle (the description is based on an alcohol specimen; there are indications that the entire lateral fields and the median field are pale-coloured in the living tick); coarse punctations in the lateral fields and the central portion of the median field, interspersed with small punctations; cervical grooves broad, curved and deep posterior extremities approaching each other and each ending in a deep, circular depression; eyes medium in size, pale, oval and flat, situated at the level of the anterior quarter of the scutum. *Capitulum*: 2·75 × 1·5 mm., basis capituli rectangular, postero-lateral angles barely salient, porose areas large and deep, oval, interval about equal to diameter; hypostome long, teeth confined to anterior half, dentition 4 | 4, corona absent, emargination at tip slight; palps club-shaped, article 2 two-and-a-quarter times as long as article 3. *Venter*: spiracle large, triangular, with rounded angles. *Legs*: stout, colour dark-brown with pale-coloured annulations at the distal extremities of the articles; coxa I with two short, blunt, flattened spurs of which the internal is the larger;

coxae II–IV each with a pair of short, rounded, plate-like spurs conjoined by a salient, sharp-edged ridge; tarsi attenuated abruptly.

Description based on 1 ♀ found on a "land-tortoise," Darien Country, **Colombia, South America,** by Mr M. T. Dawe; no other particulars. From the Imp. Bur. Entomol. Coll. (I.B.E. 1198).

52. AMBLYOMMA HUMERALE Koch, 1844.

Figs. 84 and 85.

Synon., Lit. and Iconogr.:

Amblyomma humerale Koch, C. L., 1844, pp. 223–224, brief description of ♂; 1847, pp. 50–51, specific description of ♂; Tab. VII, Fig. 26, ♂ dorsum (coloured). 1899, Neumann, L. G., pp. 230–231, specific description of the ♂. 1905, Neumann, L. G., p. 233, degrades *Amb. gypsatum* to a synonym of *Amb. humerale.* 1911, Neumann, L. G., p. 74, brief description of the ♂.

Amblyomma gypsatum Neumann, L. G., 1899, p. 259, specific description of the ♂.

Amblyomma longirostrum Cooper, W. F., and Robinson, L. E., 1908, pp. 457–459, specific description of the ♀; Figs. 1–5, ♀ dorsum, spiracles, capitulum from dorsal and ventral aspects, coxae I–IV.

Male (Fig. 84). Diagnosis: A medium-sized tick; scutum smooth, broad oval, convex, indistinctly ornate; marginal groove absent; eyes small, pale and flat; coxae I–IV each with two short, blunt spurs.

DESCRIPTION. *Body*: *L.* 5·4 mm., *W.* 5·0 mm., contour broad oval, narrower in front, sides rounded. *Scutum*: smooth, convex; indistinctly ornate, with small, irregular, pale spots on a dark-brown ground; postero-median, postero-accessory, antero-accessory, falciform, cervical stripes, and frontal, ocular and lateral spots barely distinguishable on the dark ground; cervical grooves short, deep and narrow; marginal groove absent; punctations numerous, irregular, moderately large in the lateral fields; eyes small, pale and flat; festoons large, separations narrow. *Venter*: dark earthy-yellow, punctate; genital aperture opposite coxa II; spiracles large, comma-shaped. *Capitulum*: *L.* 1·6 mm.; basis narrower in front, postero-lateral angles non-salient, lateral margins slightly convex; palps club-shaped, article 2 more than twice as long as article 3; hypostome dentition 4 | 4. *Legs*: long; coxae I–IV each with two short, blunt spurs; tarsi long, attenuated in talus.

Female (Fig. 85). Diagnosis: A medium-sized tick; scutum triangular-cordiform, posterior angle rather narrow; ornate, with a dark border extending from the scapular angles to the posterior angle;

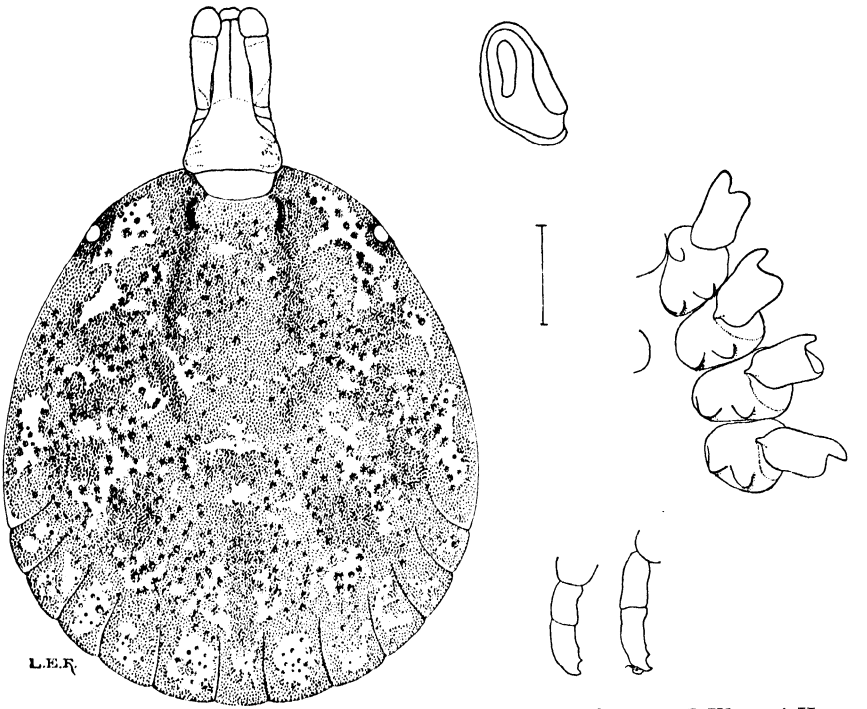


Fig. 84. *Amblyomma humerale* ♂. Scutum, capitulum, spiracle, coxae I–IV, tarsi II and IV. (N. 1261.)

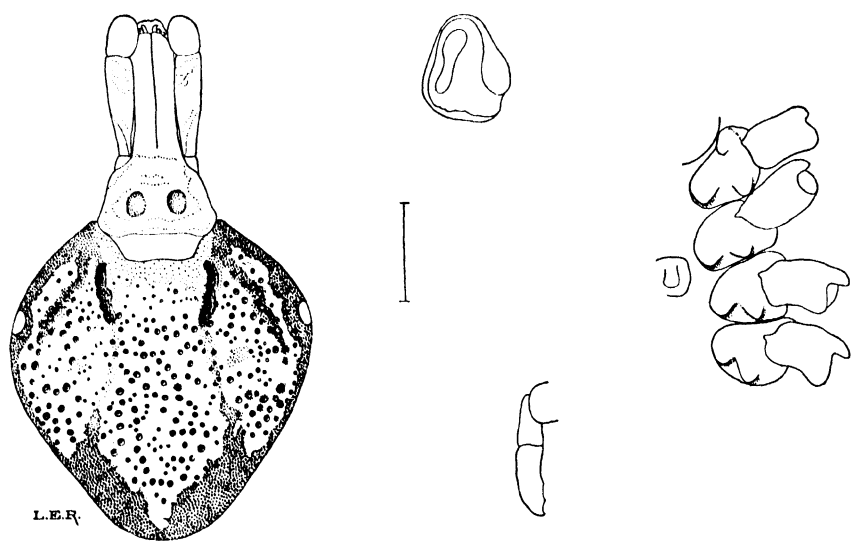


Fig. 85. *Amblyomma humerale* ♀. Scutum, capitulum, spiracle, coxae I–IV, tarsus IV. (N. 1261.)

limiting spots large, contracting the pale median field to a point posteriorly; cervical stripes indistinct; frontal spots linear, divergent posteriorly; punctations numerous, irregular; eyes rather small, pale and flat; coxae I–IV each with two short, blunt spurs.

DESCRIPTION. *Body*: *L.* 5·0–5·5 mm., *W.* 4·5–5·0 mm., contour broad oval, narrower in front; dorsum reddish-brown, wrinkled, with coarse punctations, especially on the marginal ridge and festoons; marginal groove well-defined, continuous. *Scutum*: 3·3 × 3·2 mm., triangular-cordiform, posterior angle rather narrow; ornate, with a dark margin extending from the scapular angles completely round the posterior margin; limiting spots large, meeting at the posterior angle where they contract the pale median field to a point; cervical stripes indistinct; frontal spots in the form of linear streaks commencing near the anterior ends of the cervical grooves and running backwards and outwards, parallel to the antero-lateral margins of the scutum to a short distance beyond the level of the eyes; cervical grooves short, deep, narrow and slightly curved; punctations numerous, moderately coarse, interspersed with fine punctations; eyes rather small, pale and flat. *Venter*: smoother than dorsum, with small, scattered hairs; genital aperture opposite the interspace between coxae II and III; spiracles large, triangular with rounded angles. *Capitulum*: *L.* 2·2 mm., basis sub-triangular, postero-lateral angles barely salient; porose areas broad oval, interval equal to diameter; palps long, club-shaped, article 2 two-and-a-half times as long as article 3; hypostome long, spatulate, dentition 4 | 4. *Legs*: long; coxae I–IV each with two short, blunt, well-separated spurs; tarsi attenuated in talus.

Geographical Distribution and Hosts.

The type came from Bahia, Brazil (Berlin Mus.), host not specified. Berlese (1888) records a ♂ (and a probably related ♀) from Rio Apa, Brazil. Neumann's description of *Amb. gypsatum* is based on 4 dried ♂s, off *tortoise*, from north of Goyaz, **Uruguay.** Aragão (1912, pp. 159 and 162) records the occurrence of the species on *Podocnemis* sp., Belem, Xinga (Pará), **Brazil.** The Cambridge collection contains a ♂ and ♀, host not specified, Rio Xinga, State of Pará, Brazil, Dr H. de B. Aragão donor (N. 1261). The type of *Amb. longirostum* is a ♀, host not specified, **British Guiana,** S. America, 1907, E. C. Foot coll. (C. 265).

53. AMBLYOMMA SABANERAE Stoll, 1886–1893.

Fig. 86.

Lit. and Iconogr.: Stoll, O. (1886–1893), p. 23, specific description of ♀; Pl. XIV, Fig. 2, ♀ dorsum. Neumann, L. G., 1899, p. 261, description of ♀; 1911, p. 70, brief description of ♀.

Male: unknown.

Female (Fig. 86). Diagnosis: A medium-sized tick; scutum triangular, ornate; punctations numerous, large, confluent in places; marginal groove short, not continuous; capitulum long; coxa I with two short, sub-equal spurs; coxae II–IV each with two spurs, the internal spur being the smaller and decreasing in size on the successive coxae.

Description. *Body*: broadly elliptical, *L.* 7·0 mm., *W.* 5·0 mm. (partly gorged); dorsum with scattered, coarse punctations; marginal groove not continuous, terminating posteriorly at the external festoon from which it runs forwards for a short distance only; festoons clearly defined. *Scutum*: triangular, 2·7 × 3·2 mm.; posterior angle narrow, postero-lateral margins almost straight; ornate, with an irregular pale patch in each antero-

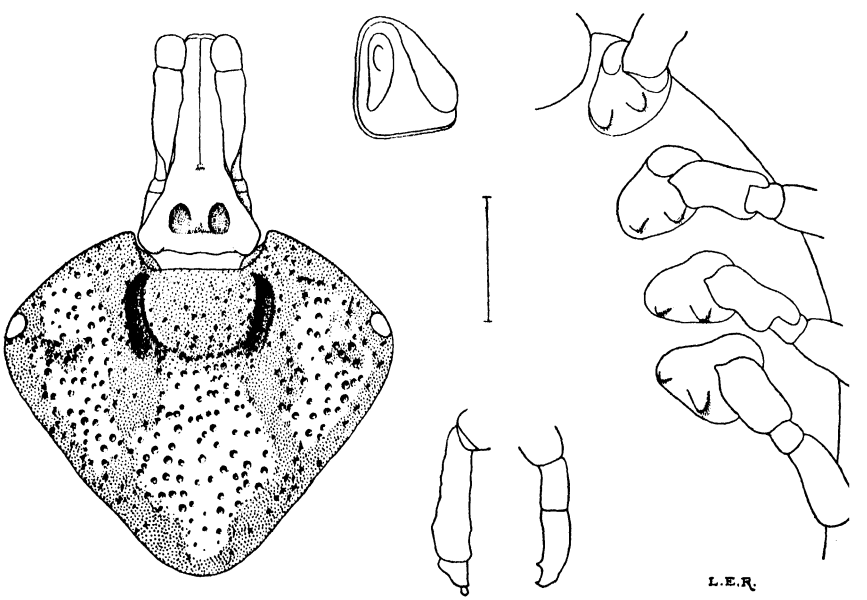


Fig. 86. *Amblyomma sabanerae* ♀. Scutum, capitulum, spiracle, coxae I–IV, tarsi I and IV. (Type, Trouessart Coll. Toulouse.)

lateral field (in the specimen the pale areas are obscured as a result of defective preservation but there are indications that the median and lateral fields are pale in the living or well-preserved tick, with a dark marginal border extending from the ocular spots to the posterior angle; with the cervical stripes extending posteriorly to reach the limiting spots, and a small frontal spot adjoining the ocular spot); cervical grooves deep, rather wide, curved with the convexity external; punctations numerous, large, confluent in places; eyes rather small, pale and flat. *Venter*: similar to dorsum; genital aperture opposite the interspace between coxae I and II; spiracles large, triangular, with rounded angles. *Capitulum*: *L.* 1·8 mm., long and narrow, basis triangular, postero-lateral angles slightly salient; porose areas large, oval, with a small transverse depression uniting their bases, interval rather less than diameter; palps long and slender, article 2 three-and-a-half times as long as article 3; hypostome long, spatulate, dentition 4 | 4. *Legs*: long and slender; coxa I with two well-separated, short, sub-equal spurs; two short spurs on each of coxae II–IV, the internal spur diminishing in size on the successive coxae; tarsi long, gradually attenuated at the distal extremity.

Description based on one of the 2 ♀s (types), off "Sabanera" (a small tortoise?), Retalhulen, **Guatemala, Central America,** O. Stoll (Trouessart Coll. Toulouse). Neumann (1899, p. 261) refers a badly-preserved ♀, measuring 20 × 15 mm. to this species, but with some doubt. There is no indication of the origin of the specimen, which differs from the type in the presence of a coppery spot at the posterior angle of the scutum, and in the absence of the transverse depression between the porose areas.

54. AMBLYOMMA SUPINOI Neumann, 1905.

Figs. 87 and 88.

Synon., Lit. and Iconogr.:

Ixodes testudinis Supino, F., 1897, p. 247, specific description of ♀, based on tarsus only; Tab. XII, Fig. 1, tarsus I; *a*, hypostome.

Aponomma testudinis (Supino) Neumann, L. G., 1899, pp. 199–200, specific description of ♀.

Amblyomma testudinis (Supino) Neumann, L. G., 1902, p. 124, description of ♀.

Amblyomma supinoi Neumann, L. G., 1905, p. 234, description of ♀; 1911, p. 88.

Amblyomma annandalei Warburton, C., 1910, p. 403, specific description of ♀; Fig. 8, capitulum and scutum, coxae, spiracle and anal groove.

Neumann first alludes to *Ixodes testudinis* Supino in the description of his *Aponomma testudinis* (1899, p. 199); in 1902 he recognised the species as belonging

to the genus *Amblyomma* and corrected his first description accordingly. In 1905 (p. 234), finding that the specific name *testudinis* was pre-occupied in *Amb. testudinis* (Conil) Lahille, Neumann renamed the species *Amblyomma supinoi.*

Male (Fig. 87). Diagnosis: A small tick; scutum broadly oval; ornate, with irregular, pale stripes in the antero-lateral fields, also near the lateral margins, anterior to, and opposite to, the external festoon, and a pair of symmetrically disposed curved patches at the posterior end opposite the 3rd to 5th festoons; marginal groove absent; punctations fine on the central part of the scutum, coarser in the marginal zone; hypostome dentition 3 | 3; coxa I–III each with two short, broad, rounded spurs; a single spur; one-and-a-half times as long as broad on coxa IV.

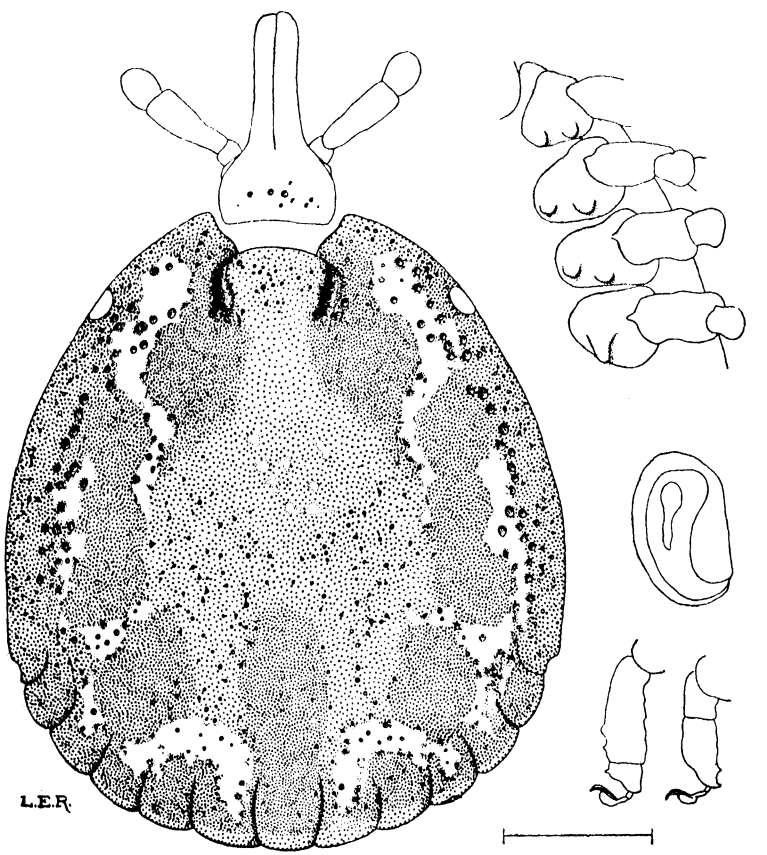


Fig. 87. *Amblyomma supinoi* ♀. Scutum, capitulum, coxae I–IV, spiracle, tarsi I and IV. (N. 3392.)

DESCRIPTION. *Body*: *L.* 4·3 mm., *W.* 3·8 mm., contour broad oval, lateral margins convex. *Scutum*: convex; ornate with pale stripes and spots on a dark-brown ground, (1) an irregular pale stripe extending from the scapular angle to the inner side of the 2nd lateral spot, (2) an irregular, pale stripe commencing at the outer side of the 1st lateral spot and extending posteriorly as far as the 2nd festoon, with a lateral prolongation which separates the 3rd lateral spot from the postero-accessory stripe, (3) a pair of curved, pale patches symmetrically disposed at the posterior end of the scutum adjacent to the 3rd to 5th festoons, separating the postero-median from the postero-accessory stripes, (4) indistinct and irregular, small, pale spots on the central fields of the scutum; postero-median and postero-accessory stripes short and broad; lateral spots large, conjoined, forming a lateral dark band which is fused at its anterior end with the dark marginal coloration; cervical stripes and frontal spots fused to form a pair of broad, dark patches in the anterior part of the scutum, fading posteriorly into the moderately dark-coloured central part of the scutum; cervical grooves deep, curved; marginal groove absent; punctations fine on the central part of the scutum, coarse in the marginal zone, especially in the antero-lateral fields and along the lateral margins from the eye to the external festoon; festoons well-defined, separations narrow. *Venter*: spiracles large, ovoid. *Capitulum*: *L.* 0·95 mm., basis rectangular, lateral margins slightly convex, postero-lateral angles non-salient; palps long, narrow, club-shaped, article 2 more than twice as long as article 3; hypostome dentition 3 | 3. *Legs*: coxae I–III each with two short, rounded, well-separated, sub-equal spurs; a single spur, one-and-a-half times as long as broad on coxa IV; tarsi attenuated in talus.

Female (Fig. 88). Diagnosis: A small tick; scutum cordiform, posterior angle narrow, ornate, with a large irregular pale patch in each lateral field and a more or less extensive pale spot in the median field; punctations unequal, coarse in the lateral fields; eyes pale and flat, situated at the anterior third; porose areas large, oval, widely-separated; hypostome dentition 3 | 3; coxae I–III each with two short, broad, rounded spurs; a single similar spur on coxa IV.

DESCRIPTION. *Body*: *L.* 4·3 mm., *W.* 3·6 mm., contour broad oval; marginal groove continuous, festoons clearly defined. *Scutum*: 2·4 × 2·6 mm., cordiform, postero-lateral margins convex, posterior angle narrow; ornate, with an irregular, pale patch in each lateral field, eroded on the external side by the ocular spot, on the internal side by the frontal spot;

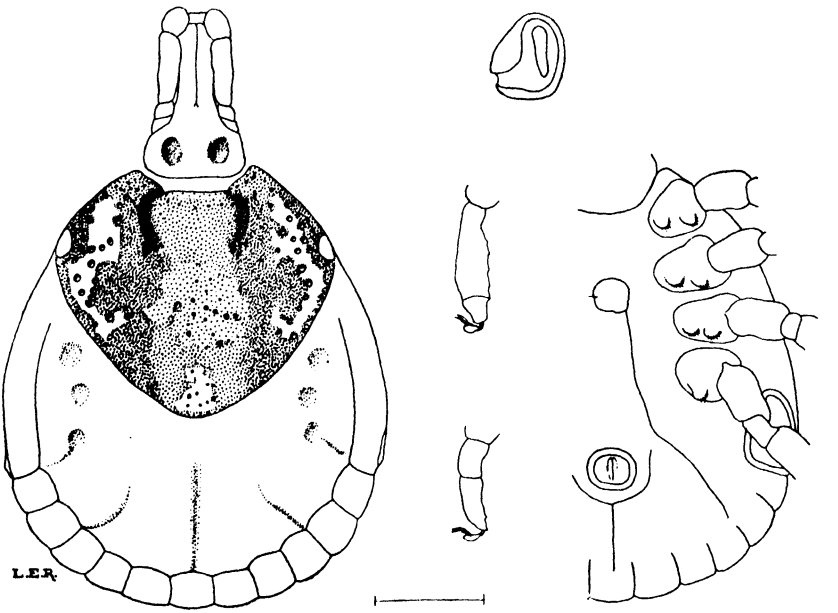


Fig. 88. *Amblyomma supinoi* ♀. Dorsum, capitulum, venter, spiracle, tarsi I and IV. (Type, Genoa Mus.)

a more or less extensive, pale patch in the median field; cervical grooves deep, curved, with the convexity external; punctations numerous, unequal, coarse in the lateral fields; eyes pale and flat. *Venter*: genital aperture opposite the interspace between coxae II and III; spiracles large, sub-triangular with broadly rounded angles. *Capitulum*: *L.* 1·6 mm., basis rectangular, lateral margins convex, postero-lateral angles non-salient; porose areas large, oval, interval nearly twice the diameter; palps long, slender, club-shaped, article 2 more than twice as long as article 3; hypostome dentition 3 | 3. *Legs*: long, coxae I–III each with two short, broad, rounded spurs; a single similar spur on coxa IV; tarsi attenuated in talus.

Geographical Distribution and Hosts.

Supino's specimen, a single ♀, came from Bhamo, **Burma,** L. Fea coll. (Genoa Mus.). Neumann records specimens from Burma, and lists as hosts: *Testudo elongata* Blyth, *Nicoria trijuga* (Schweigg.), and *Varanus bengalensis* Daud. The Cambridge collection contains ♂s, off *Testudo elongata*, Baradighi, Yalpaiguri District, **Bengal, India,** VII. 1916, W. L. Travers coll. (N. 3392), and a ♀, off *Geoemyda spinosa*, India (Burma?), Dr N. Annandale coll. (Indian Mus., Calcutta, No. 19/1; N. 1106).

55. AMBLYOMMA CRUCIFERUM Neumann, 1901.

Fig. 89.

Lit. and Iconogr.: Neumann, L. G., 1901, p. 302, description of the ♂; 1911, pp. 88–89: Dönitz, W., 1909, pp. 448–449, description of ornamentation, Fig. 8, ♂ dorsum.

Male (Fig. 89). Diagnosis: A small tick, about as broad as long; marginal groove absent; general colour earthy-yellow with indistinct brownish ornamentation; punctations numerous; hypostome dentition 3 | 3; coxae I–III each with two short, blunt spurs; a single similar spur on coxa IV.

DESCRIPTION. *Body*: short, *L.* 3·0 mm., *W.* 2·8 mm., widest at posterior third, posterior border broadly rounded. *Scutum*: slightly convex, general colour dirty-yellow with indistinct brownish ornamentation; postero-median stripe rather broad, not knobbed at the extremity; postero-accessory stripes extending horizontally towards the median line from the level of the second festoon, forming with the postero-median stripe a cruciform figure from which the specific name is derived; diverging on each side from the anterior extremity of the postero-median stripe, the anterior accessory stripes extend towards the lateral margins; immediately anterior to these an indistinct falciform stripe can be recognised;

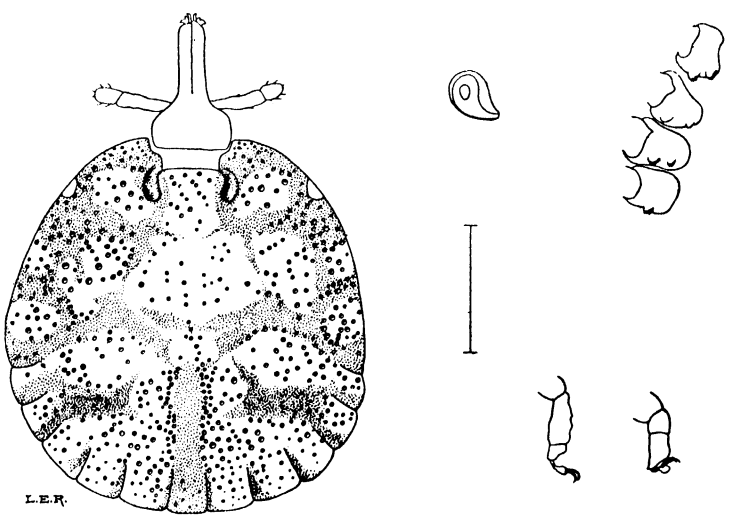


Fig. 89. *Amblyomma cruciferum* ♂. Scutum, capitulum, spiracle, coxae I–IV, tarsi I and IV. (Type, Berlin Mus.)

the three lateral spots are almost unrecognisable, being confused with the dark marginal coloration which itself is interrupted by two pale spots between the eye and the external festoon; the frontal spot bridges the interval between the cervical stripe and the ocular spot; cervical grooves short and deep; punctations numerous, not confluent, shallow, almost absent from the dark markings of the scutum which are themselves slightly raised above the general surface; marginal groove absent; eyes indistinct, pale and flat. *Venter*: dirty yellow; genital aperture opposite coxa II; spiracles small, comma-shaped, dorsal process almost pointed. *Capitulum*: relatively long, *L.* 1 mm., basis rectangular, lateral margins slightly convex, postero-lateral angles non-salient; palps long and slender, article 2 more than twice as long as article 3; hypostome spatulate, dentition 3 | 3. *Legs*: short, stout, yellowish with brown markings; coxae I–III each with two short, blunt, rounded spurs; coxa IV with a single similar spur; tarsi small, attenuated in talus.

Female: unknown.

Neumann's description is based on 4 ♂s (with 2 nymphs) off an iguana —*Metopoceros cornutus*—from **Haiti, West Indies** (Berlin Mus.). These are the only specimens known.

56. AMBLYOMMA CORDIFERUM Neumann, 1899.

Fig. 90.

Lit.: Neumann, L. G., 1899, pp. 218–219; 1911, p. 84.

Male: unknown.

Female (Fig. 90). Diagnosis: A large, inornate species; scutum cordiform, eyes situated at anterior third of length, punctations moderately coarse and practically limited to anterior half of scutum; capitulum long; palps slender and flattened on ventral surface; porose areas moderately large, elliptical and widely separated; spiracles triangular, with a large, rounded, dorsal prolongation; coxa I with two widely-separated spurs of which the external is the longer; coxae II and III with two spurs, the internal one of which is reduced to a small tubercle; coxa IV with a single spur.

DESCRIPTION. *Body*: *L.* 23·4 mm., *W.* 17·2 mm. (gorged), rounded anteriorly and posteriorly, sides sub-rectilinear and parallel; colour earthy yellowish-brown; dorsum glabrous, marginal groove absent, other grooves and festoons normal. *Scutum*: broader than long, 2·8 × 3·4 mm.,

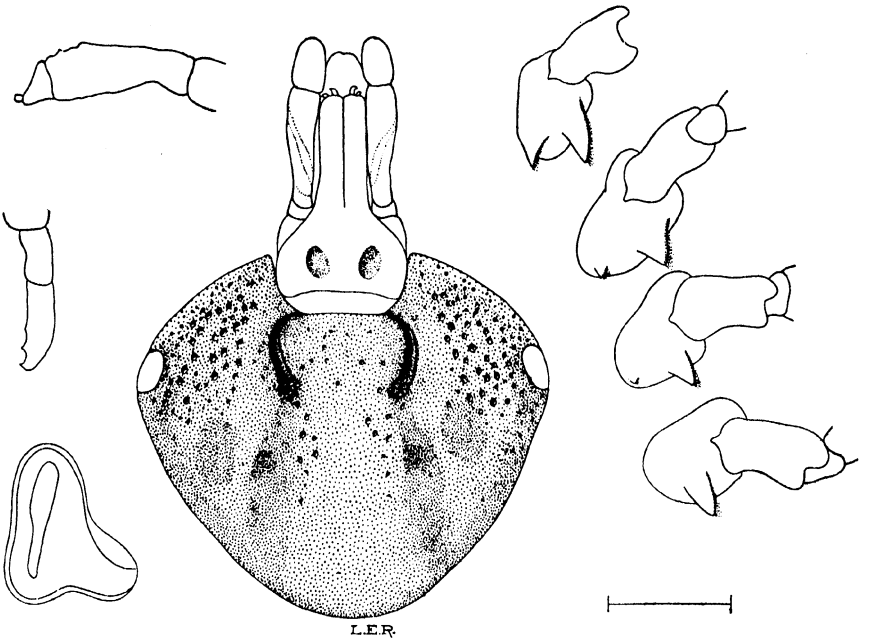


Fig. 90. *Amblyomma cordiferum* ♀. Scutum, capitulum, coxae I–IV, spiracle, tarsi I and IV. (Type, Hamburg Mus.)

cordiform, posterior angle broad; colour earthy-brown with darker markings in the form of indistinct cervical stripes, ocular and frontal spots and a narrow margin extending from the eyes to the posterior angle; margin from the eye to the scapular angle pale in colour; cervical grooves narrow, deep and curved, each terminating posteriorly in a depression formed by a group of contiguous punctations; eyes large, elliptical, flat and pale, situated at the level of the anterior third of the scutum; punctations moderately large, shallow, numerous in the anterior part of the lateral fields, few between the cervical grooves and along the inner margins of the cervical stripes, absent in the posterior part of the scutum. *Capitulum*: *L.* 2·0 mm.; basis capituli rectangular, posterior margin almost straight, postero-lateral angles barely salient; porose areas moderately large, elliptical, divergent anteriorly, interval equal to almost twice the diameter; palps long and slender, article 2 contracted proximally, more than twice as long as article 3, flattened on ventral face, hypostome long, dentition 4 | 4. *Venter*: colour, etc., as dorsum; spiracle triangular with a large, rounded, dorsal prolongation, frame narrow. *Legs*: of medium size, chestnut-brown with paler colour at the distal extremities of the articles; coxa I with two widely-separated. triangular, pointed spurs,

of which the external is about twice the length of the internal; on coxae II–IV the internal spur becomes progressively reduced in size, being represented by a small tubercle on coxa III and completely absent on coxa IV; tarsi attenuated obliquely (tarsi III and IV and the pulvilli of all the legs are missing in the specimen).

Description based on the type, a single, gorged ♀ (No. E-K. 2699, verzeichn. 928) in the Zoological Museum, Hamburg, given by Gehrckens, from **Banda Is., Moluccas.** Host not specified.

57. AMBLYOMMA DEMINUTIVUM Neumann, 1899.

Fig. 91.

Lit.: Neumann, L. G., 1899, p. 221, specific description of ♀; 1911, p. 73.

Male: unknown.

Female (Fig. 91). Diagnosis: A moderately large tick; scutum very small, cordiform, broader than long, inornate, with few very coarse punctations in the lateral fields, fine elsewhere; capitulum short and broad; hypostome dentition 3 | 3; coxa I with two small, widely-separated spurs; coxa II with two small spurs, the internal spur very small; coxa III with the internal spur vestigial or completely absent; coxa IV with a single short spur.

DESCRIPTION. *Body*: *L.* 13·5–16·0 mm., *W.* 10·5–12·5 mm. (gorged specimens), dorsum dark-brown, finely wrinkled, with few scattered, shallow punctations. *Scutum*: relatively very small, 1·7 × 2 mm., cordiform, posterior angle narrow, postero-lateral margins sinuous; colour dark reddish-brown, inornate, glossy; cervical grooves deep anteriorly, curved with the convexity external, shallow and divergent posteriorly; punctations few and coarse in the antero-lateral fields, fine elsewhere. *Venter*: as dorsum; genital aperture opposite first coxal interspace; spiracles small, triangular with rounded angles. *Capitulum*: broad and short, *L.* 1·0 mm., basis rectangular, postero-lateral angles non-salient, porose areas large, oval, widely-separated, interval greater than diameter, slightly divergent; palps slightly contracted at base, sides almost parallel, article 2 two-and-a-half times as long as article 3; hypostome dentition 3 | 3. *Legs*: short and weak; coxa I with two widely-separated, divergent, small spurs; coxa II with two similar but smaller spurs, the internal spur sometimes much reduced; coxae III and IV each with a single spur,

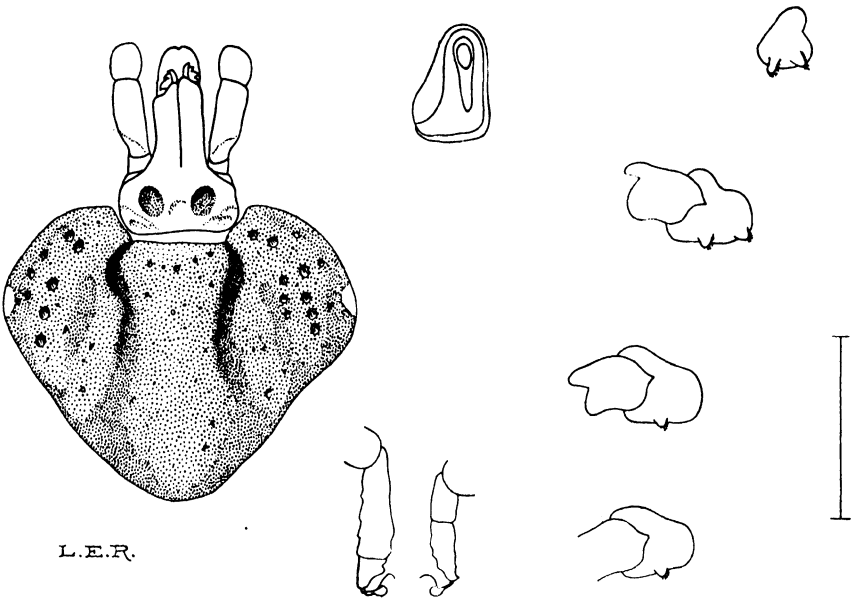


Fig. 91. *Amblyomma deminutivum* ♀. Scutum, capitulum, spiracle, coxae I–IV, tarsi I and IV. (N. 653.)

the internal spur being sometimes represented by a minute tubercle on coxa III and completely absent on coxa IV; tarsi attenuated in talus.

Description based on 4 gorged ♀s, off *snakes*, Menagerie des Reptiles, **Colombia, S. America** (Paris Mus.), and 1 gorged ♀ (Cambridge collection, N. 653), off *Boa constrictor*, **Brazil** (?), S. America, II. 1909, W. A. Harding coll. The Cambridge collection also contains a ♀, off *Lachesis lanceolatus* in the Zoological Society's Gardens, London, presented by Mr Gordon Merriman.

58. AMBLYOMMA CALCARATUM Neumann, 1899.

Figs. 92 and 93.

Lit.: Neumann, L. G., 1899, p. 226, short specific description of ♂ and ♀; 1911, p. 75.

Male (Fig. 92). Diagnosis: A small tick; scutum long oval; marginal groove absent; punctations numerous; cervical grooves short and deep; ornamentation in the form of an irregular pale spot in each antero-lateral field, small irregular pale spots scattered over the rest of the scutum; capitulum broad, postero-lateral angles

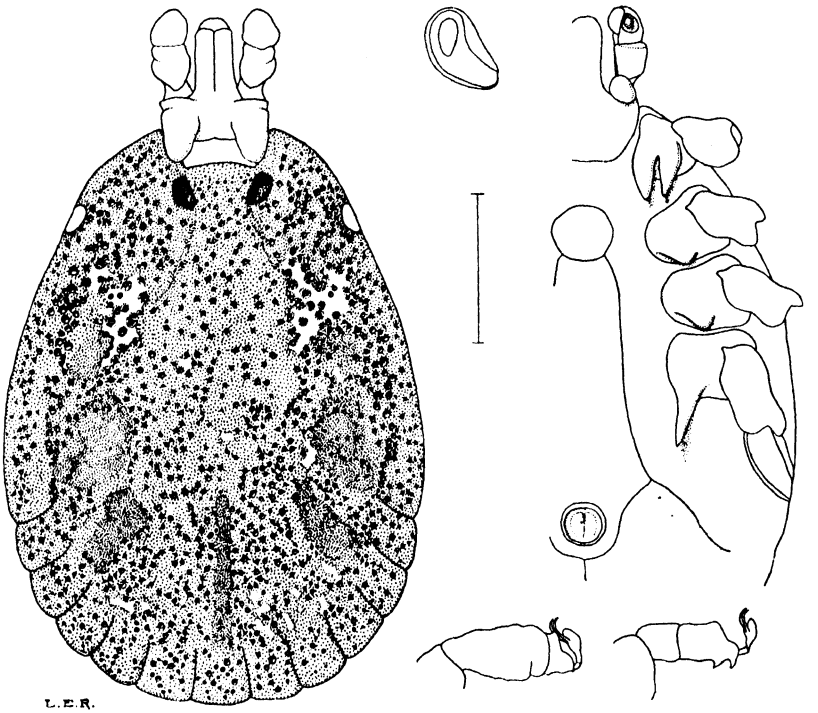


Fig. 92. *Amblyomma calcaratum* ♂. Scutum, capitulum, venter, spiracle, tarsi I and IV. (N. 2869.)

extending posteriorly as well-developed cornua; coxa I with a pair of long, pointed, contiguous spurs; a short, broad spur on each of coxae II–III; a long, pointed spur on coxa IV.

