DESCRIPTION OF *ALECTOROBIUS (RETICULINASUS) CAMICASI* SP. NOV. (ACARI: IXODOIDEA : ARGASIDAE), A PARASITE OF FRUIT BATS *ROUSETTUS AEGYPTIACUS OCCIDENTALIS* IN SENEGAL

BY Massamba SYLLA[1, 2], Jean-Paul CORNET[1] and Bernard MARCHAND[2]

TICK
ALECTOROBIUS
(RETICULINASUS)
TAXONOMY
NEW SPECIES
ROUSETTUS
SENEGAL

SUMMARY: A new tick species — *Alectorobius (Reticulinasus) camicasi* n. sp., a parasite of fruit bats, *Rousettus aegyptiacus occidentalis*, in Senegal — is described. This new species is based on laboratory reared males, females, nymphs and larvae. *Alectorobius (Reticulinasus) camicasi* n. sp. is closely related to the two other African species: *Alectorobius (Reticulinasus) salahi* (Hoogstraal, 1953), a parasite of the fruit bat *Rousettus aegyptiacus* (Geoffroy) in Egypt; and *Alectorobius (Reticulinasus) faini* (Hoogstraal, 1960), a parasite of *Rousettus leachii* (Smith) in the Congo. The new Senegalese species is easily distinguished from the Egyptian species by shape of dorsal surface of idiosoma of adults, coxal setae and hypostomal formula of the larva. It is very similar to the Congolese species, but differs from it by the appearance of the antero-dorsal surface of idiosoma of male, and by the hypostomal formula, dorsal plate, length of fourth palpal article, and the position and distance between some setae of the larva.

TIQUE
ALECTOROBIUS
(RETICULINASUS)
TAXONOMIE
NOUVELLE ESPÈCE
ROUSETTUS
SÉNÉGAL

RÉSUMÉ : Cette étude a porté sur la description d'une nouvelle espèce de tique *Alectorobius (Reticulinasus) camicasi* n. sp. parasite de *Rousettus aegyptiacus occidentalis* au Sénégal. Cette nouvelle espèce est décrite à partir de mâles, de femelles, de nymphes et de larves élevés au laboratoire. *Alectorobius (Reticulinasus) camicasi* n. sp est étroitement apparentée à deux autres espèces africaines : *Alectorobius (Reticulinasus) salahi* (Hoogstraal, 1953) parasite de *Rousettus aegyptiacus* (Geoffroy) en Égypte et *Alectorobius (Reticulinasus) faini* (Hoogstraal, 1960) parasite de *Rousettus leachii* (Smith) au Congo. L'espèce sénégalaise se distingue facilement de l'espèce égyptienne par l'aspect de la surface dorsale de l'idiosoma de l'adulte, les soies coxales et la formule hypostomale de la larve. Elle est très proche de l'espèce congolaise mais s'en distingue néanmoins par l'aspect de la région antéro-dorsale de l'idiosoma du mâle, par la formule hypostomale, la plaque dorsale, la longueur du quatrième article palpal et par la position et la distance entre certaines soies chez la larve.

INTRODUCTION

The tick herein described as *Alectorobius (Reticulinasus) camicasi* was at first considered to be *Ornithodoros (Reticulinasus) faini* (CAMICAS, *in litt.*, 1965) and after as *Ornithodoros (Reticulinasus) salahi* (MOREL, *in litt.*, 1974). Early observations on the larval stages initially gave contradictory opinions between CAMICAS and MOREL, which remain unpublished.

