



ANNALS

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A LIST OF THE TICKS OF SOUTH AFRICA, With Descriptions and Keys to all the Forms known.

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There are probably none of the external parasites of domestic animals of more importance to the stock raiser in South Africa than the ticks, owing to the large number of diseases which they transmit from animal to animal. The ticks of South Africa have, however, only been studied with regard to their connection with the transmission of diseases, and very few people are aware of the distinction between the various species and the various forms of the same species.

With a view to throwing a little more light on these creatures, and mainly of assisting the work of those interested in the study of the diseases referred to, a study of the ticks of South Africa was taken up by me about three years ago while in the Transvaal. Since then a large number of the life histories of these ticks have been worked out, and their immature stages carefully studied and compared. There are still many species which I have not been able to see owing to the rareness with which they occur, but in such cases I have compiled the literature from other authors and placed it in such shape as I consider will prove useful to the South African workers. There is still an immense amount of work to be done on this subject, and my only plea for placing this paper before the public is in the hopes that it will arouse more interest in such studies, and consequently advance the work.

FAMILY IXODIDAE.

The ticks or *Ixodidae* are distinguishable from the other families of the order *Acarina* by the following characters:—

They are always large enough to be visible to the naked eye, flat when young, more or less swollen when fully engorged with blood; the females almost always larger than the males, often attaining in certain species the size of a hazel nut. The integument is always coriaceous, and usually of a dull colour, such as brown or reddish-brown, but sometimes adorned with bright colours and designs.

GENUS AMBLYOMMA. KOCH.

Ixodes (ex. p.), Latreille (1795).*Amblyomma*, Koch (1844).*Amblyomma*, Koch (Neumann, 1899).

Eyes usually flat, slightly salient, sometimes hemispherical, shining, in a sub-marginal pit of the shield. Rostrum long; palpi valvate. Anal groove semi-circular, opening in front, uniting the sexual grooves; usually no median, ano-marginal groove. Dorsal shield often marked with designs in colour. No anal plates in the male. Stigmatic plates usually triangular, with rounded angles. Nearly always eleven posterior marginal festoons, at least in the male.

The presence of eyes separates this genus from *Ixodes* and *Aponomma*, and the absence of anal shields in the male from *Hyalomma*. Eyes are found in all degrees of development. Six forms are found in South Africa.

Males.

A. Eyes hemispherical.

B. Coxae I divided into two blunt spines; coxae IV with one blunt spine; coxae II and III unarmed *variegatum*.BB. Coxae all with two short spines *sylvaticum*.

AA. Eyes flat.

B. Coxae I entire with a single long spine on posterior margin.

C. Ground colour light; anterior longitudinal line not joined by transverse line, and attenuated at posterior end, so as not to reach median transverse arched band.
hebraeum.CC. Ground colour darker; anterior longitudinal lines of equal thickness, usually joined by transverse band, and reaching median transverse arched band.
hebraeum eburneum.

BB. Coxae I divided into two flat teeth.

C. Dorsal shield constricted at level of stigmatic plates; posterior festoons appearing like overlapping folds.
crenatum.

CC. Shield not constricted, festoons not folded

marmoreum.*Females.*

A. Eyes hemispherical.

B. Shield triangular; dark coloured *variegatum*.BB. Shield heart-shaped; light coloured *sylvaticum*.

AA. Eyes flat.

B. Coxae I with a long spine on posterior margin.

C. Anterior angles of dorsal shield and margin of cervical emargination dark coloured, like rest of shield; general colour of shield dark *hebraeum*.CC. General colour of shield lighter; anterior angles and margin of cervical emargination light reddish grey in colour *hebraeum eburneum*.

BB. Coxae I divided into two wide teeth.

C. Cervical grooves simple *marmoreum*.

CC. Cervical grooves bifurcate *crenatum*.

Nymphs.

A. Metallic reflections on shield *hebraeum*.

AA. No metallic reflections on shield.

B. Shield reddish brown *variegatum*.

BB. Shield with a yellow bloom *sylvaticum*.

Larvae.

A. Body 0.7 mm. long (unengorged) *variegatum*.

AA. Body 0.75 mm. long (unengorged) *hebraeum*.

AMBLYOMMA HEBRAEUM. KOCH.

THE BONT TICK.

Amblyomma hebraeum, Koch (1844, 1847).

Amblyomma annulipes, Koch (1844, 1847).

Ixodes poortmani, Lucas (1850).

Ixodes poortmani, Lucas, (Belval, 1861).

Amblyomma hassalli, Marx and Neumann, (Neumann, 1899).

Amblyomma ebruneum, Gerstäcker (1873).

Amblyomma ebruneum, Gerstäcker, (Neumann, 1899).

Amblyomma hebraeum (male), Koch, (Neumann, 1899).

Amblyomma annulipes, Koch, (Neumann, 1899).

Amblyomma splendidum, Giebel (1877).

Amblyomma splendidum, Giebel, (Neumann, 1899).

Plate XII, figures a to h.

Male.—*Body* in a short oval, wider behind; length 5 mm. (rostrum not included), width 4 mm. *Dorsal shield* convex, covering all the upper surface; shining sulphur yellow, with spots and lines of a deep chestnut colour; cervical grooves short and wide; marginal grooves narrow, extending from the eyes to the posterior margin, where they form the anterior margin of the festoons, and are there wider than in the lateral portions; cervical emargination deep, almost square, a little wider than long, behind this emargination a sur-based triangular spot; from each anterior angle of the shield extend two dark coloured longitudinal parallel lines, the inner one covering the cervical groove; attenuated at its posterior end, and not reaching quite to an arched transverse line near the middle of the length of the shield, which passes laterally beyond the tips of these anterior longitudinal lines; near the end of the cervical grooves, the longitudinal lines swell laterally, forming a large dark spot; the second of the pair of lines, leaving the anterior angle of the shield, extends along the margin, becoming broad where it surrounds the eye, then constricted, and suddenly bending inwards; then extends longitudinally, until just below the extremity of transverse arched band, when it again extends outward to the margin of the outermost

