

## Ticks in the South African Zoological Survey Collection, Part I.\* *Ixodes alluaudi* Neumann 1913, a Primitive Tick Parasite on Shrews.

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*IXODES ALLUAUDI NEUMANN (1913).*

*Male.*—Figs. 1, 2.

A SMALL tick, light brown in colour with slender yellow legs. In outline, an elongated oval pointed at either end, widest in the anterior half. *Scutum* about twice as long as broad; shiny, slightly convex, the posterior  $\frac{2}{3}$  edged by a pronounced marginal fold, which is lighter in colour than the scutum. No festoons; Neumann gives the posterior extremity as "en courbe courte"; in the Zoological-survey specimens the posterior extremity is rather sharply pointed, its tip showing a tendency to being slightly depressed. Punctations very fine and evenly distributed in the posterior half and towards the centre; anteriorly showing a tendency, at its widest diameter, to becoming coarser towards the sides. Neumann describes the punctations "very fine, equal, numerous, slightly finer, and less numerous anteriorly vaguely suggesting the female scutum". In our specimens the suggestion of this female scutum is so vague, that it can be considered as non-existent. Cervical grooves merely indicated by a slight depression anteriorly. Emargination deep. Neumann describes a faint postero-medial ridge as being present, this is not shown in our specimens. He also describes two submarginal ridges further forward, these are also absent in the specimens before us; their place, however, is taken by a row of four to five larger punctations; the difference between these and the general scheme of punctations is not marked at all, and would hardly call for comment, except that Neumann also noticed a slight irregularity in this region. In Neumann's specimens the punctations still retained short white hairs, these have already been rubbed off in our specimens.

*Rostrum* small. *Basis capituli* small, surface pitted, posterior margin straight and without posterior cornua; lateral margins at first parallel and then widening suddenly to form the point of attachment of the palps. The short yellow palps thus come to be attached to the sides of the *basis capituli*, and hence lean in towards one another at a pronounced angle, overlapping the short blunt hypostome. The point of attachment of the palp forms the widest part of the rostrum. *Palps*:—Articles fused, forming a short palp, which is only about twice as long as broad; anterior margin widely curved, medially it is deeply hollowed.

\* The present paper is intended to be the first of a series in which the ticks, collected in connection with the zoological survey of South Africa, are to be discussed. In addition ticks which are sent in from other sources may also be included.



Ventrally the *basis capituli* shows a point on the posterior margin, it broadens out to a lateral wing-like structure on either side, which overlaps the lateral point of attachment of the palps. The sharp angle formed by these lateral expansions is accentuated by the presence of 1 to 2 hairs on either side. *Hypostome*, short and squat, 2/2, five blunt teeth.

*Ventral surface* of body darker than the dorsal surface; punctate, with short hairs; the wide slit-like genital pore opposite Coxa ii; Neumann gives it as opposite the space between Coxae ii and iii. Pregenital plate; pentagonal, broader than long, Genital apron trapezoidal. Genito-anal plate; hexagonal, elongate, widest in the posterior quarter; in the unengorged specimens the epimeral plates tend to overlap the sides of the genito-anal plate. Anal plate; elongate, straight sides, diverging from before backwards, with a tendency to converge at the posterior extremity. Adanal plates; elongate, lozenge-shaped.