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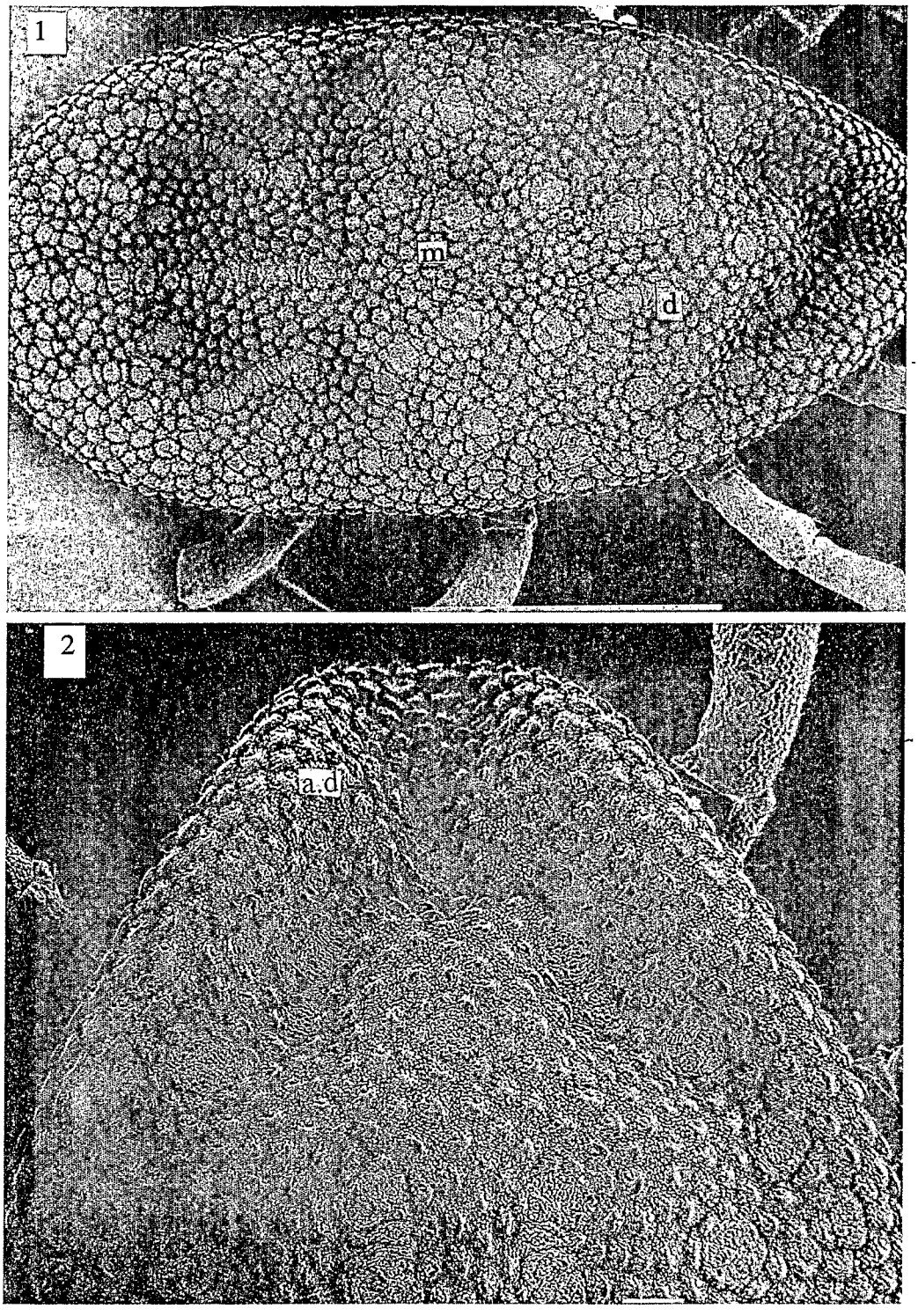


FIG. 1-2: *Alectorobius (Reticulinasus) camicasi* sp. nov., male.
1. — Dorsal view. d = disc, m = mammillae. Scale line = 1000 µm. 2. — Anterodorsal 1/3. a.d = anterior depression. Scale line = 100 µm.

In January 1993 we began rearing this tick species in the laboratory with 75 larvae collected from *Rousettus aegyptiacus occidentalis*. In this paper, data concerning taxonomic identification are presented. Details concerning life cycle and biology of this species will be published in a later paper.

To identify the Senegalese species, it was necessary to compare it with SEM photomicrographs of Egyptian and Congolese forms, its geographically nearest neighbours. J. E. KEIRANS provided photos of this series (SEMs were not included by HOOGSTRAAL in his publications).