DESCRIPTION. *Body*: *L.* 3·9 mm., *W.* 2·8 mm., contour oval, moderately elongate, broadest behind middle. *Scutum*: light-brown, with an irregular pale spot in each antero-lateral field; small irregular pale spots and marblings scattered over the rest of the scutum excepting the marginal parts, the postero-median and accessory stripes and the lateral spots; these stripes and spots are distinguishable by their darker colour and the absence of punctations; marginal groove absent; cervical grooves in the form of short oval pits, divergent anteriorly; punctations numerous, unequal, coarsest in the antero-lateral fields; eyes moderately large, pale and flat; festoons longer than broad, clearly defined, intervals fine. *Venter*: genital aperture opposite coxa II; spiracles small, comma-shaped. *Capitulum*: broad and short, *L.* 0·8 mm. (not including cornua), basis short, rectangular; postero-lateral angles prolonged backwards as stout

cornua; palps short and thick, article 2 with a postero-dorsal point, and barely longer than article 3; hypostome with teeth limited to the anterior half; dentition 3 | 3. *Legs*: coxa I with a pair of long, pointed, sub-equal spurs; a broad, plate-like spur, running into a blunt point at its external part, on each of coxae II and III; a long, pointed spur on coxa IV; tarsi short, abruptly attenuated.

Female (Fig. 93). Diagnosis: A medium-sized tick; scutum cordiform, as long or longer than broad; ornate, with an irregular, pale spot in the posterior angle; punctations numerous, evenly distributed, coarsest in the antero-lateral fields; capitulum long, basis triangular, article 2 of the palp three times as long as article 3; coxa I with two long, stout, parallel spurs; a broad, plate-like spur on each of coxae II and III; a blunt, triangular spur on coxa IV.

Description. *Body*: *L.* 5·0 mm., *W.* 3·5 mm. *Scutum*: cordiform, 2·8 × 2·65 mm., emargination shallow; ornamentation consisting of a single, irregular, pale spot at the posterior angle; ground colour light

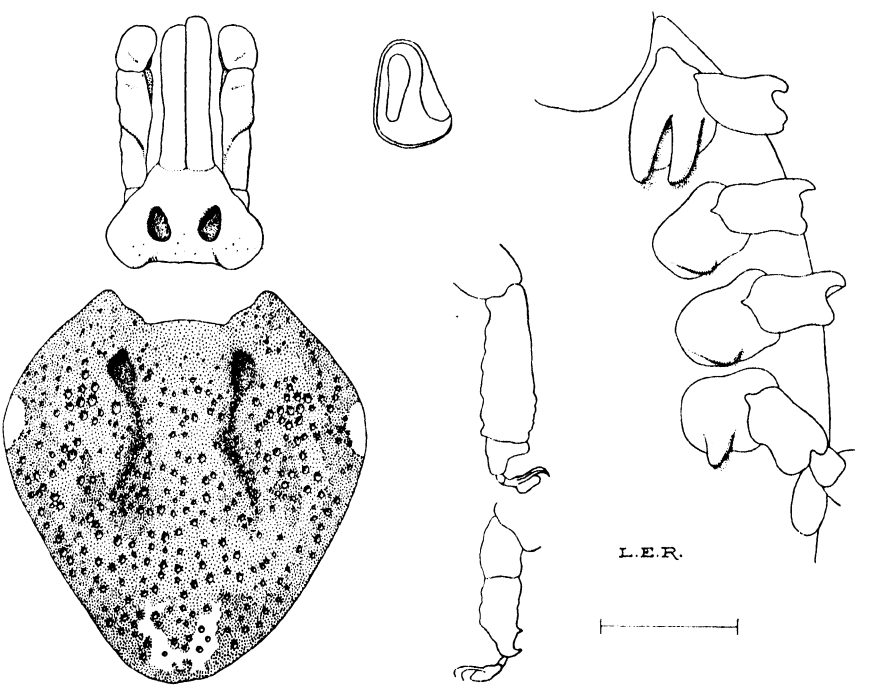


Fig. 93. *Amblyomma calcaratum* ♀. Scutum, capitulum, spiracle, coxae I–IV, tarsi I and IV. (N. 2869.)

reddish-brown, with a darker marginal zone, the cervical stripes and the frontal spots darker in colour; punctations numerous, evenly distributed, coarsest in antero-lateral fields; cervical grooves in the form of short, deep, ovoid pits from which a shallow groove extends posteriorly some little distance beyond the centre of the scutum; eyes large, pale and flat. *Venter*: spiracles relatively small, triangular, with rounded angles. *Capitulum*: *L.* 1·7 mm., basis triangular, postero-lateral angles broad, slightly salient; lateral margins very convex; porose areas medium in size, deep, ovoid and divergent, interval greater than diameter; palps long and slender, article 2 three times as long as article 3; hypostome dentition 3 | 3. *Legs*: coxa I with two long, stout, contiguous, parallel spurs; a broad, plate-like spur on each of coxae II and III; a short triangular spur, slightly longer than broad, on coxa IV; tarsus I abruptly attenuated; tarsi II–IV attenuated in talus.

Geographical Distribution and Hosts.

Neumann's original description was based on 14 ♂s and 8 ♀s, off *Myrmecophaga tetradactyla*, collected by Göldi; 2 ♂s, 1 ♀ and 1 nymph, Göldi coll.; 1 ♀ and 3 nymphs, P. S. de Magalhaes coll.; 1 ♂, Gounelle coll.; 2 ♀s, off a *dog*, Killmann coll. (Hamburg Mus.), all from **Brazil**; 1 ♀, from **Paraguay**, Cochelet coll. (Paris Mus.); and 1 ♂, without indication of origin, G. Marx coll. (Smithsonian Institution). The Cambridge collection contains ♂ and ♀ co-types presented by Prof. L. G. Neumann (N. 2869), and 2 ♂s, off *Tamandua tetradactyla*, S. Catharina, **Brazil**, 25. XI. 1915, W. Ehrhardt coll.

59. AMBLYOMMA MULTIPUNCTUM Neumann, 1899.

Fig. 94.

Lit.: Neumann, L. G., 1899, pp. 226–227, description of ♂; 1911, p. 75, brief description of ♂.

Male (Fig. 94). Diagnosis: A medium-sized tick, closely resembling *Amb. calcaratum*, of which it may be but a variety; scutum dark reddish-brown, inornate; marginal groove absent; punctations very numerous, deep, densely crowded except on the parts corresponding in position to characteristic spots and stripes, the antero-median field, the extreme lateral borders and the festoons; coxa I with two large, flat, contiguous spurs; a salient ridge, slightly bifid in the middle, on each of coxae II and III; a long, stout, pointed spur on coxa IV.

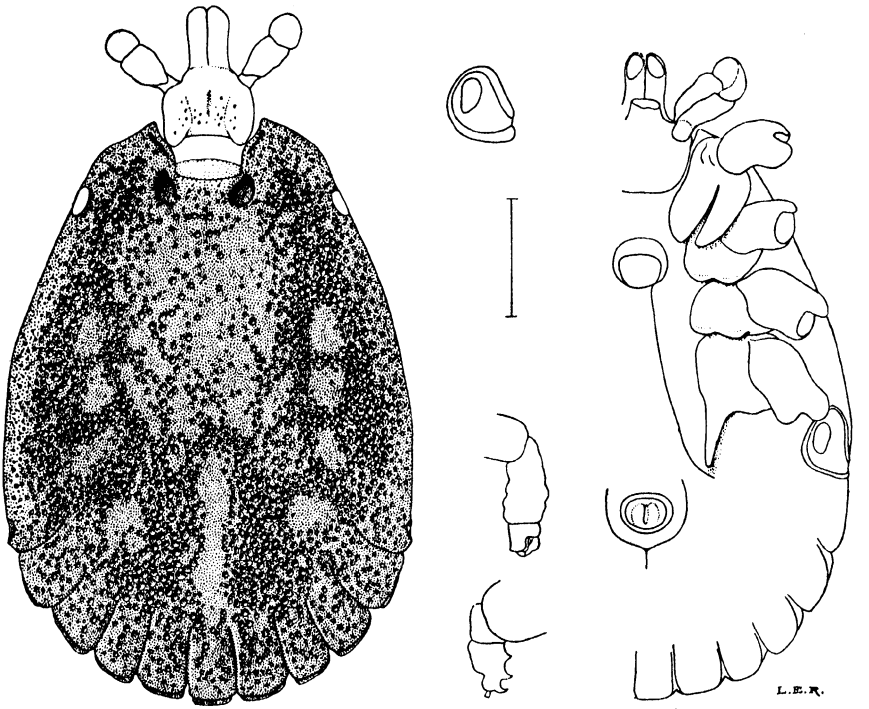


Fig. 94. *Amblyomma multipunctum* ♂. Scutum, capitulum, venter, spiracle, tarsi I and IV. (Type, Toulouse Mus.)

DESCRIPTION. *Body*: *L.* 5 mm., *W.* 3·6 mm.; contour oval, sides rounded. *Scutum*: inornate, dark reddish-brown; cervical grooves in the form of short, deep, oval pits; marginal groove absent; punctations very numerous, moderately large, deep, densely crowded except on the areas corresponding in position to the postero-median, postero-accessory and antero-accessory stripes, and the lateral spots, also the antero-median field, the extreme lateral borders and the festoons; eyes pale and flat; festoons long, well-defined, separations narrow. *Venter*: dark reddish-brown; genital aperture opposite the posterior border of coxa II; spiracles small, broad comma-shaped. *Capitulum*: *L.* 1 mm.; basis rectangular, postero-lateral angles salient; palps short and thick, constricted at base; article 1 with a broad, flat, retrograde process on the ventral face, article 2 one-and-a-half times as long as article 3; hypostome dentition 4 | 4. *Legs*: stout; coxa I with two large, flat, contiguous spurs covering the anterior part of coxa II; a broad, salient ridge, partly divided in the

middle, on coxae II and III; a single long, pointed spur on coxa IV; tarsi short and thick, abruptly attenuated.

Female: unknown.

Neumann's description is based on 2 ♂s, one of which I have examined and figured, off *Tapirus* sp. and *Dicranoceros furcatus*, **North America**, Donckier coll. (Trouessart Coll., Toulouse). Neumann (1911, p. 75) adds **Venezuela, S. America**, as a country of origin.

60. AMBLYOMMA NODOSUM Neumann, 1899.

Figs. 95 and 96.

Synon., Lit and Iconogr.:

Amblyomma nodosum Neumann, L. G., 1899, pp. 224–225, specific description of ♂ and ♀; 1902, p. 121, a note on an abnormality in the festoons of the ♀; 1911, p. 76, brief description of the ♂ and ♀.

Amblyomma uncatum Nuttall and Warburton, 1908, pp. 412–414, specific description of ♂; Figs. 37–40, ♂ dorsum, coxae I–IV, capitulum from dorsal and ventral aspects, digit of chelicera, and spiracle. I had recognised the identity of *Amb. uncatum* with *Amb. nodosum* when Aragão called attention to the fact in his *Notas Ixodidologicas* (1918, p. 4 of separate).

Male (Fig. 95). Diagnosis: A small tick; scutum with characteristic pale ornamentation on a dark-brown ground; marginal groove absent; capitulum broad and short, palps somewhat resembling those of a *Haemaphysalis*; coxa I with two long, stout spurs; coxae II and III each with a short, wide, flat spur; coxa IV with a single moderately long spur.

Description. *Body*: *L.* 3·7–4·1 mm., *W.* 2·9–3·2 mm., contour oval, little wider behind than in front. *Scutum*: slightly convex, general colour dark-brown with pale ornamentation—(1) a J-shaped pale spot in each antero-lateral field, (2) small, scattered, pale spots in the median part of the scutum, (3) a pair of symmetrically disposed pale spots at the posterior end of the scutum, immediately anterior to the festoons; small pale spots on the two external festoons; marginal groove absent; cervical grooves in the form of short, deep, oval pits, very divergent; emargination shallow; punctations numerous, medium in size, equal, distributed fairly evenly over the whole scutum; eyes pale and flat (Neumann describes them as being reddish in colour, a condition doubtless due to defective preservation of the specimen); festoons clearly defined, longer than broad, intervals narrow. *Venter*: paler than dorsum, glabrous, punctate; genital aperture opposite coxa II; spiracles relatively small, short,

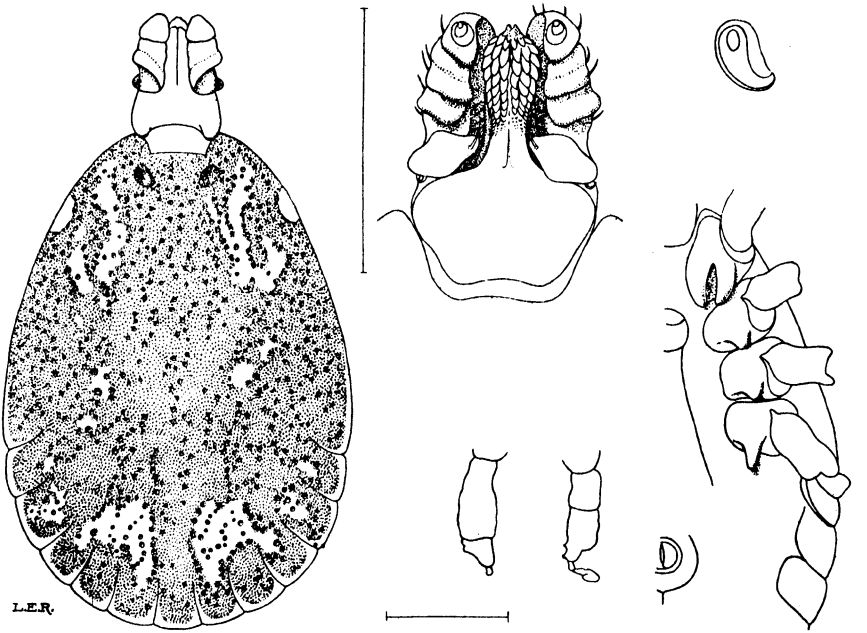


Fig. 95. *Amblyomma nodosum* ♂. Scutum, capitulum from dorsal and ventral aspects, spiracle, venter, tarsi I and IV. (N. 2875.)

comma-shaped. *Capitulum*: short, *L.* 0·9–1·1 mm.; broad; basis capituli nearly three times as broad as long, postero-lateral angles produced into stout, blunt cornua; palps short, conical, article 1 with a broad, flattened expansion on its ventral face, article 2 with a pronounced, salient, posterior margin which traverses the ventral face, projects laterally and is continued at the mesial side of the dorsal face into a strong retrograde spine; hypostome short, broad and spatulate; dentition 3 | 3, teeth covering fully two-thirds of the total length. *Legs*: of medium size, dark-brown in colour; coxa I with two long, stout, parallel, contiguous, blunt, sub-equal spurs; coxae II and III each with a short, broad spur projecting in a rounded tubercle at its external part; coxa IV with a similar but longer spur; tarsi abruptly attenuated.

Female (Fig. 96). Diagnosis: Scutum oval-cordiform, with a Y-shaped pale spot in each lateral field and a small pale spot at the posterior angle; cervical grooves in the form of small, deep, oval pits; punctations numerous, moderately coarse; capitulum of medium size; coxa I with two sub-equal, long spurs; a single, short, flattened spur on coxae II–IV.

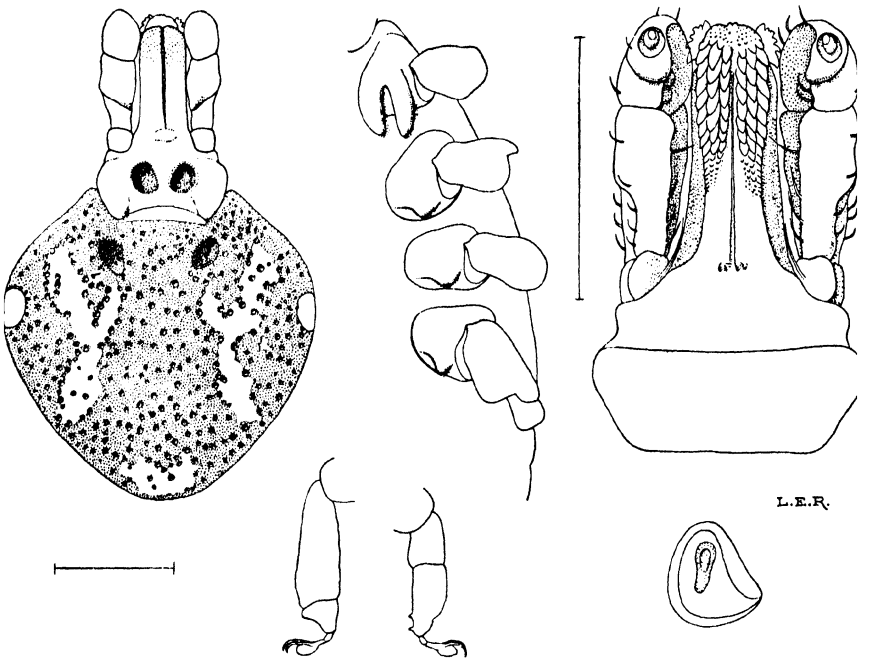


Fig. 96. *Amblyomma nodosum* ♀. Scutum, capitulum from dorsal and ventral aspects, coxae I–IV, tarsi I and IV, spiracle. (N. 2875.)

DESCRIPTION. *Body*: *L.* 5 mm., *W.* 3·5 mm., dorsum dark-brown, rugose and punctate, marginal groove present, festoons well-defined. *Scutum*: oval-cordiform, 2·5 × 2·6 mm., dark-brown, with pale ornamentation in the form of a Y-shaped figure in each lateral field and a small, pale spot at the posterior angle; punctations numerous, moderately coarse, evenly distributed; cervical grooves in the form of small, deep, oval pits, very divergent; eyes pale and flat, situated a little anterior to the middle of the scutum. *Venter*: earthy-brown, punctate, with fine scattered hairs in its posterior half; festoons distinct; genital aperture narrow, situated opposite the posterior margin of coxa II; spiracles rather small, short, pear-shaped. *Capitulum*: *L.* 1·6 mm., basis nearly three times as broad as long, lateral margins convex, posterior margin concave, postero-lateral angles salient, porose areas of medium size, ovoid, divergent, interval less than diameter; palps long, article 2 with oblique ridge on the dorsal side only, twice as long as article 3; hypostome long, dentition 3 | 3. *Legs*: long; coxa I with two long, stout, sub-equal, contiguous, parallel spurs; coxae II–IV each with a short, broad spur, projecting as a rounded tubercle at the external part, longest

on coxa IV; tarsi less abruptly attenuated than in the ♂. Gorged ♀s may attain a size of 10 × 7 mm.

Geographical Distribution and Hosts.

Neumann records ♂s, ♀s and nymphs, host not specified, from **Costa Rica**, Lafon coll. (Paris Mus.); 1 ♂, found free, **Brazil**, Göldi coll. Aragão (1911, pp. 159 and 162) reports specimens from Xerém, State of Rio, Pirapóra, State of Minas Geraes, and the banks of the Guaporé R., State of Matto Grosso and cites as hosts *Myrmecophaga jubata* L., and *Myrmecophaga* sp. Nuttall's and Warburton's specimens (N. 36) (*Amb. uncatum*) comprised 5 ♂s, off *Tamandua tetradactyla*, S. America. The host arrived at the Zoological Society's Gardens, London, 10. XII. 1905, and died 22. XII. 1905. The Cambridge collection also contains ♂ and ♀, off "Ameisenbär," **Guatemala**, ex Berlin Mus. (N. 257); a ♂, off *Myrmecophaga jubata*, Lassance, State of Minas, Brazil, 1908, the gift of Dr H. de B. Aragão (N. 1269); ♂s off *Tamandua tetradactyla*, ? Zool. Soc. Gardens, London, Dr L. W. Sambon donor, 1905; ♀, found in cage where 3-toed sloth (*Bradypus*) had been kept, Ancon, Canal zone, **Panama** 19. IV. 1913, Dr S. T. Darling coll. (N. 2317), and ♂ and ♀ co-types, from **Costa Rica**, de Lafon coll., Paris Mus., presented by Prof. L. G. Neumann (N. 2875).

61. AMBLYOMMA INCISUM Neumann, 1906.

Figs. 97 and 98.

Lit. and Iconogr.: Neumann, L. G., 1906, pp. 206–207, specific description of ♂; Fig. 8, posterior part of ♂ venter; 1911, p. 76, short description of ♂; Aragão, H. de B., 1911, pp. 175–177, specific description of ♀; Pl. XI, Fig. 13, ♀ dorsum.

Male (Fig. 97). Diagnosis: A large species; scutum ornate; punctations large, numerous, unequal, areolate; marginal groove broad and shallow, sometimes indistinct, not continuous; capitulum relatively long; coxa I with two moderately long, stout, contiguous spurs; a broad, plate-like spur, with a cusp at the external extremity, on each of coxae II and III; a short, triangular spur on coxa IV; festoons with ventral scutes prolonged into salient translucent projections at the posterior margin, some of which are bifid.

DESCRIPTION. *Body*: *L.* 7·0 mm., *W.* 4·5 mm., contour oval, a little wider behind than in front. *Scutum*: convex, ornate, postero-median

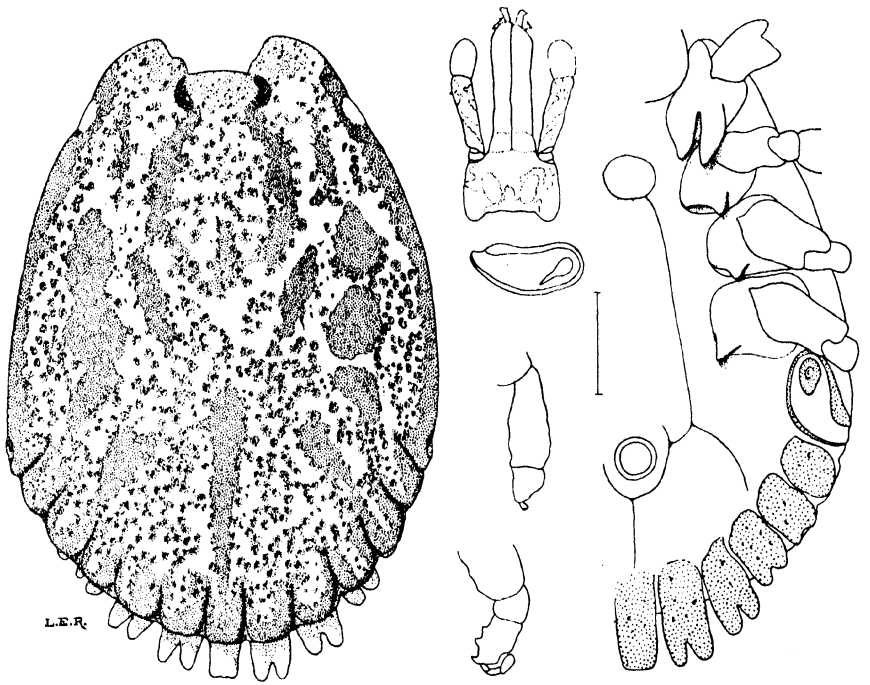


Fig. 97. *Amblyomma incisum* ♂. Scutum, capitulum, venter, spiracle, tarsi I and IV. (N. 1265.)

stripe extending nearly to the middle of the scutum; postero-accessory stripes directed towards the centre of the scutum; lateral spots separate or conjoined, distinct from the marginal dark coloration, the latter a narrow band extending from the eye to the external festoon; antero-accessory stripes and limiting spots conjoined as a pair of divergent stripes within, and at the level of, the 1st and 2nd lateral spots; frontal spot elongate, narrow; cervical stripes long, barely reaching the limiting spots; ocular spot insignificant; punctations numerous, moderately large, clustered, areolate; marginal groove short, broad and shallow, sometimes indistinguishable; cervical grooves short and deep, sigmoid; eyes medium, flat and pale, situated far forward; festoons well-defined, each marked with an extension of the pale ground of the scutum. *Venter*: glabrous, with fine punctations; genital aperture opposite coxa II; spiracles large, comma-shaped; festoons very distinct, each with a large, ventral scute, the posterior margin of which is produced posteriorly beyond the general body contour in the form of a flat, translucent, chitinous plate, the free margin of which is entire in the median festoon but deeply incised in the

5th, the notches gradually decreasing in depth as the external festoon is approached. *Capitulum*: *L.* 1·9 mm., basis rectangular with pale enamelling on the dorsal surface, twice as broad as long, postero-lateral angles slightly salient; palps with pale enamelling on the dorsal side, with long hairs, article 2 twice as long as article 3; hypostome very spatulate, dentition 3 | 3. *Legs*: long and stout; coxa I with two moderately long, equal, stout, flattened, parallel spurs; a single, broad, plate-like spur, produced into a point at the external angle, on each of coxae II and III; a single, triangular, pointed spur on coxa IV; tarsi abruptly attenuated.

Female (Fig. 98). Diagnosis: A medium-sized tick; scutum triangular, ornate; cervical grooves short, deep, sigmoid; punctations deep, areolate; hypostome dentition 4 | 4; coxa I with two moderately long stout spurs; coxae II–IV each with a single short spur.

Description. *Body*: elliptical, *L.* 5·5 mm., *W.* 3·3 mm., dorsum dark-brown, rugose, with numerous coarse punctations; marginal groove present, continuous. *Scutum*: 2·5 × 2·8 mm., triangular, ornate; a dark marginal coloration extending from the scapular angle to the limiting spot; frontal spots small, fused with the marginal coloration; cervical stripes narrow and divergent posteriorly; punctations numerous, large

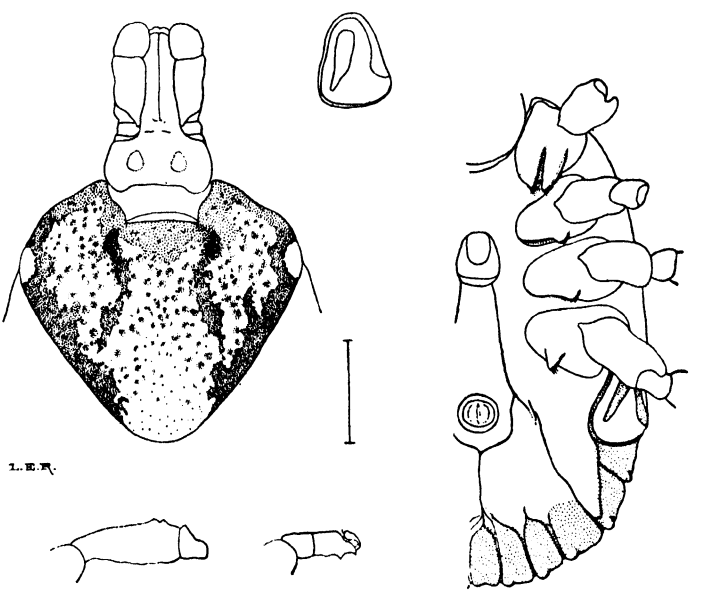


Fig. 98. *Amblyomma incisum* ♀. Scutum, capitulum, venter, spiracle, tarsi I and IV. (N. 1897.)

in the anterior half of the scutum, deep, areolate; cervical grooves short and deep, sigmoid; eyes medium, pale and flat. *Venter*: dark-brown, glabrous, punctations small; genital aperture opposite the interspace between coxae II and III; spiracles large, triangular with rounded angles; festoons each with a dark-coloured ventral scute bearing a small rounded tubercle at the postero-internal angle. *Capitulum*: *L.* 1·6 mm., basis rectangular, more than twice as broad as long; postero-lateral angles rounded and slightly salient; porose areas small, oval and widely-separated; palps long, moderately stout; article 2 twice as long as article 3; hypostome spatulate, dentition 4 | 4. *Legs*: as in the ♂.

Geographical Distribution and Hosts.

Neumann's description of the species is based on 1 ♂, from Cuenca, **Ecuador**, and 2 ♂s, off *Tapirus* sp., from **Bolivia** (in one of these ♂s Neumann notes that the ventral salient plates of the festoons are not bifid). His later description (1911) cites *Tamandua tridactyla* (L.). Aragão records the species as being found in **Brazil**, chiefly on *Tapirus americanus*, but also on *Canis azarae* and *Cervus campestris*, in Baurú, Avanhandava and São Luiz do Parahytinga, State of San Paulo, and Cerro Frio and Rio Tambaquari, State of Minas Geraes. The Cambridge collection contains 1 ♂, off *Tapirus americanus*, São Luiz do Parahytinga, State of San Paulo, Brazil, XI. 1908 (N. 1265) and 1 ♀ off the same host, from Estado do Espirito Santo, 1908, Brazil (N. 1897), both specimens given by Dr H. de B. Aragão.

62. AMBLYOMMA SCUTATUM Neumann, 1899.

Fig. 99.

Lit.: Neumann, L. G., 1899, pp. 237–238, specific description of ♂ and ♀; 1911, p. 73, brief description of ♂ and ♀.

Male (Fig. 99). Diagnosis: A small tick; scutum ornate, with dark-brown stripes and spots on a pale ground; marginal groove absent; eyes pale and flat; hypostome dentition 3 | 3; coxa I with two very short spurs; a similar spur, and a minute tubercle, on coxa II; a single short spur on each of coxae III and IV, slightly longer on coxa IV.

DESCRIPTION. *Body*: *L.* 3·5 mm., *W.* 2·6 mm., contour almost elliptical. *Scutum*: convex; ornate, with characteristic arrangement of stripes and spots; postero-median stripe and postero-accessory stripes

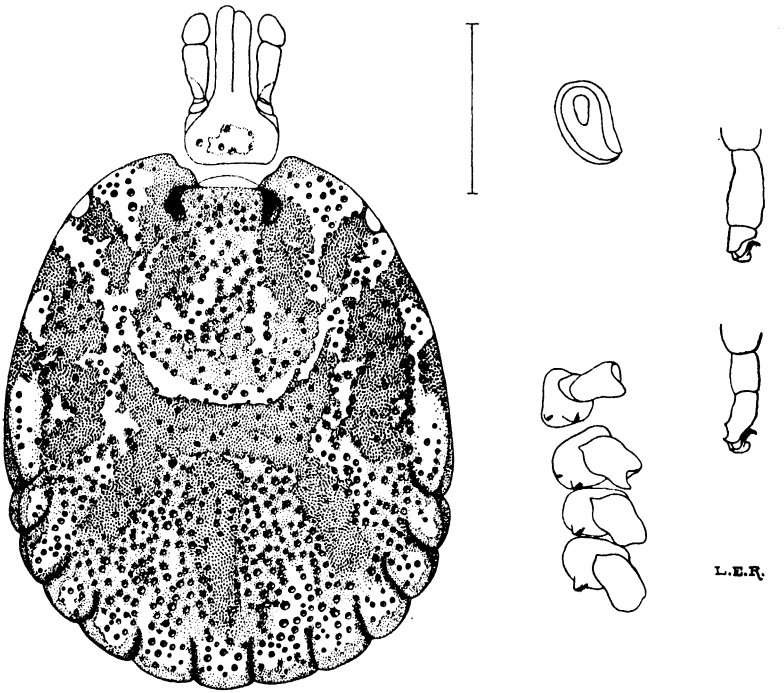


Fig. 99. *Amblyomma scutatum* ♂. Scutum, capitulum, coxae I–IV, spiracle, tarsi I and IV. (N. 2876.)

broad, attaining anteriorly to the broad falciform stripe; lateral spots conjoined; frontal spot more or less fused with the ocular spot; four pale spots on the marginal ridge between the eye and the external festoon, the first merging into the general pale ground, the two last conjoined; festoons each with a more or less extensive pale coloration; the pale ground may be more or less discoloured between the cervical stripes and the falciform stripe and elsewhere (probably as a result of defective preservation); cervical grooves short, deep, sigmoid; marginal grooves absent; punctations numerous, of medium size, dark-coloured, fairly evenly distributed; eyes pale and flat. *Venter*: earthy-yellow, wrinkled and punctate in posterior part; genital aperture opposite posterior margin of coxa II; spiracles small, comma-shaped. *Capitulum*: *L.* 1–1·3 mm., basis rectangular, postero-lateral angles non-salient, lateral margins slightly convex; palps short, club-shaped, article 2 twice as long as article 3; hypostome narrow, spatulate, dentition 3 | 3. *Legs*: medium; coxae small, coxa I with two very short spurs; coxa II with

two spurs, the external very short, the internal a minute tubercle; a single very short spur on each of coxae III and IV, slightly longer on coxa IV; tarsi attenuated in talus; pulvilli small.

Female. Diagnosis: A small tick; scutum cordiform, broader than long, posterior angle broad; ornate, with dark-brown markings on a pale ground; punctations medium, numerous, fairly regularly distributed; eyes pale and flat; porose areas small, widely-separated; hypostome dentition 3 | 3; coxa I with two very short spurs; a single similar spur on each of coxae II–IV.

DESCRIPTION. *Body*: *L.* 3·7 mm., *W.* 3·0 mm., contour oval, narrower than in the ♂; dorsum yellowish-brown, glabrous, marginal groove present; festoons well-defined. *Scutum*: 1·9 × 2·4 mm., cordiform, posterior angle broad, postero-lateral angles slightly convex; ornate, with dark-brown markings on a pale ground; cervical stripes broad, fused posteriorly with the limiting spots; ocular spots and frontal spots large, conjoined; median field with an irregular, dark, longitudinal patch; cervical grooves deep anteriorly, shallow posteriorly, extending to the posterior third of the scutum; punctations numerous, of medium size, fairly regularly distributed; eyes of medium size, pale and flat. *Venter*: similar in colour to dorsum; genital aperture opposite the posterior margin of coxa II; spiracles small, comma-shaped. *Capitulum*: *L.* 1·2 mm., basis rectangular, postero-lateral angles non-salient; porose areas small, widely-separated; hypostome dentition 3 | 3. *Legs*: relatively longer than those of the ♂; coxa I with two very short spurs; a single, similar spur on each of coxae II–IV; tarsi attenuated in talus.

Geographical Distribution and Hosts.

Neumann (1899, p. 238) records the following: 4 ♂s and 7 ♀s, off *lizard*, Guatemala, Soula coll., and 17 ♂s and 1 ♀, off *Iguana tuberculata*, Champerico, **Guatemala, Central America** (Hamburg Mus.); also a ♀, off *Bothrops lanceolatus*, origin not stated (Railliet coll.). I am doubtful about the accuracy of the determination of the nymphs, which are recorded by Neumann as belonging to this species, one of which was found on *Noctilio albiventer*, in **Paraguay** (British Mus.), and others on *Cathartes uruba*, *Didelphys pusilla* and *Dasyprocta croconata*, **Brazil** (Göldi coll.). The occurrence of a ♂ and nymph on a Virginian deer, in the Zoological Gardens, Hamburg, is noted by Neumann. The Cambridge collection contains a ♂ and ♀ (co-type), off *lizard* (sp.?), Guatemala, de Sorda coll., 1855, presented by Prof. L. G. Neumann (N. 2876).

63. AMBLYOMMA VARIUM Koch, 1844.

Figs. 100 and 101.

Synon., Lit. and Iconogr.:

Amblyomma varium Koch, C. L., 1844, p. 224, brief description of the ♂; 1847, pp. 56–57, description of the ♂; Tab. VIII, Fig. 30, ♂ dorsum (coloured). 1899, Neumann, L. G., pp. 246–247, specific description of the ♂. 1901, Neumann, L. G., pp. 304–305, specific description of the ♀. 1911, Neumann, L. G., p. 76, brief description of the ♂ and ♀.

Amblyomma crassipunctatum Stoll, O., 1886–1893, p. 22, inadequate description of the ♂; Pl. XIV, Fig. 1. 1899, Neumann, L. G., p. 247.

Male (Fig. 100). Diagnosis: A large tick; scutum elongate oval, narrow in front; indistinctly ornate with dark spots and stripes, often slightly raised, on a pale to dark reddish-brown ground; marginal groove absent; cervical grooves small, oval and deep; punctations numerous, coarse, regularly distributed, absent from the dark spots and stripes; eyes small, pale and flat; palps short; coxa I with two rather short, stout, sub-equal spurs; a single, short, blunt spur on each of coxae II–IV; tarsi attenuated in talus.