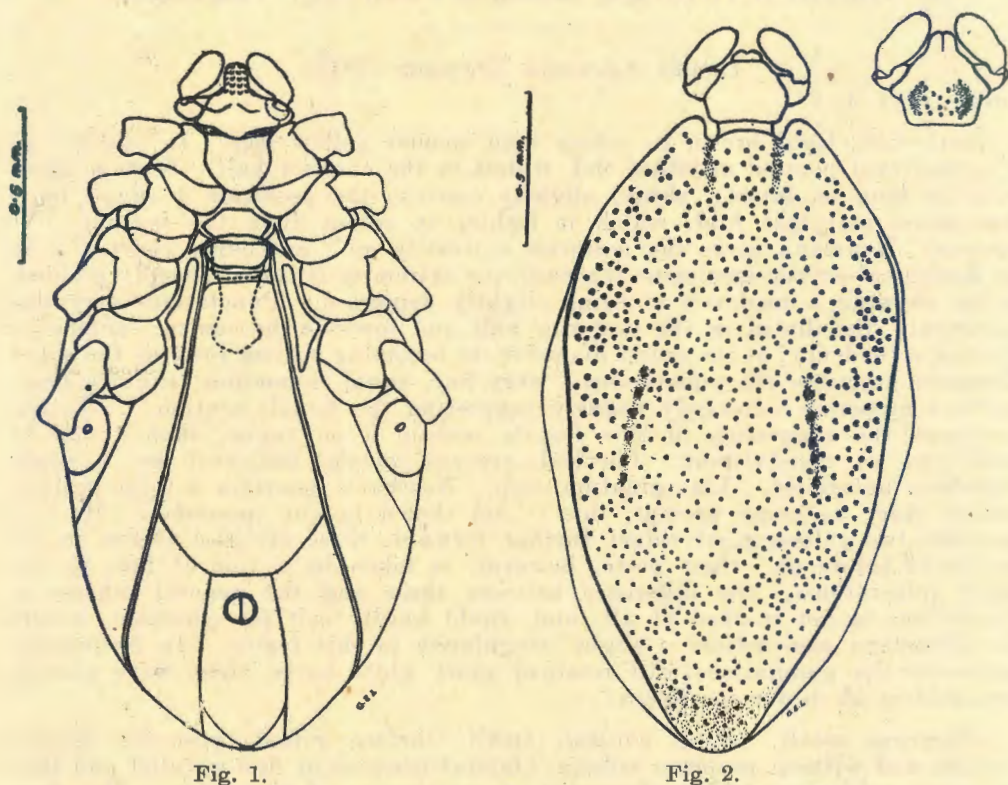


Fig. 1.

Fig. 2.

Fig. 1.—*Ixodes alluaudi*, male. Ventral view showing the four central and the two pairs of lateral sternal elements. G. E. Laurence del.

Fig. 2.—*Ixodes alluaudi*, male. Dorsal view with capitulum pointing downwards; inset capitulum lying flat; showing complete absence of wing-like expansion of trochanter. G. E. Laurence del.

Besides these usual ventral structures there are other elements present, e.g., (1) a small chitinized triangle on either side of the pregenital plate and opposite Coxa ii, (2) an elongate chitinized strip opposite Coxae iii and iv and (3) a deeply pigmented, tongue-shaped structure reaching from the genital aperture



to the level of anterior edge of Coxa iv; this chitinized tongue is not a surface structure, being only just discernible in the alcohol specimen, but it becomes conspicuous in glycerine-cleared mounts, when it shows up as being composed of two parts, a wider portion underlying the apron, and the narrower tongue-shaped posterior part.

*Legs*, yellow, slender, coxae increasing in size from before backwards, ranging from Coxa i broader than long, to Coxa iv longer than broad; unarmed. All the Coxae are syncoxae (see Schulze, 1932). The trenchant posterior margin overlaps the anterior margin of the next coxa. Tarses long, ending abruptly. Caruncle almost as long as the claws.

*Female.*—Fig. 3.

When unengorged, the small female shows the same yellowy colour as the male, with the same slender light yellow legs.

*Scutum* as wide as long, with the greatest width near the posterior end; antero-lateral borders very slightly sinuous, united by a broadly rounded posterior border; surface uniformly faintly reticulate, a few medium-sized punctations with hairs scattered unevenly over the *scutum*; no cervical grooves; emargination broad and shallow; lateral grooves, fine, running parallel to the borders.

*Dorsum* covered by fine short hairs, arranged regularly. In the unengorged females the surface is quite smooth and undisturbed by any grooves. As in the male it is edged by a marginal fold of the underlying body. *Rostrum* the same colour as the scutum. The *basis capituli*, which forms the most characteristic feature of the female, is subtriangular in shape; posterior border short, straight, without cornua; postero-lateral margins very short diverging from behind forwards; the lateral margins is peculiar in that it has both a dorsal and a ventral wing-like backwardly projecting fold of chitin (only the ventral one present in the male) lapping over the base of the palp, which latter is situated at the side of the basis capituli, this lateral margin is excavated to allow for the movement of the palps. *Porose areas* large subcircular, each with a cornual ridge on the outside, a central ridge separates the two areas. Palp articles fused, with a straight outer margin and a convex inner margin, with round distal margin. On the ventral surface, besides the two wing-like outgrowths the basis capituli shows two backwardly projecting spines, which can be taken to represent the auriculae. *Hypostome* narrow, with  $2/2$  files of seven to eight teeth.