In the following descriptions all measurements are given in millimetres. At least five measurements were taken for length and width of each stage, setal measurements according to our possibilities, with always a number into parentheses for the number of measurements made. SEM photomicrographs of *A. (R.) camicasi* were conducted at the Laboratory of Animal Biology, University Cheikh Anta Diop of Dakar.

Larval terminology follows KOHLS *et al.* (1965). Larval morphology of *A. (R.) salahi* and *A. (R.) faini* follows SONENSHINE *et al.* (1966). Host terminology follows WILSON & REEDER (1993). A new revision of the family Argasidae is given by KLOMPEN & OLIVER (1993), but in this paper the classification schemes of MOREL (1965) and CAMICAS & MOREL (1977) are adopted.

Alectorobius (Reticulinasus) camicasi sp. nov.

(Fig. 1-19)

Holotype: male from laboratory reared larvae. Deposited in the United States National Tick Collection, Georgia Southern University, U.S.A. Allotype: female, same data as holotype. Paratypes of both sexes and all nymphal instars reared in laboratory and larvae collected from *Rousettus aegyptiacus occidentalis* are deposited in US National Tick Collection; IFAN, Dakar; the Muséum national d'Histoire naturelle, Paris; and the writers' collections.

MALE

Length 3.49 (3.04-3.56), width 1.78 (1.65-1.94). Shape: unengorged specimens have an oval, elongated body. Posterior margin broadly rounded, anterior margin rounded, but more acute than posterior margin (Fig. 1). Lateral margins of body are parallel. Dorsum distinctly elevated at level of anterior fourth of body forming a slightly large rim (Fig. 2).

Dorsal integument with numerous mammillae, distinctly separated from one another. Their shape, outline and size variable. Small and scattered centrally, much larger and more conspicuous peripherally. Surfaces of these granulations smooth, some bearing a minute seta arising from a small pit near lateral margin (Fig 3).

Discs numerous, conspicuous, their shape and size variable. Selected area in SEM shows structure looking like juxtaposed shingles (Fig 3). From anterior to posterior margin of body, discs are arranged as in figures 1 and 2: anteromedian area with 2 longitudinal and parallel rows of 4 discs separated by mammillae. Anterior 1/4 of dorsum with a deep depression continued toward lateral margins by two rows forming arcs of 5 discs each. In the middle of the surface delimited by these curves, there is a single distinct disc. Medially, numerous discs appear arranged in 4 rows of two discs anteroposteriorly or two rows of 4 discs laterally, lateral discs larger. Discs of posterior half of body arranged in radiating rows (Fig. 1). Median row begins from posterior margin of body but not reaching body midlength. On either side of the median row, two large discs are found in a curving paramedian row.

The ventral integument also bears mammillae which are similar in size to those of dorsal surface. Setae minute, more conspicuous on gnathosoma (Fig. 4) and both sides of median postanal groove (Fig. 6). Genital area forming a semi-circle with smooth surface and situated between coxae I (Fig 5). Coxal and supracoxal folds present. Coxae I and II separated by a narrow integumental gap where the coxal fold begins and is continuous to the level of coxa IV. Supracoxal folds pass round anterior margin of camerostome where they join together. Posteriorly, they decrease beyond coxae IV. Preanal groove posteriorly curved, situated at level of anus and composed of two lips; the anterior lip rugose, posterior lip fringed with discs (Fig. 6). Internal extremity of each posterior lip perpendicular to a row of 4 discs (Fig 6). Median postanal groove situated in the longitudinal continuation of anus and extending to the transverse