DESCRIPTION. *Body*: *L.* 6·8–7·5 mm., *W.* 4·5–6 mm.; contour elongate oval, narrower in front than behind; some examples broader in proportion to the length than others. *Scutum*: rather flat; pale brown to dark reddish-brown with the characteristic spots and stripes appearing as smooth, slightly salient, dark-brown areas; postero-median stripe long, extending anteriorly almost to the middle of the scutum; postero-accessory stripes isolated, slightly inclined from the vertical; lateral spots small, isolated; antero-accessory stripes short, isolated, slightly divergent anteriorly; frontal spots present; cervical stripes divergent and tapering posteriorly; in alcohol-preserved material, a series of irregular, greenish, iridescent spots and streaks may be visible, commencing in the scapular field, running between the lateral spots and the antero-accessory stripe, and terminating at the 5th festoon; cervical grooves in the form of small, deep, oval pits; marginal groove absent; punctations very numerous, large and deep, fairly regularly distributed but confluent in places, absent from the dark spots and stripes, small or absent from the extreme lateral margins of the scutum and of the posterior edges of the festoons; eyes small, pale and flat. *Venter*: paler than the dorsum, with numerous shallow punctations, glabrous; genital aperture opposite coxa II; spiracles broadly comma-shaped, oblique; festoons with dark-

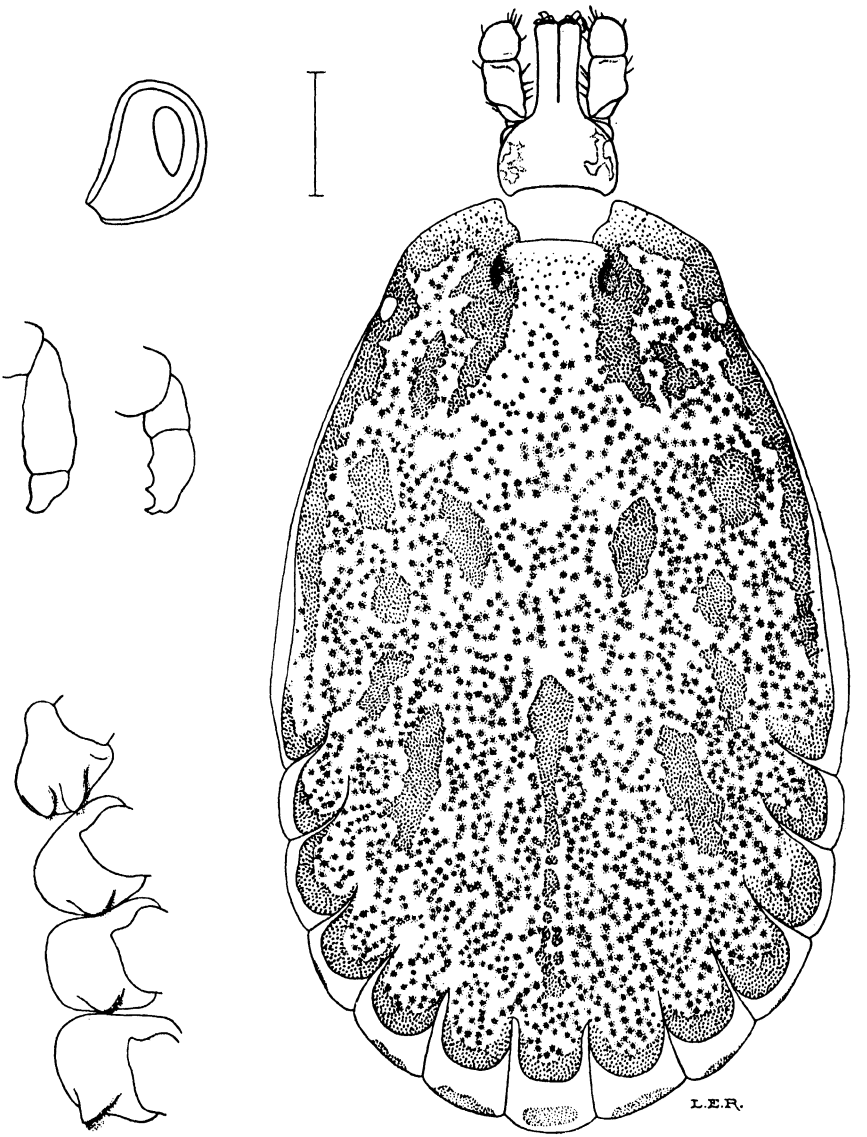


Fig. 100. *Amblyomma varium* ♂. Scutum, capitulum, spiracle, tarsi I and IV, coxae I–IV. (Type of var. "albida," Berlin Mus.)

brown scutes, not salient at the posterior margin (in Fig. 100 these ventral scutes are visible from the dorsal aspect on account of the distension of the body of the tick). *Capitulum*: short, *L.* 1·25 mm., basis rectangular, postero-lateral angles slightly salient; palps short and

stout; article 2 about one-and-a-half times as long as article 3, contracted laterally at the proximal end, the dorsal surface running to a point at the postero-internal angle; hypostome dentition 3 | 3. *Legs*: stout, dark reddish-brown with pale annulations at the distal extremities of the femur, tibia and protarsus; coxa I with two rather short, stout, blunt spurs; a single stout spur on each of coxae II–IV, longest on coxa IV; tarsi short, attenuated in talus.

Female (Fig. 101). Diagnosis: A large tick; scutum triangular to cordiform; indistinctly ornate, dark markings extensive, reducing the pale areas to somewhat irregular patches in the median and lateral fields; cervical grooves in the form of deep, oval pits continued posteriorly as far as the middle of the scutum by moderately deep depressions; punctations numerous, coarse; eyes small, pale and flat; coxa I with two stout spurs; a single short spur on each of coxae II–IV; tarsi abruptly attenuated.

DESCRIPTION. *Body*: *L.* 9 mm., *W.* 6·5 mm. (Rohr, 1909, p. 120, records the dimensions of a gorged ♀ of this species—28 × 24 × 15 mm.) contour oval, narrow in front; dorsum dark reddish-brown, with scattered shallow punctations; marginal groove and festoons present in unfed examples, obliterated later by distension. *Scutum*: triangular to cordiform; 3·1 × 3·5 mm.; indistinctly ornate, with extensive dark markings on a much reduced pale ground; ocular, cervical and limiting spots large; cervical stripes thick, not reaching the limiting spots; frontal spots irregular, isolated or more or less fused with the cervical stripes; dark patches usually present between the cervical grooves and in the median field; cervical grooves in the form of deep, oval fossettes continued posteriorly beyond the middle of the scutum by moderately deep, slightly divergent depressions; punctations numerous, coarse, dark-coloured, confluent in places; eyes small, pale and flat. *Venter*: similar in colour to dorsum; genital aperture opposite coxa II; spiracles triangular, with rounded angles. *Capitulum*: *L.* 1·75 mm., basis sub-triangular, postero-lateral angles rounded, non-salient; lateral margins convex; porose areas large, oval, divergent, interval about equal to diameter; palps relatively short, article 2 twice as long as article 3; hypostome spatulate, dentition 3 | 3. *Legs*: stout, dark-brown with narrow, pale annulations; coxa I with two short, flattened spurs, the external of which is slightly the longer; coxae II–IV each with a short, triangular spur; tarsi abruptly attenuated.

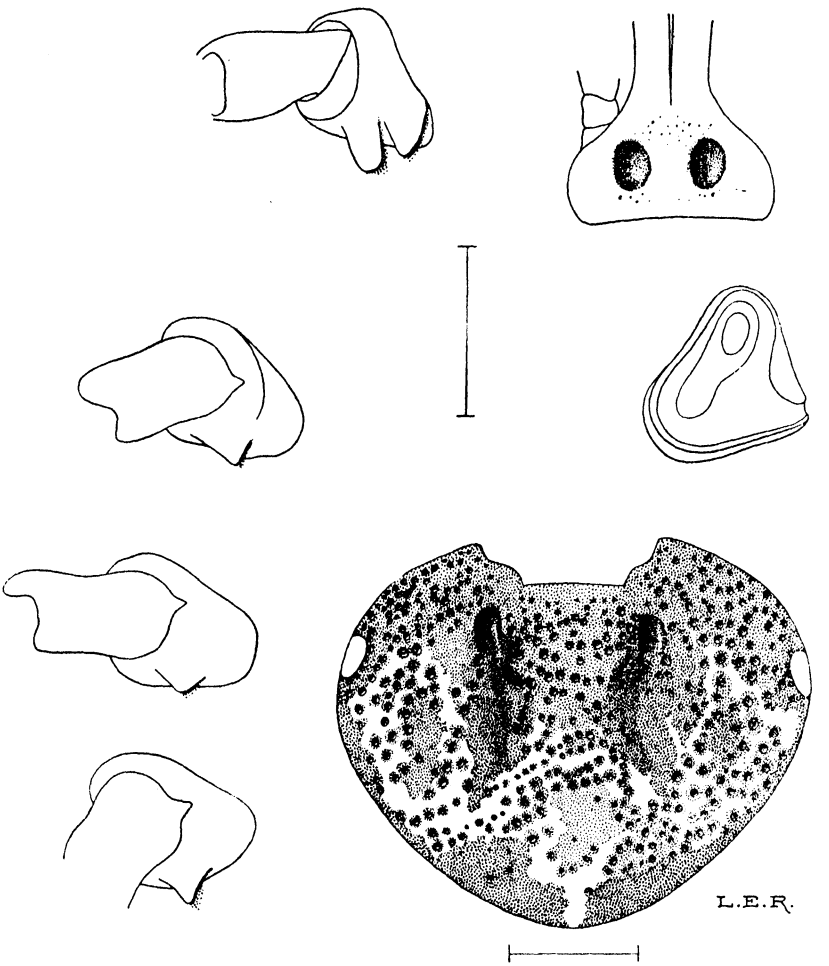


Fig. 101. *Amblyomma varium* ♀. Scutum, basis capituli, spiracle, coxae I–IV. (N. 253.)

Geographical Distribution and Hosts.

The type came from **Brazil**; Stoll's *Amb. crassipunctatum* from **Nicaragua, Central America**. Neumann (1899, p. 247) records a ♂ from **Brazil**, Freycinet coll. (Paris Mus.); ♂, off a *sloth*, Zoological Gardens, Hamburg (Hamburg Mus.); ♂, from Pará, Brazil (Trouessart collection); ♂ (var. *albida*), **Chili**, S. America (Berlin Mus.): also (1901, p. 304) ♀, Corrientes, **Argentine Republic**, S. America (Carlos Berg collection): also (1911, p. 76) Neumann mentions *Bradypus tridactylus* L. and *B. cuculliger* Wagl. as hosts, and adds **Guiana** to the countries of origin.

The Cambridge collection contains two ♀s, off *Bradypus tridactylus*, Brazil (Ex Rothschild coll., N. 253 and 993); ♂, off *Bradypus tridactylus*, Condoto, **Colombia**, S. America, 1913, Dr H. F. Spurrell coll. (N. 2618); ♂, off *large cavy*, Bonasica, **British Guiana**, IV. 1912 (N. 1738); (?), off *sloth*, **Panama**, Central America, XI. 1911, O. Garlepp coll. (N. 2808); and ♀, off *Choloepus hoffmanni*, Ancon, **Panama**, 31. X. 1913, Dr S. T. Darling coll. (N. 3156). I refer to this species a mutilated ♂, from Paramaribo, **Dutch Guiana**, sent to Cambridge for determination by Dr F. C. Bishopp, of the U.S. Dept. of Agriculture, Washington, U.S. America.

64. AMBLYOMMA PACAE Aragão, 1911.

Figs. 102 and 103.

Synon., Lit. and Iconogr.:

Amblyomma pacae Aragão, H. de B., 1911, pp. 170–172, specific description of ♂ and ♀; Pl. XI, Figs. 7–9, ♂ dorsum and venter, ♀ dorsum.

Amblyomma fiebrigi Robinson, L. E., 1911, pp. 482–484, specific description of ♂ and ♀; fig. 3, ♂ dorsum, hypostome, coxae, spiracle, venter and tarsi; Fig. 4, ♀ scutum, capitulum, spiracle, coxae and tarsi (both figs. herein reproduced).

Male (Fig. 102). Diagnosis: A small tick; scutum indistinctly ornate with dark-brown markings on a pale ground; marginal groove absent, punctations small, equal; eyes small, pale and flat; basis capituli sub-trapezoidal, hypostome dentition 3 | 3; coxa I with two moderately long, stout, sub-equal spurs; a single short spur on each of coxae II–IV, longest on coxa IV.

DESCRIPTION. *Body*: *L.* 3·85 mm., *W.* 2·85 mm., contour oval, somewhat elongate, broadest at posterior third. *Scutum*: convex, shining, indistinctly ornate, with postero-median, antero- and postero-accessory stripes and lateral spots appearing as slightly raised reddish-brown markings on a paler ground; cervical grooves short, deep and sigmoid; marginal groove absent; punctations small, numerous, fairly evenly distributed; eyes rather small, pale and flat; festoons distinct with fine and narrow separations. *Venter*: yellowish-brown, glabrous, finely punctate; genital aperture opposite coxa II; spiracles moderately large, broad comma-shaped. *Capitulum*: *L.* 1 mm., basis sub-trapezoidal, lateral margins convex, postero-lateral angles slightly salient; palps club-shaped, article 2 twice as long as article 3; hypostome long, spatulate, dentition 3 | 3. *Legs*: short and stout, earthy yellowish-brown; coxa I with two moderately long, stout, sub-equal spurs, the external spur

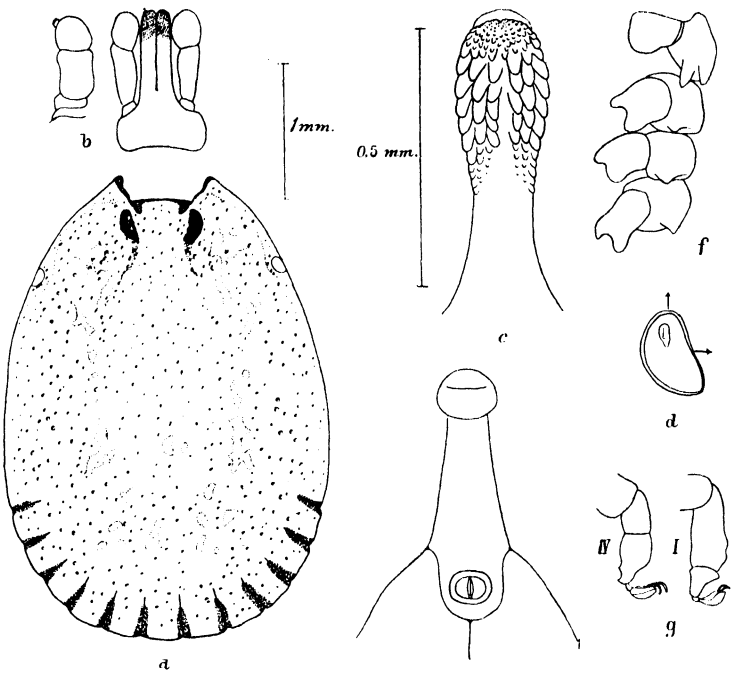


Fig. 102. *Amblyomma pacae* ♂. Scutum, capitulum from dorsal and lateral aspects, hypostome, venter, coxae I–IV, spiracle, tarsi I and IV. (C. 6. Type of *Amb. fiebrigi*, fig. reproduced from Robinson, 1911.)

extending slightly beyond the anterior margin of coxa II; coxae II and III each with a single, small, short, blunt spur; a single spur twice as long as broad on coxa IV; tarsi abruptly attenuated.

Female (Fig. 103). Diagnosis: A small tick; scutum triangular-cordiform, almost inornate; punctations small, numerous, discrete; eyes pale and flat; basis capituli sub-triangular; porose areas oval, divergent, interval about one-and-a-half times diameter; hypostome dentition 3 | 3; coxa I with two moderately long, stout, sub-equal spurs; coxae II–IV each with a single, very short, broad spur.

Description. *Body*: *L.* 3·6 mm., *W.* 2·7 mm., contour elliptical; dorsum yellowish-brown, glabrous, with shallow punctations; marginal groove terminating posteriorly at the 3rd or 4th festoon. *Scutum*: (2·2 × 2·5 mm.) triangular-cordiform, posterior angle rather narrow, postero-lateral margins sinuous; smooth and shining, indistinctly ornate with pale markings in the posterior angle and the lateral fields, general

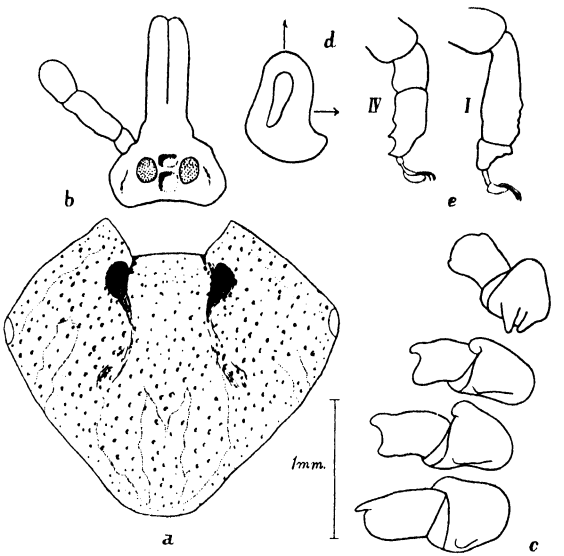


Fig. 103. *Amblyomma pacae* ♀. Scutum, capitulum, spiracle, tarsi I and IV, coxae I–IV. (C. 6. Type of *Amb. fiebrigi*, fig. reproduced from Robinson, 1911.)

colour light maroon-brown; cervical grooves deep and pear-shaped in the anterior part, continued by shallow, divergent depressions to the posterior third of the scutum; punctations small, numerous, discrete; eyes rather small, pale and flat. *Venter*: pale greyish-yellow, smooth and glabrous; genital aperture opposite interspace between coxae II and III; spiracles large, triangular with rounded angles. *Capitulum*: *L.* 1·35 mm., basis sub-triangular, postero-lateral angles rounded, non-salient; porose areas of medium size, oval, deep, divergent, interval about one-and-a-half times diameter; palps club-shaped, article 2 twice as long as article 3; hypostome long, spatulate, dentition 3 | 3. *Legs*: short and stout, earthy yellowish-brown; coxae I with two moderately long, stout, sub-equal spurs, the external spur extending a little beyond the anterior margin of coxa II (unfed example); a single, very short, broad spur at the postero-external angle of each of coxae II–IV, produced inwards as a fine salient ridge on coxae II and III; tarsi abruptly attenuated.

Description based on 1 ♂ and 1 ♀ in the Cambridge collection, off *Coelogenys paca*, the ♂ from the State of Rio, the ♀ from the State of Minas, **Brazil**, S. America, 1908, the gift of Dr H. de B. Aragão (N. 1892 and 1893); and ♂ and ♀, host not specified, collected at San Bernardino, **Paraguay**, by Dr Karl Fiebrig (W. F. Cooper, coll. No. 6).

65. AMBLYOMMA MANTIQUIRENSE Aragão, 1908.

Figs. 104 and 105.

Lit. and Iconogr.: Aragão, H. de B., 8. VI. 1908, pp. 251–252; 1911, pp. 186–189, Pl. XII, Figs. 22–24, ♂ dorsum and venter, ♀ dorsum.

Male (Fig. 104). Diagnosis: A small tick, with characteristic ornamentation on the scutum; marginal groove absent; punctations large and shallow; palps short, thick and club-shaped; coxa I with two unequal spurs, the internal spur short and blunt, the external spur long and pointed; coxae II–IV each with a short, triangular, pointed spur; hypostome dentition 3 | 3; tarsi abruptly attenuated.

DESCRIPTION. *Body*: *L.* 3·6 mm., *W.* 2·5 mm., contour almost elliptical, slightly broader behind middle than in front. *Scutum*: flat, margins rounded; ornate, with reddish-brown spots and stripes on a yellow ground; postero-median stripe long, extending nearly to the centre of the scutum; postero-accessory stripes isolated, directed towards the centre of the scutum; lateral spots separate from one another, the 1st sometimes fused with the dark marginal coloration, the latter in the form of a

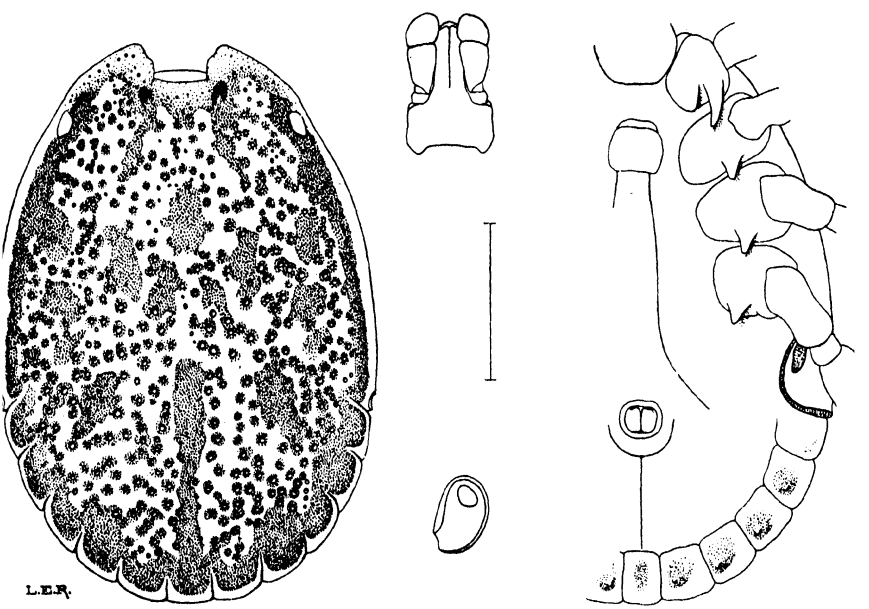


Fig. 104. *Amblyomma mantiquirense* ♂. Scutum, capitulum, venter, spiracle. (N. 822.)

narrow dark stripe extending from the ocular spot to the external festoon; cervical stripes narrow, divergent posteriorly, not reaching to the limiting spots; frontal spots absent; cervical grooves small, oval, convergent posteriorly; marginal groove absent; punctations large, shallow, numerous, areolate; eyes of medium size, flat and pale; festoons dark-coloured, divisions shallow. *Venter*: dull pale-yellow, with fine punctations and scattered, short, fine hairs; genital aperture opposite coxa II; spiracles small, broadly comma-shaped; festoons well-defined, each furnished with a dark-coloured scute and, with the exception of the median, each bearing a small chitinous tubercle. *Capitulum*: short (*L.* 0·9 mm.), basis capituli rectangular, postero-lateral angles slightly salient; palps short, club-shaped, article 2 one-and-a-half times as long as article 3, contracted on its dorsal side to form a posteriorly directed point; hypostome spatulate, dentition 3 | 3. *Legs*: slender, moderately long; coxa I with two unequal spurs, the internal spur short, broad and blunt, the external spur long and pointed; coxae II–IV each with a short, triangular, pointed spur; tarsi abruptly attenuated.

Female (Fig. 105). Diagnosis: A small tick; scutum ornate, cervical grooves in the form of small, oval pits; coarse, shallow punctations on dorsum; capitulum moderately long, basis capituli very broad in proportion to its length, lateral margins convex; porose areas medium in size, pear-shaped, widely-separated; hypostome dentition 3 | 3; coxa I with two unequal spurs, the internal spur short, blunt and stout, the external spur long and pointed; tarsi abruptly attenuated.

Description. *Body*: *L.* 4·1 mm., *W.* 3·2 mm. (unfed), contour broadly elliptical; dorsum with large, shallow punctations; marginal grooves shallow and indistinct; festoons well-defined. *Scutum*: triangular cordiform (2·1 × 2·3 mm.), ornate, ground colour pale-yellow, margins with a dark-coloured border showing extensions at the points corresponding to the cervical spots, the ocular and the limiting spots; cervical stripes small, sometimes isolated; frontal spots absent; cervical grooves in the form of small, oval pits; large, shallow punctations mostly scattered in the lateral fields; fine punctations in the scapular angles and the posterior part of the median field; eyes moderately large, flat and pale. *Venter*: glabrous, with large punctations, like those on the dorsum, on its posterior part; genital aperture opposite the interspace between coxae II and III; spiracles broadly triangular, with rounded angles. *Capitulum*: *L.* 1·35 mm., basis more than three times as broad as long; lateral margins

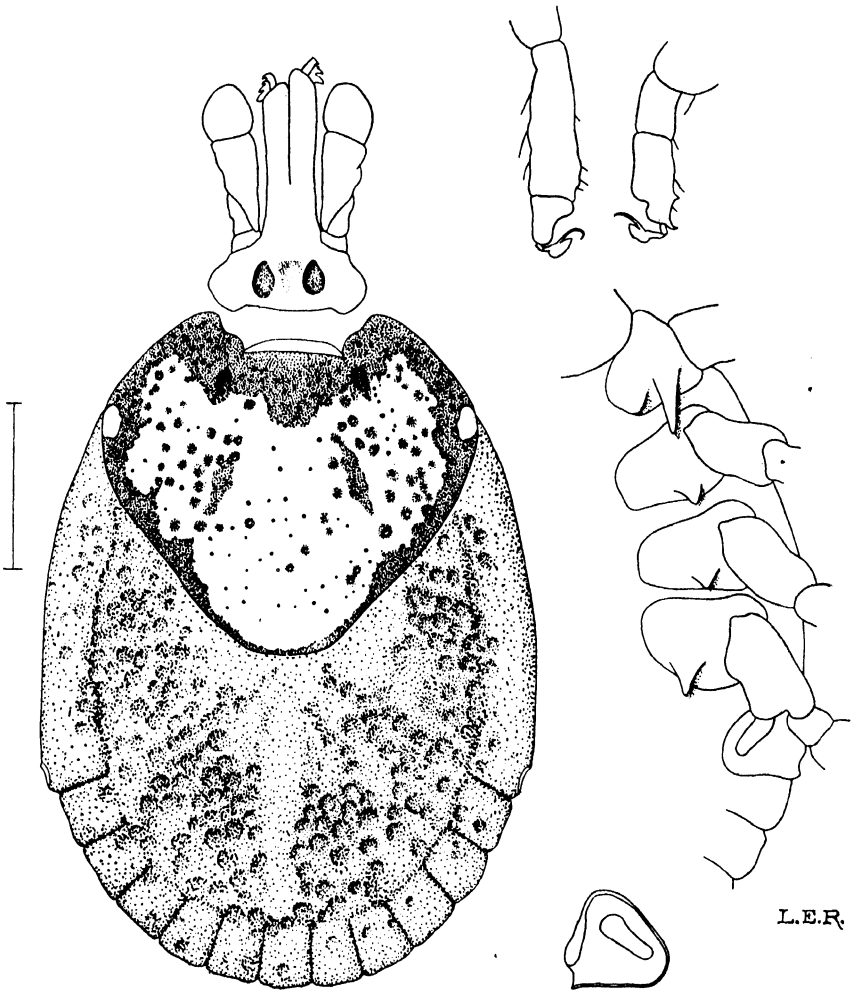


Fig. 105. *Amblyomma mantiquirense* ♀. Dorsum, capitulum, tarsi I and IV, coxae I–IV, spiracle. (N. 822.)

convex; postero-lateral angles barely salient; porose areas medium in size, pear-shaped with the small end directed anteriorly, interval a little greater than the diameter; palps relatively longer than those of the ♂, club-shaped, article 2 twice as long as article 3; hypostome dentition 3 | 3. *Legs*: somewhat longer and stouter than those of the ♂; coxal armature and tarsi similar to those of the ♂.

Geographical Distribution and Hosts.

Aragão (1911, pp. 159 and 162) gives the distribution of the species in **Brazil,** as follows: Mantiquira, Xerém (State of Rio); Itabira and R. Tambaquary (State of Minas Geraes; ? (State of Pará); hosts—*Dicotyles labiatus* Cuv., *Dicotyles torquatus* Cuv. Specimens in the Cambridge collection comprise ♂ and ♀, off *Dicotyles torquatus*, Xerém, State of Rio, Brazil, 24. VII. 1907, the gift of Dr H. de B. Aragão (N. 822); ♂ and ♀, off *Dicotyles* sp., State of Rio, Brazil, Dr H. de B. Aragão (N. 1267); ♂ and ♀, off *great anteater*, Bonasica, **British Guiana,** IV. 1912 (N. 1741); ♂ and ♀, off *peccary*, Bonasica, British Guiana (N. 1746).

66. AMBLYOMMA FULVUM Neumann, 1899.

Lit.: Neumann, L. G., 1899, pp. 236–237, specific description of ♂; 1911, p. 75, brief description of ♂.

Male. Diagnosis: A medium-sized tick; body sub-triangular, sides sub-rectilinear, dentate posteriorly at the festoons; scutum inornate, reddish-yellow, almost smooth, punctations equal and very fine; marginal groove absent; capitulum long; hypostome dentition 3 | 3; coxa I with two short, flat spurs; a single, similar spur on each of coxae II–IV, largest on coxa IV.

DESCRIPTION. *Body*: *L.* 4·5 mm., *W.* 3·0 mm., contour sub-triangular, sides sub-rectilinear, broadest at posterior quarter, posterior border but slightly rounded. *Scutum*: convex, reddish-yellow, darker at the margins, inornate; marginal groove absent; cervical grooves short and deep; punctations very fine, numerous peripherally, absent centrally; eyes flat and pale; festoons well-defined, separations deep. *Venter*: yellowish, with widely-scattered, short hairs over the posterior half; genital aperture opposite coxa II; spiracles narrow, comma-shaped; festoons well-defined. *Capitulum*: *L.* 1·3 mm., basis rectangular, lateral margins convex, postero-lateral angles slightly salient; palps long, downy, article 2 twice as long as article 3; hypostome sub-spatulate, dentition 3 | 3. *Legs*: of medium length, reddish-yellow, darker at the distal extremities of the articles; coxa I with two short, flat spurs; coxae II–IV each with a single broader and flatter spur; tarsi relatively short, abruptly attenuated; pulvilli one-third length of claws.

Female: unknown.

Neumann's description is based on 1 ♂, off *Eunectes murinus*, **Brazil** (?), S. America (Marx coll., Smithsonian Inst.).

67. AMBLYOMMA HELVOLUM Koch, 1844.

Fig. 106.

Synon. and Lit.:

Amblyomma helvolum Koch, C. L., 1844, p. 230, No. 39, brief description of the ♀; 1847, pp. 93–94, specific description of ♀; Tab. XVIII, Fig. 66, ♀ dorsum (coloured). 1899, Neumann, L. G., pp. 278–279, description of ♀. 1901, p. 312, a correction of the previous description. 1911, Neumann, L. G., p. 90, brief description. I have carefully compared the type of *Amb. helvolum* with numerous ♀s of *Amb. decoratum* and can find no constant distinguishing characteristic. Koch's description of *Amb. helvolum* precedes that of *Amb. decoratum*, which name, by the rule of priority, must lapse into synonymy.

Amblyomma decoratum Koch, C. L., 1844, p. 230, No. 40, brief description of ♂; 1847, pp. 94–95, specific description of ♂; Tab. XVIII, Fig. 67, ♂ dorsum (coloured). 1899, Neumann, L. G., p. 245, description of the ♂. 1901, Neumann, L. G., p. 304; degrades *Amb. fimbriatum* Koch to a synonym of *Amb. decoratum*. 1911, Neumann, L. G., p. 87; brief description of ♂ and ♀.

Amblyomma fimbriatum Koch, C. L., 1844, p. 231, No. 42, description of ♂; 1847, p. 95, description of ♂; Tab. XVIII, Fig. 68, ♂ dorsum (coloured). Degraded by Neumann (1901, p. 304) to a synonym of *Amb. decoratum*.

Amblyomma quadrimaculatum Neumann, L. G., 1899, pp. 245–246, description of ♂. Degraded by Neumann (1911, p. 87) to a synonym of *Amb. decoratum*.

Amblyomma furcosum Neumann, L. G., 1901, pp. 299–300, description of ♀. Degraded by Neumann (1911, p. 87) to a synonym of *Amb. decoratum*.

Amblyomma (*Aponomma*) *tenimberense* Hirst, S., and Hirst, L. F., 1912, pp. 307–308, description of ♂; Fig. 9, ♂ dorsum.

Male (Fig. 106). Diagnosis: A small *Aponomma*-like tick; scutum broad oval, ornate, with a small, pale spot in each scapular angle, an elongate, pale spot near the middle of the lateral margin, and a pair of symmetrically-disposed, adjacent, pale spots anterior to the posterior margin; punctations numerous, rather small, coarser towards the periphery; marginal groove absent; eyes pale, flat and indistinct; hypostome dentition 3 | 3; coxa I with two short spurs, of which the external is the longer; a single, short, triangular spur on each of coxae II–IV.

DESCRIPTION. *Body*: *L.* 2·5–3·0 mm., *W.* 2·3–2·9 mm., contour broad oval, often sub-quadrilateral. *Scutum*: convex; ornate, with pale spots on a dark reddish-brown ground; a small, sub-triangular, pale spot in each scapular angle; a larger, elongate and somewhat irregular spot in each lateral field, terminating anteriorly some distance behind the eye, and posteriorly a little distance in front of the external festoon; a pair of adjacent symmetrically-disposed spots in the posterior field immediately

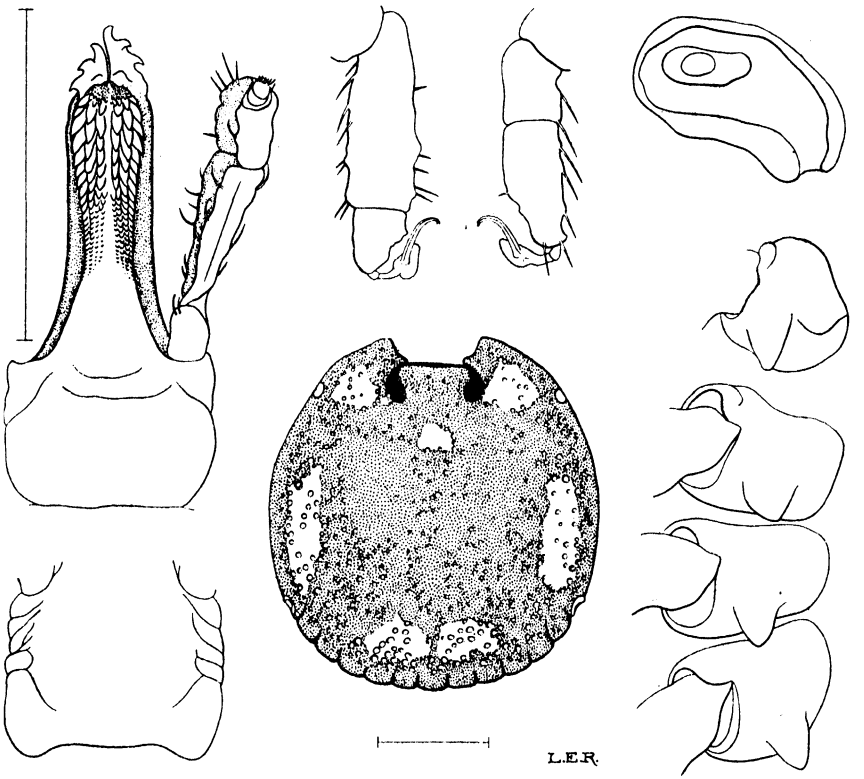


Fig. 106. *Amblyomma helvolum* ♂. Scutum, capitulum from ventral aspect, basis capituli from dorsal aspect, tarsi I and IV, spiracle, coxae I–IV. (N. 25 *a*.)

anterior to the 4th and 5th festoons; occasionally a median spot occupying the position corresponding to the posterior angle of the ♀ scutum; cervical grooves short, deep, curved, with the convexity external; marginal groove absent; punctations numerous, unequal, coarser towards the periphery, regularly distributed; eyes pale, flat and indistinct (often invisible until the specimen is examined while immersed in alcohol); festoons clearly defined, separations narrow. *Venter*: earthy-yellow, glabrous; genital aperture opposite coxa II; spiracles long oval, dorsal process not prominent. *Capitulum*: *L.* 1·2–1·5 mm.; basis rectangular, long in proportion to breadth, postero-lateral angles barely salient; palps long and slender, article 2 twice as long as article 3; hypostome long, spatulate, dentition 3 | 3. *Legs*: moderately long; coxa I with two short spurs, the external spur being the longer; coxae II–IV each with a

single, short, stout, triangular spur; tarsi of medium length, tapering gradually at the distal extremity; pulvilli about half length of claws.

Female. Diagnosis: A small, *Aponomma*-like tick; scutum ornate, with a pale spot in each scapular angle and at the posterior angle, sometimes a small, pale spot close to the inner margin of the cervical groove; eyes pale and flat; porose areas small, oval, divergent, interval about equal to diameter; hypostome dentition 3 | 3; coxa I with two short, unequal spurs; a single, short, triangular spur on each of coxae II–IV; tarsi tapering gradually.

Description. *Body*: *L.* 3·8–4·8 mm., *W.* 3·0–3·8 mm., contour broad oval, narrower anteriorly, dorsum earthy yellowish-brown, punctate; marginal groove absent; festoons present, separations narrow. *Scutum*: 1·7–2·0 × 2·0–2·35 mm., cordiform, posterior angle medium, postero-lateral margins slightly convex, sometimes sinuous; ornate, with pale spots on a dark ground; scapular spots irregularly triangular, with an external angle adjacent to the anterior margin of the eye; postero-median spot rounded or oblong (in the type a small, pale spot is visible close to the inner margin of the cervical groove); cervical grooves deep and inverted comma-shaped anteriorly, shallower, curved and slightly divergent posteriorly, extending almost to the postero-lateral margins of the scutum; punctations medium to small, fairly numerous and regularly distributed; eyes small, pale and flat, sometimes indistinct. *Venter*: similar in colour to dorsum, finely punctate; genital aperture opposite coxa II; spiracles broad comma-shaped. *Capitulum*: *L.* 1–1·2 mm., basis rectangular, postero-lateral angles rounded and slightly salient, lateral margins slightly convex; porose areas small, deep, oval, divergent, interval about equal to diameter; palps long, article 2 twice as long as article 3; hypostome dentition 3 | 3 (hypostome and chelicerae missing in the type). *Legs*: long and slender; coxa I with two short, unequal spurs, the external being the longer; a single, triangular spur on each of coxae II–IV; tarsi long, gradually tapering at the distal extremity; pulvilli half length of claws.

Geographical Distribution and Hosts.