*Venter* darker than dorsum; hairs present as on dorsum; Vulva opposite Coxa iii. Sexual grooves, long straight, divergent. Anal grooves flatly rounded in front of the anus, otherwise long and sub-parallel tending to curve slightly inwards at the hind end. Coxae; all syncoxae, large, flat, unarmed; the trenchant posterior margin overlapping the anterior edge of the next successive coxa.

*Legs* yellow, slender; tarsi ending abruptly as in the males, pad almost as long as claws.

*Nymph.*—Figs. 4, 6 (a), (b).

Like the female the nymph is characterised by the wing-like outgrowths, both dorsal and ventral to the basis capituli, which are excavated laterally to allow for the articulation of the palps. It resembles the female in its essential characters, but shows a reduction in the size of the dorsal expansion of the palpal tronchanter.

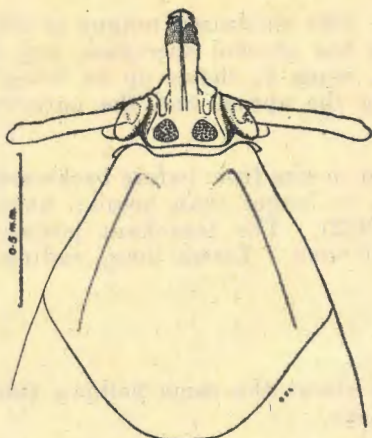


Fig. 3.

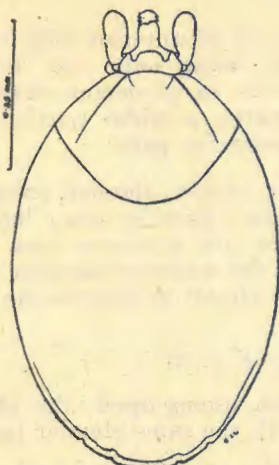


Fig. 5.

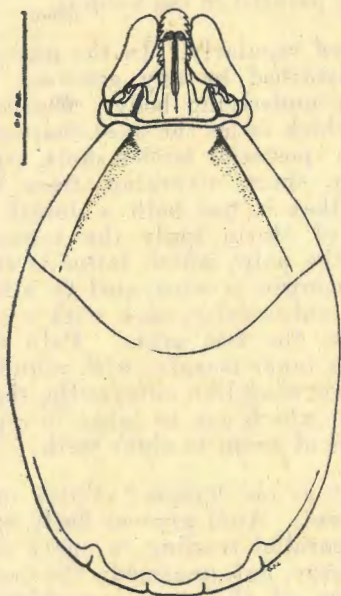


Fig. 4.

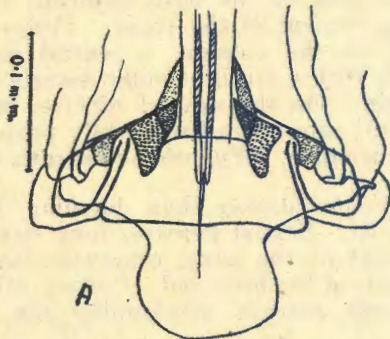
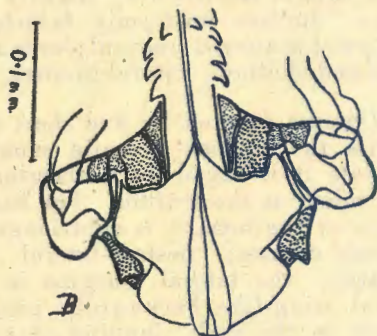


Fig. 6.

- Fig. 3.—*Ixodes alluaudi*, female. Dorsal view, showing the enlarged palpal trochanter (palpiger) G. E. Laurence del.
- Fig. 4.—*Ixodes alluaudi*, nymph. Dorsal view, showing a reduction in size of the dorsal expansion of the trochanter. G. E. Laurence del.
- Fig. 5.—*Ixodes alluaudi*, larva. Dorsal view, showing a further reduction in size of the dorsal expansion of the trochanter. G. E. Laurence del.
- Fig. 6 (a).—*Ixodes alluaudi*, nymph. Basis capituli dorsal view, as seen in a glycerine cleared specimen.
- Fig. 6 (b).—*Ixodes alluaudi*, nymph. Basis capituli ventral view, as seen in a glycerine cleared specimen.