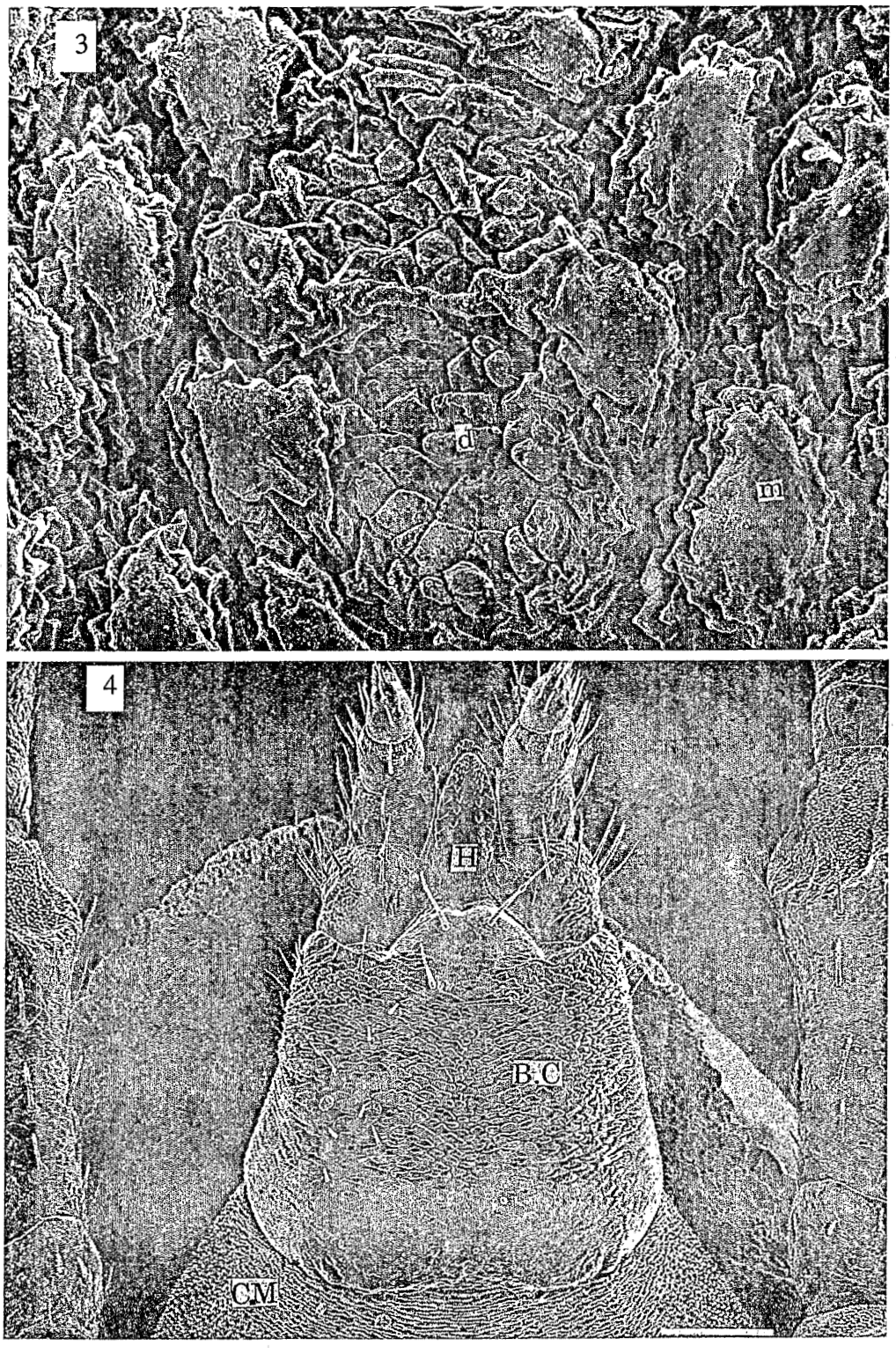


FIG. 3-4: *Alectorobius (Reticulinasus) camicasi sp. nov.*, male.

3. — Selected area in S.E.M. Discs (d) and adjacent area. m = mammillae. Scale line = 10 µm. 4. — Capitulum, ventral view. B.C = basis capituli, C.M = membranous collar. Scale line = 100 µm