The **East Indies**, from the **Nicobar Is.** to **New Guinea** and **Australia**; on Reptilia. The type and Koch's *Amb. fimbriatum*, came from Manila, **Philippine Is.**; the type of *Amb. decoratum* was also found in the Philippine Is. Neumann (1899, p. 245) records 5 ♂s (*Amb. decoratum*) from the Philippine Is., G. Semper coll., labelled "*Ixodes aquilae*"

(Hamburg Mus.); his *Amb. quadrimaculatum*, a single ♂, off *Triglyphedon dendrophilum*, came from Java (Oudemans coll.); his *Amb. furcosum*, 2 ♀s, off *Python reticulatus*, also came from Java (Berlin Mus.). Neumann (1911, p. 87) includes Sumatra, and adds *Zamenis mucosus* and *Varanus salvator* to the list of hosts. I have examined ♂s, off *Varanus salvator*, Cantor, Nicobar Is., India (Ind. Mus. coll. 5987/10); ♂s and ♀, off *Ptyas* (*Zamenis*) *korros*, Kuala Lumpur, Federated Malay States, II. 1910, A. T. Stanton coll. (N. 1016); ♂s and nymph, off *Iguana*, St John's Is., Singapore, Straits Settlements, X. 1908, Dr A. R. Wellington coll. (N. 482); ♂s, off *Varanus salvator*, Singapore, II. 1910, A. T. Stanton coll. (N. 1017 *b*); (?), off *Python* sp., Kuching, Sarawak, Borneo, VII. 1907, Dr A. R. Wellington coll. (N. 303); ♀s, off *Coluber onicephalus*, Java, Dutch East Indies, 1908, Dr J. C. Koningsberger coll. (N. 486); (?), off *Ptyas* (*Zamenis*) *korros*, Java, 1908, Dr J. C. Koningsberger coll. (N. 490); ♂s and ♀, off *Varanus salvator*, Buitzenzorg, Java, IV. 1913, F. P. Jepson coll. (N. 2187 *a*); ♀, off *Varanus* sp., Quambone, N. S. Wales, Australia, W. F. Cooper coll. (C. 257); also a ♂, off *Geoemyda grandis*, Zoological Gardens, Calcutta, India (Ind. Mus. coll.).

68. AMBLYOMMA BOULENGERI Hirst & Hirst, 1910.

Lit. and Iconogr.: Hirst, S., and Hirst, L. F., 1910, pp. 301–304, specific description of ♂ and ♀; Figs. 3 and 4, ♂ and ♀ dorsum.

Male. Diagnosis: A very small tick; scutum rather elongate oval, indistinctly ornate, pale-brown and drab coloured (coppery when immersed in alcohol), with a more or less well-defined pseudoscutum; marginal groove absent; an oblique curved depression on each side, commencing posteriorly at the external festoon and extending inwards and forwards towards the postero-lateral angles of the pseudoscutum; punctations numerous and fine; eyes small, flat and pale; hypostome dentition 3 | 3; coxa I with two short, inconspicuous spurs; coxae II and III unarmed or with a very short spur; coxa IV with a single short spur; tarsi gradually attenuated.

Description. *Body*: *L.* 1·75 mm., *W.* 1·4 mm., contour oval, rather elongate, narrower in front. *Scutum*: indistinctly ornate, with a more or less well-defined pseudoscutum; general colour drab, the pseudoscutum light-brown (coppery when immersed in alcohol); postero-median stripe represented by a narrow dark line; ocular spots present; a short longitudinal spot at each extremity of a pale transverse line which delimits the posterior margin of the pseudoscutum, a minute, dark, central speck

between these two; the median field between the cervical grooves sometimes darker coloured than the rest of the scutum; marginal groove absent; a characteristic oblique curved depression, commencing posteriorly at the external festoon and extending inwards and forwards towards the postero-lateral angles of the pseudoscutum, formed in part of enlarged punctations, broad at the posterior extremity, narrowing anteriorly; punctations numerous and very fine; cervical grooves deep anteriorly, shallow and divergent posteriorly; eyes small, pale and flat; festoons short, fairly well-defined. *Venter*: finely wrinkled, spiracles long, narrow, comma-shaped. *Capitulum*: *L.* 0·47 mm., basis rectangular; hypostome dentition 3 | 3. *Legs*: short; coxa I with two short, inconspicuous spurs; coxae II and III unarmed or with a single, very short spur; coxa IV with a single, short spur; tarsi gradually attenuated.

Female. Diagnosis: A very small tick; scutum cordiform, indistinctly ornate, dark-brown, with pale enamelling; punctations numerous, fairly deep, sub-equal; eyes small and inconspicuous, pale and flat; hypostome dentition 3 | 3, porose areas well-defined, oval, interval equal to diameter; coxa I with two short spurs; a single, very short spur on each of coxae I–IV.

Description. *Body*: *L.* 2·5 mm., *W.* 2·0 mm., contour oval, narrower in front; dorsum brownish, with drab-coloured hairs. *Scutum*: 1·26 × 1·53 mm., cordiform; indistinctly ornate, dark-brown with pale enamelling; cervical grooves well-defined, deep and curved anteriorly, shallow and divergent posteriorly where they terminate some distance from the posterior margin of the scutum; punctations numerous, fairly deep, sub-equal; eyes small, flat and inconspicuous, yellowish in colour. *Venter*: spiracles comma-shaped. *Capitulum*: *L.* 0·86 mm.; porose areas well-defined, oval, interval about equal to diameter; hypostome dentition 3 | 3. *Legs*: short; coxa I with two short spurs; coxae II–IV each with a single, very short spur; tarsi gradually attenuated, tarsus IV stouter and not so gradually narrowed as that of the ♂.

Geographical Distribution and Hosts.

The original description is based on 2 ♂s and a ♀, off *Tropidurus delanonis*, Hood Island, **Galapagos**, S. Pacific Ocean (British Museum). Two closely resembling ♀s have been found on *Tropidurus barringtonensis* and *Conolophus subcristatus* respectively from Barrington Island and another place in the Galapagos Is. (exact locality not specified).

69. AMBLYOMMA DARWINI Hirst & Hirst, 1910.

Lit. and Iconogr.: Hirst, S., and Hirst, L. F., 1910, pp. 299–301, specific description of ♂ and ♀; Figs. 1 and 2, ♂ and ♀ dorsum.

Male. Diagnosis: A very small tick; scutum inornate, the characteristic stripes and spots represented by shallow depressions; marginal groove absent; punctations numerous, small, sub-equal; eyes pale and very slightly convex; article 2 of palp humped on dorsal side; hypostome dentition 3 | 3; coxa I with two small spurs; a single, small, conical spur on each of the other coxae, longest on coxa IV.

DESCRIPTION. *Body*: *L.* 2·56 mm., *W.* 2·12 mm., contour oval, narrower in front. *Scutum*: convex, dark-brown, inornate; postero-median stripe and postero-accessory stripes represented by shallow grooves; lateral spots and antero-accessory stripes in the form of small dimple-like depressions; cervical grooves deep, fairly long, divergent posteriorly; marginal groove absent; punctations numerous, small, sub-equal; eyes small, pale, slightly convex; festoons indistinct, with shallow separations. *Venter*: dirty yellowish-white, with numerous superficial punctations; spiracles elongate comma-shaped. *Capitulum*: *L.* 0·64 mm., basis almost smooth on dorsal face; article 2 of palp with a dorsal, hump-like prominence; hypostome dentition 3 | 3. *Legs*: of medium length; coxa I with two small spurs; coxae II–IV each with a single, small, conical spur, longest on coxa IV; tarsi gradually attenuated.

Female. Diagnosis: A small tick; scutum cordiform, broader than long, indistinctly ornate; punctations fairly numerous, not very deep, rather unequal in size; cervical grooves in the form of oval pits, with a second pair of deep and rather large grooves, external to which there is a small dimple-like depression; porose areas deep, oval; hypostome dentition 3 | 3; coxa I with two short spurs; a single, small conical spur on each of coxae I–IV; tarsi gradually attenuated.

DESCRIPTION. *Body*: *L.* 4 mm., *W.* 2·75 mm., contour oval, dorsum dark-brown, somewhat hairy; marginal groove absent, postero-median and accessory grooves present, lateral grooves in the form of dimple-like depressions as in the male; festoons indistinguishable. *Scutum*: 1·12 × 1·6 mm., cordiform, dark-brown with irregular pale patches (visible in dried specimens only); cervical grooves in the form of oval pits behind which is a pair of deep and rather large grooves extending almost to the posterior margin of the scutum; punctations fairly numerous, not very deep, rather unequal in size; eyes small, indistinct, situated a little

posterior to the lateral angles of the scutum. *Venter*: yellowish-brown, spiracles almost comma-shaped. *Capitulum*: *L.* 0·9 mm., porose areas deep and oval, palps with article 2 humped on the dorsal surface; hypostome dentition 3 | 3. *Legs*: dark-brown with narrow whitish annulations at the extremities of the articles; armature of coxae similar to that of the ♂; tarsi gradually attenuated; tarsus IV different in shape from that of the ♂, stout, rather convex dorsally.

Geographical Distribution and Hosts.

The original description is based on 3 ♂s and 2 ♀s, off *Amblyrhynchus cristatus*, Albemarle Island, **Galapagos**, S. Pacific Ocean; 3 ♀s, with several nymphs and larvae, off *Amblyrhynchus cristatus*, Galapagos Is. (exact locality not given); 2 dry ♀s, host not specified, St Paul's Is., and 2 dry ♀s, labelled "Galapagos," both lots collected by Charles Darwin (British Museum).

70. AMBLYOMMA GUIANENSE Neumann, 1907.

Figs. 107 and 108.

Lit. and Iconogr.: Neumann, L. G., v. 1907, pp. 96–98, specific description of ♂ and ♀; Figs. 6 and 7, ♂ coxae, ♀ scutum and basis capituli (herein reproduced): 1911, p. 76, short description of ♂ and ♀.

Male (Fig. 107). Diagnosis: A large tick; scutum ornate; marginal groove absent; punctations numerous, deep, sub-equal; hypostome dentition 4 | 4; coxa I with two stout spurs; a short, broad, rounded spur on each of coxae II and III; a moderately long, pointed spur on coxa IV.

Description. *Body*: *L.* 7·5 mm., *W.* 5·5 mm., contour short oval, broadest towards posterior third. *Scutum*: slightly convex, glabrous, surface slightly mamillated; ornate, postero-median and postero-accessory stripes slightly elevated; falciform stripe (?) limiting the posterior margin of a pseudoscutum; irregular prominences in the lateral and antero-lateral fields (lateral and frontal spots?); cervical grooves deep, very short and curved; marginal grooves absent; punctations numerous, deep, sub-equal, distributed over the entire scutum except the dark, elevated markings; festoons well-defined, twice as broad as long, separations deep; eyes large, very flat, yellowish-white, not bordered by punctations. *Venter*: brownish, almost glabrous, numerous shallow punctations in the posterior part; festoons distinct; genital aperture opposite coxa II; spiracles large, short, comma-shaped. *Capitulum*:

long, *L.* 2·0 mm., basis rectangular, twice as broad as long, posterior border concave, postero-lateral angles broad and barely salient; palps flat, beset with long, whitish hairs, article 2 at least twice as long as article 3; hypostome long, but slightly spatulate, dentition 4 | 4. *Legs*: stout and long, reddish-brown; coxa I with two stout, pointed, separated spurs of which the external is the longer and twice as long as broad; coxae II and III each with a single, broad, flat, rounded spur; coxa IV with a moderately long, pointed spur at the postero-internal angle; tarsi relatively short, abruptly attenuated.

Female (Fig. 108). Diagnosis: A medium-sized tick; scutum subcordiform, broader than long, ornate; cervical grooves deep anteriorly, broad and shallow posteriorly; punctations numerous, deep, sub-equal, absent from the post-ocular border; capitulum long; porose areas large, deep, oval; coxa I with two stout spurs; a single, broad, flat spur on each of coxae II and III; a single spur, as broad as long, on coxa IV.

DESCRIPTION. *Body*: *L.* 10 mm., *W.* 7 mm., broadest towards the middle; dorsum dark-brown, glabrous, punctate, marginal groove complete, festoons well-defined. *Scutum*: triangular-cordiform, 3·5 × 4·2 mm.;

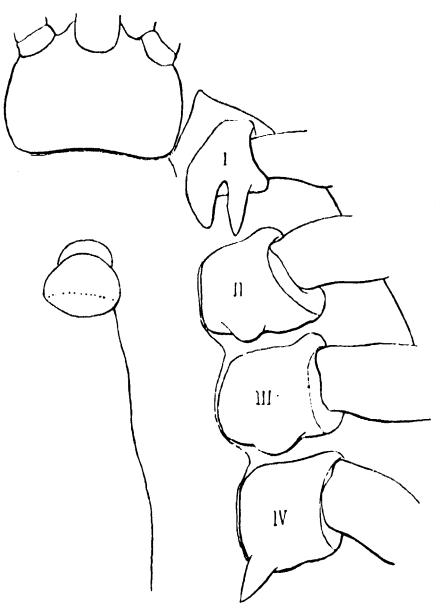


Fig. 107.

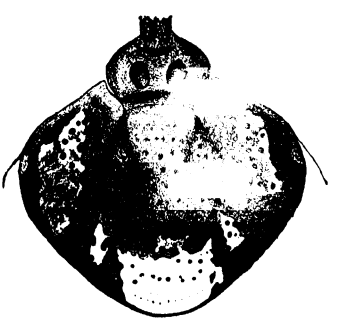


Fig. 108.

Fig. 107. *Amblyomma guianense* ♂. Coxae. (Neumann, 1907, Fig. 6.)
Fig. 108. *Amblyomma guianense* ♀. Scutum and basis capituli. (Neumann, 1907, Fig. 7.)

ornate, a dark margin extending from the cervical spots to the ocular spots and continued posteriorly as far as the limiting spots; cervical stripes extending backwards as far as the limiting spots; frontal spots irregular, fused with the dark marginal coloration; the dark median patch between the cervical stripes may be due to defective preservation; cervical grooves deep anteriorly, continued posteriorly as broad, shallow depressions reaching the posterior half of the scutum; punctations numerous, deep, sub-equal, absent from the post-ocular margin; eyes large, pale and flat. *Venter*: as in ♂, with larger and deeper punctations; spiracles very large, sub-triangular. *Capitulum*: *L.* 2·5 mm., base as in ♂, porose areas large, deep, oval, interval equal to lesser diameter; hypostome and palps as in ♂. *Legs*: longer and stouter than those of the ♂; coxal armature similar, except that the spur on coxa IV is only as long as broad.

Neumann's description is based on 2 ♂s and 1 ♀, host not specified, from Surinam, **Guiana** (Leyden Nat. Hist. Mus.).

71. AMBLYOMMA ALBOLIMBATUM Neumann, 1907.

Figs. 109 and 110.

Lit.: Neumann, L. G., 1907, p. 218, specific description of ♂; 1911, p. 86, short description of ♂ and ♀.

Male (Fig. 109). Diagnosis: A medium-sized species; scutum dark-brown with pale spots in the scapular angles and a narrow, pale stripe along the lateral margins, extending from the eye to the external festoon; marginal groove represented by a series of contiguous punctations extending forwards for a short distance from the external festoon; punctations coarse, marginal in distribution; coxa I with two spurs; a single spur on each of coxae II–IV, long on coxa IV.

DESCRIPTION. *Body*: *L.* 4·4–4·8 mm., *W.* 3·5–3·9 mm., contour oval, twice as broad behind as in front. *Scutum*: convex, glossy, dark-brown, with an irregular, pale spot in each scapular field; a minute, pale spot at the middle of the outer margin of the cervical groove, and a continuous, narrow, pale stripe on the margin of the scutum, extending from the eye to the external festoon; marginal groove short, formed of a series of contiguous punctations; cervical grooves long and deep, curved, with the convexity external in the anterior half, slightly divergent in the posterior half; punctations coarse for the most part, scattered over the marginal parts; eyes pale and flat; festoons well-defined. *Venter*: dirty

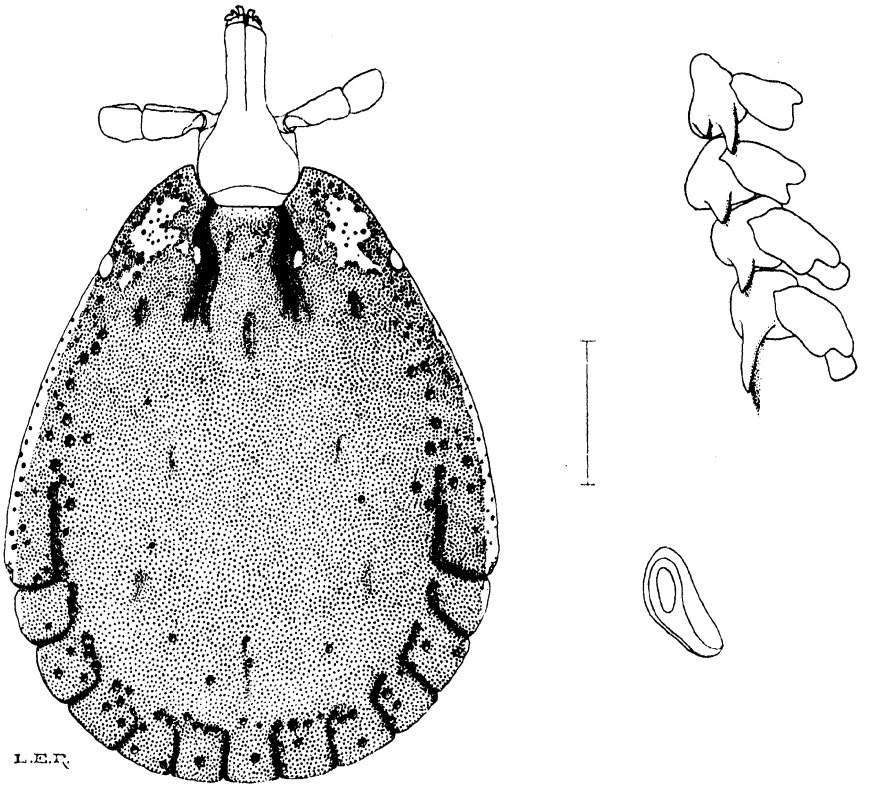


Fig. 109. *Amblyomma albolimbatum* ♂. Scutum, capitulum, coxae I–IV, spiracle. (N. 3124.)

yellow, almost glabrous; genital aperture opposite coxa II; spiracles narrow, comma-shaped. *Capitulum*: *L.* 1·2 mm., basis rectangular, postero-lateral angles slightly salient, posterior border concave; palps club-shaped, contracted at the base of article 2, which is one-and-a-half times as long as article 3; hypostome long, spatulate, dentition 4 | 4. *Legs*: stout, long, reddish-brown in colour; coxa I with two pointed, well-separated spurs, of which the external is twice as long as broad; a single, triangular, pointed spur on each of coxae II and III; a single, long, pointed spur on coxa IV; tarsi attenuated in talus.

Female (Fig. 110). Diagnosis: A medium-sized tick; scutum cordiform, ornate, with an irregular, pale spot in each scapular field; eyes large; cervical grooves long, deep anteriorly, divergent posteriorly; coxa I with two sub-equal, short spurs; a single spur on each of coxae II–IV.

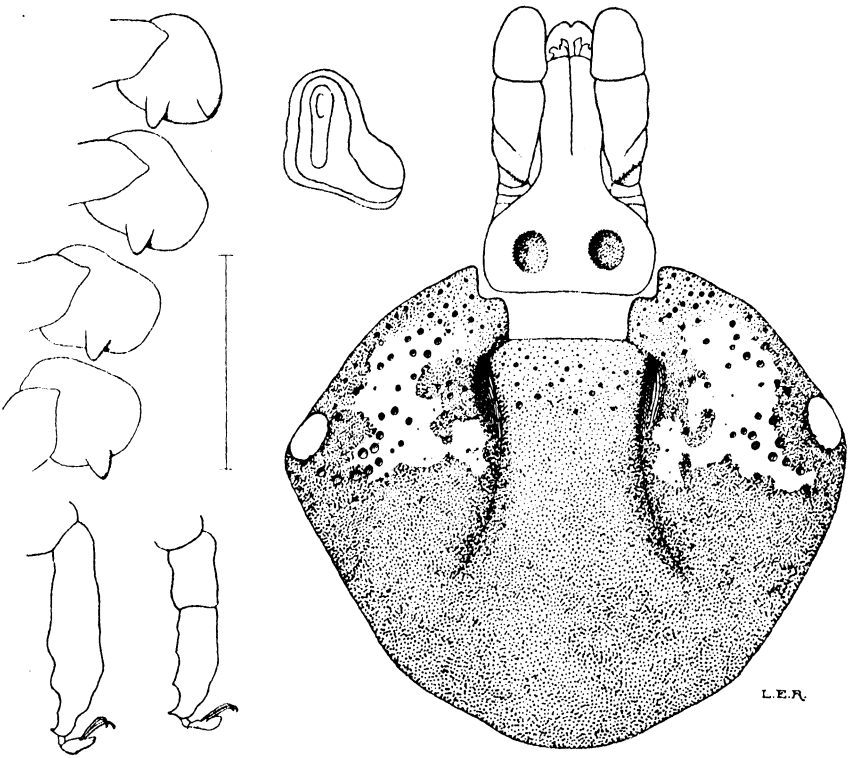


Fig. 110. *Amblyomma albolimbatum* ♀. Scutum, capitulum, coxae I–IV, spiracle, tarsi I and IV. (N. 569.)

DESCRIPTION. *Body*: *L.* 6–11 mm., *W.* 4–8 mm. *Scutum*: 2·25 × 2·65 mm., cordiform, posterior angle wide; colour dark-brown, with an irregular, pale spot in each scapular field and a small, pale spot at the external border of the cervical groove; punctations unequal, many, coarse, distributed in the anterior part of the scutum; cervical grooves long, narrow and deep anteriorly; divergent posteriorly, where they extend to the posterior third of the scutum; eyes large, pale and flat. *Venter*: almost glabrous; genital aperture opposite to coxa II; spiracles small, comma-shaped with a pronounced dorsal extension. *Capitulum*: large, *L.* 1·3 mm., basis rectangular, lateral margins slightly convex, postero-lateral angles non-salient; porose areas almost circular, large, interval one-and-a-half times diameter; palps long, stout, club-shaped, article 2 one-and-a-half times as long as article 3; hypostome long, spatulate, dentition 4 | 4. *Legs*: coxa I with two short, stout, widely-

separated, pointed spurs; coxa II–IV each with a single similar spur; tarsi attenuated in talus; pulvilli half length of claws.

Description based on 4 ♂s, off *Trachysaurus rugosus*, **Australia**, 12. VI. 1906, the gift of the Wellcome Bureau of Scientific Research (N. 3124), and 1 ♀, off *Diemenia superciliosa*, Herdman's Lake, **West Australia** (N. 1569). Neumann's original description was based on 2 ♂s, off *Trachysaurus rugosus*, in the Zoological Gardens, Rotterdam (Leyden Mus.). In his later description (1911, p. 86) Neumann gives W. Australia as the habitat of the species.

72. AMBLYOMMA CAELATURUM Cooper & Robinson, 1908.

Figs. 111 and 112.

Synon., Lit. and Iconogr.:

Amblyomma caelaturum Cooper, W. F., and Robinson, L. E., II. 1908, pp. 460–462, specific description of ♂ and ♀; Figs. 6–9, ♂ dorsum, ♂ and ♀ spiracles, ♂ tarsus I, and ♀ scutum and capitulum (herein reproduced).

Amblyomma malayanum Neumann, L. G., III. 1908, pp. 14–16, specific description of ♂ and ♀; Figs. 9 and 10, ♂ coxae and ♀ dorsum (fig. 10 herein reproduced); p. 21, analytical key: 1911, p. 89, brief description of ♂ and ♀.

Male (Fig. 111). Diagnosis: A large tick; scutum almost circular; ornate, with a pale spot in each scapular angle and a median pale spot in the posterior angle of a well-defined pseudoscutum; postero-median stripe, lateral spots and antero-accessory stripes in the form of smooth, salient ridges and bosses; postero-accessory stripes represented by oblique, wide, shallow grooves; marginal groove absent; punctations numerous, large and deep; eyes pale, flat, indistinct; hypostome dentition 4 | 4; coxa I with two short, blunt, spurs; coxae II–IV each with a small spur; tarsi attenuated in talus.

DESCRIPTION. *Body*: *L.* 7·1 mm., *W.* 6·8 mm., contour almost circular, slightly narrower in front, very slightly concave in the region of the eye. *Scutum*: dark-brown, paler in the anterior part; ornate, with a pale spot in each scapular angle and a median pale spot in the angle of the well-defined and slightly-salient pseudoscutum; postero-median stripe in the form of a smooth, longitudinal ridge extending from the anterior margin of the median festoon to the centre of the scutum; postero-accessory stripes represented by a pair of obliquely-placed, wide, shallow depressions commencing posteriorly opposite the 3rd festoon

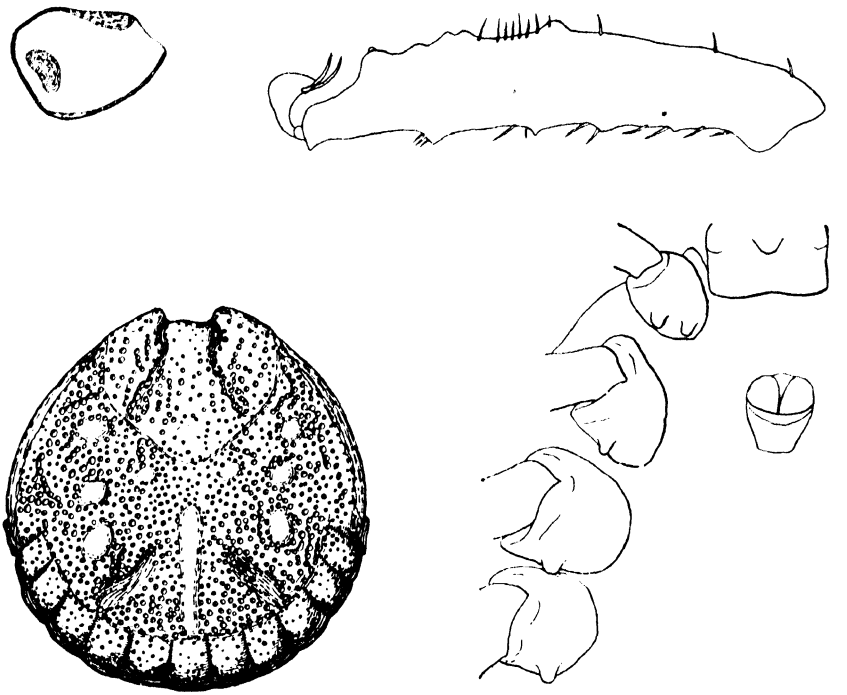


Fig. 111. *Amblyomma caelaturum* ♂. Scutum, capitulum, tarsus I, spiracle. (From Cooper and Robinson, 1908, Figs. 6–9, C. 259.) Coxae I–IV. (From Neumann, III. 1908, Fig. 9.)

and directed towards the anterior extremity of the postero-median stripe; lateral spots and antero-accessory stripes in the form of smooth bosses; cervical grooves deep anteriorly, curved with the convexity external, the posterior part shallow and divergent; marginal groove absent or represented by a linear arrangement of coarse punctations along the anterior margins of the festoons; punctations very numerous, large and deep, fairly evenly distributed, sparser on the pseudoscutum, the marginal ridges and the festoons, absent from the salient areas; eyes flat, pale and indistinct; festoons well-defined, convex, with deep separations; their posterior edges not attaining the margin of the body. *Venter*: dark-brown, finely wrinkled, with superficial punctations and few fine hairs in the posterior part; genital aperture opposite coxa II; spiracles large, very broad, sub-triangular. *Capitulum*: *L.* 1·3 mm., basis rectangular, postero-lateral angles barely salient; palps relatively short and thick, article 2 twice as long as article 3; hypostome shorter than palps, dentition 4 | 4. *Legs*: long and relatively slender, dark-brown

with pale spots on the dorsal side of the extremities of the femur, tibia and protarsus; coxa I with two small, blunt, sub-equal spurs; a single, short, blunt spur on each of coxae II–IV; tarsi attenuated in talus.

Female (Fig. 112). Diagnosis: A large tick; scutum triangular, posterior angle broad; ornate, with a pale spot in each scapular angle and a median pale spot in the posterior angle; punctations large, fairly numerous, unequal and somewhat irregular in distribution; eyes pale, flat and indistinct; foveae unusually large and distinct; basis capituli trapezoidal, porose areas circular, deep, interval about equal to diameter; hypostome dentition 4 | 4; coxa I with two short, sub-equal spurs; coxae II–IV each with a single, short, blunt spur.

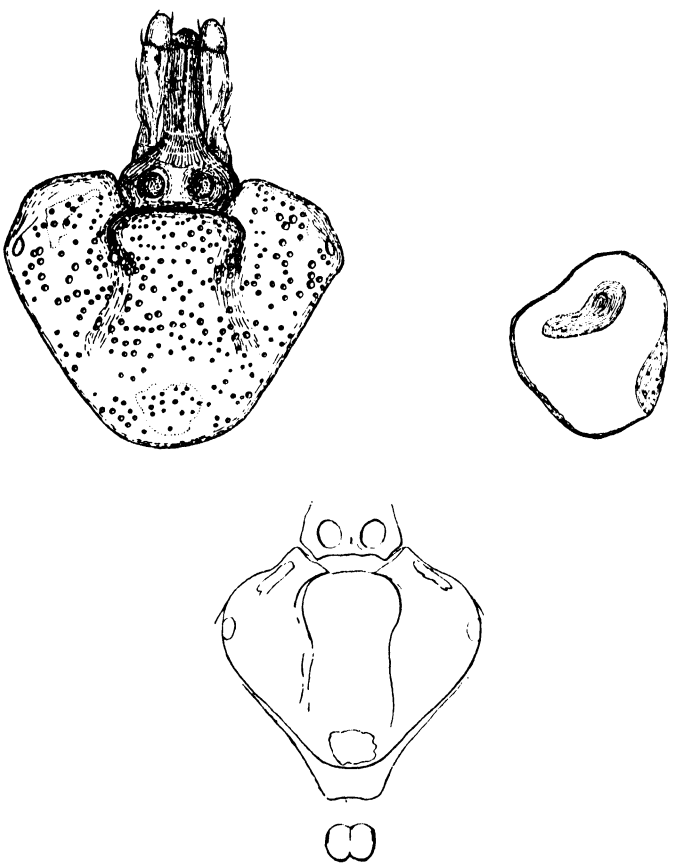


Fig. 112. *Amblyomma caelaturum* ♀. Scutum, capitulum, spiracle. (From Cooper and Robinson, 1908, Figs. 6–9, C. 259.) Scutum in outline, with foveae posterior thereto. (From Neumann, III. 1908, Fig. 10.)

DESCRIPTION. *Body*: *L.* 8–9 mm., *W.* 6–7 mm. (the type specimen, a partially-gorged example, measures 11·6 × 9·5 mm.); dorsum dark-brown, with numerous whitish hairs; foveae unusually large, appearing as a pair of adjacent salient plaques situated a short distance posterior to the scutum. *Scutum*: 3·3 × 3·5 mm., triangular, posterior angle broad and rounded, postero-lateral margins rectilinear, antero-lateral margins prominent; ornate, with a pale spot in each scapular angle and a median pale spot in the posterior angle; punctations fairly numerous, large, irregularly distributed and unequal in size, confluent in places; cervical grooves deep anteriorly, shallow and divergent posteriorly; eyes pale, flat and indistinct. *Venter*: like dorsum; genital aperture small, situated opposite coxa II; spiracles large, very broad, sub-triangular. *Capitulum*: *L.* 2 mm., basis trapezoidal, postero-lateral angles non-salient; porose areas of medium size, circular, deep, interval about equal to diameter; palps relatively longer than those of the ♂, article 2 three times as long as article 3; hypostome dentition 4 | 4. *Legs*: long and rather slender; coxa I with two short, blunt, sub-equal spurs; a single, short, blunt spur on each of coxae II–IV; tarsi long, attenuated in talus.

Geographical Distribution and Hosts.

The types, a ♂ and a partially gorged ♀, were found on *Geoemyda spinosa*, Kuala Aring, **Federated Malay States**, 1899, Dr N. Annandale coll. (Skeat Expedition), the gift of Mr F. F. Laidlaw (C. 259). In the original description they were described erroneously as having been collected by Mr Laidlaw in Java; I have to thank Dr N. Annandale for the correction. Neumann's description is based on a ♂ and 2 ♀s, host not specified, from Bukitima, **Singapore** (British Mus.). In addition to the types, the Cambridge collection contains specimens, ♂ and ♀, off *tortoise*, Malay Peninsula, 1906, Dr H. E. Durham coll. (N. 202).

73. AMBLYOMMA GEOEMYDAE (Cantor, 1847).

Fig. 113.

Synon., Lit. and Iconogr.:

Ixodes geoemydae Cantor, T., 1847, p. 608.

Amblyomma geoemydae (Cantor) Neumann, L. G., 1906, pp. 214–216, specific description of ♀; Figs. 15 and 16, ♀ scutum and basis capituli, spiracle (herein reproduced).

Male: unknown.

Female (Fig. 113). Diagnosis: A large tick; scutum broad and triangular, posterior angle narrow; ornate, with pale spots on a maroon-brown ground; punctations numerous, large; basis capituli

sub-triangular, porose areas large, oval, divergent, interspace less than diameter; hypostome dentition 4 | 4; coxa I with two short, flat, sub-equal spurs, a single similar spur on each of coxae II–IV; tarsi attenuated in talus.

DESCRIPTION. *Body*: *L.* 18–25 mm., *W.* 12–19 mm. (all gorged examples); ovoid, swollen; dorsum yellowish-brown, with short and very scattered hairs. *Scutum*: 2·5 × 3·4 mm., triangular, postero-lateral margins rectilinear, posterior angle narrow; ornate, with a pale spot in the posterior angle and irregular pale markings along the scapular borders and in the lateral fields; cervical grooves deep, long, anterior portion convex externally, continued backwards as shallow, divergent depressions almost to the posterior border; punctations numerous, large,

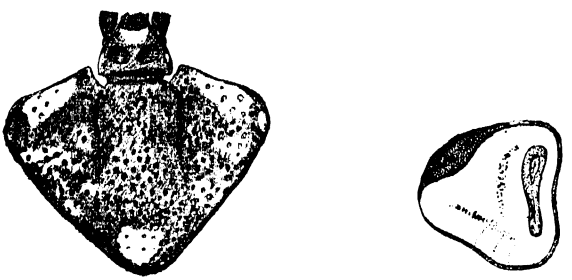


Fig. 113. *Amblyomma geoemydae* ♀. Scutum and basis capituli, spiracle. (From Neumann, 1906, Figs. 15 and 16.)

deep, sub-equal; eyes pale and flat. *Venter*: colour and hairs as dorsum; spiracles large, sub-triangular with broadly-rounded angles. *Capitulum*: *L.* 1·8 mm., basis sub-triangular, with pale enamelling at the angles, lateral margins rounded, postero-lateral angles non-salient; porose areas large, oval, divergent, interval less than diameter; palps thick, article 2 almost twice as long as article 3; hypostome dentition 4 | 4. *Legs*: long; coxa I with two short, flat, sub-equal, well-separated spurs, as broad as long; a single similar spur on each of coxae II–IV; tarsi long, attenuated in talus.

Geographical Distribution and Hosts.

Cantor's specimen was found attached to the neck of a *tortoise*, *Geoemyda spinosa* Gray, Pinang Hills, **Sumatra** (British Mus.). Neumann records 3 gorged ♀s, from Mt Kina Balu, **Borneo**, J. Whitehead coll.

74. AMBLYOMMA BREVISCUTATUM Neumann, 1899.

Fig. 114.

Lit.: Neumann, L. G., 1899, p. 214, specific description of the ♀: Dönitz, W., 1907, p. 214, very brief description of the ♀, after Neumann: Neumann, L. G., 1911, p. 81, brief description of the ♀.

Male: unknown.

Female (Fig. 114). Diagnosis: A moderately large species; scutum triangular cordiform, considerably broader than long, ornate; punctations numerous, coarse, unequal; coxa I with two short, blunt spurs; a single spur on each of coxae II–IV.

DESCRIPTION. *Body*: *L.* 6·0 mm., *W.* 5·0 mm., contour oval, dorsum yellowish-red, punctate, with stiff whitish hairs; festoons well-marked. *Scutum*: 2·65 × 3·35 mm., triangular-cordiform, posterior angle broad;

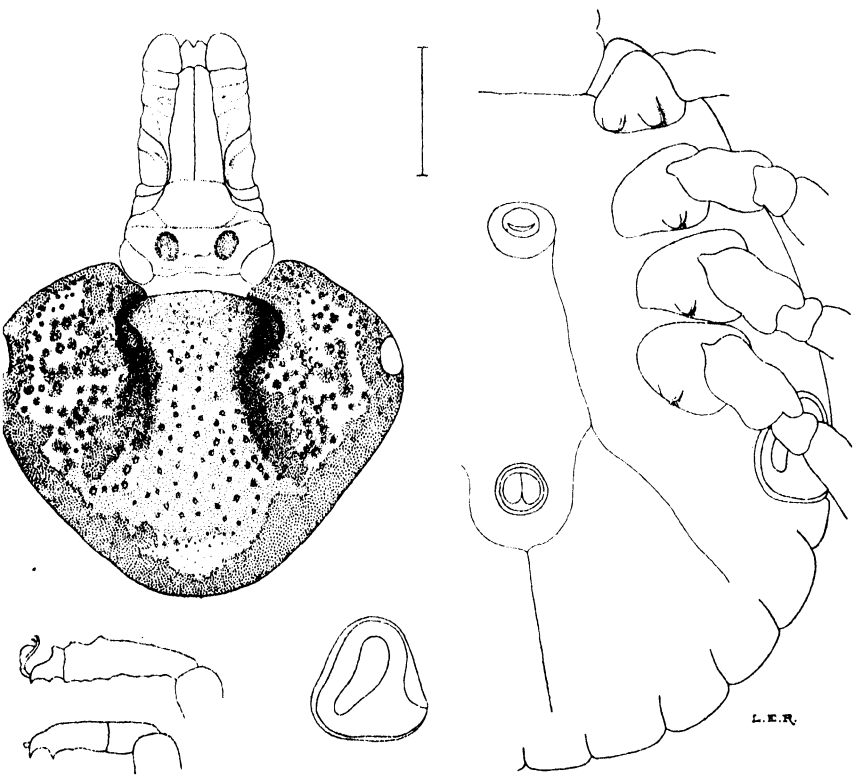


Fig. 114. *Amblyomma breviscutatum* ♀. Scutum, capitulum, venter, tarsi I and IV, spiracle. (Type, Paris Mus.)

ornate, with a dark marginal coloration extending from the scapular to the posterior angle; ocular and limiting spots barely distinguishable from the dark margin; cervical stripes broad, divergent posteriorly; punctations numerous, unequal, coarse and areolate in the lateral fields (in the specimen here described the pale median field shows a yellowish-red colour, due to preservation in alcohol); cervical grooves deep and sigmoid anteriorly, continued posteriorly as shallow, divergent depressions; eyes large, pale and flat. *Venter*: with abundant short hairs; punctations finer than on dorsum; festoons distinct; genital aperture opposite coxa II; spiracles broadly triangular with rounded angles. *Capitulum*: long, 1·9 mm., basis a little wider at the posterior part than in front; postero-lateral angles broadly rounded, salient, demarcated by a suture-like depression; porose areas small, oval, divergent, widely-separated; palps long, sides almost parallel, article 2 three times as long as article 3; hypostome long, dentition 4 | 4. *Legs*: long, reddish-brown, with pale annulation at the distal extremities of the articles; coxa I with two short, stout, rounded spurs; a single, short, blunt spur on each of the other coxae; tarsi tapering gradually.