festoon; this line is of varying width, sometimes wide, and again constricted; from its end, a dark line follows the lateral groove and the posterior end, forming the anterior margins of the festoons; a median dark line extends from the centre festoon, anteriorly to near the arched line, swollen at its tip, but does not join the arched line; on each side from the margin, a short dark line extends anteriorly; the festoons light coloured except the two extreme ones; lines of separation, chestnut coloured; dorsal porose areas present on posterior margin of the transverse arched band; punctuations equal, very fine, indicated by dark colour on the clear background; eyes flat, large, shining, surrounded by the dark spot on the margin. *Ventral surface* dirty sulphur yellow, sometimes with greenish or brownish tinge, glabrous; anus near posterior third, dark coloured; festoons dark chestnut, except the two extreme ones on each side, the inner of which has a dark spot on the median margin; five dark spots anterior of the chestnut coloured festoons; an elongate one opposite the median festoon; one opposite second festoon from median, which is circular, and an elongate one opposite extreme dark coloured festoons; stigmatic plates, triangular with rounded angles prolonged outward and backward; porcelain white, with orifice and border chestnut coloured. *Legs* long and thick, all the articles chestnut coloured, but ringed with lighter colour at their distal extremities, except the tarsi; coxae I with a long blunt spine on the posterior margin, a similar spine on the posterior margin of coxae IV; coxae II and III unarmed (*XII, h*); tarsi short and suddenly attenuated on dorsal extremity; tarsi II, III, and IV armed with two stout consecutive spurs; caruncle reaching scarcely to middle of length of claws. *Rostrum* (*XII, b*) 2 mm. long, narrow, base wider than long, sides rounded of a dark brown colour; digit of mandible strongly armed (*XII, c*); outer apophysis with one large curved tooth leaving a very tiny tooth on its cephalic edge; inner apophysis elongate, transverse bidentate; hypostome spatulate; tip bearing numerous denticles, then three longitudinal rows of teeth on each side of the anterior half, then four rows to middle of length, eight or nine teeth in each row, below these mere crenulations extending to base; palpi valvate on inner side, with article II slightly curved, and almost three times as long as article III, which is as wide as long; article IV small and conical, situated in a pit on the anterior ventral side of article III.

Female.—*Body* oblong, sides parallel, posterior margin widely rounded; 16 mm. long (not including rostrum), 14 mm. wide. *Shield* cordiform, wide in front, narrow behind, postero-lateral edges nearly straight, as wide or nearly as wide as long; cervical grooves well marked, very deep anteriorly, reaching almost to the posterior margin; no marginal grooves; general colour dark chestnut brown; central area between cervical grooves of a light metallic bronze colour, darker anteriorly, two lighter spots in each lateral area, punctuations few and large, remainder of shield reticulated; eyes shining, usually light coloured, but sometimes dark; large punctuations anterior, and mostly outside the cervical grooves, in lateral areas. *Dorsal surface* (*XII, a*) dark brown, when not fully engorged, with a reddish tinge, especially anteriorly and around margins. When fully engorged, olive brown in colour, darker on edges and reddish on caudal end, lighter about shield and legs; dorsal porose areas present at anterior quarter of length, dark coloured and raised from surface in fully engorged female;

two longitudinal grooves in anterior half, parallel and extending from margin of shield where cervical grooves emerge; lateral of each of these, another groove curved inward, and broken in the middle; on posterior half three grooves, one median and extending anteriorly between the base of the anterior median grooves, two lateral grooves curved sharply outward below the middle of the length; between each of these and the median groove, near lateral margin, a very short groove, also a short groove on each side of median groove near posterior margin. *Ventral surface* same colour as dorsal; sexual orifice opposite first intercoxal space; anus near posterior third, ano-marginal groove present; two short grooves lateral of it, one on each side; genital grooves turning sharply outward, and posteriorly below coxae IV. In unengorged females caudal festoons are well marked on both surfaces; stigmatic plates triangular, wide, with a sharp short point extending laterally, but not as long as in male, white, with orifice and margin dark brown. *Rostrum* a little longer than that of the male, base as long as wide, extending anteriorly over the mandibles, making it appear almost triangular; sides rounded; porose areas large, oval; digit of mandibles with outer apophysis bearing three teeth, anterior tooth very tiny, other two very large, posterior largest (*XII, d*); inner apophysis tridentate; hypostome elongate, resembling that of male. *Legs* and coxae as in the male, except that the spine of coxae IV is almost obsolete; tarsi as in male.

Nymph.—Unengorged nymph 2 mm. long by 1.5 mm. wide, broadly oval in outline, wider behind, resembling male in general contour, colour deep chestnut brown, lighter on the edge; posterior festoons well marked. *Shield* (*XII, e*) cordiform; postero-lateral edges emarginate near centre; eyes shining, dark coloured, large and slightly orbited; cervical emargination very shallow; cervical grooves deep, converging at first, then sharply diverging to middle of postero-lateral margin; surface of shield covered with small reticulations evenly distributed over its whole extent; colour deep chestnut brown; median area lighter, and of a metallic reddish colour in posterior half, shading to almost yellow at cervical emargination; reddish at angles of emargination. *Ventral surface* same colour as dorsal; stigmatic plates large and circular, opening eccentric; anus at posterior third. *Rostrum* (*XII, e*) light dirty yellow, base triangular on dorsal surface, pentagonal on ventral surface; palpi as in adult, only article III is longer than wide; hypostome with only two rows of teeth on each half; digit of mandibles as in female. *Legs* small and slender, light yellowish in colour; coxae small, rectangular in outline; coxae I bidentate; coxae IV with a single blunt tooth.