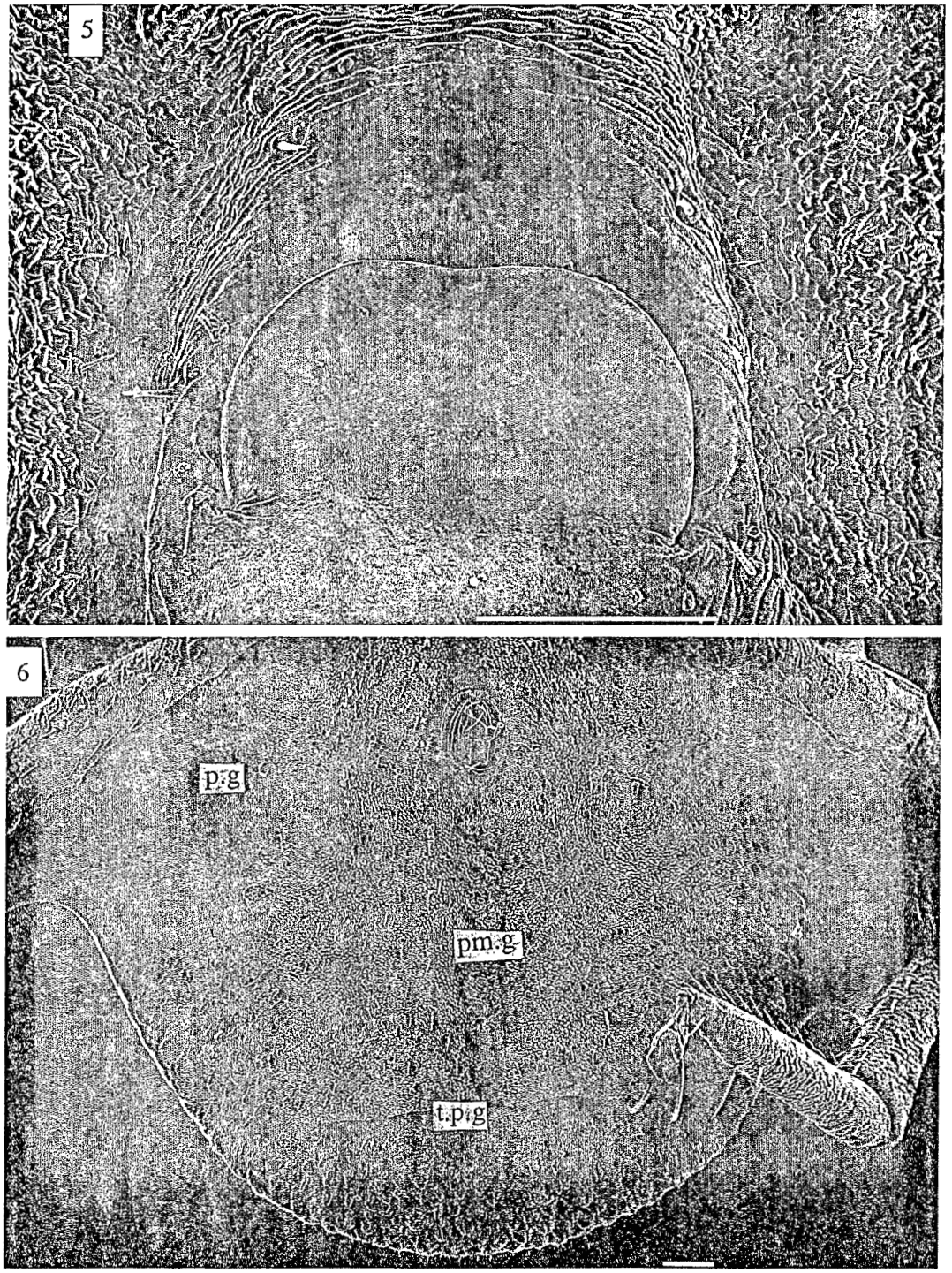


FIG. 5-6: *Alectorobius (Reticulinasus) camicasi* sp. nov., male.

5. — Genital area. Scale line = 100 µm. 6 — Posteroventral 1/3. Position of different grooves. p.g = preanal groove, pm.g = posteromedian groove, t.p.g = transverse postanal groove. Scale line = 100 µm.

postanal groove (Fig 6). It contains an average of 9 discs. This last groove is situated on the posterior ninth of body length and is composed of two contiguous lips; the anterior lip is divided into two parts by the last disc of the median postanal groove (Fig. 6). Dorsoventral groove absent.