Description from the type, a ♀ from the **Congo**, collected by Thollon, 1886 (Paris Mus.).

75. AMBLYOMMA CYPRIUM Neumann, 1899.

Figs. 115 and 116.

Synon., Lit. and Iconogr.:

Amblyomma cyprium Neumann, L. G., 1899, pp. 219–221, specific description of ♂ and ♀; 1911, pp. 87–88, brief description of ♂ and ♀.

Amblyomma scaevola Oudemans, A. C., 1905, p. 216; 1906, pp. 130–131, Pl. III, Figs. 51–58, ♂ dorsum and venter, part of capitulum from dorsal and ventral aspects, palps and digit of chelicera.

Male (Fig. 115). Diagnosis: A medium-sized tick; scutum broadly oval, narrowing anteriorly; ornate, with characteristic dark-coloured, raised ornamentation on a pale ground; marginal groove absent; punctations numerous, coarse and areolate; capitulum short, palps thick; hypostome short and broad, dentition 4 | 4; coxa I with two unequal spurs, the external spur being the longer; a single, triangular, pointed spur on each of the other coxae.

Description. *Body*: *L.* 5·6 mm., *W.* 5·0 mm., contour broad oval, widest behind middle, narrowing anteriorly. *Scutum*: convex, ornate, with dark-brown markings on a pale ground (the latter shows a coppery

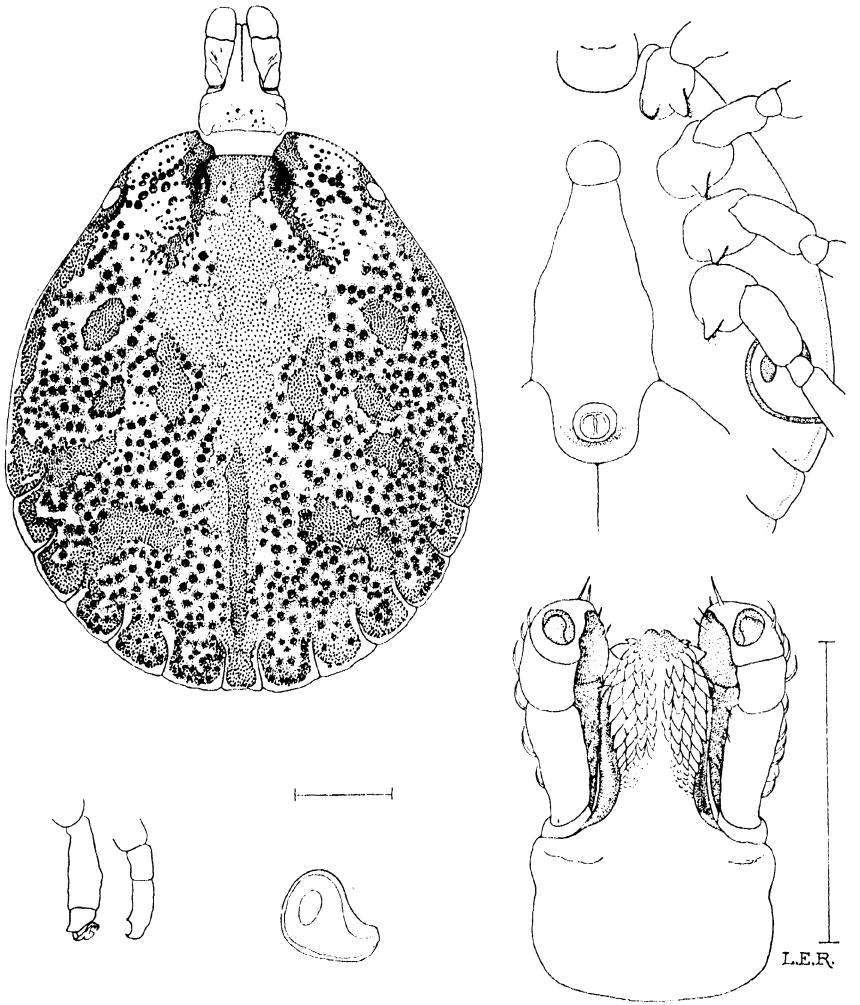


Fig. 115. *Amblyomma cyprium* ♂. Scutum, capitulum from dorsal and ventral aspects, venter, tarsi I and IV, spiracle. (N. 72.)

lustre in alcohol-preserved specimens); postero-median stripe narrow, extending from the median festoon nearly to the centre of the scutum; postero-accessory stripes extending from the 2nd festoon in an almost horizontal direction towards the median line; the three lateral spots small, distinct; falciform stripe absent; antero-accessory stripes situated between the 2nd lateral spots, slightly divergent anteriorly; a narrow dark stripe on each marginal ridge, extending from the ocular spot to

the external festoon; cervical stripes very divergent posteriorly; festoons dark-coloured, excepting the 1st, 2nd, 3rd and 5th, upon each of which an extension of the pale ground colour may encroach; marginal groove absent; cervical grooves short and deep, continued posteriorly by a very shallow depression; punctations large, deep, numerous, confluent in places, areolate, absent from the dark raised markings; eyes rather small, flat, indistinct and yellowish; festoons well-defined, with broad separations. *Venter*: reddish-yellow, wrinkled, finely punctate; genital aperture opposite coxa II; spiracles large, comma-shaped. *Capitulum*: relatively short, *L.* 1·2 mm., basis rectangular, postero-lateral angles raised and slightly salient; palps short and stout; article 2 one-and-a-half times as long as article 3; hypostome short, broad, spatulate, dentition 4 | 4 (internal row shorter than the others). *Legs*: long, strong, dark-brown in colour; coxa I with two spurs, the external spur twice as long as broad; coxae II–IV each with a short, stout, triangular spur; tarsi moderately long, tapering gradually; pulvilli half length of claws.

Female (Fig. 116). Diagnosis: A medium-sized tick; scutum cordiform, ornate; porose areas large, widely-separated, almost tangential to the posterior margin of the basis capituli; hypostome dentition 4 | 4; coxa I with two short, blunt spurs; a single similar spur on each of the other coxae.

Description. *Body*: *L.* 6 mm., *W.* 5 mm.; dorsum dark-brown, wrinkled, punctate, with numerous large whitish hairs; marginal groove absent; festoons well-defined, as broad as long. *Scutum*: cordiform, posterior angle moderately narrow, postero-lateral margins convex; 2·5 × 3·0 mm.; ornate, ocular and limiting spots large; frontal spot elliptical, clearly defined; cervical stripes narrow and divergent, not reaching the limiting spots; a narrow dark edging extending round the entire margin of the scutum behind the eyes; cervical grooves short, deep, comma-shaped, continued posteriorly by a shallow depression; punctations numerous, coarse in the antero-lateral fields; eyes rather small, flat, indistinct. *Venter*: dark-brown, smoother than the dorsum; genital aperture opposite the posterior margin of coxa II; spiracles large, triangular, with rounded angles. *Capitulum*: longer than in the ♂, *L.* 1·5 mm.; basis trapezoidal, narrowing anteriorly; lateral margins convex; postero-lateral angles non-salient; porose areas large, broadly elliptical, widely-separated, almost tangential to the posterior margin of the basis; palps moderately long, contracted at base, article 2 more

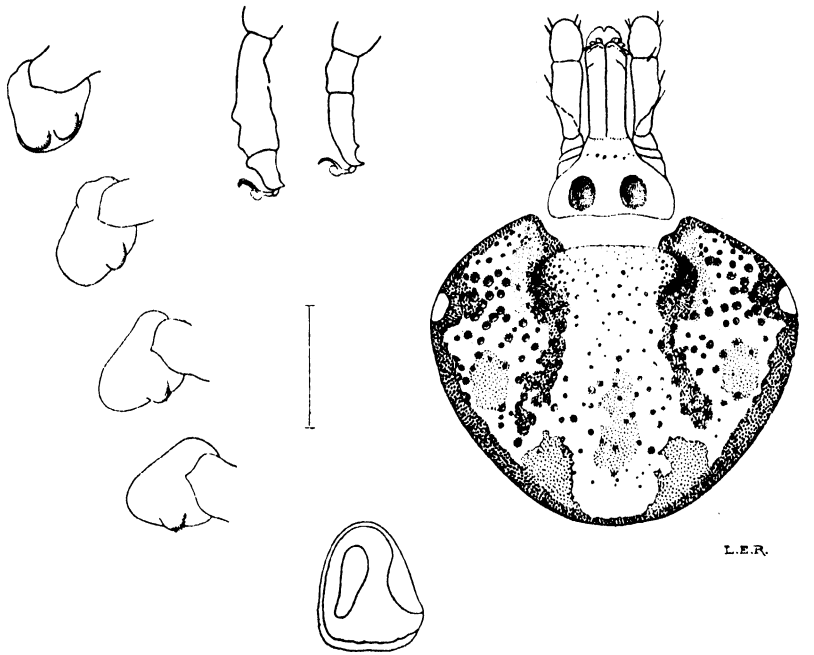


Fig. 116. *Amblyomma cyprium* ♀. Scutum, capitulum, coxae I–IV, tarsi I and IV, spiracle. (Berlin Mus. No. 672/1911.)

than twice as long as article 3; hypostome long, dentition 3 | 3. *Legs*: dark-brown in colour, long and stout; coxal armature as in ♂, the spur on coxa IV being weaker. Gorged ♀s may attain a length of 16 mm. and a width of 13 mm.

Geographical Distribution and Hosts.

South-eastern Asia, particularly the islands of the **Malay Archipelago** and the China Sea, ranging north to **Formosa**; the known hosts are *Chelonia* spp. Neumann (1899) records ♂s and ♀s, host not specified, from the **Marianne Is.**, Marche coll.; in his later description (1911) he adds the **Philippine Is.**, **New Guinea** and the **Malay Peninsula**. Oudemans' *Amb. scaevola*, a single ♂, host unknown, came from Manokwari, **New Guinea**, v. 1903, Messrs de Beaufort and Lorentz coll. The Zool. Mus. collection, Berlin, contains ♀s, off *Cyclemys* sp., Kankan, **Formosa**, VII. and 20. VIII. 1909, H. Sauter coll. (Jr. No. 672/1911), which I have identified with this species. The Cambridge collection contains ♂s, off *Sus celebensis*, **Celebes**, the gift of Lord Rothschild (N. 73).

76. AMBLYOMMA QUASICYPRIUM, n.sp.

Fig. 117.

Male: unknown.

Female (Fig. 117). Diagnosis: A medium-sized, ornate tick; scutum triangular-cordiform, punctations coarse in lateral fields, eyes dark-coloured; capitulum long, basis capituli more than twice as broad as long, sides convex, postero-lateral angles salient, porose areas small and very widely separated; spiracles triangular with rounded angles, broader than long; coxa I with two short spurs; coxae II–IV each with a single short spur.

DESCRIPTION. *Body*: *L.* 11·7 mm., *W.* 9·4 mm. (gorged), broadest behind level of spiracles, narrow in front; dorsum dark-claret coloured, finely striate, with a moderate covering of white hairs, marginal groove absent, festoons almost obliterated by distension, other grooves and

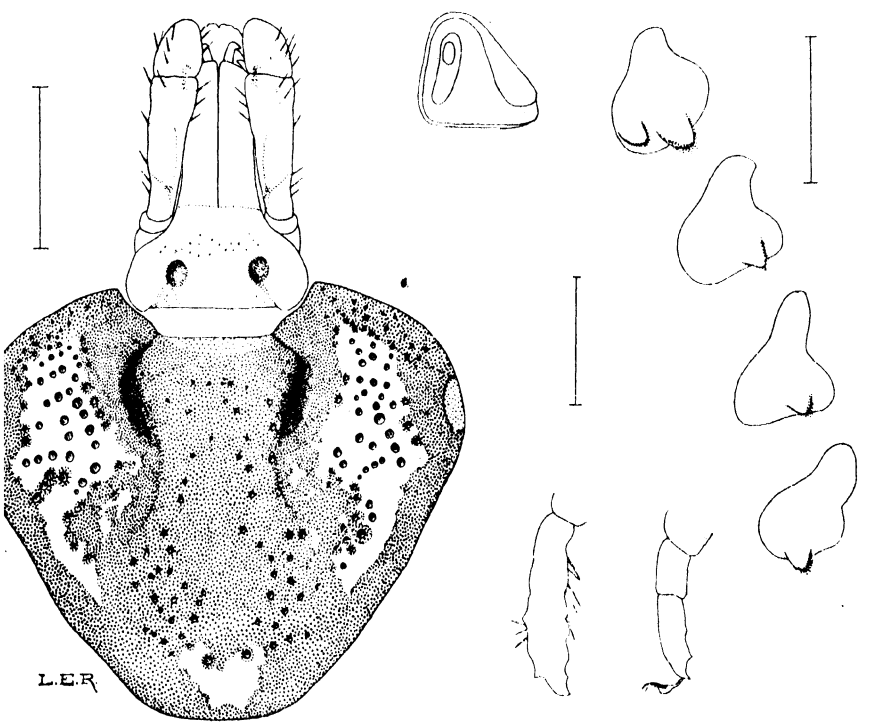


Fig. 117. *Amblyomma quasicyprium* ♀. Scutum, capitulum, spiracle, coxae I–IV, tarsi I and IV. (N. 564.)

depressions normal. *Scutum*: broader than long, 3·3 × 2·6 mm., triangular-cordiform, posterior angle broad; a large irregular pale area in each lateral field and a small pale spot in the posterior angle; dark-brown round eyes and cervical grooves, and a dark margin extending from the eyes to the posterior angle; punctation coarse in lateral fields, finer and sparser elsewhere; eyes dark-coloured, large, flat, oval, situated at level of anterior fourth of scutum; cervical grooves deep in front, broad and curved, continued posteriorly as shallow divergent depressions which extend barely beyond the middle of the scutum. *Capitulum*: *L.* 1·8 mm.; basis capituli rectangular, more than twice as broad as long, sides convex; postero-lateral angles salient in the form of short, blunt cornua; porose areas small, very widely separated; palps long, club-shaped, article 2 two-and-a-half times the length of article 3; hypostome slightly spatulate, dentition 4 | 4. *Venter*: of same colour as dorsum, almost glabrous, with a few small whitish hairs; spiracles triangular, with rounded angles, broader than long. *Legs*: slender, dark-brown; coxa I with two short, blunt spurs of which the external is the longer; a single, short, blunt spur on each of the other coxae; tarsi moderately long, tarsus I humped on dorsal side giving it the appearance of being abruptly attenuated, tarsi II–IV tapering gradually; pulvilli of medium size.

Description based on a gorged female, off *Ateles melanochir*, from Frontera, Tabasco, **Mexico** (ex Rothschild coll., No. 243) (N. 564). A second gorged female tick in the Cambridge coll. (N. 1188), off a *cow*, Tavenni, Fiji Is., collected and sent by Mr F. P. Jepson, 13. VII. 1910, labelled "*Amblyomma cyprium*, detd. by L. G. Neumann," undoubtedly belongs to this species. It differs from *A. cyprium* in many minor respects but principally in the fact that the porose areas are small and well removed from the posterior border of the basis capituli, whereas in *A. cyprium* the porose areas are large and tangential to the posterior border of the basis capituli.

77. AMBLYOMMA PICTUM Neumann, 1906.

Synon., Lit. and Iconogr.:

Amblyomma pictum Neumann, L. G., 1906, pp. 204–206, specific description of ♂ and ♀; 1911, p. 73, brief description of ♂ and ♀.

Amblyomma conspicuum Aragão, H. de B., 1913, pp. 265–266, specific description of ♂; Pl. XXVI, Figs. 1 and 2, ♂ dorsum and venter (coloured).

Male. Diagnosis: A large tick; scutum elongate oval, marginal groove absent; ornamentation indistinct, consisting of a yellowish

patina in the spaces between the various dark-brown spots and stripes, outlining the contour of a pseudoscutum; postero-median and other stripes, lateral spots, etc., slightly salient; punctations small, deep, very numerous, confluent in places; eyes small, pale and flat; hypostome dentition 4 | 4; coxa I with two flat, sub-equal spurs; a single, flat spur, about as broad as long, on each of the other coxae, longest on coxa IV.

DESCRIPTION. *Body*: *L.* 8·0 mm., *W.* 4·9 mm., contour elongate oval, slightly broader behind than in front. *Scutum*: glabrous, shining, with a yellowish patina outlining a pseudoscutum; postero-median stripe extending anteriorly nearly to the centre of the scutum; postero-accessory stripe rather long, directed towards the centre of the anterior part of the scutum; lateral spots small, isolated; antero-accessory stripes present; frontal spots small, fused with the cervical stripes; marginal groove absent; cervical grooves short, deep and divergent anteriorly; punctations not coarse; eyes small, pale and flat; festoons well-defined, longer than broad. *Venter*: paler than dorsum, glabrous; genital aperture opposite the interspace between coxae I and II; spiracles large, broad comma-shaped. *Capitulum*: short, *L.* 1·22–1·60 mm., basis rectangular, postero-lateral angles barely salient; article 2 of palp one-and-a-half times as long as article 3; hypostome short, spatulate, dentition 4 | 4[1]. *Legs*: stout, dark-brown, narrowly annulated with yellow at the distal extremities of the articles; coxa I with two short, stout, flat, sub-equal spurs; a single spur, about as broad as long, on each of coxae II–IV, largest on coxa IV; tarsi attenuated in talus.

Female. Diagnosis: A large tick; scutum triangular-cordiform; ornate, with dark marginal coloration, cervical stripes, etc., on a pale-yellow ground; cervical grooves deep anteriorly; punctations medium in size, numerous; eyes pale and flat; hypostome dentition 4 | 4; coxa I with two sub-equal spurs; a single short spur on each of coxae II–IV.

DESCRIPTION. *Body*: *L.* 7 mm., *W.* 4 mm., contour oval, barely broader behind than in front; dorsum brown, striated, punctate, almost glabrous; marginal groove and festoons well-defined. *Scutum*: 2·9 × 2·9 mm., triangular-cordiform, postero-lateral margins slightly convex, posterior angle fairly broad; ornate, ground colour pale-yellow with a dark marginal coloration extending from the ocular spot to the posterior

[1] Neumann gives the hypostome dentition 4 | 4; Aragão, in his description of *Amb. conspicuum*, gives it as 3 | 3.

angle, where it is very narrow; cervical grooves deep anteriorly, extending as shallow depressions nearly to the posterior border of the scutum; punctations numerous, of medium size; eyes pale and flat. *Venter*: similar to dorsum. *Capitulum*: *L.* 1·8 mm., with yellow enamelling on the dorsal surface of the basis and palps; basis rectangular, posterior angles broad and slightly salient; porose areas small, circular, interval slightly greater than diameter; palps long, article 2 at least twice as long as article 3; hypostome long, slightly spatulate, dentition 4 | 4. *Legs*: long and stout; coxa I with two sub-equal spurs, twice as long as broad; coxae II–IV each with a single, short spur, longest on coxa IV; tarsi long, attenuated in talus.

Geographical Distribution and Hosts.

Neumann's original description (1906, p. 206) is based on 3 ♂s, off *Myrmecophaga jubata* L., from S. America, and 2 ♀s from Bahia, **Brazil** (British Mus.); in his later description (1911, p. 73) he records *Tamandua tridactyla* (L.) as a host. Aragão (1913, p. 266, *Amb. conspicuum*) describes a ♂, off *dog*, from Corrego Flor, north-west of Matto Grosso, **Brazil**, Dr M. de Campos coll., and 3 ♂s from the Xingu R. basin, State of Amazonas, **Brazil**, Dr Aben-Athar coll.

78. AMBLYOMMA NITIDUM Hirst & Hirst, 1910.

Lit. and Iconogr.: Hirst, S., and Hirst, L. F, 1910, pp. 304–305, specific description of ♂ and ♀; Figs. 5 and 6, ♂ and ♀ dorsum.

Male. Diagnosis: A small, *Aponomma*-like tick; scutum smooth, shining, with very fine punctations; colour dark-brown, inornate; marginal groove absent; eyes minute and almost invisible; hypostome dentition 4 | 4; coxa I with two very short spurs; a single similar spur on each of the other coxae, slightly longer on coxa IV.

Description. *Body*: *L.* 4·1 mm., *W.* 3·5 mm., contour broad oval, slightly narrower in front. *Scutum*: smooth, shining; colour dark-brown, inornate; cervical grooves deep anteriorly, shallow and divergent posteriorly; marginal groove represented by very ill-defined, wide and superficial lateral depressions terminating in front of the external festoons; punctations numerous, very fine, especially towards the centre, slightly larger towards the periphery; eyes minute and almost invisible. *Venter*: dark-brown, much furrowed and pitted in the posterior part; spiracles very broad, sub-triangular. *Capitulum*: *L.* 1·08 mm., hypo-

stome dentition 4 | 4. *Legs*: pale-brown; coxa I with two very short spurs; coxae II–IV each with a single very short spur, slightly longer on coxa IV; tarsi gradually attenuated.

Female. Diagnosis: A rather small *Aponomma*-like tick; scutum triangular, dark-brown in colour, inornate; punctations numerous, small, fine in the median field, a little coarser in the lateral fields; eyes very indistinct; porose areas oval, rather large; hypostome dentition 4 | 4; coxa I with two very short spurs; a single similar spur on each of coxae I–IV.

DESCRIPTION. *Body*: *L.* 5·2 mm., *W.* 4·0 mm., contour elliptical; dorsum brownish. *Scutum*: 1·45 × 2·03 mm., triangular, posterior angle obtuse, postero-lateral margins slightly concave; colour dark-brown, inornate; cervical grooves well-defined, deep anteriorly, shallow and divergent posteriorly where they extend to the posterior margin of the scutum; punctations numerous, small, fine in the median field, coarser in the lateral fields; eyes very inconspicuous. *Venter*: brownish; spiracles broadly comma-shaped. *Capitulum*: *L.* (?), fairly long; porose areas oval and of rather large size; hypostome dentition 4 | 4. *Legs*: pale-brown; coxa I with two very short spurs; a single similar spur on each of the other coxae; tarsi gradually attenuated.

The only known examples of this species are the types, a ♂ and a ♀, off a *sea-snake*, **Solomon Islands**, Staff-Surgeon Vidal Sharpe, R. N. coll. (British Museum).

79. AMBLYOMMA GOELDII Neumann, 1899.

Figs. 118 and 119.

Lit.: Neumann, L. G., 1899, pp. 238–239, specific description of ♂ and ♀; 1911, p. 72, brief description of ♂ and ♀. 1909, Rohr, C. J., pp. 170–171. His notes on the biology (pp. 118–120) relate to *Amb. rotundatum* (*agamum*), which he misidentified as *Amb. goeldii*.

Male (Fig. 118). Diagnosis: A small tick; scutum inornate, dark-reddish brown; cervical grooves in the form of small, divergent, oval pits; marginal groove absent; punctations of medium size, numerous, evenly distributed; eyes pale and flat; hypostome dentition 4 | 4; coxa I with two moderately-long, sub-equal spurs, not attaining the anterior border of coxa II; a single, very short, broad spur on each of coxae II and III; a single small spur, as broad as long, on coxa IV.

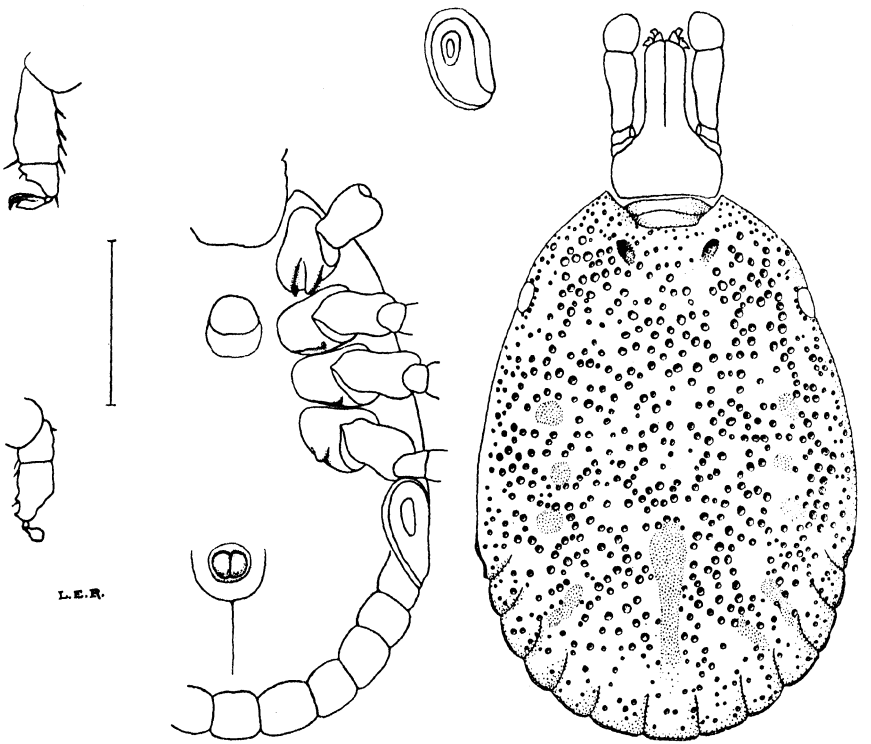


Fig. 118. *Amblyomma goeldii* ♂. Scutum, capitulum, venter, spiracle, tarsi I and IV. (N. 2873.)

DESCRIPTION. *Body*: *L.* 3·4 mm., *W.* 2·5 mm., contour oval, almost elliptical. *Scutum*: dark reddish-brown, inornate; postero-median and postero-accessory stripes slightly salient, lateral spots and cervical stripes distinguishable by their darker colour; cervical grooves in the form of small, divergent, oval pits; marginal groove absent; punctations of medium size, numerous, evenly distributed; eyes pale and flat; festoons clearly-defined. *Venter*: yellowish, with scattered punctations; genital aperture opposite coxa II; spiracles moderately large, broadly comma-shaped. *Capitulum*: *L.* 1·1 mm.; basis rectangular, lateral margins slightly convex, postero-lateral angles non-salient; palps club-shaped, article 2 twice as long as article 3; hypostome spatulate, dentition 4 | 4. *Legs*: medium; coxa I with two moderately long, stout, sub-equal, contiguous spurs which do not attain the anterior margin of coxa II; coxae II and III each with a very short, broad, flat spur, which is prolonged towards the postero-internal angle of the coxa as a fine salient ridge; tarsi short and thick, abruptly attenuated.

Female (Fig. 119). Diagnosis: A medium-sized tick; scutum triangular-cordiform, dark reddish-brown, inornate; cervical grooves commencing as deep, oval pits, continued posteriorly as a shallow and irregular depression; punctations fairly numerous, unequal in size, coarser in the scapular angles and lateral fields; eyes pale and flat, situated in front of the anterior third; hypostome dentition 3 | 3; coxae I–IV each with two short, blunt spurs.

DESCRIPTION. *Body*: *L.* 6·0 mm., *W.* 4·0 mm. (gorged specimens may attain dimensions of 19 × 13 mm.); contour oval; dorsum dark reddish-brown, with few punctations; marginal groove continuous, festoons well-defined. *Scutum*: 2·4 × 2·3 mm., triangular-cordiform, postero-lateral margins slightly convex, posterior angle narrow; colour dark reddish-brown, inornate, or with a small pale spot at the posterior angle; cervical grooves commencing as deep, oval pits, continued posteriorly as shallow, irregular depressions; punctations fairly numerous, unequal in size, coarse in the scapular angles and lateral fields, fine elsewhere; eyes rather small, pale and flat, situated in front of the anterior third of the length of the scutum. *Venter*: similar to dorsum in colour, punctations finer; genital aperture opposite coxa II; spiracles large, triangular, with

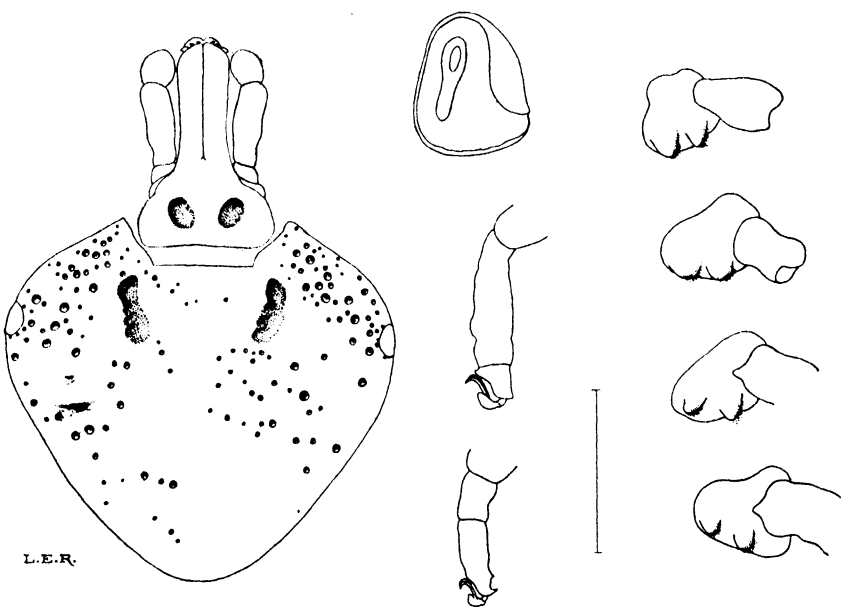


Fig. 119. *Amblyomma goeldii* ♀. Scutum, capitulum, spiracle, coxae I–IV, tarsi I and IV. (N. 2874.)

rounded angles. *Capitulum*: *L.* 1·4 mm., basis sub-triangular, postero-lateral angles non-salient, lateral margins convex; porose areas moderately large, oval, divergent, interval greater than smaller diameter; palps long, slender, article 2 two-and-a-half times as long as article 3; hypostome dentition 3 | 3. *Legs*: more slender than those of the ♂; coxae I–IV each with two short, blunt spurs, diminishing a little in size on each successive coxa; tarsi moderately long, attenuated in talus.

Geographical Distribution and Hosts.

Neumann's original description (1899, pp. 238–239) is based on 6 ♂s and 1 ♀, off *Myrmecophaga tetradactyla*; 4 ♀s, off *Bufo agua*, Pará, **Brazil**, Göldi coll.; 1 ♀ from Demerara, **British Guiana** (Berlin Mus.), and one gorged ♀, from Haut Carsevenne (Franco-Brazilian frontier). Aragão (1911, pp. 159 and 161) records the species from Manguinhos and Meyer (Federal District); State of Santa Catharina; banks of Guaporé R., State of Matto Grosso, **Brazil**, and lists *Bufo* sp., *Boa constrictor* and *Elaps* sp. as hosts.

The Cambridge collection contains co-types (N. 2873, 2874), ♂ and ♀, from Pará, Brazil, presented by Prof. L. G. Neumann; also specimens, off a *toad*, Condoto, **Colombia**, S. America, 1913, Dr H. T. G. Spurrell coll. (N. 2617).

80. AMBLYOMMA SUBLAEVE Neumann, 1899.

Figs. 120 and 121.

Synon., Lit. and Iconogr.:

Rhipicephalus javanensis Supino, F., 1897, p. 233.

Dermacentor indicus Supino, F., 1897, p. 236.

Aponomma politum Neumann, L. G., 1899, p. 191, description of the ♂.

Amblyomma sublaeve Neumann, L. G., 1899, p. 221, specific description of the ♀; 1901, pp. 298–299, specific description of the ♂ and ♀; 1911, pp. 85–86, brief description of the ♂ and ♀, synonymy.

Amblyomma badium Neumann, L. G., 1901, pp. 300–301, specific description of the ♂, ♀ and nymph.

Aponomma javanense Cooper, W. F., and Robinson, L. E., 1908, pp. 464–466, Figs. 15–17, ♀ scutum and capitulum, ♀ capitulum from ventral aspect, ♀ spiracle.

Male (Fig. 120). Diagnosis: A medium-sized tick; scutum broad oval, narrow anteriorly, inornate; punctations all fine or few coarse, shallow punctations in the peripheral parts; marginal groove obsolete or completely absent; eyes indistinct; coxa I with two short, flat spurs; a single, broad, flat spur on each of coxae II–IV.

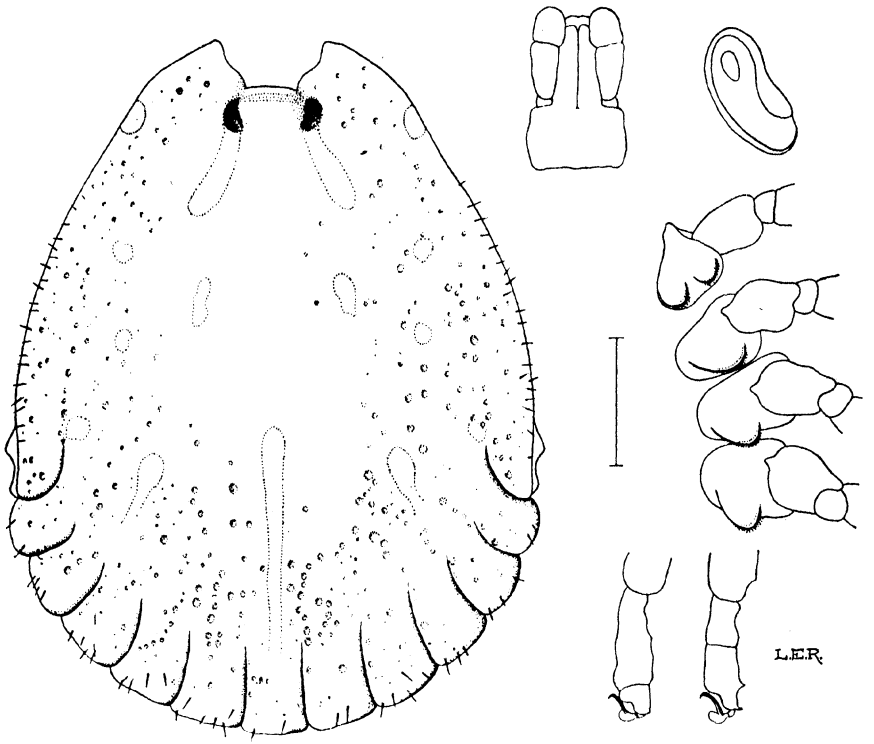


Fig. 120. *Amblyomma sublaeve* ♂. Scutum, capitulum, spiracle, coxae I–IV, tarsi I and IV. (N. 483.)

DESCRIPTION. *Body*: *L.* 5·5 mm., *W.* 4·5 mm., contour broad oval, narrow anteriorly. *Scutum*: flat or slightly convex, with scattered hairs on the marginal parts; colour dull ochre-yellow to dark maroon-brown, darker towards periphery; inornate, but the postero-median and postero-accessory stripes, lateral spots, etc., are more or less visible as darker markings on the dark ground colour; cervical grooves small, crescentic, deep; marginal grooves absent or represented by a few linearly-arranged punctations extending for a short distance anteriorly from the external festoon; punctations fine, few coarse and shallow, more or less absent from the median part of the scutum; eyes often indistinct, festoons well-defined, separations narrow. *Venter*: earthy-yellow, punctate, scattered with fine hairs; genital aperture opposite coxa II; spiracles elongate comma-shaped. *Capitulum*: *L.* 1·2 mm., basis rectangular, lateral margins slightly convex, postero-lateral angles non-salient; palps short, club-shaped, article 2 one-and-a-half times the length of article 3; hypostome dentition 3 | 3. *Legs*: short

and stout, maroon-brown; coxa I with two short, broad, well-separated, flat spurs; a single, very broad, flat spur on each of coxae II–IV; tarsi abruptly attenuated.

Female (Fig. 121). Diagnosis: A medium-sized tick; scutum cordiform, colour brown, inornate; punctations numerous, shallow but usually clearly visible; eyes often indistinct; porose areas small, oval; coxa I with two short, blunt, flat spurs; a single, very broad, flat spur on each of coxae II–IV.