Larva (unengorged).—*Body* a very short oval, widest behind coxae III, nearly circular with five to seven festoons plainly marked; length 0.75 mm., width 0.60 mm.; colour light reddish brown. *Shield* (*XII, g*) covering front half of body, heart shaped, resembling that of female, postero-lateral margins nearly straight, longer than antero-lateral; posterior angle well rounded, cervical emargination shallow and wide with a reddish metallic lustre, cervical grooves well marked, nearly straight, and reach to the posterior margins; eyes large and dark coloured, flat at lateral angles of shield. *Ventral surface* (*XII, f*) same colour as dorsal surface; a large spine anterior of each emargination of the ten caudal festoons; three pairs of spines on intercoxal area; one pair opposite postero-median extremity of each pair of coxae; one pair of stigmatic openings between coxae I and II, another between II and

III, and one pair behind coxae III. *Legs* slender, light yellowish in colour; tarsi very long and slender; coxae I and II rectangular, coxae III triangular, with apex inward and widely rounded. Base of *rostrum* triangular on dorsal surface, with lateral angles sharp and prominent, pentagonal on ventral surface; palpi as in adult; hypostome with two rows of teeth on each half; digits of mandibles as in female.

Larva (engorged).—2 mm. long by 1.25 mm. wide, elongate, elliptical; sides parallel; broadly rounded at both extremities, colour dark chestnut brown, shield same colour as body.

Eggs.—Length 0.75 mm., width 0.30 mm; colour light chocolate brown, surface smooth and shining. Towards hatching time a white spot appears, indicating region of the anus of embryo.

Hosts.—Most warm-blooded animals, chiefly cattle, also horses, asses, dogs, sheep, goats, ostriches, fowls, several species of the antelope, man, and found rarely on hares. It has also been taken from the following wild animals:—Giraffe (*Camelopardalis giraffa*), the rhinoceros (*Rhinoceros lucerius*), *Lycaon pictus* in Cape Colony, *Boselaphus oreas* in British East Africa; buffalo, and elephant.

Habitat.—Cape Colony, Transvaal, Natal, Mozambique, German East Africa, British East Africa, Abyssinia, Congo.

This tick is most numerous along the southern and eastern coasts of South Africa, and is seldom found on the high veld, except in cattle recently brought up from the coast, although I have specimens collected at Pretoria, Middelburg, and Tzaneen Estate (Zoutpansberg). It transmits the disease known as heartwater to sheep and calves.

AMBLYOMMA HEBRAEUM, var. EBURNEUM. (GERSTACKER).

Amblyomma eburneum, Gerstäcker (1873).

Amblyomma eburneum, Gerstäcker (Neumann, 1899).

Amblyomma hebraeum, Koch, var. *eburneum* (Gerstäcker) (Neumann, 1904).

Male differs from the type as follows:—

General ground colour of shield darker; the anterior lateral bands are wide throughout their entire length, and not attenuated at their posterior ends; they also plainly join the median transverse arched band; the posterior median line also joins the central transverse arched band; a transverse band joins the anterior longitudinal bands, although this band may be obsolete or nearly so; all the dark coloured markings are much stronger and wider than in *hebraeum*; the rostrum is darker brown in colour.

Female differs from type as follows:—

In formaline or alcohol the body is of a brownish to yellowish green colour, while the type is always very dark, deep brown in colour. The shield bears in its posterior median area an irregularly rounded spot of reddish grey, which is continued anteriorly in the median area by a narrow longitudinal greyish line just inside each cervical groove; these lines may, however, be so wide as to become confluent; the anterior angles and the margin about the cervical emargination are also greyish in colour; the general colouration of the shield is of a lighter shade than in *hebraeum*, the rostrum is also of a lighter colour. Unengorged females of *eburneum* are wider and fuller anteriorly than those of *hebraeum*.

Hosts.—Same as *hebraeum*.

Habitat.—Same as *hebraeum*.

A careful study of my specimens of these two forms shows that they are very difficult to distinguish one from the other, and that there are many intermediate forms which might be included under either form. I find that in specimens of males which are plainly *eburneum* the transverse line connecting the two anterior longitudinal bands running along the cervical grooves is more often not present than present; also the posterior median dark line does not always run completely into the transverse median arched band. The differences between the type and the variety seems to be mainly one of intensity of colouration. In the females I also find the variations slight, although they are more easily distinguished than the males. I find that in the type occasionally the posterior median light coloured area may be extended anteriorly by two light coloured lines, which may be even confluent as in *eburneum*, but these areas are always of a dark bronzy colour in the type instead of a reddish grey as in the variety. The eyes of *hebraeum* seem to be usually of a darker colour than those of *eburneum*, but *hebraeum* never has the light coloured anterior margin to the shield which is present in *eburneum*, nor is the body of partly engorged females ever of the light colour which seems characteristic of *eburneum* females when in preservative fluid.

AMBLYOMMA VARIEGATUM. (FABRICIUS.)

THE VARIEGATED TICK.

Acarus variegatus, Fabricius (1794).

Ixodes elegans, Guérin-Ménéville (1829-1843).

Amblyomma venustum, Koch (1844, 1847).

Amblyomma variegatum (Fabricius) (Neumann, 1896.)

Plate XII, figures *k*, *l*; *Plate XIII*, figures *a*, *b*.

Male.—*Body* oval, wider behind, 5 mm. long (rostrum not included) by 3.5 to 4 mm. wide. *Dorsal shield* convex, covering all the upper surface, deep reddish brown, with copper-red spots, bordered with metallic green; cervical grooves short and deep; marginal grooves narrow, commencing a little behind the eyes, contouring the posterior margin, from which it is further distant than from the lateral edges, forms the anterior borders of the festoons; behind the cervical emargination, a copper-red spot, equal to about a third of the width, wider behind, where it is bordered by a curved, brown band; on each side of this spot is another, irregular longitudinal, concave inward, approaching the eye, on the corresponding side, with its anterior extremity, sometimes united to the median spot by a part of its inner margin, and continuing behind by a wide median spot which occupies almost all the width, and is separated from the marginal groove by a brown line, this latter is prolonged on the median line in a very narrow line, and may have another triangular prolongation in front opposite the penultimate festoon; festoons elongate, reddish brown, bordered with yellowish white the same as all the contour of the body; punctuations scattered, ordinarily not very deep, unequal; eyes hemispherical, shining, anterior, brownish or yellowish, in orbits. *Ventral*