Capitulum broad, lying in a deep camerostome located between anterior margins of coxae I and anterior body margin. Cheeks, eyes and hood absent (Fig. 4). Only a membranous collar fringes the camerostome at level of antero-posterior sides.

Hypostome convex, measuring 0.14 in length with denticles situated on the anterior 2/3 (Fig 7). Corona with 5 rows of five or six hooklets; symmetrical on either side of median hypostomal axis. External row of denticles larger than internal and with five denticles, internal row with 4 denticles. Basis capituli subrectangular, with lateral minute setae (Fig. 4), prolonged anteriorly by a median extension at the apex of which appears a small hole (Figs. 4, 7). First pair of posthypostomal setae pH1 (0.0852) extends to apex of first palpal segment. Second pair pH 2 (0.0676) arises a little lower. Palpi exceeding hypostome by length of last two segments, segment 4 narrowly elongate, segments 2 and 3 subequal in length with granulations on their apical half (Fig. 7). First palpal segment widest of all segments, its surface forming a large internal flange with a crenellated rim overlapping the basal 1/3 of the hypostome. Palpal segment I with 8 setae, 3 setae arising in a latero-external position, 5 on the ventral surface. Palpal segments 2 and 3 each with 2 ventral setae, and 2 to 3 lateral setae. Palpal segment 4 with more than 13 setae (Fig 4).

Long legs, diameter of succeeding segments increasing from coxa to tarsus, each segment bearing rows of setae. Anterior 3 pairs of legs are approximately equal in length, measuring: (1): 2.17; (2): 2.08; (3): 2.04; fourth pair is the longest (2.47). Tarsi gradually tapering distally, tarsus I with a dorsal hump bearing the Haller's organ (Fig. 8); II to IV lacking humps and protuberances. The apical extremity of each tarsus shows a pulvillus and two curved claws (Fig. 8).

Female

Length. 3.93 (3.71-4.11); width 2.32 (2.2-2.4). Similar to male except for sexual characteristics and larger size (Figs. 9, 10). Genital aperture forming a transverse slit as illustrated (Fig. 10, 11), situated between coxae II (Fig. 10). Anterior lip smooth centrally and striated laterally; posterior lip with striations delimited by membranous folds converging behind. Between striations arise minute setae (Fig. 11). Spiracular plate situated laterad of coxa IV (Fig. 10).

Nymphs

Similar to adults except for size and absence of genital aperture. Number of nymphal instars is four for male and five for female. Large nymphs (N3 — N5) (unengorged N3: Fig. 12). Length of third nymphal instar varying from 2.16 to 2.7, width from 1.24 to 1.5. Integumental mammillae similar to those of adults (Fig. 12). Dorsal discs appear during third nymphal instar. Length of fourth nymphal instar varying from 2.3 to 2.78, width measuring approximately 1.6. Length of fifth nymphal instar varying from 3.24 to 3.75, width from 1.84 to 1.92.

Small nymphs (N1-N2) (unengorged N 1: Fig. 13). First instar nymph measures 1.65 to 1.75 in length, 0.92 to 0.98 wide. Capitulum lies in a camerostome (Fig. 14). Basis capituli with 4 pairs of anterolateral setae (Fig. 14). Second instar nymph unengorged measures 1.78 to 1.85 in length, 1.10 wide.

Larva

Engorged larva measures 1.05 to 1.16 in length, 0.52 to 0.7 wide. Body is oval, elongated, broader posteriorly than anteriorly. Dorsal integument striated (Fig 15). Dorsal surface of idiosoma with 14 pairs of setae distributed as follows (Fig. 15): 3 posterior long pairs (pte), 9 sublateral pairs (1 pair at the end of lateral margin of body, before beginning of convexity of posterior margin; 2 pairs at level of legs III; 2 pairs at level of legs II; 2 pairs at level of legs I; 2 antero-external pairs of setae (ate) at level of palpi), 2 submedian pairs on both sides of dorsal plate. Setae on ventral surface of body (excluding capitulum) totalling 14 pairs distributed as follows (Fig. 16): 1 pair on each coxa (= 6 pairs of cx); 3 central pairs (ct) located in the intercoxal area; 3 circumanal pairs (ca) distributed around anus; 1 postero-external pair (pte)