Larva. Figs. 5, 7, 8.

The larva resembles the nymph, showing a further reduction in the size of the dorsal expansion of the palpal tronchanter. *Area coxalis* very much reduced.

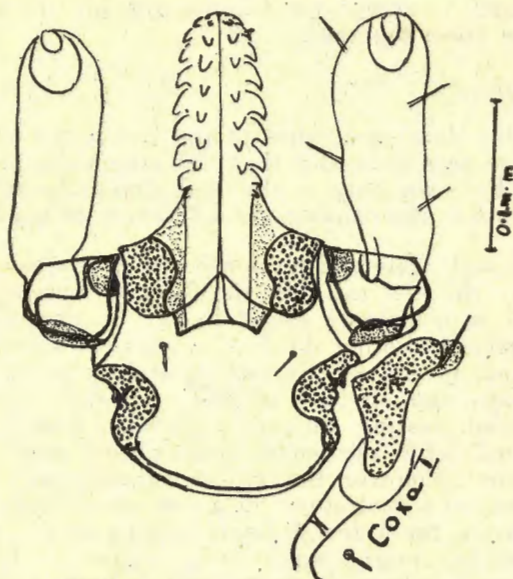


Fig. 7.—*Ixodes alluaudi*, larva. Capitulum ventral surface, as seen in a glycerine cleared specimen.

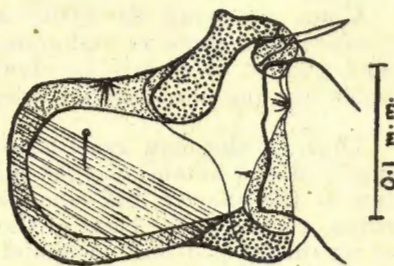


Fig. 8.—*Ixodes alluaudi*, larva. Coxa I ventral view, showing chitinous supporting rod (*Stutz spange*), *processus (Lade)* with one bristle, reduced *area coxalis*, coxal hairs, and sub-coxa.

#### Occurrence.

*I. alluaudi* was described by Neumann in 1913. His description is based on 2 males; one, April, 1912, from the alpine prairies of the Bismarck Hügel at an altitude of 2,740 m. above the forest regions of Kilimandjaro; the other is merely listed as from German East Africa.

For South Africa we have the following records, up to date, i.e. July, 1941.

*Crocidura flavescens* (Red shrew).—Four batches of males and females; five batches of nymphs; 3 batches of larvae; all trapped in Grahamstown or its near neighbourhood.

*Otomys irroratus* (Vlei rat).—1 batch of adults; one of larvae; trapped in Grahamstown or its near neighbourhood.

*Rhodomys pumilio* (the striped mouse).—One batch nymphs; one batch larvae, from Howiesons Poort, seven miles from Grahamstown.

*Ablysomus hottentotus* (the Eastern Province Golden mole).—One batch of larvae from Howiesons Poort, near Grahamstown.

*Tatera brantsi maecalinus* (Brants gerbille).—Two batches of adults; 3 batches nymphs; and one batch larvae, from the farm Wonderboom, in the Kroonstad District of the Orange Free State.

*Tatera lobengulae* (Lobengula's gerbille).—One batch adults from Rietvlei, near Pretoria, Transvaal.

#### Habits.

Probably a three host tick; as thus far the adults, nymphs and larvae, invariably, have been collected separately; except for two records for Brant's gerbille, when adults and nymphs were taken together.

#### Host.

Upon surveying the above available data one comes to the conclusion that *Crocidura flavescens* is undoubtedly the true host and that the others are only second choice, or purely accidental. For, not only is the Red shrew the most consistently and most heavily infested, but it also shows quite a diversity of habits.

Thus, in the long grass associated with vleis and river beds, it is frequently trapped in the extensive runs made by the vlei rat. In the drier regions it is taken in the shorter and smaller runs so commonly found in the bunches and clusters of grass at the bases of thorn bushes and other shrubs, i.e. runs and shelters used by the striped- and by the multimammate-mice. Shrews apparently not only make use of the above-ground runways and shelters of the above-mentioned rodents, but also of their under-ground nesting burrows. Hence, it is not surprising to find them, also associated with the more open-veld-frequenting gerbilles, which have extensive warrens, wherever the soil is suitably soft to allow for burrowing. One engorged female tick dropped in a runway or burrow could act as a source of heavy infestation for a few animals coming to rest in the near neighbourhood; or her offspring might serve as a source of light infestation for a larger number of animals, where the population is greater and where there is more movement.