surface often swollen, greenish grey, with the marginal chitinous, reinforcements brownish, separated by grooves and corresponding to the dorsal festoons; sexual orifice opposite coxae II, wide, anterior valve chitinous, sexual grooves at first almost parallel, then very divergent between coxae IV and the anus; anus near the posterior quarter; hairs very short on all the ventral surface; stigmatic plates white, with chestnut margins triangular with rounded angles, the postero-lateral angles well marked. *Rostrum* (XIII, a) 2 mm. long; base concave on its posterior margin, lateral margin convex; mandibles (XII, k) with inner apophysis sub-terminal, transverse, festooned in three points, one median, and two lateral, of which the inner is elongate transversely; outer apophysis with two teeth, the terminal small, the other very strong; hypostome a little spatulate, numerous denticles on the tip, followed by three then by four rows of teeth on each half, which gradually diminish and become squamiform on the basilar half of the organ; palpi 1.4 mm. long; article I with its ventral surface twice as long as the dorsal and prolonged on the inner edge by an obtuse point over article II; article II twice as long as article III, and prolonged on its extero-dorsal base into a flat point over the first; hairs rather long on the two edges of the convex surface of articles II and III. *Legs* thick, reddish brown; coxae contiguous (XII, l); coxae I divided into two blunt spines; the outer longer; coxae IV with a single strong spine; coxae II and III unarmed; the other articles, save the tarsi, ringed with whitish colour on their distal extremities; tarsi I at least four times as long as wide, suddenly attenuated near the extremity; tarsi II, III, and IV at least three times as long as wide, with two strong consecutive spines; caruncle reaching scarcely to the middle of the length of the claws; short hairs on all the articles.

Female.—*Body* almost the same form as in the male, relatively narrower, dimensions ordinarily a little larger, even when young; colour generally deep greenish brown, except the shield, the rostrum, and the legs, which are deep reddish brown. *Shield* triangular in its posterior two thirds, with posterior angle rounded, a little wider (3 mm.) than long, deep brown, sometimes with a reflection or spot of greenish metallic red in the centre or near the posterior angle and the origin of the cervical grooves; cervical grooves deep in front, prolonged almost to the posterior margin; punctuations deep, large, unequal, very numerous, often contiguous; eyes near the anterior quarter, similar to those of the male. *Dorsal surface* unicoloured, deep green, a marginal groove situated at a nearly uniform distance from the margin, forming the anterior margin of the eleven posterior festoons, which are scarcely longer than wide. A median groove, extending from the median festoon to a certain distance from the shield; two lateral grooves, concave outward, beginning at the space between the penultimate and antepenultimate festoons; punctuations deep, equal, scattered over all the surface. *Ventral surface* deep green, similar to that of the male; sexual orifice narrower; marginal festoons not chitinous; an ano-marginal groove; stigmatic plates larger. *Rostrum* (XII, b) 2.6 mm. long, similar to that of the male, except in the following particulars: porose areas present and large, oval digit of mandibles with inner apophysis bicuspid, base swollen; outer apophysis with three teeth, the two posterior strong. *Legs* rather longer, hairs rather long; spine of coxae IV reduced to a flat tuberosity; the penultimate tarsal spine attenuated, often almost effaced.

The fecundated and engorged female can reach the largest dimensions of the family (24 mm. long by 15 mm. wide, and almost as thick). At first

it is the same colour as in earlier stages, but later it becomes nutmeg brown. The body is at first rectangular, with rounded angles, and faces only a little convex, then it becomes more and more swollen ; coxae very distant ; no grooves or festoons.

Nymph.—*Body* brownish, 2 mm. long (rostrum included), the shape of a young female. *Shield* without metallic reflections, reddish brown. *Coxae* with spines scarcely visible ; no tarsal spines.

Larva.—*Body* oval, swollen, 0.7 mm. long.

Hosts.—Cattle principally, but also horses, goats, rhinoceros (Mocambique, German East Africa, Abyssinia), zebra, and sheep.

Habitat.—Abyssinia, Zanzibar, Madagascar, Mauritius, Senegal, Congo, Ivory Coast, Sierra Leone, River Niger, River Zambesi, Transvaal, Cape Colony, Manicaland (Rhodesia), German East Africa, Mocambique, Angola, Togo, Guinea.

Life History.—Never reared in Transvaal, but Lounsbury has tried and found that it was practically the same as *A. hebraeum*. It always leaves the host to moult. This tick is very closely related to *hebraeum*. It is confined, however, mostly to tropical Africa, and is only occasionally taken in South Africa. It has become naturalised in Guadaloupe Islands, where it seems to have been taken from Senegal.

AMBLYOMMA MARMOREUM. KOCH.

THE TORTOISE TICK.

Amblyomma marmoreum, Koch (1844, 1847).

Hyalomma devium, Koch (1844, 1847).

Amblyomma devium (Koch) (Neumann, 1899).

Amblyomma rugosum, Neumann (1899).

Amblyomma marmoreum, Koch (Neumann, 1901).

Plate XII, figures *m*, *n* ; *Plate XIII*, figures *c* to *k*.

Male.—*Body* oval, reaching 8.5 mm. long (not including rostrum), by 7 mm. wide. *Dorsal shield* (*XIII*, *c*) a little convex, punctuations unequal, fine ones very numerous and very fine, the others very large, scattered, showing granulations at their bottoms ; cervical grooves narrow and deep ; marginal groove deep at a distance from the margin, beginning about at level of coxae III, and contouring the posterior margin, where it forms the anterior margin of the festoons very distinctly ; anteriorly it is indicated by a row of punctuations more or less regular ; general colour light grey, with a metallic copper tinge, and with dark brown spots as follows : Two narrow bands on the cervical grooves ; behind these two rectangular areas separated behind, but joined in their middle by a transverse line in the posterior third ; three bands converging in front, enlarged, or not in their anterior extremity, on the marginal cushion, in front of the festoons, three to five successive spots, the anterior of which borders on the outer edge of the eye ; the festoons bordered with brown on their inner edges. *Eyes* large, flat, yellowish. *Ventral surface* light greyish in colour, the festoons marked by brown spots and grooves of separation ; a dark line anterior of median, and festoons second from median ; stigmatic plates triangular ; postero-lateral angle prolonged laterally. *Rostrum* rather short, dark coloured, base small, rectangular on posterior margin ; metallic spot on

dorsal surface; palpi short and thick; article II curved toward the ventral surface, twice as long as article III; hypostome with numerous denticles at tip; followed by seven or eight rows of strong teeth, three to a row; below this numerous squamiform teeth; from middle of hypostome downward a fourth row of small teeth along median line; inner apophysis of mandible transverse, unidentate (*XII, m*); outer apophysis bidentate. *Legs* strong, chestnut brown, ringed with lighter colour at distal extremities of articles; marked with punctuations; coxae I with two short, flat spines, a single spine similar to these, but stronger, on coxae IV (*XII, n*); tarsi short, thick, suddenly attenuated.