Description. *Body*: *L.* 7–12 mm., *W.* 5·5–9 mm., contour oval, dorsum dull earthy-brown, with fine, scattered punctations bearing short whitish hairs; marginal groove obsolete. *Scutum*: 2·4 × 2·9 mm., cordiform, postero-lateral margins convex, posterior angle rounded, colour maroon-brown, inornate, with darker markings at periphery and cervical stripe; punctations numerous, fine for the most part, discrete, shallow; cervical grooves short, in the form of deep, oval fossae; eyes flat and often indistinct. *Venter*: as dorsum; genital aperture opposite coxa II; spiracles comma-shaped, very obliquely disposed. *Capitulum*: *L.* 1·4 mm., relatively longer than that of ♂; basis rectangular, postero-lateral angles

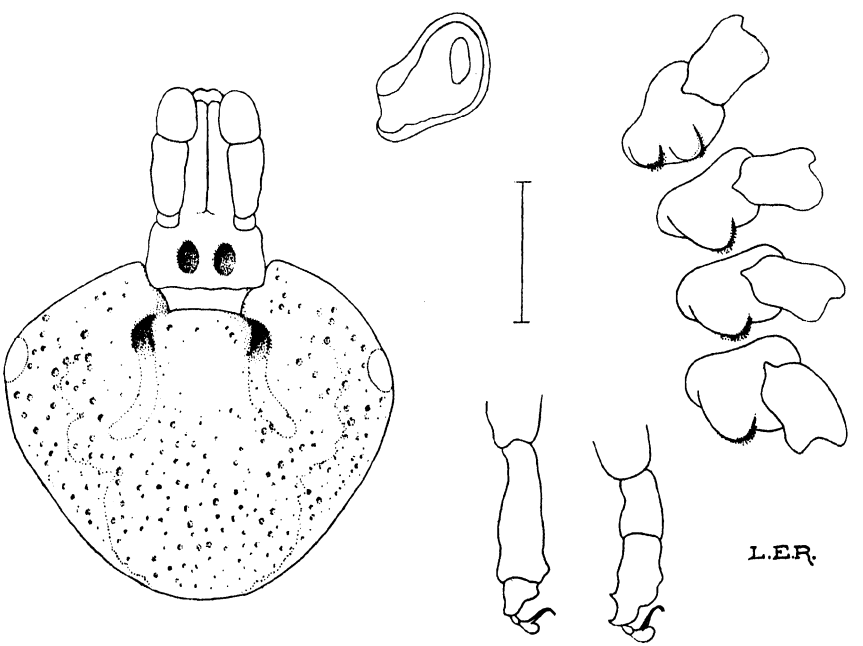


Fig. 121. *Amblyomma sublaeve* ♀. Scutum, capitulum, spiracle, coxae I–IV, tarsi I and IV. (N. 483.)

non-salient; porose areas small, oval, interval equal to smaller diameter; palps club-shaped, article 2 one-and-a-half times as long as article 3; hypostome broad, spatulate, dentition 3 | 3. *Legs*: longer and more slender than those of the ♂; coxae similar to those of the ♂; tarsi abruptly attenuated.

Geographical Distribution and Hosts.

Neumann (1899, p. 191) records ♂s (*Amb. politum*), off *Python molurus*, ♀s from **Siam**, and ♀s from Canton, **China**, host not specified (Berlin Mus.); 1901, pp. 299 and 301 (*Amb. badium*), ♂s from **Sumatra**, Mösch coll., host not specified; ♂s off a pangolin (*Manis* sp.), without indication of country of origin (Berlin Mus.); ♂s, ♀s and nymphs, off *Manis javanica*, **Java**, Kohlbrugge coll. (Oudemans Coll.). In his last description (1911, p. 86), Neumann notes *Manis aurita* Hdgs. as additional host. The ♀ (*Ap. javanense*) described by Cooper and Robinson (1908) came from *Varanus salvator*, Biserat, State of Jalor, Siam, Drs R. Evans and N. Annandale colls. Supino's specimens (*Rhip. javanensi* and *Derm. indicus*) came from **Burma**. The Cambridge collection contains ♂s and ♀s, off *Manis javanica*, Java, Dutch East Indies, 1908, Dr J. C. Koningsberger coll. (N. 483); ♂s and ♀s, off *Manis* sp. Kuala Lumpur, **Federated Malay States** (N. 824), the gift of Dr A. E. Shipley; ♂s, off *Manis javanica*, Negri Sembilan, Federated Malay States, III. 1910, Dr A. T. Stanton coll. (N. 1063); ♂ and ♀, off *Manis* sp., Kuala Lumpur, Federated Malay States (N. 1292 and 1293), the gift of Dr A. E. Shipley; ♂s and ♀, off *Euprepes* sp., Karachi, Sind, **India**, J. A. W. Murray coll. (N. 1101); ♂s and ♀, off *Manis pentadactyla*, India (N. 1102); ♀ and nymph, off *Hyaena hyaena*, Ghodasgaon, Kandeish, India, v. 1911, C. A. Crump coll. (N. 1664); and ♂s, off *Manis pentadactyla*, Nagpur, Central Provinces, India, VIII. 1912, E. A. D'Abreu coll. (N. 1944). From material sent to Cambridge for determination, the following records have been noted: specimens off *Manis aurita*, Kakhyen Hills, Chinese Frontier, Upper Burma; ♂s and ♀, off *Manis pentadactyla* (in Zool. Gardens, Calcutta) Chittagong (?), India (Ind. Mus. 5956/10); ♂, off *Manis aurita*, Hotha Yunnan, 1908, J. Anderson coll. (Ind. Mus. 5955/10); ♀, off *Manis* sp., Chota Nagpur, India, 1908 (Ind. Mus. 5942/10).

81. AMBLYOMMA FUSCUM Neumann, 1907.

Fig. 122.

Lit. and Iconogr.: Neumann, L. G., v. 1907, pp. 94–95, specific description of ♂; Fig. 5, ♂ coxae (herein reproduced): 1911, pp 73–74, short description of ♂.

Male (Fig. 122). Diagnosis: A small tick; scutum short oval, brown, with a narrow whitish border; marginal groove absent; punctations few, large and deep; hypostome dentition 3 | 3; coxa I with two stout, flattened spurs; a single, short, broad spur on each of coxae II and III; a short triangular spur on coxa IV.

Fig. 122. *Amblyomma fuscum* ♂. Coxae. (From Neumann, 1907, Fig. 5.)

Description. *Body*: *L.* 6·0 mm. (including capitulum), *W.* 4·0 mm., contour short oval, broadest at posterior third. *Scutum*: slightly convex, glabrous, without elevations; general colour maroon-brown, paler towards the centre, with a narrow yellowish-white border commencing at the scapular angles and running round the body, narrowing posteriorly and sending fine prolongations along the external or anterior border of each festoon, excepting the median, which it flanks on either side; cervical grooves in the form of short pits; marginal groove absent; punctations few, large, deep, sparse, absent on the festoons and on the marginal zone; festoon distinct, separations shallow; eyes large, very flat and pale. *Venter*: whitish, with few very short hairs and indistinct punctations; spiracles medium in size, elongate, comma-shaped. *Capitulum*: *L.* 1·6

mm., basis rectangular, posterior border concave, postero-lateral angles broad and barely salient; palps flat, bearing long whitish hairs, article 2 more than twice as long as article 3, dorsal border salient; hypostome long, spatulate, dentition 4 | 4. *Legs*: of medium length, reddish-brown, coxa I with two flat, pointed, contiguous, equal spurs, as broad as long; coxae II and III each with a broad, flat, sharp-edged spur; coxa IV with a flat, triangular spur, as broad as long; tarsi relatively short, tapering in talus.

Female: unknown.

Neumann's description is based on 5 ♂s, off *Boa constrictor* (?), South America (?), M. Korthals coll. (Leyden Nat. Hist. Mus.).

82. AMBLYOMMA THOLLONI Neumann, 1899.

Pl. VI, fig. 1, Text-figs. 123 and 124.

Lit.: Neumann, L. G., 1899, pp 242–244, specific description of the ♂ and ♀; 1901, p. 304, note on ornamentation; 1911, p. 81, brief description of ♂ and ♀. Dönitz, W., 1907, p. 86, brief description.

Male (Fig. 123). Diagnosis: A medium-sized tick; scutum broad oval, smooth and convex; ornate, with pale spots on a maroon-brown ground (in some examples the pale spots are insignificant or entirely absent); marginal groove absent; punctations fine and superficial; eyes pale and flat; festoons with shallow separations; hypostome dentition $3\frac{1}{2}$ | $3\frac{1}{2}$; coxa I with two spurs; a curved, salient ridge on each of coxae II and III; a single short spur on coxa IV.

Description. *Body*: *L.* 5 mm., *W.* 4 mm., contour broad oval, sometimes sub-rectangular. *Scutum*: smooth and convex; generally ornate, with pale spots on a maroon-brown ground; a large **C**-shaped pale spot in each antero-lateral angle; small irregular spots in the lateral fields in the vicinity of the 2nd and 3rd lateral spots; a pair of pale spots symmetrically disposed immediately anterior to the 3rd–5th festoons; postero-median, accessory stripes, lateral spots, etc., practically indistinguishable on the dark ground colour; cervical grooves short, deep and curved; marginal groove absent; punctations fine and superficial, larger and more numerous in the antero-lateral fields and near the margins; eyes moderately large, pale and flat; festoons with shallow separations. *Venter*: greyish-brown, glabrous; genital aperture opposite the posterior margin of coxa II; spiracles broad comma-shaped. *Capitulum*: *L.* 2 mm., basis rectangular, postero-lateral angles non-salient; lateral margins

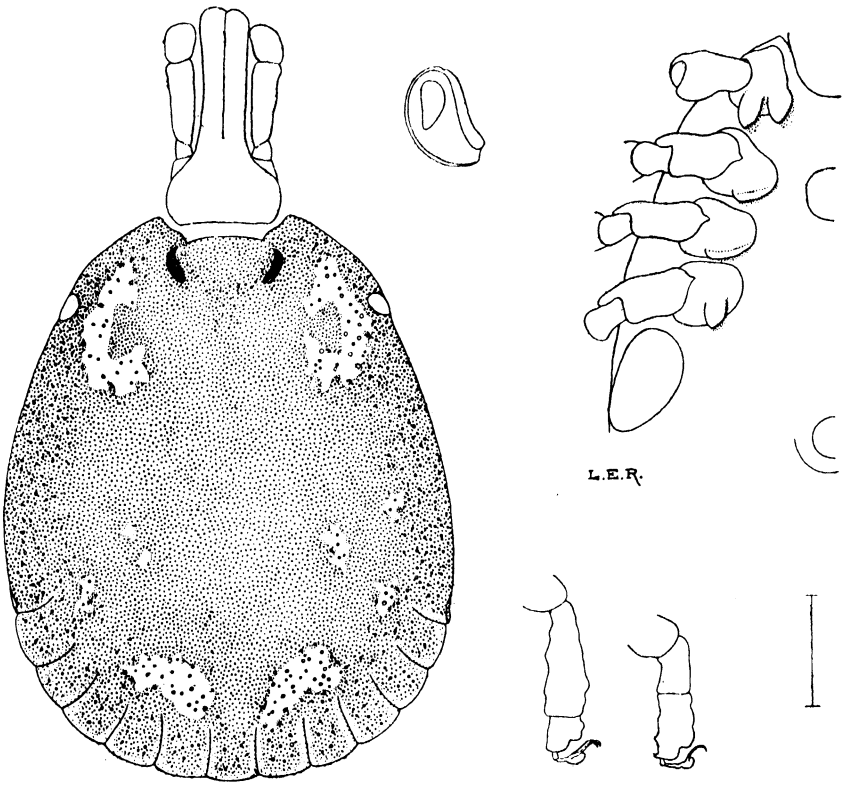


Fig. 123. *Amblyomma tholloni* ♂. Scutum, capitulum, spiracle, coxae I–IV, tarsi I and IV. (N. 3381.)

slightly convex; palps long and slender, article 2 two-and-a-half times as long as article 3; hypostome large, dentition $3\frac{1}{2} \mid 3\frac{1}{2}$. *Legs*: medium, rather slender, dark-brown, distal extremities of the articles very narrowly annulated with white; coxa I with two stout, unequal spurs, the external longer and more pointed; coxae II and III each with a broad, curved, salient ridge; a single spur, about twice as long as broad, on coxa IV; tarsi abruptly attenuated.

Female (Fig. 124 and Pl. VI, fig. 1). Diagnosis: A medium-sized tick; scutum large, triangular, posterior angle rather narrow; ornate, with a large, irregular, pale spot in each lateral field and a pale spot at the posterior angle; punctations fine; eyes large, pale and flat; porose areas medium, oval, slightly divergent, interval one-and-a-half times the diameter; hypostome dentition 4 | 4; coxa I with two short

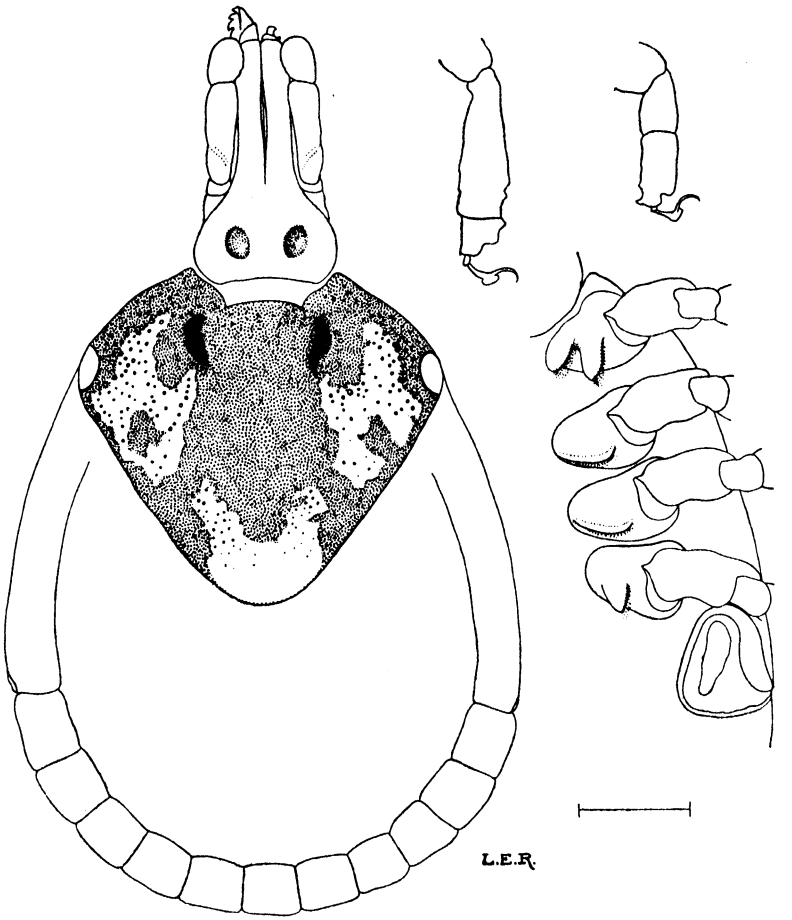


Fig. 124. *Amblyomma tholloni* ♀. Dorsum, capitulum, tarsi I and IV, coxae I–IV, spiracle. (N. 3381.)

spurs; a salient ridge on each of coxae II and III; a single, short, stout spur on coxa IV; tarsi abruptly attenuated.

DESCRIPTION. *Body*: *L.* 5·9 mm., *W.* 4·7 mm.; contour broad oval, slightly narrower in front; dorsum dark-brown, smooth and glabrous; marginal groove continuous; festoons well-defined; other grooves indistinct. *Scutum*: 3·0 × 3·3 mm., triangular, posterior angle rather narrow, postero-lateral margins almost rectilinear; ornate, with a large, irregular, pale patch in each lateral field, encroached upon by the cervical spot, ocular spot and frontal spot; cervical stripes fused posteriorly with the large limiting spots; the median field, excepting its posterior

extremity, dark-coloured; cervical grooves short, deep and curved; punctations very fine in the median field, larger but still fine in the lateral fields; eyes large, pale and flat. *Venter*: dull earthy-brown, smooth and glabrous; genital aperture opposite the posterior margin of coxa II; spiracles large, triangular with rounded angles. *Capitulum*: *L.* 2 mm., basis rectangular, postero-lateral angles non-salient, lateral margins convex; porose areas medium, oval, slightly divergent, widely-separated; palps long and slender, article 2 two-and-a-half times as long as article 3; hypostome dentition 4 | 4. *Legs*: rather long and slender, dark-brown with narrow white annulations at the distal extremities of the articles; coxa I with two stout spurs, the external spur being the longer; a broad, curved, salient ridge on each of coxae II and III, a single short spur, barely longer than broad, on coxa IV; tarsi long, abruptly attenuated; pulvilli small.

Geographical Distribution and Hosts.

Neumann's description is based on 1 ♂ and 2 ♀s from the **Congo,** Thollon coll.; 2 gorged ♀s, from Upper Oubanghi, Viancin coll.; and 2 gorged ♀s, off *elephant*, **Nyassa** and **Tanganyika** regions, E. Foa coll. (Paris Mus.). In a later note (1901, p. 304) he records ♂s and ♀s, off a *gazelle*, Kilimandjaro, **Tanganyika Territory**, Schillings coll. (Berlin Mus.) and reports that the species occur in the **Cameroons.** In his most recent description (1911, p. 81) Neumann lists *Loxodon africanus* (Blbch.), *Antilope* sp. and *Equus caballus* L. as hosts. The Cambridge collection contains the following: **Sudan**: ♀, off *elephant*, 1908, H. H. King coll. **Sierra Leone**: ♂s, ♀s and nymphs, off *elephant*, Katanta, IV. 1912, J. J. Simpson coll (N. 1915 and I.B.E. 578); ♂s and ♀s, off *elephant*, Fereukia, 31. VII. 1913 (N. 2483 *a*); ♂s and ♀s, off *elephant*, Kalakunko, 22. VII. 1913 (N. 2507); ♂s and ♀, off *elephant*, Yeria, v. 1913, Capt. Stanley and Dr J. Y. Wood colls. (N. 2263 amd 2271). **Uganda**: ♀s, off *elephant*, XI. 1906, E. B. Haddon coll. (N. 218); ♂ and ♀, off *elephant*, Mpumu, Chagwe, v. 1909, Sir David Bruce coll. (N. 773); ♂s and ♀s, off *elephant*, L. Albert, 1905, Dr Christy coll. (N. 1603); ♂s, off *elephant*, Kafu R., 24. x. 1912, F. A. Knowles coll. (N. 2018 and I.B.E. 611); ♀, off *grass*, Semliki Forest, XI. 1911, Dr S. A. Neave coll. (N. 3092). British East Africa; ♂ and ♀, off *elephant*, Toro Forest, II. 1911, C. C. Gowdey coll. (N. 1809); ♂ and ♀, off *elephant*, no other particulars, Dr S. Williamson coll. (C. 67). **Belgian Congo**: ♂s and ♀s, host not specified, Region des Lacs, Dr Sagona coll. (N. 3381 and 3384). **Portuguese Congo**: ♂s and ♀s, off *elephant*, 1909–1910, Dr Mercier Gamble

coll. (N. 1217, 2717). **Nyasaland**: ♂s, ♀ and nymph, off *elephant*, Marimba District, XII. 1909, H. S. Stannus coll. (N. 1232); ♂s and ♀s, off *elephant*, Chiromo, XII. 1910, H. S. Stannus coll. (N. 1318). **Tanganyika Territory**: ♂ and ♀, off *leopard*, Lindi District, 1913, Dr Kudicke coll. (N. 3301 *c*, also 2595).

83. AMBLYOMMA TESTUDINARIUM Koch, 1844.

Figs. 125 and 126.

Synon., Lit. and Iconogr.:

Amblyomma testudinarium Koch, C. L., 1844, p. 226, description of ♂; 1847, pp. 67–68, description of ♂; Tab. XI, Fig. 40, ♂ dorsum (coloured). 1899, Neumann, L. G., pp. 240–242, specific description of ♂ and ♀; 1911, pp. 86–87, brief description of ♂ and ♀.

Amblyomma infestum Koch, C. L., 1844, p. 226, description of ♂ and ♀; 1847, pp. 68–70, description of ♂ and ♀; Tab. XII, Figs. 41 and 42, ♂ and ♀ dorsum (coloured).

Ixodes auriscutellatus Koningsberger, J. C., 1900, p. 6 (according to Neumann, 1901, p. 303).

Amblyomma compactum Neumann, L. G., 1901, pp. 296–297, specific description of ♀.

Male (Fig. 125). Diagnosis: A large tick; scutum with characteristic ornamentation consisting of somewhat diffuse dark-brown markings on a pale ground; falciform stripe large and thick, delimiting the posterior margin of a well-defined pseudoscutum; postero-median stripe fused anteriorly with the falciform stripe; postero-accessory stripes directed towards the anterior extremity of the postero-median stripe; marginal groove absent; punctations numerous, deep, unequal; eyes large, pale and flat; coxa I with two stout spurs, of which the external is the longer; a single, broad, rounded spur on each of coxae II and III; a single, stout spur, twice as long as broad, on coxa IV.

DESCRIPTION. *Body*: *L.* 6 mm., *W.* 5·5 mm., contour broadly oval, narrower in front, rather flat. *Scutum*: ornate, yellowish, with dark-brown spots and stripes; postero-median stripe fused anteriorly with the broad and large falciform stripe, the latter delimiting the posterior margin of a well-defined pseudoscutum; antero-accessory stripes fused with the extremities of the falciform stripe; lateral spots small, the two anterior spots often conjoined; postero-accessory stripes directed towards, but not reaching, the anterior extremity of the postero-median stripe; cervical stripes divergent, sometimes extending posteriorly to join the

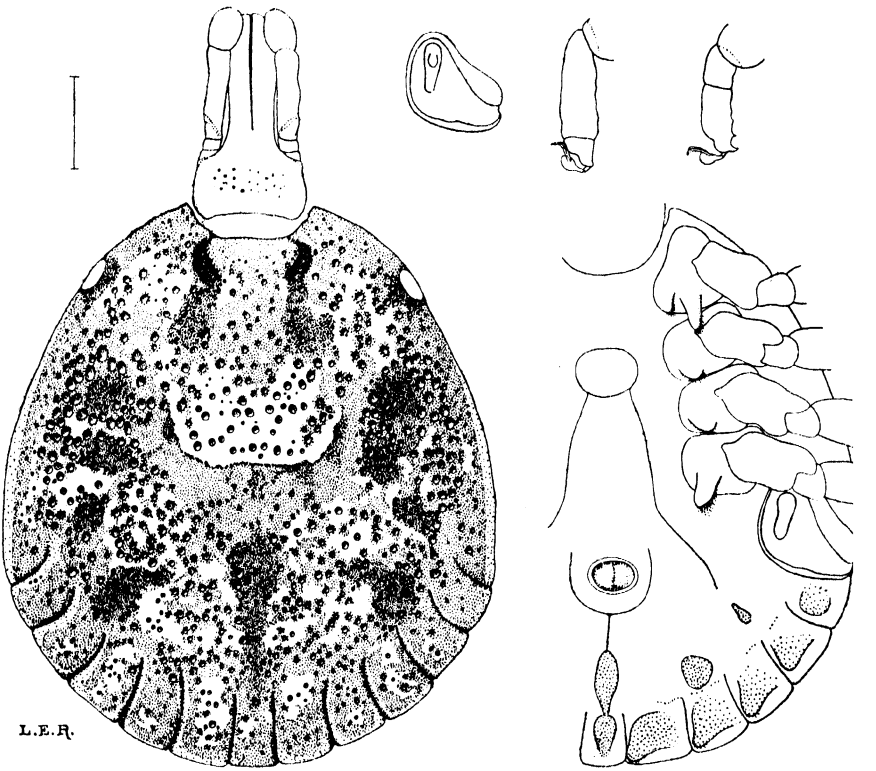


Fig. 125. *Amblyomma testudinarium* ♂. Scutum, capitulum, venter, spiracle, tarsi I and IV. (C. 91.)

antero-accessory stripes; marginal ridge and festoons for the most part dark-coloured, 3rd and 5th festoons with moderately large, irregular, pale spots, small, pale spots present or absent on the remaining festoons; cervical grooves short, deep and curved, with the convexity external; marginal groove absent; punctations numerous, large, deep, irregularly distributed, unequal; eyes large, pale and flat; festoons large, well-defined, separations narrow. *Venter*: yellowish, glabrous, punctate in posterior half; genital aperture opposite coxa II; spiracles rather narrow, comma-shaped, oblique; festoons with dark-brown ventral scutes, slightly salient at the postero-internal angles. *Capitulum*: *L.* 2·2 mm., basis rectangular, postero-lateral angles non-salient; palps long, article 2 twice as long as article 3; hypostome long and narrow, dentition 4 | 4. *Legs*: long and stout, light-brown with pale annulations at the extremities of the articles; coxa I with two stout spurs, of which the

external is the longer; a short, broad, rounded spur on each of coxae II and III; a single stout spur, twice as long as broad, on coxa IV; tarsi abruptly attenuated.

Female (Fig. 126). Diagnosis: A large tick; scutum triangular, posterior angle narrow; ornate, ground colour yellowish, with a narrow, reddish-brown border extending from the scapular angles to the limiting spots; cervical stripes usually fused posteriorly with the limiting spots; eyes large, pale and flat; punctations numerous, coarse in the lateral fields, irregular; porose areas moderately large, oval, parallel, interval about equal to diameter; hypostome dentition 4 | 4; coxa I with two moderately stout spurs; a single, broad spur on each of coxae II to IV.

DESCRIPTION. *Body*: *L.* 7·3 mm., *W.* 6·2 mm., contour broad oval, almost elliptical, flat; dorsum dark earthy-brown, coarsely punctate, glabrous; marginal groove and festoons well-defined. *Scutum*: triangular, angles rounded, posterior angle narrow; 4·2 × 4·8 mm., ornate, with

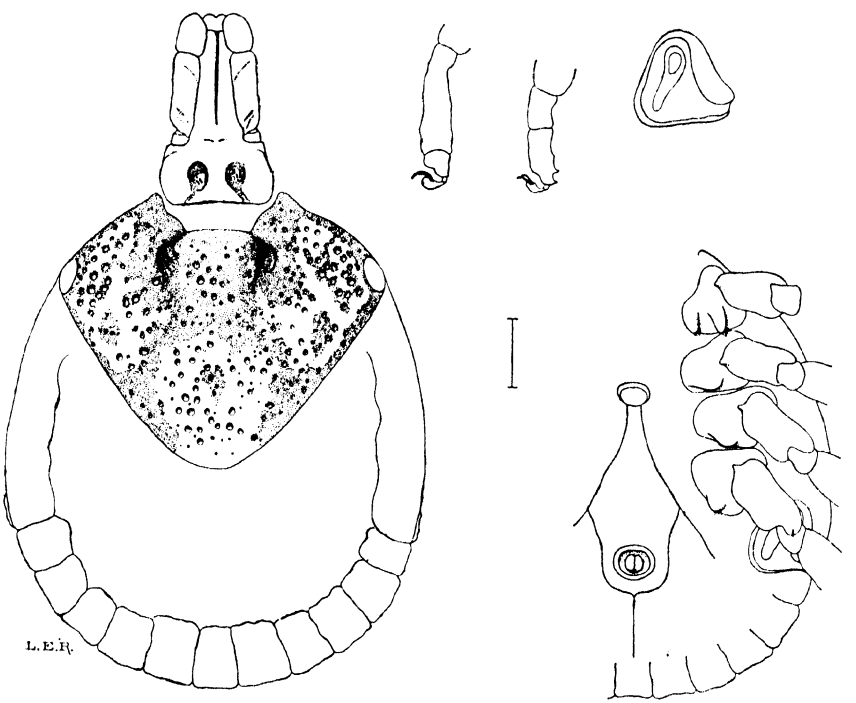


Fig. 126. *Amblyomma testudinarium* ♀. Scutum, capitulum, venter, tarsi I and IV, spiracle. (C. 91.)

brown markings on a pale yellowish ground; a narrow, dark border extending from the scapular angle to the limiting spot; cervical stripes divergent, usually fused with the limiting spots at their posterior extremities; frontal spot small, generally isolated; cervical grooves short and deep anteriorly, very shallow and divergent posteriorly; punctations numerous, coarse in the lateral fields; irregular; eyes large, pale and flat. *Venter*: similar in colour to dorsum, glabrous, punctations smaller, less numerous, limited to the posterior part; genital aperture opposite the interspace between coxae II and III; spiracles large, triangular with rounded angles. *Capitulum*: *L.* 2·7 mm., basis rectangular, posterolateral angles non-salient, lateral margins slightly convex; palps long, article 2 twice as long as article 3; porose areas moderately large, oval, parallel, often with a shallow, narrow groove running from the hinder end towards the posterior margin of the basis; hypostome dentition 4 | 4. *Legs*: long, reddish-brown, with whitish annulations at the distal extremities of the intermediate articles; coxa I with two moderately-long, stout spurs; a single, short, broad, rounded spur on each of coxae II–IV; tarsi abruptly attenuated.

Geographical Distribution and Hosts.

Koch's type came from **Java**; his ♂ and ♀ (*Amb. infestum*) from Bintang, **Further India.** Neumann (1899, p. 241) records specimens from Chaudoc Mts, **Cochin China** (Paris Mus.), Harmand coll.; ♂s, off *Tapirus* and *Rhinoceros*, Java (Paris Mus.): (1901, p. 303) ♀s, off *tiger*, from **Annam**, J. M. Bel coll. (Paris Mus.); **Ceylon**; ♂s and ♀s, off *Sus larvatus*, Grabowsky coll., **Borneo** (Berlin Mus.); ♂, off *Sus vittatus*, and ♀s, off *Buffelus indicus*, Java, Koningsberger coll.: (1911, p. 87), Neumann lists as hosts *Sus vittatus* Müll. Schl., *Potamochoerus larvatus* Fr. Cuv., *Buffelus indicus* (L.), *Tapirus indicus* Cuv., *Rhinoceros javanicus* Desm., and *Felis tigris*. I have examined specimens derived from the following sources: **India**: ♂ and ♀, off *cattle*, Bombay, IV. 1911, F. M. Howlett coll. (N. 1908); ♀, off *cattle*, Bamauk, India, XI. 1911, F. M. Howlett coll. (N. 1909); ♀, host not specified, Singlia (1800 ft.), Darjeeling Distr., IV. 1913, Lord Carmichael coll. (C.C. 367 *a*); ♂s, off *Felis tigris*, Sibsagar, Assam, S. E. Peal coll. (N. 1084); ♀s, host not specified, Assam, Capt. R. M. Carter coll. (N. 1859); ♀, host not specified, N.E. Mangali Distr., Assam-Bhutan frontier (Ind. Mus. 1070/17); ♀, found under logs, Sadiya, N.E. Assam, XI. 1911 (Ind. Mus. 1252/17); ♂ and ♀s, from Sibsagar, Assam, V. 1910 (Ind. Mus. coll.); ♂s and ♀s, off *Sus cristatus*, Kobo, 5. XII. 1911, S. W. Kemp coll. (Abor

Expedition) (Ind. Mus. 1201/17, N. 1568); off (?), below Damada, Siyon R., 1. II. 1912, S. W. Kemp coll. (Ind. Mus. 1249/17), Burma: off *Felis tigris*, Pugyi, 10. VI. 1918, Christopher coll. (N. 3338); **Ceylon:** ♂ and ♀, from jungle, Peradeniya, 25. XII. 1913, A. Rutherford coll. (I.B.E. 766). **Federated Malay States:** ♂ and ♀, off mouse-deer (*Tragalus* sp.), Biserat, Jalor, Drs R. Evans and N. Annandale coll. (Skeat Expedition) (C. 91); ♂, from jungle, Negri Sembilan, III. 1910, Dr A. T. Stanton coll. (N. 1056 *a*); ♂, off *Sus jubatus*, Perak, X. 1911, Col. A. Alcock donor (N. 1369); ♂s and ♀s, off *water buffalo*, Sungei Lembing, Kuantan, Pahang, II. 1913, Dr Oscar Pou coll. (N. 2103). **Sumatra:** (?), off *Bos bubalus*, Pamebnang, 1908, Dr J. C. Koningsberger coll. (N. 495 *a*); ♂s, ♀s and nymph, off *Bos bubalus*, W. coast of Sumatra, I. 1909, Dr J. C. Koningsberger coll. (N. 540 *a*, 540 *e* and 540 *h*); off (?), Dr W. Schüffner coll. (Schüffner coll., No. VI *b*). **Java:** ♂s, off *Bos bubalus*, 1908, Dr J. C. Koningsberger coll. (N. 489); ♂s and ♀, off *Cervus* sp., Bali (N. 541); ♂s and ♀s, off *buffalo*, Buitzenzorg, 1914, Dr de Blieck coll. (N. 3161). **Borneo:** ♂s, off *water buffalo*, Labuk R., XII. 1912, Dr H. F. Conyngham coll. (N. 2119 *a*). **Sarawak:** ♀, off (?), Matang, IV. 1904 (Ind. Mus., Sarawak, SM/16). **Formosa:** (?), off *cattle*, Taihoku, 16. VII. 1909 (N. 2914 *a*). **Japan:** (?), off *horse*, Takanabe, Kiushiu, VI. and 12. X. 1912 (N. 2909 *a*); (?), off *water buffalo*, Koshin, 7. VIII. 1911 (N. 2916 *a*); off (?), Amamioshima, Kiushiu (N. 2919).

84. AMBLYOMMA PERSONATUM Neumann, 1901.

Pl. V, figs. 1 and 2, Text-fig. 127.

Lit. and Iconogr.: Neumann, L. G., 1901, pp. 306–307, specific description of ♂ and ♀; Fig. 12, ♂ scutum. 1907, Dönitz, W., p. 85, brief description of ♂; 1909, pp. 49–50, description of ornamentation of the ♂; Fig. 9, ♂ scutum. 1911, Neumann, L. G., p. 81, brief description of the ♂ and ♀.

Male (Pl. V, fig. 1). Diagnosis: A very large tick; scutum with characteristic dark-brown markings on a pale ground; postero-median and postero-accessory stripes usually fused, forming a figure resembling a bird with expanded wings; 1st and 2nd lateral spots conjoined with the antero-accessory stripes, the limiting spot and the dark marginal coloration, forming a large, irregular, dark patch in the antero-lateral field; marginal groove absent.

DESCRIPTION. *Body*: *L.* 8 mm., *W.* 6·8 mm.; contour broad oval, slightly narrower in front. *Scutum*: convex, smooth; with characteristic

dark-brown ornamentation on a yellowish ground; postero-median stripe very much dilated in its anterior half; postero-accessory stripes short pear-shaped, often fused with the postero-median stripe to form a figure resembling a bird with outstretched wings; falciform stripe absent; 1st and 2nd lateral spots conjoined and fused with the dark marginal coloration, the antero-accessory stripes and the limiting spots, forming a large, irregular, dark patch, disposed obliquely in the antero-lateral field, posterior to the eye; 3rd lateral spots small, often fragmentary; cervical stripes small; festoons with more or less extensive incursions of the general pale ground, 4th and median festoons dark-coloured; cervical grooves short, deep and curved; marginal groove absent; punctations numerous, for the most part fine; few larger punctations scattered in the lateral fields and over the posterior half; eyes relatively small, pale and flat. *Venter*: dark-yellow; plaques and ventral scutes of festoons reddish-brown; genital aperture opposite coxa II; spiracles large, triangular, with rounded angles. *Capitulum*: *L.* 2·4 mm., basis rectangular, postero-lateral angles rounded, barely salient; palps long, laterally compressed, article 2 two-and-a-half times as long as article 3; hypostome long, spatulate, dentition $4\frac{1}{2} \mid 4\frac{1}{2}$. *Legs*: stout, maroon-brown with broad yellow annulations; coxa I with two stout, sub-equal spurs; coxae II and III each with a broad, flat, plate-like spur; coxa IV with a stout spur nearly three times as long as broad; tarsi abruptly attenuated; tarsi II–IV very short.

Female (Fig. 127 and Pl. V, fig. 2). Diagnosis: A very large tick closely resembling *Amb. petersi*; scutum triangular-cordiform; ornate, with dark-brown markings on an extensive pale field; limiting and ocular spots present; cervical stripes often isolated, sometimes prolonged to reach the limiting spot; frontal spots absent; few medium-sized punctations chiefly in the antero-lateral fields, interspersed with numerous exceedingly fine punctations; eyes moderately large, pale and flat.

Description. *Body*: *L.* 8·6–10·5 mm., *W.* 7·0–8·5 mm., contour broad oval, slightly narrower in front; dorsum dark reddish-brown, smooth, glabrous, coarse punctations on posterior half, marginal groove continuous, festoons clearly-defined. *Scutum*: triangular-cordiform, 3·5–4·2 × 4·0–5·0 mm., posterior angle moderately broad and rounded, postero-lateral margins almost rectilinear; ornate, with dark-brown markings on an extensive pale-yellow ground; cervical, ocular and limiting spots present; scapular margins pale; a narrow, dark margin extending from the ocular

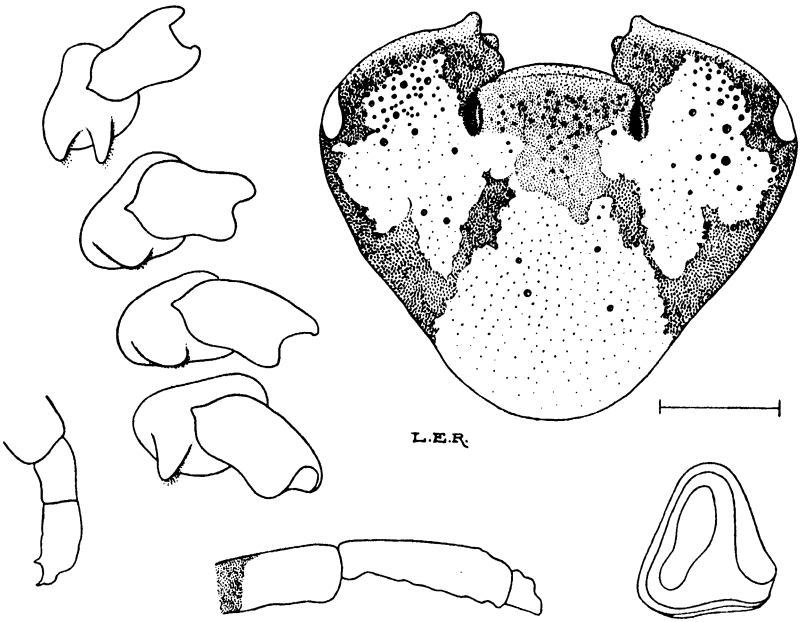


Fig. 127. *Amblyomma personatum* ♀. Scutum, coxae I–IV, tarsi I and IV, spiracle. (N. 326.)

spot to the limiting spot; cervical stripes often isolated, sometimes continued posteriorly by a very narrow stripe which fuses with the limiting spot; a dark median spot between the cervical grooves, with which the cervical spots sometimes fuse; cervical grooves short and deep; punctations for the most part exceedingly fine, a few larger punctations chiefly in the antero-lateral fields; eyes moderately large, pale and flat. *Venter*: paler than dorsum, smooth and glabrous, with large, shallow punctations on the posterior third and festoons; genital aperture opposite coxa II; spiracles large, triangular with rounded angles. *Capitulum*: *L.* 2·5 mm., basis rectangular, postero-lateral angles rounded and barely salient; porose areas large, elliptical, interval equal to diameter; palps long, laterally compressed, article 2 more than twice as long as article 3; hypostome dentition $4\frac{1}{2} \mid 4\frac{1}{2}$. *Legs*: long and stout, reddish-brown with very broad yellow annulations; coxa I with two stout, sub-equal spurs; a single, broad, rounded, plate-like spur on each of coxae II and III; a short, blunt spur, barely longer than broad, on coxa IV; tarsi small, abruptly attenuated.