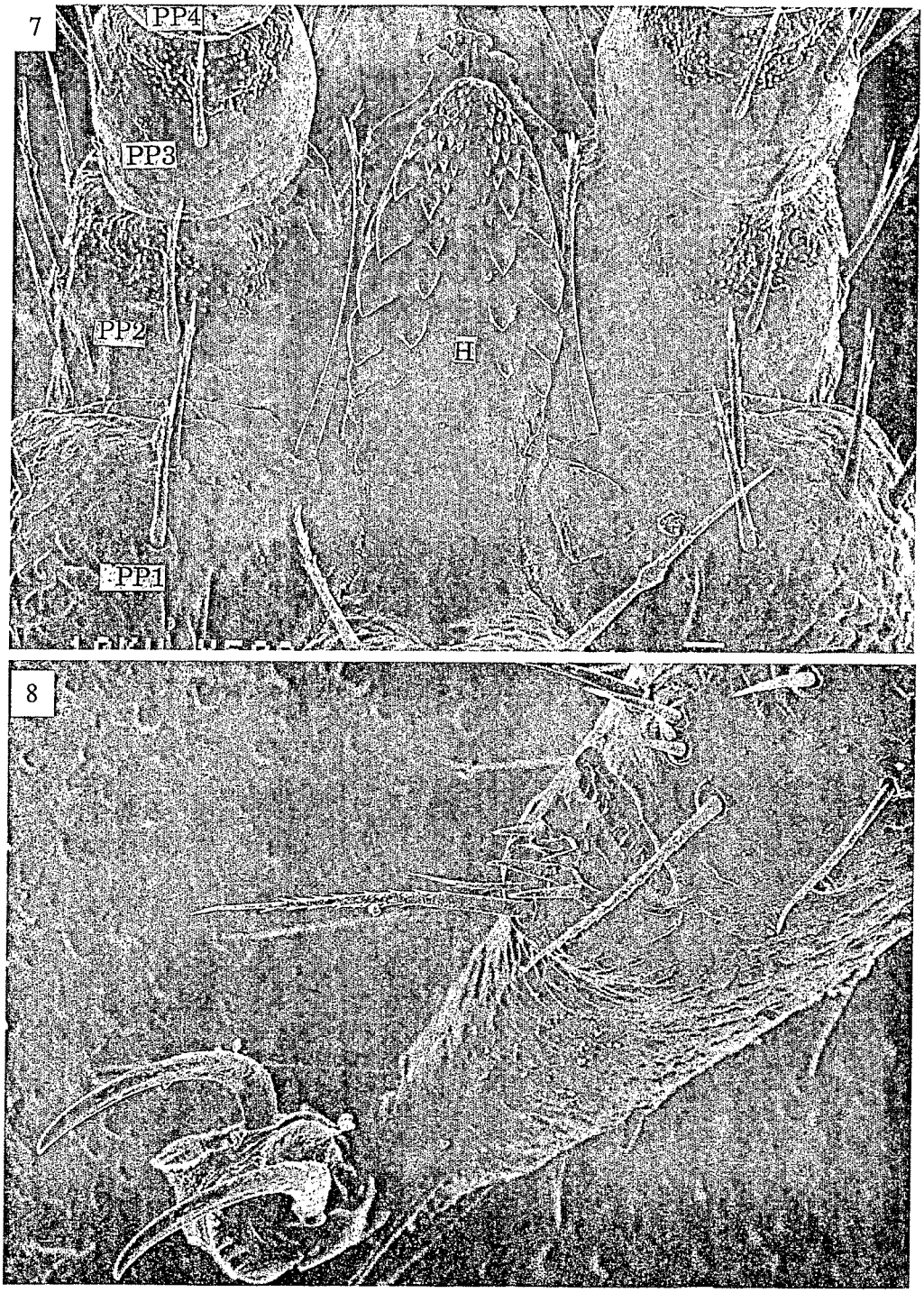


FIG. 7-8: *Alectorobius (Reticulinasus) camicasi* sp. nov., male.