Female.—Unengorged, female a little larger than male; when engorged, body oval, flat, reaches dimensions of 33 mm. long by 20 mm. wide. *Shield* (*XIII, d*) triangular, scarcely wider (4 mm.) than long; posterior lateral sides almost straight; posterior angle narrow; scapular angles prominent in anterior points; eyes in anterior third of length; cervical grooves deep and wide, prolonged almost to the posterior margin; punctuations unequal; large ones rare; fine ones numerous, marked on light areas by black spots; ground colour bronzy grey as in male, and with spots of brown along the anterior margins, on the cervical grooves around the eyes, on the posterior margin opposite the cervical grooves, and near the posterior third of the lateral areas; eyes flat, whitish, brown when in preservative fluid. *Dorsal surface* (*XIII, d*) deep red-brown, wrinkled and deeply punctuated; a marginal groove; eleven posterior festoons well marked, dorsal porose areas present. *Ventral surface* reddish brown; posterior festoons very apparent. When engorged, body becomes light brownish grey, with a few salmon coloured blotches, surface usually covered with a whitish bloom; dorsal and ventral surface with grooves as in *hebraeum*; stigmatic plates large, whitish, triangular, with angles rounded; posterior lateral angle prolonged laterally, but not so much as in male. *Rostrum* 2.5 mm. long, reddish brown; porose areas of medium size, almost circular; hypostome spatulate, numerous denticles at tips, eleven rows of teeth on each half, three teeth to a row; squamose denticles to base; inner apophysis of mandibles with process transverse, tridentate (*XIII, e*); outer apophysis tridentate; palpi curved toward the ventral surface from the base of article II, wide, with parallel edges, otherwise similar to those of male. *Legs* long, strong, chestnut brown, ringed with lighter at distal ends of segments. Coxae I with two short teeth, strong, flat, separated; a triangular prominence flat, on the posterior margin of the others, larger on coxae IV; tarsi II, III, and IV sharply attenuated near their extremity.

Nymph (engorged).—*Body* widely elliptical, broadly rounded on both ends, with sides nearly parallel; up to 9 mm. long by 6 mm. wide; colour dark bluish, changing to a bright brown toward moulting time, and often covered with a coarse brown bloom. *Dorsal shield* (*XIII, h*) a little wider than long, broadly rounded on posterior angle, posterior lateral edges nearly straight; colour uniform dark brown, cervical grooves deep, then broad and shallow, extending nearly to posterior edges; punctuations unequal, large ones very large; eyes at lateral angles light coloured. *Dorsal surface* smooth, four anterior furrows; outer ones broken in middle; three posterior furrows, reaching nearly to the posterior margin, where there are two short furrows between their extremities. *Ventral surface* with furrows as in female; stigmatic plates whitish with dark

margins, slightly elliptical, with elongation extending postero-laterally ; anus at posterior third of length. *Rostrum* (*XIII, h*) short, dark brown in colour ; dorsal surface of base triangular in outline ; palpi elongate and slender ; article II more than twice as long as article III ; hypostome spatulate, denticles on its tip, followed on each half by one row of four teeth, then by six or seven rows of strong teeth, two to a row, squamose denticles to base ; mandibles with process of inner apophysis of digit tridentate, outer apophysis bidentate, with two small denticles on anterior edge of anterior tooth. *Legs* short, slender, dark reddish brown in colour ; coxae each with a wide, sharply pointed spine on the posterior margin ; tarsi short and thick, not sharply attenuated at terminus.

Larva (unengorged).—Colour light yellowish brown, shield darker, oval in outline, slightly longer than wide ; length 0.75 mm., width 0.50 mm. *Shield* covers anterior third of body, much wider than long, broadly rounded behind, surface reticulated ; cervical grooves deep and straight, almost reaching the posterior margin ; no marginal groove ; cervical emargination very deep ; eyes flat, at lateral angles, small, yellowish. *Dorsal surface* (*XIII, k*) with a long median groove ; a marginal groove extending all round the body, forming the limit of the festoons, and in dried specimens causing the edge of the body to turn up sharply ; festoons large, well marked. *Ventral surface* (*XIII, i*) with three posterior grooves, radiating from the anus, which is anterior of the posterior third ; festoons well marked ; marginal groove not marked ; stigmatic openings large in three pairs, one pair posterior of each pair of coxae. *Rostrum* wide and narrow on dorsal surface ; lateral angles sharply pointed, posterior margin straight ; articulated with shield by a very long neck ; ventral surface more or less rectangular in outline, lateral angles not prominent ; hypostome spatulate, with denticles at tip, then four rows of large sharp teeth, seven teeth in each row ; mandibles (*XIII, g*) with outer apophysis bidentate, the anterior margin of the anterior tooth bearing a crest composed of two larger teeth, on the inner edge of them a row of saw teeth ; inner apophysis with process tridentate ; palpi long and slender, article I very short, cylindrical ; articles II and III of about equal length, swollen at their anterior ends ; article II very much constricted at its base, anterior half and article III concave on their inner edges. *Legs* thick, almost translucent in colour ; coxae large, well separated from each other, coxae I triangular, coxae II and III rectangular in outline, each with two wide blunt teeth on posterior margin, almost unnoticeable on coxae III ; tarsi normal.