Geographical Distribution and Hosts.

Neumann's original description is based on 1 ♂, from Irangi, **Tanganyika Territory** and 2 ♂s and a ♀ from **Gabun** (Berlin Mus.). Neumann (1911, p. 81) gives *Rhinoceros bicornis* as the host. The Cambridge collection contains ♂s and ♀, off *Rhinoceros*, Nairobi, **Kenya**, III. 1907, Dr P. H. Ross coll. (N. 250, 326); and ♂, off *Rhinoceros*, Nairobi, **Kenya** (ex Col. A. Alcock's Coll.). W. F. Cooper's collection contains ♂s, off *Rhinoceros*, Punda Milia, British East Africa, 3. VIII. 1909, W. F. Cooper coll. (C. 10 and 11). I have also examined examples sent to Cambridge by the Entomological Research Committee.

85. AMBLYOMMA PETERSI Karsch, 1878.

Pl. IV, fig. 1, and Text-figs. 128 and 129.

Synon., Lit. and Iconogr.:

Amblyomma petersi Karsch, F., 1878, pp. 336–337, brief description of ♂; Pl. I, Fig. 4, ♂ dorsum. 1899, Neumann, L. G., pp. 306 and 309, degrades *A. aureum* and *A. foài* to synonyms. 1907, Dönitz, W., pp. 84–85, brief description of ♂ and ♀, with note on distribution. 1911, Neumann, L. G., pp. 81–82, brief description of ♂ and ♀.

Amblyomma aureum Neumann, L. G., 1899, pp. 254–255, description of ♀; Fig. 56, ♀ dorsum.

Amblyomma foài Neumann, L. G., 1899, pp. 262–263, description of ♂.

Male (Fig. 128 and Pl. IV, fig. 1). Diagnosis: A very large tick; scutum with variable but characteristic ornamentation consisting of dark reddish-brown spots and stripes on a dull ochre-yellow ground, delimiting a well-defined pseudoscutum anteriorly; postero-median stripe much expanded at the anterior extremity, usually fused with the broad, divergent, antero-accessory stripes to form a Y-shaped figure; postero-accessory stripes often fused with the expanded extremity of the postero-median stripe, forming, together with the antero-accessory stripes, an hourglass-shaped figure; falciform stripe narrow, the middle part often missing; festoons each with a more or less extensive pale spot; marginal groove insignificant or completely absent; surface scattered with large dark-coloured punctations interspersed with numerous fine punctations; eyes relatively small, pale and flat.

DESCRIPTION. *Body*: *L.* 8·5 mm., *W.* 7·5 mm., contour broad oval, narrowing anteriorly. *Scutum*: convex; ornate, with dark reddish-brown markings on an ochre-yellow ground; postero-median stripe long, narrow

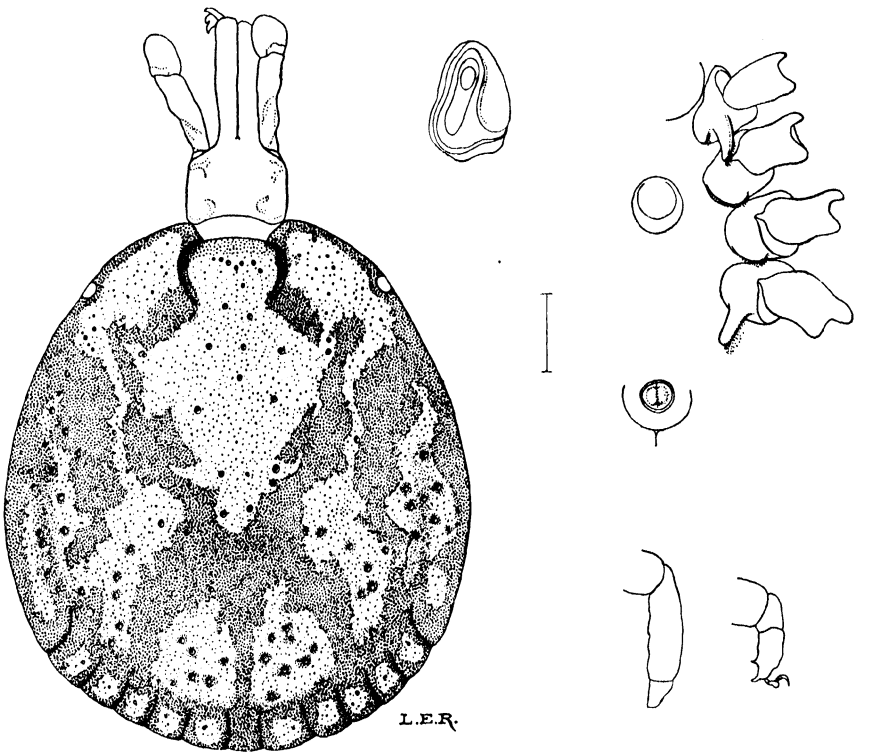


Fig. 128. *Amblyomma petersi* ♂. Scutum, capitulum, spiracle, coxae I–IV, tarsi I and IV. (C. 10.)

posteriorly, much expanded anteriorly where it fuses with the thick, divergent, antero-accessory stripes to form a Y-shaped figure; postero-accessory stripes long, often fused anteriorly with the expanded extremity of the postero-median stripe, and then forming, together with the antero-accessory stripes, an hourglass-shaped figure; lateral spots usually conjoined, the 3rd smaller than the 1st and 2nd and sometimes irregular and broken; falciform stripe narrow, its extremities applied to, and generally fused with, the inner sides of the antero-accessory stripes, its middle portion often missing; limiting spots usually present, delimiting the postero-lateral margins of a well-defined pseudoscutum; cervical stripes variable in size, broad, spindle-shaped and divergent, or reduced to narrow, dark, tapering streaks posterior to the cervical grooves; marginal ridge dark-coloured with four more or less distinct encroachments of the pale ground colour between the eye and the external festoon (representing the marginal spots as seen in *Amb. marmoreum* and *Amb.*

nuttalli); festoons each with a more or less extensive pale spot; cervical grooves short, deep, slightly curved with the convexity external; marginal groove insignificant or completely absent; surface scattered with large dark-coloured punctations some of which are surrounded by a dark-coloured areola, interspersed with numerous very fine punctations; eyes relatively small, pale and flat; festoons well-defined, with wide separations. *Venter*: smooth, pale reddish-brown, almost glabrous; genital aperture opposite coxa II; spiracles large, sub-triangular with rounded angles; festoons with dark reddish-brown ventral scutes, the latter not salient at the posterior margin. *Capitulum*: *L.* 2·85 mm., basis rectangular, postero-lateral angles rounded and slightly salient; palps stout, club-shaped, article 2 two-and-a-half times as long as article 3; hypostome dentition 4 | 4. *Legs*: long and stout, dark reddish-brown with pale marbling and very narrow annulations at the distal extremities of the articles; coxa I with two stout spurs of which the external is the longer; a broad, flat spur on each of coxae II and III; a single stout spur two-and-a-half times as long as broad on coxa IV; tarsi attenuated in talus.

Female (Fig. 129). Diagnosis: A very large tick; scutum very large (5 mm.), cordiform, extensively pale-coloured (reddish-golden in alcohol-preserved material) with a dark marginal coloration extending from the ocular spot to the scapular angle; cervical stripes usually in the form of small, irregular, isolated spots situated some distance posterior to the cervical grooves; limiting spots large; frontal spots usually absent; few large, dark-coloured punctations interspersed with very numerous fine punctations; eyes moderately large, slightly convex, reddish.

Description. *Body*: *L.* 9 mm., *W.* 8 mm., flat, contour elliptical, dorsum dark reddish-brown, coarsely punctate in posterior half and on the marginal ridge and festoons; marginal groove continuous, festoons well-defined. *Scutum*: 4·2 × 5·15 mm., cordiform, posterior angle fairly broad; ornate, with dark reddish-brown markings on an extensive pale field; anterior margins from the ocular spot to the scapular angles with a dark border, also continued across the capitular emargination; cervical stripes linear, fusiform, or in the form of an irregular spot, generally isolated; limiting spots large; cervical grooves short, deep, almost parallel; few large dark-coloured punctations interspersed with many fine punctations; eyes moderately large, slightly convex, reddish in colour. *Venter*: like dorsum, with few short, scattered, whitish hairs; genital aperture opposite the interspace between coxae II and III;

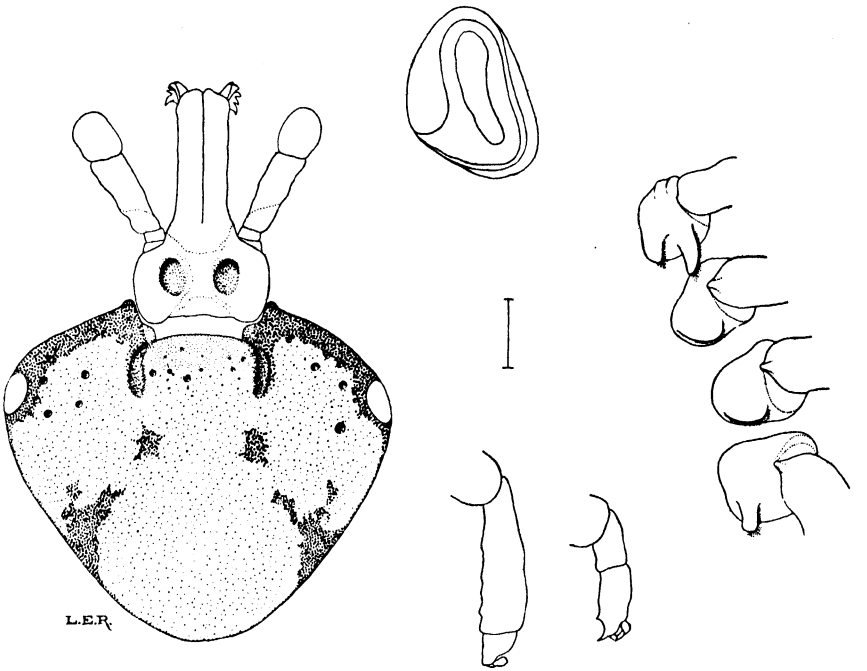


Fig. 129. *Amblyomma petersi* ♀. Scutum, capitulum, spiracle, coxae I–IV, tarsi I and IV. (C. 16.)

spiracles large, triangular with rounded angles. *Capitulum*: *L.* 2·85 mm., basis rectangular, posterior margin slightly concave, postero-lateral angles rounded, barely salient; porose areas large, oval, slightly divergent, interval about equal to diameter; article 2 of palps twice as long as article 3; hypostome long, spatulate, dentition 4 | 4. *Legs*: long and strong, reddish-brown with very narrow pale annulations at the extremities of the articles; coxa I with two stout spurs of which the external is the longer; a single, broad, rounded spur on each of coxae II and III; a single spur, one-and-a-half times as long as broad, on coxa IV; tarsi attenuated in talus.

Geographical Distribution and Hosts.

Eastern Tropical Africa, from the Nile Province, **Uganda** to **Portuguese East Africa**; principal host *Rhinoceros*. Karsch's specimen came from Mozambique, Portuguese East Africa. Neumann (1899, p. 263, *Amb. foài*) records two ♂ specimens from Cafreria, Delalande coll., and 5 ♂s, off *Rhinoceros*, E. Foà coll. (Paris Mus.); (p. 255, *Amb. aureum*) ♀, found on *grass*, Ngourou Plains, Zanzibar, A. Leroy coll. (Paris Mus.);

(1901, p. 306) ♀s, **Tanganyika Territory**, Schillings coll., off *Rhinoceros lucerius*; he also notes the species has been found in different parts of Tanganyika Territory by Bohm, Fülleborn, O. Neumann, Reichardt and Schillings, in **Madagascar** by Hildebrant, in Zanzibar, and in Liberia (Berlin Mus.). Neumann (1911, p. 82) also records *Rhinoceros bicornis* L., and *Antilope oreas* Pall. I have examined specimens in the Cambridge collection and examples sent for determination by the Imperial Bureau of Entomology, as follows: **Uganda:** ♂, off *Rhinoceros*, Nimule, Nile Province, 22. III. 1906, W. A. Densham coll. (N. 29 *a*); ♂, off *Rhinoceros*, White Nile, Col. A. Alcock coll. (N. 956); ♂, off *vegetation*, Azzar, Nile Province (?), 29. VII. 1909, H. H. King coll. (N. 829 *a*); ♂s and ♀s, 6 miles east of Palango Station (3700 ft.), R. Nile, X. 1912, R. Paske Smith coll. (N. 1719–1721); ♂s and ♀s, off *Rhinoceros*, Mpumu, Chagwe, v. 1909, Sir D. Bruce coll. (N. 779); ♂s and ♀s, off *long grass*, near Bussu, X. 1909, Dr H. Bayon coll. (N. 941); ♀s, off *grasses*, E. Busoga, VII. 1911, Dr S. A. Neave coll. (I.B.E. 465); ♂, off *grasses*, Makindu, IV. 1911, Dr S. A. Neave coll. (I.B.E. 257 *b*): **Kenya:** 2 ♀s, off *grasses*, Kibwezi, Uganda Railway, III. 1911, Dr S. A. Neave coll. (I.B.E. 265 *a*); ♀, off *grasses*, Mtito Andei, Uganda Railway, III. 1911, Dr S. A. Neave coll. (I.B.E. 264); ♀, off *grasses*, Valley of Mirua and Sondo Rivers, S. Kavirondo, v. 1911, Dr S. A. Neave coll. (I.B.E. 306); ♂s, off *Rhinoceros*, Yatta Plains, Ukamba Province, VIII. 1910, S. W. J. Scholefield coll. (N. 1435, I.B.E. 316 *c*); ♂ and ♀, off *Rhinoceros*, Kitui, v. 1911, S. W. J. Scholefield coll. (I.B.E. 322 *a*, 324 *a*); ♂s and ♀s, off *Rhinoceros*, Punda Milia, Kikuyu Province, 6. VIII. 1909, W. F. Cooper coll. (C. 10, 16, 19 *a*, 21, 27); ♂s and ♀s, off *Rhinoceros*, Tana R., Kenia Province, VIII. 1909, W. F. Cooper coll. (C. 38 *d*). **Nyasaland:** ♂s, off *grass*, Deep Bay, Vua Road, N. Nyasa, v. 1909, Dr J. B. Davey coll. (N. 1031, 1032, 1098); ♂s and ♀s, off *Rhinoceros*, Deep Bay, N. Nyasa, XI. 1909, Dr J. B. Davey coll. (N. 1089). **Rhodesia:** ♀, off *grass*, Upper Luangwa Valley, VIII. 1910, Dr S. A. Neave coll. (N. 1315). **Tanganyika Territory:** ♀, off *grasses*, on road to Kilossa, S. Usagara, XII. 1910, Dr S. A. Neave coll. (I.B.E. 205).

86. AMBLYOMMA ACUTANGULATUM Neumann, 1899.

Fig. 130.

Lit.: Neumann, L. G., 1899, p. 240, brief specific description of the ♀; 1911, pp. 84–85.

Male: unknown.

Female (Fig. 130). Diagnosis: A small, ornate tick; scutum triangular-cordiform, posterior angle very narrow, almost pointed; punctations small, evenly distributed, coarser in the antero-lateral fields; capitulum relatively long, palps slender, porose areas small, almost circular, widely separated; coxae I and II each with two short spurs; a single spur on each of coxae III and IV.

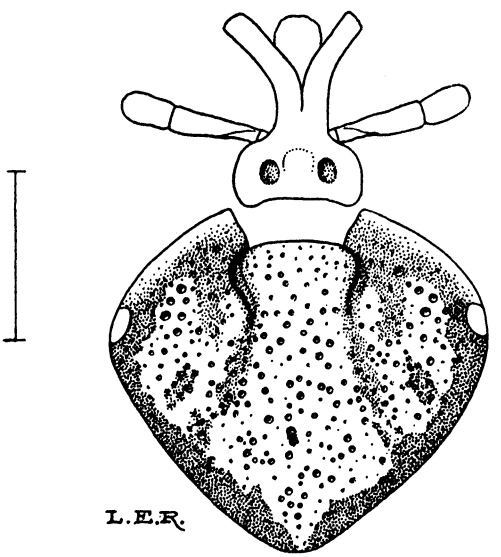


Fig. 130. *Amblyomma acutangulatum* ♀. Scutum, capitulum. (Type, British Mus.)

DESCRIPTION. *Body*: *L.* 6·0 mm., *W.* 4·0 mm.; marginal groove absent. *Scutum*: 2·05 × 2·2 mm.; median field and central parts of lateral fields pale-coloured; a dark-coloured margin extending from the scapular angle to the posterior angle, expanded slightly at the ocular and limiting spots; cervical stripes narrow, extending posteriorly almost to the limiting spots; frontal spots small; punctations numerous, fine, evenly distributed, coarser in the antero-lateral fields; cervical grooves

narrow and deep anteriorly, curved, with the convexity external; eyes small, pale and flat, situated a short distance behind the anterior third. *Capitulum*: *L.* 1·1 mm., basis more than twice as broad as long, lateral margins convex, postero-lateral angles broad and slightly salient; porose areas small, almost circular, interval equal to twice the diameter; palps long and slender, article 2 almost twice as long as article 3; hypostome spatulate, dentition 4 | 4. *Legs*: coxa I with two short, well-separated, unequal spurs, the external spur longer than broad; two short spurs on coxa II; a single short spur on coxae III and IV.

Description based on a single ♀, off a *snake*, Suva, Viti Levu, **Fiji Is.**, Woodford coll. 1884 (British Mus.). The specimen is dried and gummed to a card, which makes it impossible to examine the ventral surface. For the ventral parts in the above description, I have had to rely upon the observations of Neumann. Neumann's description is based on three ♀s, off *Varanus* sp. (?), Viti Levu, Fiji Is., Godeffroy coll. They were labelled *Amblyomma varani* L. Koch (Hamburg Mus.), but, as Neumann has observed in a footnote (1899, p. 240), it is impossible to find in what work L. Koch has employed this specific name. It would appear, therefore, that he never published a description.

CLASSIFIED LIST OF HOSTS

INVERTEBRATA.

MOLLUSCA.

GASTEROPODA.

		PAGE
Stenogyridae		103
Limicolaria adansoni Pfr.	*Amblyomma variegatum*	

VERTEBRATA.

BATRACHIA.

ECAUDATA.

Bufonidae		
Bufo marinus (L.) (*agua*)	*Amblyomma cajennense*	53
	,, *dissimile*	167
	,, *goeldii*	244
,, sp.	,, *goeldii*	244
	,, *rotundatum*	169

REPTILIA.

LACERTILIA.

Scincidae		
Trachysaurus rugosus Gray	*Amblyomma albolimbatum*	227
Iguanidae		
Iguana tuberculata var. *rhinolopha* Gray	,, *dissimile*	167
	, *scutatum*	204
,, sp.	,, *nuttalli*	93
Amblyrhynchus cristatus Bell	,, *darwini*	222
Cyclura carinata Harl. (*harlani* D. B.)	,, *albopictum*	156
Metopoceros cornutus (Latr.)	,, *cruciferum*	188
Tropidurus barringtonensis	,, *boulengeri*	220
,, *delanonis*	,, *boulengeri*	220
Teiidae		
Tupinambis (*Podinema*) *teguixin* (L.)	,, *maculatum*	44
Varanidae		
Varanus bengalensis Daud.	,, *supinoi*	186
,, *salvator* Laur.	,, *helvolum*	219
	,, *sublaeve*	247
,, *niloticus* L. (*saurus* Laur.)	,, *eburneum*	119
,, *varius* Shaw	,, *moreliae*	150
,, sp.	,, *acutangulatum*	266
	,, *australiense*	137
	,, *helvolum*	219

			PAGE
Gen. et spp. div.	*Amblyomma loculosum* (Seychelles)		65
	„	*marmoreum* (Africa)	90
	„	*rotundatum* (Brazil)	169
	„	*nuttalli* (Africa)	93

OPHIDIA.

Viperidae			
Bitis arietans Merr.	*Amblyomma*	*marmoreum*	90
	„	*variegatum*	103
„ *gabonica* Dum. et Bibr.	„	*marmoreum*	90
Lachesis mutus L.	„	*dissimile*	167
„ (*Bothrops*) *lanceolatus* Lacép. = (*Trigonocephalus jararaca*)	„	*deminutivum*	191
	„	*dissimile*	167
	„	*rotundatum*	169
	„	*scutatum*	204
Crotalus terrificus Wgm.	„	*dissimile*	167
Boiidae			
Python spilotes Lacép. = (*Morelia variegata* Gray) = (*Morelia argus* Dum. et Bibr.)	„	*limbatum*	146
	„	*moreliae*	150
Python molurus L.	„	*sublaeve*	247
„ *reticulatus* Schn.	„	*helvolum*	219
„ sp.	„	*marmoreum* (Africa)	89
	„	*helvolum*	219
Boa constrictor L.	„	*deminutivum*	191
	„	*dissimile*	167
	„	*fuscum* (?)	249
	„	*goeldii*	244
„ *imperator* Daud.	„	*dissimile*	167
Eunectes murinus L.	„	*fulvum*	215
Epicrates cenchrys Wagl.	„	*dissimile*	167
Colubridae			
Leptodeira annulata Fitz.	„	*dissimile*	167
Oxyrhopus neuwiedii Dum. et Bibr. (*Scytale coronatum* Dum. et Bibr.)	„	*dissimile*	167
Coluber onicephalus (*Typhlops sp.*?)	„	*helvolum*	219
Xenodon severus L.	„	*dissimile*	167
Spilotes variabilis Wagl.	„	*dissimile*	167
Elaps sp.	„	*goeldii*	244
Zamenis mucosus L.	„	*helvolum*	219
Diemenia textilis Dum. et Bibr. (*superciliosa* Günth.)	„	*albolimbatum*	227
Oxybelis acuminatus Wied.	„	*dissimile*	167
Zamenis (*Pytas*) *korros* Schleg.	„	*helvolum*	219
Dipsadomorphus dendrophilus Boie (*Triglyphedon dendrophilum* Dum.	„	*helvolum*	219

CHELONIA.

			PAGE
Testudinidae			
Nicoria trijuga Schw.	*Amblyomma supinoi*		186
Emys sp.	,,	*nuttalli*	93
Geoemyda spinosa Gray	,,	*caelaturum*	230
	,,	*geoemydae*	231
	,,	*supinoi*	186
,, *grandis* Gray	,,	*helvolum*	219
Testudo argentina Sclater (*sulcata* Dum. et Bibr.)	,,	*testudinis*	162
,, *elegans* Schoepff	,,	*clypeolatum*	81
,, *elongata* Blyth	,,	*supinoi*	186
,, *leopardinus*?	,,	*marmoreum*	90
,, *mauritanica* Dum. et Bibr.	,,	*marmoreum*	89
Cinixys erosa Schw.	,,	*clypeolatum*	81
Testudo polyphemus Daud.	,,	*tuberculatum*	177
Pelomedusidae			
Podocnemis sp.	,,	*dissimile*	167
	,,	*humerale*	181
Gen. et spp. div.	,,	*crassum* (Colombia)	179
	,,	*cyprium* (Asia)	236
	,,	*sabanerae* (Guatemala)	183

MAMMALIA.

MONOTREMATA.

Ornithorhynchidae			
Ornithorhynchus paradoxus Blum.	*Amblyomma triguttatum*		57
Echidnidae			
Echidna aculeata Gray	,,	*australiense*	137

MARSUPIALIA.

Macropidae			
Macropus sp.	*Amblyomma triguttatum*		57
Didelphyidae			
Didelphys pusilla Desm.	,,	*scutatum*	204
,, sp.	,,	*cajennense*	54

EDENTATA.

Bradypodidae			
Bradypus tridactylus L.	*Amblyomma geayi*		61
	,,	*varium*	208
,, *cuculliger* Wagl.	,,	*varium*	208
,, sp.	,,	*varium*	208

		PAGE
Dasypodidae		
Dasypus novemcinctus L.	*Amblyomma cajennense*	54
	„ *concolor*	69
„ *villosus* Fischer		
„ sp.	„ *cajennense*	54
	„ *concolor*	69
	„ *oblongoguttatum*	36
	„ *pseudoconcolor*	72
Tolypeutes tricinctus L.	„ *concolor*	69
Manididae		
Manis aurita Hodgson	„ *sublaeve*	247
„ *javanica* Fischer	„ *sublaeve*	247
„ *pentadactyla* L.	„ *sublaeve*	247
„ sp.	„ *sublaeve*	247
Myrmecophagidae		
Myrmecophaga jubata L.	„ *cajennense*	53
	„ *nodosum*	199
	„ *pictum*	240
„ sp.	„ *cajennense*	53
	„ *nodosum*	199
	„ *mantiquirense*	215
Tamandua (*Myrmecophaga*)	„ *calcaratum*	194
„ *tetradactyla* (L.)	„ *goeldii*	244
	„ *nodosum*	199
„ *tridactyla* (L.)	„ *cajennense*	53
	„ *incisum*	202
	„ *pictum*	240

UNGULATA.

Proboscidia.

Elephantidae		
Elephas (*Loxodon*) *africanus* Blum.	*Amblyomma cohaerens*	110
	„ *tholloni*	252

Perissodactyla.

Tapiridae		
Tapirus americanus Gm.	*Amblyomma cajennense*	53
	„ *coelebs*	33
	„ *cooperi*	75
	„ *incisum*	202
	„ *oblongoguttatum*	36
	„ *scalpturatum*	134
„ *indicus* Cuv.	„ *testudinarium*	256
„ sp.	„ *coelebs*	33
	„ *incisum*	202
	„ *multipunctum*	196
	„ *ovale*	29

			PAGE
Rhinocerotidae			
Rhinoceros bicornis L.	*Amblyomma*	*crenatum*	77
	,,	*gemma*	122
	,,	*marmoreum*	89
	,,	*personatum*	260
	,,	*petersi*	263
	,,	*variegatum*	103
,, *lucerius*?	,,	*hebraeum*	106
	,,	*petersi*	264
,, *sondaicus* Desm. (*javanicus* Cuv.)	,,	*testudinarium*	256
Equidae			
Equus caballus L.	,,	*americanum*	48
	,,	*cajennense*	53
	,,	*gemma*	122
	,,	*hebraeum*	107
	,,	*parvum*	38
	,,	*tholloni*	252
	,,	*triguttatum*	57
,, *asinus* L.	,,	*hebraeum*	107
	,,	*variegatum*	103
,, *asinus* ♂ × *caballus* ♀	,,	*americanum*	48
	,,	*gemma*	122
	,,	*pomposum*	100
,, *zebra* L.	,,	*variegatum*	103

Artiodactyla.

Dicotylidae			
Dicotyles torquatus Cuv.	*Amblyomma*	*americanum*	48
	,,	*brasiliense*	132
	,,	*cajennense*	53
	,,	*mantiquirense*	215
	,,	*oblongoguttatum*	36
,, *labiatus* Cuv.	,,	*mantiquirense*	215
Suiidae			
Sus scrofa L.	,,	*americanum*	48
	,,	*cajennense*	153
,, *cristatus* Wagn.	,,	*testudinarium*	256
,, *jubatus* Mill.	,,	*testudinarium*	257
,, *larvatus* (see *Potamochoerus*)	,,	*testudinarium*	256
,, *celebensis* Müll. et Schleg.	,,	*cyprium*	236
,, *vittatus* Müll. et Schleg.	,,	*testudinarium*	256
,, sp.	,,	*splendidum* (Africa)	124
Potomachoerus (*Sus*) *larvatus* (Cuv.)	,,	*testudinarium*	256
Phacochoerus aethiopicus Cuv.	,,	*gemma*	122
	,,	*variegatum*	103
Camelidae			
Camelus dromedarius L.	,,	*lepidum*	97
	,,	*variegatum*	103
Lama vicugna Molina	,,	*parvitarsum*	40

			PAGE
Tragulidae			
Tragulus sp.	*Amblyomma testudinarium*		257
Cervidae			
Cervus campestris	,,	*brasiliense*	132
	,,	*incisum*	202
	,,	*maculatum*	44
,, (*Odocoileus*) *virginianus* Bodd.	,,	*ovale*	29
,, sp.	,,	*americanum*	48
	,,	*cajennense*	53
	,,	*oblongoguttatum*	36
Giraffidae			
Giraffa camelopardalis (L.)	,,	*gemma*	122
	,,	*hebraeum*	106
,, *camelopardalis* var. *schillingsi* Matschie	,,	*eburneum*	119
Bovidae			
Taurotragus oryx Lydd.	,,	*petersi*	264
(*Antilope oreas* Pallas	,,	*marmoreum*	90
Oreas canna Gray?	,,	*hebraeum*	106
Boselaphus oreas Smuts)			
Antilope sp.	,,	*tholloni*	252
Bos bubalis L. (*indicus*)	,,	*integrum*	114
	,,	*testudinarium*	257
,, *taurus* L.	,,	*cajennense*	53
	,,	*dissimile*	167
	,,	*gemma*	122
	,,	*hebraeum*	106
	,,	*integrum*	114
	,	*lepidum*	96
	,,	*maculatum*	44
	,,	*ovale*	29
	,,	*pomposum*	100
	,,	*splendidum*	125
	,,	*testudinarium*	256
	,,	*triguttatum*	57
	,,	*variegatum*	103
Bubalus jacksoni Thomas	,,	*variegatum*	103
Bos (*Buffelus*) *caffer* Matschie	,,	*cohaerens*	110
	,,	*eburneum*	119
	,,	*hebraeum*	106
	,,	*lepidum*	97
	,,	*marmoreum*	90
	,,	*variegatum*	103
,, *caffer* var. *brachyceros* Lydd.	,,	*astrion*	126
	,,	*splendidum*	124
Capra hircus L.	,,	*americanum*	48
	,,	*cajennense*	53
	,,	*hebraeum*	107
	,,	*lepidum*	97
	,,	*maculatum*	44
	,,	*variegatum*	103

			PAGE
Catoblepas (*Connochaetes*) *gnu* H. Smith	*Amblyomma*	*gemma*	122
Cephalopus sp.	,,	*hebraeum*	107
Cervicapra sp.	,,	*variegatum*	103
Kobus ellipsiprymnus (Ogilby) A. Smith	,,	*variegatum*	103
Dicranoceros furcifer Brookes	,,	*multipunctum*	196
Egoceros (*Hippotragus*) *niger* Harris	,,	*pomposum*	100
	,,	*variegatum*	103
Ovis aries L.	,,	*americanum*	48
	,,	*cajennense*	53
	,,	*hebraeum*	107
	,,	*maculatum*	44
	,,	*variegatum*	103
Tragelaphus sp.	,,	*variegatum*	103
Oryx callotis Thomas	,,	*gemma*	122
Strepsiceros sp.	,,	*pomposum*	100
Alcephalus caama Gray	,,	*pomposum*	100

RODENTIA.

Leporidae			
Lepus cuniculus L.	*Amblyomma*	*cajennense*	53
	,,	*maculatum*	44
,, sp.	,,	*maculatum*	44
Caviidae			
Hydrochoerus capybara Erxl.	,,	*cajennense*	53
	,,	*cooperi*	75
	,,	*dissimile*	167
	,,	*maculatum*	44
Hystricidae			
Coendu (*Sphingurus*) *insidiosus* (Licht.) Kuhl.	,,	*longirostre*	140
Cercolabes villosus Cuv.	,,	*albopictum*	156
	,,	*longirostre*	140
Dasyproctidae			
Dasyprocta aguti Hensel	,,	*brasiliense*	132
,, *croconata* Wagn.	,,	*scutatum*	204
Coelogenys paca L.	,,	*brasiliense*	132
	,,	*pacae*	211

CARNIVORA.

Carnassidentia.

Mustelidae			
Mephitis sp.	*Amblyomma*	*americanum*	48
Conepatus suffocans Illig.	,,	*concolor*	69
Procyonidae			
Nasua socialis Wied.	,,	*cajennense*	54
	,,	*ovale*	29

			PAGE
Canidae			
Vulpes sp.	*Amblyomma*	*americanum*	48
	,,	*maculatum*	44
Lupus sp.	,,	*americanum*	48
Canis azarae Wied.	,,	*cajennense*	53
	,,	*incisum*	202
	,,	*maculatum*	44
	,,	*ovale*	29
,, *familiaris* L.	,,	*americanum*	48
	,,	*cajennense*	53
	,,	*hebraeum*	107
	,,	*maculatum*	44
	,,	*ovale*	29
	,,	*pictum*	240
	,,	*variegatum*	103
,, *griseus* Gray	,,	*maculatum*	44
Cynhyaena picta (Temm.)	,,	*hebraeum*	106
Viverridae			
Viverra civetta Schreb.	,,	*hebraeum*	106
Genetta pardina Is. Geoff.	,,	*marmoreum*	89
Felidae			
Felis domestica Brisson	,,	*americanum*	48
	,,	*variegatum*	103
,, *leo* L.	,,	*eburneum*	119
,, *onça* L.	,,	*ovale*	29
,, *pardalis* L.	,,	*americanum*	48
,, *tigris* L.	,,	*testudinarium*	256
Hyaenidae			
Hyaena hyaena	,,	*sublaeve*	247
	INSECTIVORA.		
Erinaciidae			
Erinaceus sp.	*Amblyomma nuttalli* (W. Africa)		93
	CHIROPTERA.		
Noctilio albiventer Spix.	*Amblyomma scutatum* (nymphs?)		204
	PRIMATES.		
	Anthropoidea.		
Cebidae			
Ateles melanochir Desm.	*Amblyomma quasicyprium*		238
Hominidae			
Homo sapiens L.	,,	*americanum*	48
	,,	*cajennense*	53
	,,	*ovale*	29
	,,	*variegatum*	103

GEOGRAPHICAL DISTRIBUTION OF THE GENUS AMBLYOMMA

Europe.	
Spain (Southern)	*dubitatum*
Africa.	
Sudan	*lepidum, marmoreum, variegatum*
Abyssinia	*lepidum, variegatum*
Somaliland	*gemma, lepidum, marmoreum, variegatum*
West Africa (Sierra Leone, Gold Coast, etc.)	*astrion, cuneatum, nuttalli, paulopunctatum, splendidum, tholloni, variegatum*
Cameroons	*cuneatum, hebraeum* (?), *nuttalli, tholloni, variegatum*
Congo	*cohaerens* (Eastern), *dubitatum* (?), *cuneatum, breviscutatum, marmoreum, pomposum, splendidum* (Western), *tholloni, variegatum*
Nigeria	*nuttalli, splendidum, variegatum*
Uganda	*cohaerens, cuneatum, gemma, marmoreum, nuttalli, paulopunctatum, petersi, tholloni, variegatum*
Kenya (British E. Africa)	*cohaerens, gemma, hebraeum* (?), *lepidum, marmoreum, personatum, petersi, variegatum*
Tanganyika Territory (German E. Africa)	*gemma, eburneum, hebraeum, lepidum, marmoreum, personatum, petersi, pomposum, tholloni, variegatum*
Nyasaland	*marmoreum, petersi, tholloni, variegatum*
Portuguese East Africa	*hebraeum, petersi, variegatum*
South Africa	*hebraeum, latum, marmoreum, nuttalli, petersi* (N. Rhodesia), *pomposum* (N. Rhodesia)
Madagascar	*variegatum*
Seychelles	*cuneatum, loculosum*
Asia.	
India and Burma	*clypeolatum, integrum, sublaeve, supinoi, testudinarium*
Ceylon	*clypeolatum, integrum, testudinarium*
Siam	*sublaeve*
Malay Peninsula	*caelaturum, cyprium, helvolum, sublaeve, testudinarium*
Singapore	*caelaturum, extraoculatum, helvolum*
Sumatra	*geoemydae, helvolum, sublaeve*
Java	*helvolum, sublaeve*
Borneo	*geoemydae, testudinarium*
New Guinea	*cyprium, papuana*
Philippine Is.	*americanum* (?), *cyprium, dissimile* (?), *helvolum*
Australasia.	
Australia	*albolimbatum, australiense, limbatum, moreliae, postoculatum* (King I.), *triguttatum*
Oceania.	
Marianne Is.	*cyprium*
Moluccas	*cordiferum*
Fiji Is.	*acutangulatum, quasicyprium* (?)
Solomon Is.	*nitidum*

North America.

United States	*americanum, cajennense, maculatum, tuberculatum* (Florida, Alabama)
West Indies	*albopictum* (Cuba), *cajennense, cruciferum* (Haiti), *dissimile, longirostre* (Trinidad), *variegatum*

Central America.

Mexico	*cajennense, coelebs, dissimile, maculatum, ovale, quasicyprium*
Guatemala	*cajennense, dissimile, sabanerae, scutatum, variegatum*
Honduras	*cajennense, dissimile*
Costa Rica	*cajennense, nodosum, ovale*
Panama	*cajennense, dissimile, oblongoguttatum, varium*

South America.