That *Ixodes alluaudi* is essentially a shrew- and not a rodent-tick, is also borne out by the fact that (a) the Otomids show but a low percentage of infestation; only two records for a catch of a couple of hundred of these rodents; (b) the Rhabdomids give practically a negligible infestation, and (c) the ubiquitous Mastomids show no infestation at all; (d) the Gerbille records are all from the same warren; and (e) the numerous gerbilles from other warrens show no *Ixodes alluaudi* at all.

The record of a batch of larvae from the Eastern Province golden mole is of particular interest, in that it tends to stress the adaptability of the larval *I. alluaudi* to a varied range of hosts; for the chrysochloridae are otherwise singularly free of external parasites; again, there is no question but that the shrew dropped the female tick in the mole burrow, and that the larvae, *faut de mieux* attacked the mole.

Roberts (1935), in connection with his work on plague and tropical typhus, in his survey of the rodents and their parasites in the Nairobi District, surprisingly enough did not find *I. alluaudi* infesting any of the numerous wild rats or mice examined.

#### DISCUSSION.

Neumann (1913) only described the male of *Ixodes alluaudi*, so that Schulze in his study of the primitive *Ixodes* overlooked it, more especially since Neumann's description of the ventral surface was incomplete.



In studying the structures as shown by *I. albaudi*, in all its phases, we find that it shows a whole range of primitive features:—

- (a) The palps are placed laterally on to the coxal portion of the basis capituli.
- (b) The tronchanter of the palp is expanded to form a wing-like projection both ventrally and dorsally in the female, reduced dorsally in the nymph and larva, and entirely absent dorsally in the male. Nuttall and Warburton, in their description of *I. tenuirostris*, consider these expansions part of article 1.
- (c) The male shows vestigial sternal elements (Fig. 1), whose homology is somewhat difficult to ascertain without access to other primitive forms of ticks and to further literature, both of which are difficult to obtain in these troublous times. The central row of elements present seem to represent (1) a pregenital plate, (2) a genital apron. Both (1) and (2) are surface structures in front of the sexual orifice, which latter has moved forward and lies between coxae ii. (3) and (4), lying behind the sexual orifice is the tongue-shaped element formed of two highly chitinized structures, which are fused, so that it would seem that this male tick retains the original four parts of its sternal apparatus. Added to the above vestigial sternum are the lateral surface-elements; a small pair of plates opposite coxae ii and long narrow strips reaching to coxa iv, which four elements may be equvalated with the Endopodal plates of Schulze (1935), as figured for *Sternalixodes cordifer*. In the female, nymph and larva all traces of sternal elements have been lost. Heretofore Schulze reports sternal elements as being present only in female *Sternalixodes* and possibly in the nymphs, and states that there are only indications of them in the sub genera *Endopalpiger* and *Exopalpiger*.

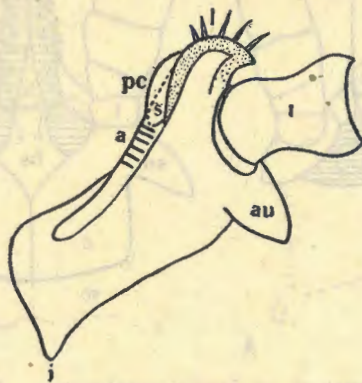


Fig. 9.—Schematic representation of an original Ixodid-coxa. After Schulze (1932)  
Fig. 5. a=area coxalis; au=external spur; i=internal spur; l=Lade=processus coxalis;  
p.c.=processus cymatii; s=dorsal supporting rod; t=trochanter.