Eggs.—Small, elliptical, surface smooth and shining ; 0.75 mm. long by 0.3 mm. wide ; colour light reddish brown, singly, but in a mass dark reddish brown.

Hosts.—Tortoise, rhinoceros (*Rhinoceros lucerius*), snakes. Larvae and nymphs also feed readily on ox and goat, and on some kinds of birds and lizards.

Habitat.—Cape Colony, Transvaal, German East Africa, British East Africa, Zanzibar, Upper Zambesia.

This tick is a very common parasite on tortoises in South Africa. It does not seem to be influenced by climatic conditions to the same extent as the two last-mentioned species, being found alike in the dry, semi-desert regions, and in regions of abundant rainfall. Nymphs and adults are found in large numbers on tortoises.

AMBLYOMMA CRENATUM, NEUMANN.

THE RUFFLED TICK.

Amblyomma sublutum, Neumann (1899).*Amblyomma crenatum*, Neumann (1899).

Plate XII, figure i.

Male.—*Body* a short oval, sides rounded, 7 mm. long (without rostrum), 6.5 mm. wide. *Shield* a little convex, dirty yellow, with a thin whitish bloom in the scapular angles and on the sides; in the middle a brownish, narrow band, prolonged to the lateral margin by a wider band, not distinctly limited; near the posterior quarter, a median irregular spot of the same colour, joined in front to the transverse border by two curved lines, and giving off behind three short prolongations, of which one is a median. *Eyes* large, flat, scarcely paler than the shield and finely bordered with brown; cervical grooves short and deep; marginal groove narrow; not very deep, contouring the posterior margin, from which it is twice as far removed as the lateral margin; festoons narrow, at least twice as long as wide; punctuations numerous, large, equal, not very deep, regularly distributed, and of the colour of the shield; among them some punctuations more numerous, very fine, superficial, brown. A posterior constriction, well marked, at the level of the stigmatic plates. *Ventral surface* of the same colour as the shield, glabrous; posterior festoons very apparent, not limited in front, marked in the middle by diffuse brownish spots; stigmatic plates large, whitish, comma-shaped, with tail short, projecting outward. *Rostrum* very large (3 mm.), brownish; base a little constricted behind, posterior angles scarcely salient, very finely punctured; hypostome armed, in its anterior third, with three rows of strong teeth on each half; palpi long, brownish, the second article more than twice as long as the third. *Legs* very long, strong, intermediate articles yellowish white, the fourth reddish in the middle, the fifth in its proximal half; coxae I divided into two large spines, the outer strong and sharp, the inner wide and a half shorter; a long blunt spine on coxae IV; tarsi relatively long, with two strong consecutive spurs.

Female.—*Body* in a short oval; sides rounded; flat; 9 mm. long (without rostrum), 8 mm. wide. *Shield* (XII, i) triangular, a little wider (5.2 mm.) than long; cervical emargination prolonged in front by two points, anterior margins a little oblique, the latero-posterior almost straight, posterior angle wide and a little rounded; cervical groove at first straight and very divergent, then bifurcate, the inner branch bordering on the median area, the outer short; median area a little salient; punctuations numerous, unequal, abundant, and confluent about the eyes; colour reddish yellow, with a yellowish white bloom on the lateral areas, along the cervical margin and in the posterior angle; a small brownish marginal spot on each side at the posterior third of the lateral border. *Eyes* large, flat, relatively anterior, yellowish. *Dorsal surface* (XII, i) reddish brown, pitted with numerous and large punctuations; a marginal groove, bordering the posterior festoons in front, which are longer than wide, inner margins longer than outer, giving a crenulate aspect to the posterior margin of the body. *Ventral surface* of the same colour; punctuations finer, surmounted by fine hairs; stigmatic plates large (2.6 mm. long), triangular angles rounded. *Rostrum* (XII, i) very

long (4 mm.) ; base wider than long ; hypostome a little spatulate, armed, on the interior half, on each side with three longitudinal rows of 8 to 10 teeth each, the outer row longer, the inner removed from its neighbour and doubled behind by a fourth shorter row ; squamiform denticles behind the teeth ; palpi with the third article as wide as long, dilated on its inner dorsal margin. *Legs* very long, strong ; coxae I bicuspid ; the others flat, and a little attenuated on their posterior margin ; tarsi long, sharply attenuated at their extremity, two strong terminal spines, claws long, caruncle short.

Hosts.—Rhinoceros.

Habitat.—Sumatra (?), Cape Colony.

I have never seen a specimen of this species. The description is taken from Neumann.

AMBLYOMMA SYLVATICUM, (DE GEER).

THE CAPE TORTOISE TICK.

Acarus sylvaticus, De Geer (1778).

Cynorhaestes sylvaticus, Hermann (1804).

Amblyomma sylvaticum, Koch (1844).

Hyalomma devium (female), Koch (1847).

Ixodes sylvaticus, Gervais (1844).

Amblyomma sylvaticum (De Geer) (Neumann, 1899).

Male.—*Body* regularly oval ; sides rounded ; 4.5 mm. long (rostrum not included), 3.2 mm. wide. *Shield* chestnut brown, lighter on the margin, convex ; cervical grooves short, deep, lunate ; no marginal groove ; posterior festoons with separations not very deep ; punctuations numerous, deep, very unequal, some disposed in a series replacing the marginal groove on the sides ; eyes small, shining, hemispherical, sub-marginal in an orbicular excavation ; on the margins and on the last penultimate festoon an irregular spot, yellowish white, or reddish yellow. *Ventral surface* yellowish ; stigmatic plates in a short comma, bordered with whitish. *Rostrum* chestnut brown, 1.7 mm. long, base relatively long and narrow ; hypostome wide spatulate, with numerous anterior denticles, of which the marginal ones are bifid or trifid, followed on each half by four rows of eight teeth each, decreasing from front to back ; numerous posterior squamose denticles ; palpi of medium length, spotted with whitish on the inner margin of their upper surface. *Legs* of medium length ; coxae small, all with two short points on their posterior margins ; movable articles whitish on their dorsal border ; tarsi sharply attenuated at their extremity ; a terminal spur, very small on tarsi II, III, and IV ; caruncle scarcely passing the base of the claws.