Venezuela	*cajennense, bispinosum, longirostre, multipunctum*
Colombia	*cajennense, crassum, deminutivum, dissimile, geayi, goeldii, ovale*
Guiana	*americanum (foreli), cajennense, dissimile, geayi, goeldii, guianiense, humerale, mantiquirense, oblongoguttatum, ovale, varium*
Ecuador	*incisum, maculatum*
Brazil	*americanum (foreli), brasiliense, albopictum, calcaratum, coelebs, concolor, cooperi, deminutivum* (?), *dissimile, fulvum* (?), *fuscum* (?), *geayi, goeldii, humerale, incisum, maculatum, mantiquirense, nodosum, oblongoguttatum, ovale, pacae, parvum, pictum, pseudoconcolor, rotundatum, scalpturatum, scutatum, varium*
Peru	*maculatum*
Bolivia	*coelebs, incisum, longirostre, oblongoguttatum, ovale, parvitarsum, scalpturatum*
Paraguay	*cajennense, calcaratum, cooperi, dissimile, maculatum, pseudoconcolor, ovale, scutatum*
Uruguay	*humerale, maculatum*
Argentine Republic	*cajennense, concolor, furcula, maculatum, ovale, testudinis, varium*
Chile	*maculatum, parvitarsum*
Patagonia	*maculatum*
Galapagos Is.	*boulengeri, darwini, hirtum, pilosum*

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NOTES ON THE BIOLOGY OF AMBLYOMMA

Of the 86 species of the genus *Amblyomma*, the life-history has been observed and described, more or less completely, in some 10 species only. Our knowledge of the subject is, therefore, still too meagre to allow us to generalise, but, so far as it goes, and excepting the occurrence of parthenogenesis, there are no remarkable differences between the biology of Amblyommas and other Ixodid genera.

With a single exception, all the species are three-host ticks, that is to say, they drop off the host to moult and must, therefore, seek a new victim in each life-phase—larva, nymph, and adult. The one observed exception is *A. rotundatum* (*agamum* Aragão) which, under certain conditions still unexplained, may pass through the larval or the nymphal moult without detaching itself from the host. It was in the course of the study of the biology of this species that the phenomenon of parthenogenesis was observed, for the first time in Ticks, by Aragão. Since then, Bodkin has observed parthenogenesis in *A. dissimile*, in which the normal process of pairing of the sexes also occurs. Hitherto, the male form of *A. rotundatum* has never been seen, and in raising experiments comprising a succession of generations reproduced parthenogenetically, the very numerous progeny has consisted of females without exception. In *A. dissimile* on the other hand, Bodkin has recorded the appearance of both sexes among the immediate offspring of a parthenogenetic generation.

Amblyomma maculatum

The following notes are derived mainly from Hooker, Bishopp and Wood (1912); the biology has also been studied by Lahille (1905), Hunter and Hooker (1907), and Newstead (1909).

When this tick occurs in large numbers, it is a source of great irritation to domestic animals, particularly cattle. Apart from this it is of small economic importance.

Oviposition may occur as early as 3 days after the dropping of the female from the host in summer, or it may be delayed to the 9th day. Deposition of eggs continues for 13 to 75 days, according to the air temperature.

The minimum incubation period observed by Hooker, Bishopp and Wood was 21 days, at a mean temperature of 81° F. In a case observed

by Lahille, a female commenced to lay 10 days after its arrival, and, allowing for the days of the journey to the laboratory, the pre-oviposition period would amount to 12 or 13 days. Larvae hatched out in 50 days (at laboratory temperature, 27th Oct. to 16th Dec.). In another case, oviposition commenced in 10 days, and the first larvae hatched in 63 days after the commencement of oviposition.

The greatest longevity[1] observed in the larva was 179 days. Larvae engorge in 3 to 7 days, the majority dropping off the host on the 4th and 5th days. The larva-nymph moult may take place as soon as 7 days, but in one recorded case, a larva which dropped off the host in November moulted 121 days later.

Nymphs engorge in 5 to 8 days, the majority in 6 to 7 days. In the summer the nymph-adult moult may occur within 17 days of dropping from the host; in the winter the pre-moult period may range from 51 to 71 days. No record of the longevity of the unfed nymph is available.

Females may engorge to repletion in 14 days. The greatest adult longevity recorded is between 388 and 411 days.

Copulation takes place upon the host, and it would appear that some degree of engorgement is necessary to the development of the sexual instinct. When a male has mated with a female, he usually remains with her until she drops from the host; he then goes in search of another mate. The males remain attached to the host for long periods after the females have dropped and may mate with many females. This habit accounts for so many males being taken on the host at certain seasons of the year when the females cannot be found.

Amblyomma americanum

The biology of this species has been studied by Hunter and Hooker (1907), and by Hooker, Bishopp and Wood (1912), from whose paper the following notes have been compiled.

A. americanum has a wide range of hosts, apparently attaching itself to any mammal with which it comes into contact. It is also known to attack birds. It readily attaches itself to domestic animals and man, and, although it is not known to be the vector of any specific disease, it is capable of inflicting very severe bites accompanied by extensive inflammation and suppuration. Attempts, made by Mayo and Morgan, to transmit bovine piroplasmosis by this tick, failed. The tick is reputed

[1] Throughout these notes, the word "longevity" means the duration of life of a tick kept unfed from the date of its emergence, from the egg in the case of the larva, and from the previous moult, in the case of the nymph and adult.

to be a serious pest to poultry in some parts of the United States, where the larvae infest chickens in such numbers as to kill them.

Oviposition commences 5 to 13 days after the dropping of the engorged female from the host and continues for about a week to a fortnight. The maximum number of eggs observed to be deposited by a female of this species was 8330; the average number amounts to a little more than 3000. In laboratory experiments, the minimum period of incubation was 23 days, in June and July, at a mean temperature of 80·5° F., but out of doors, in July and August, at a mean temperature of 82·5° F., 32 days passed before hatching commenced.

Larval engorgement may be completed in 3 days, but the greatest number fall from the host on the 4th day. The longest period required for engorgement was 9 days, which may have been due to the larvae failing to attach themselves at once, or because they became attached at a point where the blood supply was poor.

When engorged, the larvae drop from the host and the larva-nymph moult takes place in 8 to 26 days in the summer; in the winter months the period would, doubtless, be much longer. Unfed larvae have survived for 279 days in a tube in a protected place out of doors; in the laboratory, the longevity of the larvae did not exceed 176 days and usually ranged from 2 to 4 months.

The minimum observed period for the engorgement of the nymph was 3 days, the majority dropping off the host from the 3rd to the 5th day. In a few cases the nymphs may remain attached to the host for 8 days. In summer, nymphs moult 13 to 16 days after dropping from the host. The longest observed period was 46 days. The maximum longevity of the nymph has been recorded as 476 days. Engorgement is accomplished in 11 to 24 days. The greatest longevity of adults recorded was between 393 and 430 days.

Copulation appears to take place upon the host and the sexual instinct is not manifested until after several days' feeding. Fertilisation may be essential to engorgement, for females collected from vegetation became attached to the host quite readily, but, in the absence of males, failed to engorge and died in about a month. Males of *A. americanum* placed upon the scrotum of a bovine to which the females of other species of ticks were already attached, have been found *in coitu* with these females (*Boophilus australis*, *Amb. maculatum*, and *Dermacentor nitens*).

The males have been observed to remain on the host for more than $1\frac{1}{2}$ months after the females have dropped, and a single male is capable of fertilising several females.

Amblyomma cajennense

The biology of *A. cajennense* has received attention in the papers of Hunter and Hooker (1907), Newstead (1909), Rohr (1909), and Hooker, Bishopp and Wood (1912).

The last-named authors state that this tick is of economic importance in the lower Rio Grande Valley of Texas only, where it is very abundant at certain seasons of the year and is a cause of great irritation to horses, mules, cattle and other domestic animals. Stoll has recorded that in Guatemala, the larvae of *A. cajennense* hang on the grass in clusters of thousands and are a source of great annoyance to travellers. Human beings are often attacked, and cases of severe illness are known to have occurred as the result of numerous bites leading to suppurating sores and the wounds produced by scratching.

The following information is derived for the most part from Hooker, Bishopp and Wood (1912).

Oviposition commenced, in one instance, 9 days after the dropping of the female from the host (August, mean laboratory temperature 84° F.), while out of doors, at the same mean temperature, 11 days were required. At lower temperatures, the pre-oviposition period extended to 16, 18, 20 days and more. The average number (13 cases) of eggs laid by one female was 3536. Newstead states that the number of eggs laid by a female amounts to 2000 according to Williams, but that Wortley gives the figure 7240, which is probably nearer the average, and Rohr has recorded a number of 7742 from one individual.

The incubation period at an average temperature of 75° F. is stated by Newstead to be 43 to 50 days. The minimum period observed by Hooker and his collaborators was 37 days (mean temperature 80° F.). Under out of doors conditions, with a mean temperature of 66·2° F., the incubation period was 154 days. The maximum larval longevity observed was 386 days.

Larval engorgement is completed in from 3 to 7 days, the majority of larvae dropping off the host on the 4th and 5th days. The shortest recorded period prior to the larva-nymph moult was 10 days, and this at a mean temperature of 89·8° F. The greatest longevity observed in the unfed nymph was 1 year and 43 days.

Nymphs may engorge in as few as 3 days, the majority taking 4 to 5 days. In August, at a mean temperature of 89° F., the nymph-adult moult commenced as soon as the 12th day from the dropping of the

nymph. The longest time observed to be required for moulting was 105 days, the mean temperature being about 53° F.

Adult ticks engorge in from 7 to 10 days. The longevity of unfed adults may certainly exceed one year.

So far as is known mating takes place upon the host.

Amblyomma marmoreum

Although the usual hosts of this tick are Chelonians, Lizards, and occasionally Snakes, it is also a frequent parasite on the Rhinoceros in East Africa, but is rarely found on other mammals.

Lounsbury (1905) reports that all his specimens were found on tortoises, excepting a few taken on snakes, and that the adults would not feed on oxen or goats unless they were first partially fed on a tortoise. Larvae and nymphs, on the other hand, are not so particular, for they were found to feed readily on cattle or goats, as well as on tortoises. The larvae will also readily attack birds.

Little is known of the details of the life-history. The following observations were made by Lounsbury. A female, collected on the 23rd September, 1903, began to oviposit about the 25th November. Larvae commenced to hatch out on the 23rd January, 1904. Larvae fed to repletion on the scrotum of an ox in 5 days, and on the leg of a goat in 6 days. Sixteen days after the completion of the larval engorgement, nymphs moulted out (in incubator). Nymphs engorged in 7 to 9 days, and the nymph-adult moult took place 82 days later (19th Sept. to 10th Dec.) at room-temperature. These figures indicate that the various life-phases take about the same time as do those of *A. hebraeum*.

Only 5 females were fed to repletion, and of these one dropped from the host in 16 days, one in 20 days, two in 27 days, and one in 45 days. Unlike *A. hebraeum*, both males and females attach themselves to the host in the first instance without reference to each other. It is not known whether the female seeks the male or *vice versa*.

Amblyomma variegatum

Notwithstanding its wide distribution in Africa, and its almost universal presence on domestic cattle, no complete study of the life-history of this species has yet been made.

Lounsbury (1905) notes that it is closely allied to *A. hebraeum*, and that the eggs take the same time to hatch and the larvae and nymphs the same time to feed and moult, as would *A. hebraeum* under the same conditions.

Nuttall (1915) records observations which he made on material collected as engorged nymphs, from cattle in the Lower Congo (23–30. IV. 1912). When received in Cambridge in June, 1912, most of them had emerged, as adults, from the nymphal skins. Females placed upon calves remained attached for 11 to 20 days, at a temperature ca. 18° to 20° C., and 23 to 33 days, at a temperature ca. 15° C. A female remained attached to the scrotum of a ram for 51 days (temperature ca. 20° C.). The males were observed to remain attached to the host long after the females had dropped off engorged; 4 males remained attached for 4 to 8 months. They may even die *in situ*. Oviposition began 9 to 46 days after the females had dropped from the host; the process lasted 26 to 90 days, and the females survived for 2 to 10 days after it was completed. The number of eggs laid by the female is about the same as in *A. hebraeum*. Of 10 batches of eggs laid by as many females, 8 failed to hatch (temperature ca. 15° C.), while 2 batches hatched at a temperature of 30° C. Larvae emerged from the eggs in 16 to 31 days from the deposition of the eggs. Attempts to raise the larvae failed. The life-history of *A. variegatum* appears to be essentially similar to that of *A. hebraeum*.

Amblyomma hebraeum

Commonly known in South Africa as the "Bont Tick," this species has acquired an evil reputation, and deservedly, for, until a few years ago, it was so prevalent, particularly in the south-western provinces, as to be a veritable scourge to sheep and dairy-cattle.

It is the vector of the disease "Heartwater," which affects cattle, sheep and goats, and, moreover, is often the cause of sloughing of the teats in cows, and of other extensive injuries to infested stock by the severity of its bites.

For most of our knowledge of the life-history and habits of this species, we are indebted to Mr Charles P. Lounsbury, Chief of the Division of Entomology, Department of Agriculture of the Union Government of South Africa. Concerning the habits of *A. hebraeum*, Lounsbury writes (1899) "The 'Bont Tick' attacks all kinds of stock farmed in this colony and is not at all averse to fastening on to human beings, black as well as white. Ostriches become affected, and if it were not for their ability to pick off the creatures from most parts of their bodies, they would doubtless suffer severely. It is a matter of common observation that the adult tick, even when abundant on an animal, is confined almost exclusively to the under parts. The favourite

places of lodgment are the relatively bare places beneath the shoulders and about the genitals and udder; also between the toes of small stock and beneath the fetlocks of horses. Yet while evidently preferring these places, the tick, at least in its larval and nymphal stages, will thrive even amongst the thick hairs on the sides and back of Angora goats and on the legs of cattle. The adult tick is not at all expert in climbing about in hair, and it is doubtless largely owing to this fact that it does not infest the backs of cattle. On man, the tick in all stages shows a preference for the parts analogous to those most subject to attack in animals. This preference cannot be wholly ascribed to the location of the openings or the arrangement of the clothing, for native children, clothed in modesty alone, are most bitten in the same places."

A. hebraeum appears to require a warm, moderately humid climate. It thrives best in veld shaded by high bushes and quite fails to establish itself in open low grass veld and in the Karroo (Lounsbury, 1905). Shade seems to be necessary to protect its quiescent stages from desiccation. The eggs are particularly sensitive and make it difficult to maintain a proper degree of humidity in raising experiments.

The following information is derived from Lounsbury's papers. The female Bont Tick, when fully distended with blood, loosens her hold on the host and voluntarily drops to the ground, where she seeks concealment and appears restless until she succeeds in getting at least the fore portion of her body hidden from the light.

The actual operation of oviposition has been described in detail by Lounsbury, but does not differ from the process as observed and adequately described in other species of ticks. In summer time, oviposition commences within 2 weeks or less after dropping from the host, but in cold weather, 10 to 11 weeks may elapse.

In one batch of eggs which he had under observation, L. J. Roberts, who assisted Lounsbury in his observations, estimated the number of eggs to be 13,260. Claude Fuller counted 6000 eggs in one batch and estimated the remainder to amount to 11,500. It is probable that the complement varies with different females from 10,000 to 20,000 eggs.

The number of eggs laid daily throughout the period of oviposition varies. During one interval of 2 days, only 18 eggs were laid, while on the following day there were no less than 370 in 20 hours, an average of one every $3\frac{1}{2}$ minutes. In summer, or when kept warm in an incubator, oviposition is completed in a much shorter time than in the winter at ordinary temperature, the periods in the instance observed being from

3 to 9 weeks. The normal period out of doors in summer is probably at least 6 weeks.

The incubation period is variable and is dependent on the temperature and other conditions. Development is very slow in cold weather. Eggs laid in the middle of winter (S. Africa) had not hatched even in the following January. In summer, the period is relatively short and the first eggs hatch a few weeks after the last eggs are laid. Eggs laid on the 26th January, isolated and kept in the office, began to hatch on the 13th April, 11 weeks later. Eggs laid in spring and early summer generally hatch before the commencement of the cold weather, but those laid in late summer and during the winter, remain unhatched until the mid-summer of the following year. The shortest adult-larva stage at ordinary temperatures, observed by Lounsbury, took 76 days, and the longest, 279 days.

The newly-hatched larvae show a propensity to creep upwards towards the light. Their favourite support is a grass blade and upon one of these, Lounsbury and Roberts counted 2250 larvae on the terminal 2 inches of a narrow blade. The larvae show considerable longevity. Examples hatching out in a small bottle in the laboratory, between the 13th April and the 15th May, were still alive in the following November.

Larvae attached to the host show little change in appearance until about the 4th day, when they begin to swell perceptibly. Complete distension is achieved in from 4 to 20 days, the usual time being about 6 days. The time varies according to the host animal and the part to which the tick is attached.

With artificial heat (incubator at 90°–100° F.) nymphs moulted out from the larval skins in 15 days, but under natural conditions in winter, even in sheltered sunny situations, no nymphs appeared in less than 7 weeks. Under veld conditions, allowing for variations of season and situation, the period probably varies from 1 to 3 months.

Like the larvae the nymphs show a considerable degree of longevity. Specimens kept in the laboratory were still alive and active after the lapse of 15 weeks, and there is reason to believe that, in the open, nymphs may survive for 3 months and more.

Engorgement of the nymph takes from 4 to 8 days, a few have been observed to take as long as 30 days. Lounsbury noticed no difference in these limits in nymphs raised on sheep and goats respectively.

The nymphal moult took place 11 weeks after dropping from the host.

The observed periods which elapsed between the dropping of the nymphs and the moulting out of the adult form ranged from 26 to 160

days at ordinary temperatures, but in incubated batches the nymphal skins began to rupture in from 18 to 28 days. The absolute longevity of the adult was not studied, but examples moulted 3 months previously were still active. Lounsbury records one instance of an adult which was still alive 14 months after feeding as a nymph. Males attach to the host and feed for 4 to 7 days before they become attractive to the females, and the latter are loth to attach themselves to the host until they have found a male capable of fertilising them. For a few days after the female has found her mate, she distends but little; she then begins to swell slowly and may be half distended by the 5th day. Complete engorgement is usually achieved by the 7th or 8th day. Males often remain attached to the host for many months, even a year, and in the course of his sojourn on the host, a male may fertilise several females successively.

The complete life-cycle is of variable length. At the very least, Lounsbury estimates that 9 months are required, and that, under exceptional circumstances, 2 full years might pass and the cycle be still incomplete. Ordinarily, there cannot be more than 1 generation in the course of a twelve-month. The minimum and maximum times occupied by the successive life-phases as observed by Lounsbury are summarised as follows:

Oviposition	3 weeks to		9 weeks
Incubation	11 „	„	6 months
Larval engorgement	4 days	„	9 days
Engorgement to larval moult ...	16 „	„	9 or more weeks
Nymphal engorgement	4 „	„	8 days
Nymphal moult	18 „	„	11 weeks
Adult engorgement (♀)	7 „	„	8 days
Total	147 „	„	409 or more days

Professor G. H. F. Nuttall carried out, in 1906 and 1913, extensive raising experiments with *A. hebraeum*, the material for the later experiments being the progeny of 2 gorged females sent to him by Mr C. P. Lounsbury.

Larvae were placed on the scrotum of a ram in January, 1913, the mean air temperature at the time being 4° C. They engorged to repletion in from 5 to 18 days, the largest number dropping from the host on the 6th to the 9th day. In a second experiment (mean temperature 3·3° C.) the period of engorgement ranged from 5 to 19 days, the majority of the larvae dropping off on the 6th to the 9th day. In some earlier raising experiments conducted in 1906, larvae placed on hedgehogs took

from 12 to 42 days before dropping from the host. Larvae attached themselves readily to sheep and hedgehogs; nymphs were fed on sheep, goats, and calves, and adults on sheep and calves. Upon hedgehogs, in September (temperature ca. 18° C.) the larvae remained for 12 to 17 days, mostly dropping about the 13th or 14th day; in January (temperature ca. 12° C.) they remained on the host for 5 to 19 days, mostly dropping off gorged on the 8th day.

Nymphs remained on sheep for 5 to 18 days, but the greatest numbers dropped off on the 6th and 7th days; on goats they remained attached for 6 to 22 days, and on calves from 4 to 12 days, mostly 5 or 6 days.

Females were found to remain for 6 to 12 days on the ears of calves which were already infested with males. Of 50 males under observation, 21 remained on the calf for 8 days, 10 for 7 days, 8 for 9 days, 5 for 10 days, and 3, 2, and 1 dropped off on the 6th, 11th, and 12th day, respectively.

Males remained attached to a calf from 41 to 267 days. Nuttall notes that a certain amount of humidity is essential during the metamorphoses. The time required for development, from oviposition to the hatching of the larva, was from 47 to 63 days (temperature 30° C.); engorged larva to nymph, 12 to 13 days (temperature 30° C.); engorged nymph to adult, 18 to 21 days at a temperature of 30° C. and 44 days at a temperature of 37° C. The mortality at this stage was low, 102 adults emerging from 106 nymphs in one case, and 825 adults from 1145 nymphs in another case. There appeared to be a preponderance of males; thus, among 1242 adults descended from a single female, 747 were males and 495 were females.

Gorged females began to oviposit 8 to 11 days after dropping from the host, when maintained at a temperature of 30° C., and the females survived for 1 to 15 days after the operation was completed. Oviposition continued for 24 to 35 days, and the number of eggs deposited by individual females ranged from a minimum of 12,300 to a maximum of 18,500.

Nuttall records interesting observations on the longevity of *A. hebraeum*. Several lots of larvae lived unfed for upwards of 346 days; nymphs lived for 250 days, and some males survived for more than 660 days at room-temperature. Adults, after fasting for 412 days and more, fed normally upon a ram, the sexes paired as usual, and the females oviposited. He raised *A. hebraeum* in the laboratory through two generations. The life-cycle of the first generation was completed in 240 days, and that of the second generation in 171 days.

Amblyomma testudinis

Lahille (1905) has given some information on the biology of this species. On the 6th February, 1903, he received a tortoise (*Testudo argentinae*) with gorged ticks which presently detached themselves. Oviposition commenced on the 13th February, and the first larvae hatched out 66 days later, on the 20th April.

Larval engorgement was completed in 8 days or more, and nymphs moulted from the larval skins 15 to 20 days later, at a mean laboratory temperature of 22° C.

The nymphal stage endured generally for about a month, and this was also about the time required by the female to attain maturity and drop off fully engorged from the host.

Lahille makes the observation that, in *A. testudinis*, as in almost all the species of which the males are of a relatively large size, the parasites of this sex remain attached to the host long after the females of their generation have dropped off engorged, and that he has been able to verify the fact that these males may pair with females of the following generation. He placed on a tortoise which harboured 7 old males, 6 young females of another generation. Of these females, 3 only attached themselves to the host, and each of these ultimately laid fertile eggs. Lahille had no doubt but that copulation had taken place, for he did not believe, in the absence of other proof, that parthenogenesis had occurred.

Amblyomma dissimile

The biology of *A. dissimile* has been studied by Newstead (1909), Hooker, Bishopp and Wood (1912), and others, but especially by Bodkin (XI. 1918), who was the first to observe the occurrence of parthenogenesis in this species.

The usual hosts are Amphibians and Reptiles, and the adult female will engorge only on such animals. Larvae and nymphs, on the other hand, will feed on warm-blooded hosts. *A. dissimile* is a 3-host tick, and Newstead was in error in supposing that it moulted on the host.

Bodkin considers the species to be of small economic importance, but notes that it does occasionally cause the death of toads, which do some good in the consumption of insect pests.

He commenced his raising experiments with 3 females captured on toads. They were confined in glass tubes in the laboratory, and oviposition commenced on the 22nd October, 1915. The operation proceeded regularly for about 16 days and the females were dead on the 18th November.

In an observation made by Newstead, the number of eggs laid by a female was 1784. Hooker, Bishopp and Wood report a count of 1655.

At a temperature of 80°–82° F., larvae engorged on a toad in about 15 days on the average (Newstead gives "about a week"; Hooker, Bishopp and Wood, 10 to 16 days on tortoise, 4 to 9 days on bovines), and moult into the nymphal phase some 15 days later. The greatest longevity observed was 84 days, this in larvae confined in glass tubes stuck in damp sand (Hooker, Bishopp and Wood record the greatest longevity observed by them as 95 days).

Nymphs, fed on toads, were fully engorged in 13 to 17 days at an average temperature of 82° F., and in 8 to 14 days at an average temperature of 80·1° F. (Hooker, Bishopp and Wood, 11 to 13 days upon a tortoise, in August, 5 to 8 days on a bovine). Moulting took place 14 to 16 days later (average temperature 82° F.). The average longevity of two lots of nymphs was about 99 days (Hooker, Bishopp and Wood observed a greatest longevity of 130 days).

Unfertilised females engorged on a toad (average temperature 82° F.) in 29 to 34 days; in a second series of observations, at an average temperature of 80·1° F., unfertilised females engorged in 37 to 44 days, and fertilised females in 40 to 45 days. Newstead reports 3 females to have engorged in 14, 17 and 23 days respectively. At the same temperature, two unfertilised and unfed females lived for 427 days and 496 days, respectively. The second female was placed on a toad on the 451st day and soon became attached. She dropped off, three-quarters engorged, 29 days later and produced fertile eggs in due course without access to a male.

Provided that each stage promptly finds a host, the complete life-cycle may be completed in about 153 days:

Oviposition to hatching of larva	27 days
Time allowed for larvae to harden before attaching to the host	5 ,,
Larval engorgement	15 ,,
1st ecdysis	15 ,,
Time allowed for nymph to harden	7 ,,
Nymphal engorgement	13 ,,
2nd ecdysis	15 ,,
Time allowed for adult to harden	10 ,,
Adult engorgement	41 ,,
Completion of engorgement to oviposition	5 ,,
Total	153 ,,

Owing to the improbability of the tick finding a host without delay in each of its life-stages, the period of the life-cycle is doubtless much longer under natural conditions.

Although males and females are present on the host at the same time, Bodkin never observed copulation on the host. Males and females were found to copulate quite readily when placed together in glass tubes. In most cases the act took place immediately, but males that had been kept in captivity for some time showed a reluctance to copulate. The act was observed when females about one-quarter engorged and forcibly removed from the host were placed together with males.

Bodkin captured on 30 toads a total number of 55 adult ticks, of which 46 were males and 9 were females. From this observation he surmised that, under natural conditions, the males largely predominate. Hooker, Bishopp and Wood observed that 7 per cent. of 28 individuals moulting to adults were females.

Parthenogenesis in A. dissimile.

Bodkin obtained absolute proof of the occurrence of parthenogenesis. Two females were carefully bred from ova in the laboratory and then kept in strict captivity in glass tubes, every needful precaution being taken to exclude even a remote chance of males obtaining access. These females engorged normally and laid normal quantities of eggs, all of which, as far as could be ascertained, were fertile. Owing to lack of space and equipment, Bodkin was not able to raise even one-quarter of the larvae derived from the eggs of any one female. Some of the progeny of these ticks were carefully raised and 65 females were eventually secured. Some of the latter were allowed to engorge and to produce another generation. In all, Bodkin raised four successive generations parthenogenetically from the 2 original females and, moreover, these generations were comprised entirely of females. No diminution in size or vigour was noticed. Females of a parthenogenetically developed generation are susceptible to fertilisation. With the object of acquiring experimental evidence of this, Bodkin took 2 females of the 4th parthenogenetic generation and mated them with males captured in the field. Of the progeny of the first female, only 6 reached maturity, and all of these were females. In the case of the second female, 15 of the progeny reached maturity; 1 was a male and the rest were females.

It is interesting to note that, in the course of his investigations in Jamaica, Newstead was never able to find males of *A. dissimile*, although careful searches were made.

Amblyomma rotundatum

(=*agamum* Aragão)

The biology of this species was first studied by Rohr (1909, 118–120) who mis-identified it as *A. goeldii*. He was followed by Aragão (1912) who was the first to recognise definitely the occurrence of parthenogenesis in this tick, although Rohr had remarked upon the complete absence of males in the material with which he worked and that 398 nymphs evolved entirely into females. In 1924, Brumpt published an account of his investigations, in which he brings to light other interesting facts which, so far as present knowledge goes, are peculiar to this tick.

A. rotundatum is exclusively parasitic on Amphibia and Reptiles. Aragão states that, under natural conditions, he has only met with it on *Boa constrictor* and *Bufo* sp. but that all terrestrial forms of cold-blooded animals may serve as hosts for the collective developmental stages of the species. He succeeded in feeding his specimens on terrestrial tortoises, on various snakes (*Elaps*, *Eunectes*, etc.) and on lizards (*Tejus* and *Tropidurus*). In his experiments, Brumpt has fed the species on divers European snakes (*Zamenis viridiflavus*, *Tropidonotus natrix*), on lizards (*Lacerta viridis*, *L. ocellata*), on both terrestrial and aquatic tortoises (*Testudo graeca*, *Cistudo lutaria*, and batrachians (*Bufo viridis*, *Discoglossus pictus*, *Rana esculenta*). Nymphs, having refused to become attached to *Bombinator pachypus*, *Rana temporaria*, *Molge palmata*, *Alytes obstetricans*, and *Bufo calamita*, rapidly fixed themselves on a grass snake.

As Brumpt observes, it is interesting from a general point of view to demonstrate the remarkable parasitic ubiquity of this tick, which, coming from Brazil, will attack a variety of European hosts, which shows, once more, how difficult it would be to put into practice the methods of trophic education suggested by Roubaud for the prophylaxis of the various parasitic diseases.

A. rotundatum refuses to attach to warm-blooded animals.

The following account of the life-history is mainly derived from Aragão's memoir.

The tick usually attaches itself rapidly when brought to the host, excepting at the time immediately following a moult, when the sucking apparatus has not yet acquired sufficient firmness to penetrate the skin, selecting for preference, the thin-skinned parts—the articular folds, between the scales, etc.

Animals attacked by *A. rotundatum* suffer severely, not only as a result of loss of blood, but especially by the inoculation of toxic sub-

stances into the organism of the host. Even when the ticks are attached in large numbers, loss of blood, over a prolonged period, affords no sufficient explanation in itself for the frequently fatal effect on the host. A toad of ordinary dimensions always failed to survive the simultaneous bites of 10 ticks, and 100 ticks almost caused the death of a boa constrictor $1\frac{1}{2}$ metres in length.

When fully gorged, the female tick drops off the host and crawls about actively in search of some crevice or the shelter of a stone in which to deposit her eggs. As soon as a suitable position has been found, the tick becomes inactive and oviposition commences. The operation may begin within 5 days of dropping from the host, but more often the rest period is about 9 days. The act of oviposition is hastened by an elevation of the air temperature, and to some extent by the degree of humidity, which is most important in connection with the development of the eggs; these dry up and perish unless they are placed in a moist atmosphere. The act of oviposition continues without intermission for 22 to 26 days, only in the last 4 days there may be exceptionally a pause in the operation. The total number of eggs usually exceeds 3000. The actual maximum number observed was 3277. The females die 6 to 8 days after oviposition is completed.

In a humid atmosphere the larvae begin to hatch out in 28 to 30 days. At first the newly-hatched larvae are inactive and show no propensity to become attached to the host to which they are brought. After the lapse of 24 hours, however, they commence to move about actively and to collect in detached groups on the walls of the containing vessel. This habit of aggregation of the larvae in groups appears to be an instinctive act of self-preservation and is also exhibited by other species, notably *A. cajennense*, in the free condition. The maximum larval longevity is at least 3 months.

When placed upon a suitable host, the larvae soon begin to feed and engorgement is completed in 6 to 8 days, when about 50 per cent. drop off one by one. The remainder do not leave the host but moult thereon into nymphs which refix themselves to the same host. In an experiment conducted by Brumpt, described below, none of the larvae moulted on the host. The larva-nymph metamorphosis is accomplished much more quickly in the case of the larvae that remain attached to the host; they require 2 days less than the larvae that drop off, these requiring 10 to 11 days.

Like the larvae, the nymphs are at first inactive, but in the course of 24 hours, they begin to move about and then collect into groups on

the walls of the container. Nymphal engorgement is completed in 7 to 10 days, and the engorged nymphs drop off the host without exception. Brumpt records an instance of nymphs moulting on the host (see below). Moulting takes place some 13 to 15 days later and all the nymphs transform into females.

Two days after emergence from the nymphal skin, the females are ready to feed, and engorgement is completed in 17 to 22 days.

The complete life-cycle, in the conditions obtaining in laboratory experiments, occupies at least 90 days.

Parthenogenesis in A. rotundatum.

For a long time Aragão and his collaborators were puzzled by the fact that the ticks captured on infested animals were invariably females, and that from nymphs collected on the same animals only females moulted out. Rohr had already noted, in the course of his observations of the development of this species, the interesting fact that from 398 nymphs, females alone were obtained.

After repeated observations in this direction, Aragão proceeded to carry out careful experiments to elucidate the matter. The ease with which this tick can be raised on cold-blooded hosts facilitated the work to such an extent that he was soon convinced that the occurrence of parthenogenetic reproduction accounted for the absence or rarity of males. As a matter of fact, the male of this species has never been seen. Aragão's conclusions were based on two extensive series of observations, one in which three or four successive generations were bred, and another with a completely closed generation in which the eggs laid by the females proved to be fertile notwithstanding the absence of males.

In the course of his experiments in Brazil and France, Brumpt was able to confirm, almost entirely, the observations of Aragão, but in one or two instances important differences were noted. He distributed the progeny of a female tick, captured on a snake in the north of Brazil, on 5 toads (ca. 25th October, 1922), and engorged larvae commenced to drop from the hosts during the return to France (from the 5th to 14th November). The curious fact to be noted was that none of the larvae moulted on the toads, and Brumpt asks the question—"Is this a peculiarity of the pedigree of this single tick, or is it due to the influence of environment?" The answer to a part of this question is to be found in a footnote, in which Brumpt states that, among the larvae of the second generation derived from the above-mentioned female, and fed on a fresh water tortoise, a very large percentage moulted on the host.

The nymphs derived from these larvae (1st generation) were raised easily on various cold-blooded hosts and in due course developed into females.

In a particular case which Brumpt reports in detail, the nymphs moulted on the host (*Testudo lutaria*). Thirty dwarf females, derived from nymphs raised on a terrestrial tortoise which died before they had completed their engorgement, and a certain number of half-gorged nymphs, removed from a snake (*Zamenis viridiflavus*) possibly 3 days dead, were placed in a linen bag containing an aquatic tortoise. After the lapse of a few hours, all the parasites had attached themselves to the tortoise, which was then transferred to an incubator (temperature 25° C.). Eight days later (21st May) the nymphs were well gorged, but, strange to relate, the dwarf females did not appear to have fed, although the controls of the same lot, placed on grass snakes, or re-fixed on tortoises, had engorged normally. On the 29th May the tortoise was removed from the incubator and kept at the laboratory temperature (12°–15° C.). From the 29th May to the 8th June none of the nymphs dropped into the tray placed beneath the cage, notwithstanding that they were completely gorged. The dwarf adults proceeded to engorge themselves normally with blood. On the 9th June the temperature rose suddenly, and Brumpt noticed that 5 nymphs, still on the host, had developed into females which sought to attach themselves, and that all the other nymphs were about to moult. On the 10th June 2 more nymphs had moulted, and the tortoise was then placed in an incubator (temp. 20° C.) in order to accelerate the development of the parasites. From the 9th to the 15th June 15 more moults of nymphs took place on the host. In all, 29 adults gorged on this tortoise without killing it.

Amblyomma tuberculatum

The biology of *A. tuberculatum* has been studied by Hooker, and the following information is taken from Hooker, Bishopp and Wood (1912).

The adult tick feeds on the Gopher Tortoise (*Testudo polyphemus*) only; experimental attempts to attach them to bovines have failed. The nymphs, while usually found on the tortoise, will engorge on bovines. Engorged larvae have been found in large numbers on dogs and rabbits, and in smaller numbers on cattle and birds of prey. Larvae have been found on owls and hawks, but may have crawled from the small mammals which these birds devour.

Laboratory observations have shown that the females begin to oviposit 8 to 10 days after dropping from the host (a box-tortoise), at a mean

temperature of 84° F., and deposition continued for 16 to 21 days. The largest number of eggs laid by a single female was 5481, and the average number amounted to 3839. Under natural conditions it is probable that several thousand more eggs are laid, for, in the females observed, they were still of large size when oviposition ceased. The process of oviposition appears to follow the course observed in other ticks.

The minimum period of incubation observed was 91 days, at a mean temperature of 71·19° F. From the fact that only a small percentage of the eggs hatched, many of them being black and shrivelled at the time of deposition, it would appear that there was something in the conditions of the experiment unfavourable to development, and it may be that under natural conditions the incubation period is shorter. The greatest larval longevity observed was between 95 and 110 days. The period required for larval engorgement was not determined. Engorged larvae taken from a rabbit in December and kept in the laboratory at a mean temperature of 61·4° F., did not commence to moult until 86 days later.

The maximum observed longevity of the unfed nymph was 81 days. Nymphs engorged on bovines in from 8 to 11 days, the majority dropping from the host on the 9th and 10th days. Although the nymphs attached themselves readily to bovines, some trouble was experienced on account of scabs forming around the mouth-parts and causing the ticks to drop before becoming fully engorged. Individuals were found to change their point of attachment several times before imbibing much blood. Upon a cold-blooded host, the process of engorgement is doubtless more protracted. At a mean temperature of 81° F., nymphs commenced to moult 29 days after dropping from the host.

Unfed adults survived for as long as 90 days in the laboratory at summer temperature, but it is probable that the longevity would be much greater under natural conditions. Males and females placed upon a tortoise in July attached themselves readily, and the first female dropped off engorged 20 days later, the other 2 females dropping on the 21st and 25th day respectively. Copulation upon the host was not observed to take place, but when the first engorged female was removed from the bag in which the host had been placed it was found apparently *in copula* with a male which had also dropped from the host. Hooker surmises from this observation that copulation takes place after the female has dropped from the host, but the fact that males were seen to remain attached long after the females had dropped makes this questionable.