- (d) In all stages the coxae are syncoxae and show all the elements postulated by Schulze (1935) as present in a hypothetical primitive Ixodid-coxa (Fig. 9). The *processus coxalis* (Lade) usually is reduced somewhat and bears only one to two bristles; the chitinous support to the processus is well-developed as also the *area coxalis*. (Compare Figs. 8 and 9.) This latter shows a tendency to decrease in size in

successive coxae from before backwards and is not so well-developed in the immature stages; in the larva there is only one gland present in this area. Besides the anterior dorsal chitinous support, figured by Schulze, *I. alluaudi* also shows one at the base of the trochanter at the posterior margin of the coxa. In none of the stages, however, is there any indication of the external and internal spurs common to a large number of ticks, and which Schulze includes as elements belonging to the hypothetical primitive coxa.

- (e) In how far the separate elements of the capitulum, which could be made out, can be correlated with the primitive elements postulated by Schulze (Fig. 10) is still a matter of conjecture. That the palps represent a coxa with a modified appendage placed vertically instead of horizontally, can be clearly seen. Thus, if we compare Fig. 7 with Fig. 8, the highly chitinized anterior and posterior supports (*Stutsleiste*) are well developed in both instances, as also the less heavily pigmented chitinous ring round the base of the appendage, as also the bristle on the coxa itself. The resemblance is so striking that one instinctively looks for the bristle(s) of the *processus (Lade)* at the internal angle of the palp, and for the parallel-lines of the sub-coxa. It would seem that the coxa ventrally, completely covers the deuterosternum; Schulze's central element, the lower lip is undoubtedly present; that the two lobes of the hypostome (*Clava*) are derived from the *processus (Lade)* seems quite probable, if a shifting of this structure relative to the chitinous support is postulated.

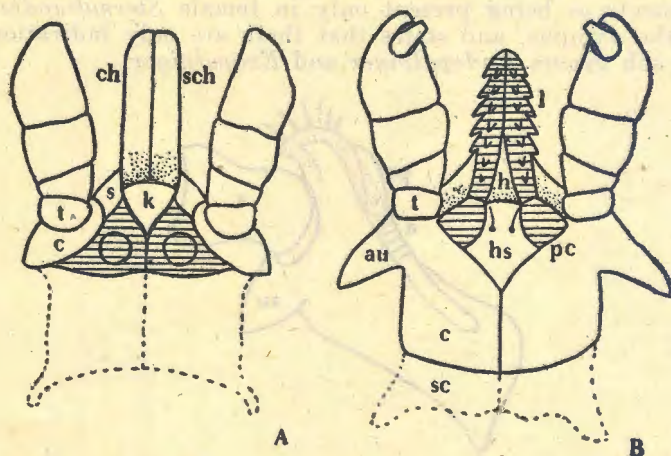


Fig. 10.—Scheme for structure of an Ixodid-gnathosoma. A.—Dorsal view; B.—ventral view. After Schulze (1932) Fig. 6. au=auriculae; c=coxa; ch.sch.=cheliceral sheath; h=hypopharynx; h.s.=hypostome; k=kopflappenteil; l=Lade=*processus coxalis*; p.c.=*processus cymatii*; s=sella=dorsal supporting rod of *processus dorsalis*; sc=subcollare; t=palptrochanter.

#### CLASSIFICATION.

In 1935 Schulze split off from the Genus *Ixodes* three sub-genera, namely *Sternaloxides* (type *I. cordifer*); *Endopalpiger* (type *E. luxuriosus*); and *Exopalpiger* (type *I. priscicollaris*), which show somewhat more primitive structural characters than do the rest of the Ixodes.



Two of the above only concern us here:—

A. Sub-genus *Exopalpiger*, Schulze (1935).

In the female the porose area of the basis capituli is sharply demarcated off from the coxal portion. The palp-trochanter is large, applied to and extends more or less beyond the coxal portion of the basis capituli. Lateral margin of scutum fairly straight, diverging posteriorly, so that the scutum is at its widest posteriorly. At least the first two coxae are syncoxae. *Areae coxales* absent. *Type I. Priscicollaris*, Schulze (1932).

In this sub-genus he also includes *I. feicalis* Nuttall and Warburton (1909) from *Dasyuris*, West Australia, with its sub-species "var." *aegrifossus* from *Opossum*, Queensland, and from *Perameles*, West Australia, and states that in all probability the three European mice parasites also belong here, viz., *I. trianguliceps* Birula (1895), *I. tenuirostris*, Neumann (1901), and *I. nivalis* Rondelli (1928), *I. nivalis* var. *suecicus* Schulze (1930), from *Hypudaeus*, Sweden.