Female.—*Body* oval, 6 mm. long (not including rostrum), 5 mm. wide. *Shield* oval, cordiform, as wide or wider than long, whitish yellow in the larger part of its extent ; a border of blackish brown on the sides, narrow, except at the level of the eyes, which it surrounds ; cervical grooves deep in front, reaching almost to the posterior margin, covered by a blackish band in the middle of the lateral area, a small black spot ; punctuations deep, unequal, black ; sometimes a brown spot in the median area ; eyes as in the male. *Dorsal surface* reddish brown ; when young a marginal

groove stopping at the penultimate or antepenultimate festoon ; festoons well marked ; punctuations deep, distant ; hairs scattered, rather long. *Rostrum* as in male, often a yellow spot between the porose areas ; long hairs on the palpi. *Legs* as in male. Engorged female can reach to 15 mm. long by 11 mm. wide.

Nymph.—Form of the female, shield relatively wider ; yellow bloom less extended.

Habitat.—Cape Colony.

Hosts.—Tortoise, deer.

I have not seen this species, and have taken the description from Neumann.

GENUS APONOMMA, NEUMANN.

Ixodes (ex. p.), Latreille (1796).

Ophiodes, Murray (1879). (Name preoccupied.)

Aponomma, Neumann (1899).

No eyes. Base of rostrum usually pentagonal, with latero-dorsal edges very short. Palpi long. *Male* with body wider or almost as wide as long ; ventral surface naked ; sexual grooves very divergent behind, anal groove semi-circular or pointed, opening in front, joining the sexual grooves ; ano-marginal grooves median ; dorsal shield covering all the upper surface, and usually marked with metallic green spots ; stigmatic plates comma-shaped. *Shield of Female* shorter or scarcely longer than wide, usually marked with metallic green spots, disposed in a triangle ; grooves on the ventral surface as in the male ; stigmatic plates shorter, less attenuated at the postero-external extremity.

This genus occurs almost exclusively on snakes and lizards, although *Aponomma exornatum* is reported as having been found in South Africa on a dog. From the colouration and grooves on the ventral surface it would seem to be closely related to the genus *Amblyomma*. It differs from that genus, however, by the absence of eyes and the form of the body. The absence of eyes and length of rostrum have generally made species of this genus rank among the *Ixodes*, from which they differ, however, by the general conformation. Only three forms are reported from South Africa.

Male.

A. Shield marked with nine metallic green spots. *exornatum*.

AA. Shield uniform, pale brownish, without metallic green spots.

B. Tarsi II, III, and IV attenuated at extremity

laeve capense.

BB. Tarsi with a bosse at extremity *latum*.

Females.

A. Shield marked with three metallic green spots ; shield as long or longer than wide ; punctuations fine, close *exornatum*.

AA. Shield uniform, reddish brown, without green spots ; wider than long ; punctuations small and few.

B. Coxae I with blunt, flat spurs, punctuations on dorsal shield obsolete *latum*.

BB. Spines on coxae I sharp ; punctuations small and few
laeve capense.

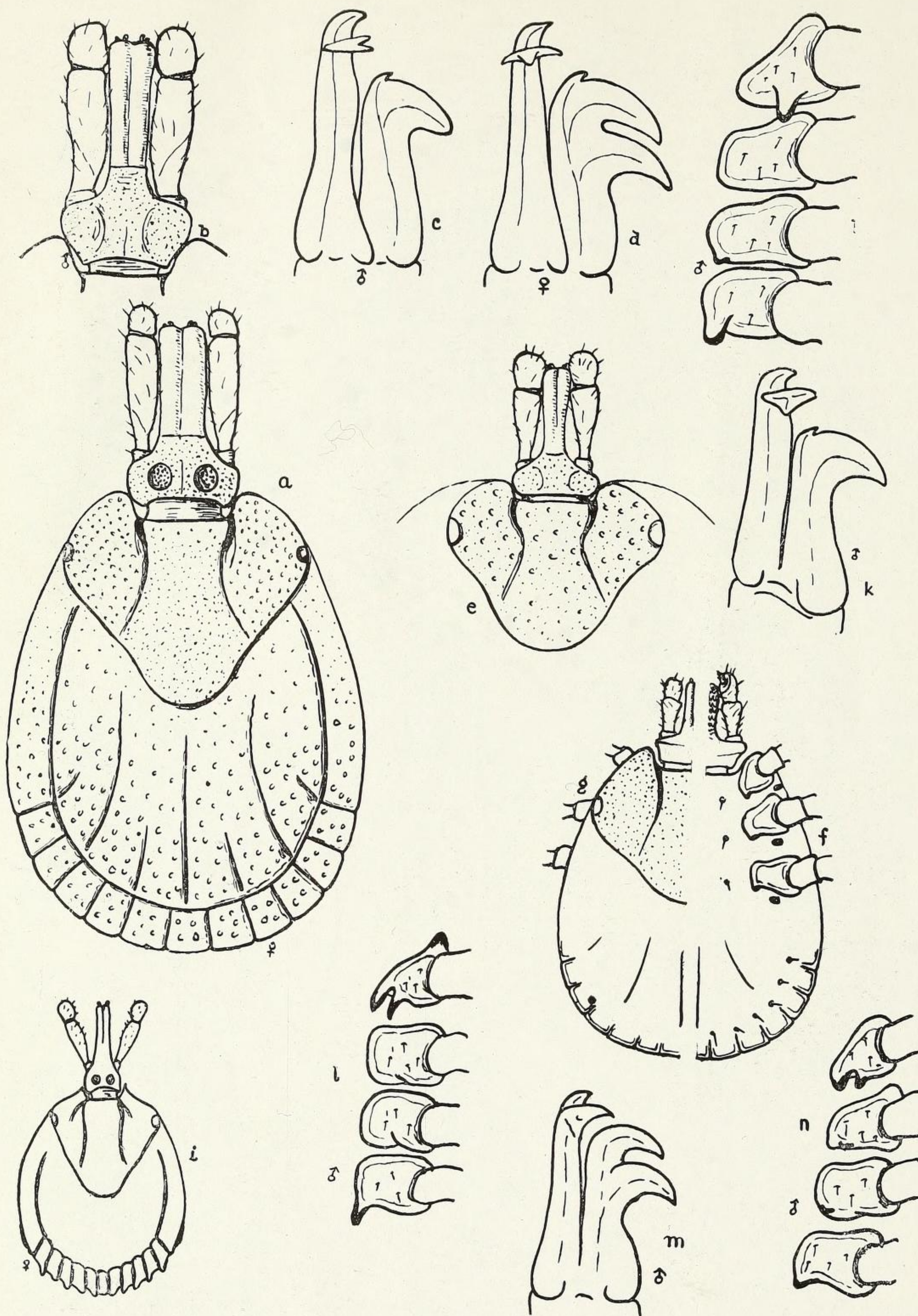


Plate XII.