B. Sub-genus *Endopalpiger* Schulze (1935).

Palp articles 2 and 3 fused. In the female the palpiger is sharply marked off from the rest of the basis capituli and is greatly enlarged, dorsally it projects forwards and inwards between the palps and the chelicerae-sheaths, ventrally it projects outwards well beyond the basis capituli. The chelicerae-sheaths are folded over on to the ventral surface. Porose areas not pronounced. Coxae with a clearly visible *processus* and *areae coxales*, especially on Coxa i. The coxae are syncoxae. In *E. luxuriosus* two rosette glands are present besides the *area coxales* in Coxae ii and iii). Fully engorged female extraordinarily slender.

Nymphae and larvae agree with the female. *Type E. luxuriosus* off *Mallomys*, North New Guinea.

In this sub-genus he also includes *E. steini* off *Phascogale*, New Guinea; *I. australiensis* Neumann (1904) off *Bettongia* and Dog, *I. victoriensis* Nuttall (1916) off *Phascolomys*; *I. hydromyidis* Swan (1931) off *Hydromys*, and *Rattus rattus*, W. Australia; and *I. tasmani* Neumann (1899) off *Petauroides* and *Tricusurus*, Tasmania and Queensland.

In both these sub-genera the coxae are syncoxae. In both the palpiger, or trochanter of the palp, tends to be drawn out into the wing-like expansions and the palps themselves are hollowed out medially. In neither case is there any mention of the presence of a sternal element in the adult forms, although a sternal element has been reported for the nymph of *I. priscicollaris*.

*I. alluaudi* seems to fit most readily into the sub-genus *Exopalpiger*, in that its cheliceral sheaths behave normally and the porose areas are sharply demarcated off. The palps for *I. tenuirostris*, *I. feicalis* and *I. nivalis* all show a separate article 3, but the type species *I. priscicollaris* also shows a complete fusion of the first three articles as is seen in *I. alluaudi*.

Unfortunately it has not been possible to obtain a copy of Rondelli's description of *I. nivalis*, but according to Schulze's (1938) Fig. 4 of the female capitulum and his figures for the male, it would seem that *I. alluaudi* has its greatest affinity for this form, except that the *I. nivalis* male apparently shows none of the sternal elements so characteristic of the *I. alluaudi* male. The information as regards the venter of the male *I. tenuirostris* and *I. feicalis* may be incomplete, and a further study of glycerine-cleared specimens may show the presence of sternal elements. Unlike *I. nivalis* and all other species included by Schulze in his sub-genus *Exopalpiger*, *I. alluaudi* shows an *area coxalis* on each of its syncoxae.



However, despite these differences and in view of the fact that our knowledge of these primitive groups of Ixodids is, as yet, very incomplete, it seems advisable to place *I. alluaudi* temporarily into the sub-genus *Exopalpiger* rather than to create a new sub-genus for it.

## GENERAL REMARKS.

As regards the distribution of these three primitive groups, *Sternalixodes* and *Endopalpiger* are confined to the Australian regions (*Endopalpiger heroldi* a nymph, described from *Evotomys glareolus*, Basalberg, Rotstein bei Schland, Oberlausitz, may yet prove not to be an *Endopalpiger*), and *Exopalpiger* is distributed in the Australian, Aethiopian and European regions.

The first two sub-genera are parasites of Marsupials only, a primitive parasite on a primitive host. The data which have come to hand for *I. alluaudi* point to those primitive mammals, the shrews, as being the original hosts of the *Exopalpiger* group outside of Australia, with the rats, mice and moles as the second choice. Of the European forms *I. tenuirostris*, thus far, is the only one reported parasitic on shrews as well as on mice, but further investigation will probably show the other forms also to be parasitic on shrews, so that the transference would be from the marsupials via the primitive to the more recent mammals giving an evolution of adaptation to change of environment (host).

## SUMMARY.

1. Neumann's (1913) description of the male of *Ixodes alluaudi* is enlarged upon and the female, nymph and larva described for the first time.
2. It is shown that it is essentially a parasite of the shrew, which may, *faut de mieux*, infest fieldmice, gerbilles, vlei rats and golden moles.
3. Attention is drawn to the primitive coxae and to the sternal apparatus.
4. Its systematic affinities are discussed, and it is temporarily placed in the sub-genus *Exopalpiger* Schulze (1935).

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