Amblyomma.

Amblyomma hebraeum, Koch.

- (a) Dorsal surface of unengorged female.
- (b) Dorsal surface of rostrum of male.
- (c) Mandible of male.
- (d) Mandible of female.

- (e) Shield and rostrum of nymph.
- (f) Ventral surface of larva.
- (g) Dorsal surface of larva.
- (h) Coxae of male.

Amblyomma crenatum, Neumann.

- (i) Dorsal surface and rostrum of female (redrawn from Neumann).

Amblyomma variegatum, (Fabricius).

- (k) Mandible of male.

- (l) Coxae of male.

Amblyomma marmoreum, Koch.

- (m) Mandible of male.

- (n) Coxae of male.

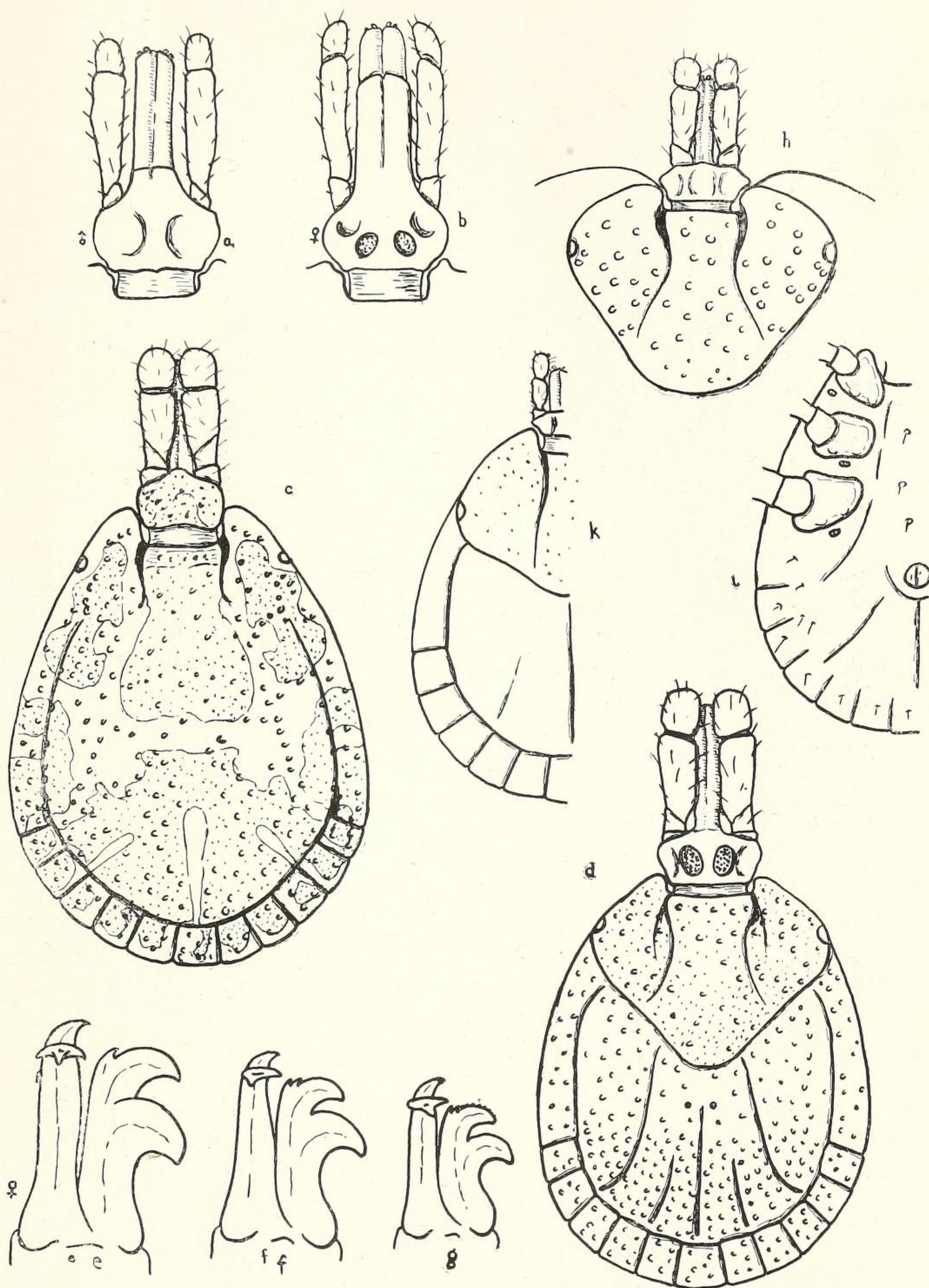


Plate XIII.

Amblyomma

Amblyomma variegatum, (Fabricius).

(a) Dorsal surface of rostrum of male (redrawn from Dönitz).

Amblyomma marmoreum, Koch.

(c) Dorsal surface of male.

(d) Dorsal surface of unengorged female.

(e) Mandible of female.

(f) Mandible of nymph.

(b) Dorsal surface of rostrum of female (redrawn from Dönitz).

(g) Mandible of larva.

(h) Shield and rostrum of nymph.

(i) Ventral surface of larva.

(k) Dorsal surface of larva.