7. — Hypostome and palpal segments. G = granulations, H = hypostome, PP1 = first palpal article, PP2 = second palpal article, PP3 = third palpal article, PP4 = fourth palpal article. Scale line = 10 μm. 8. — Tarsus I. Scale line = 10 μm.

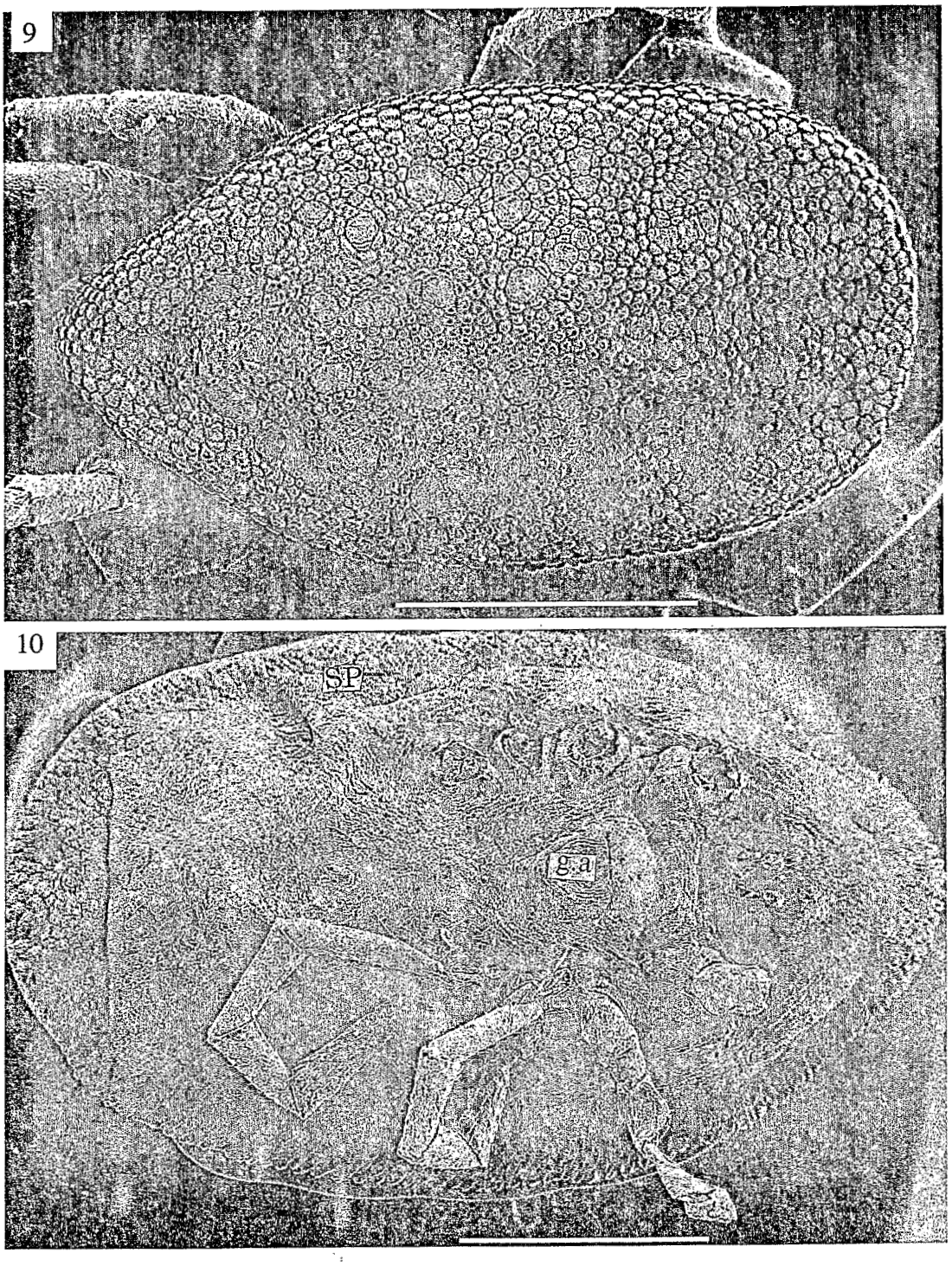
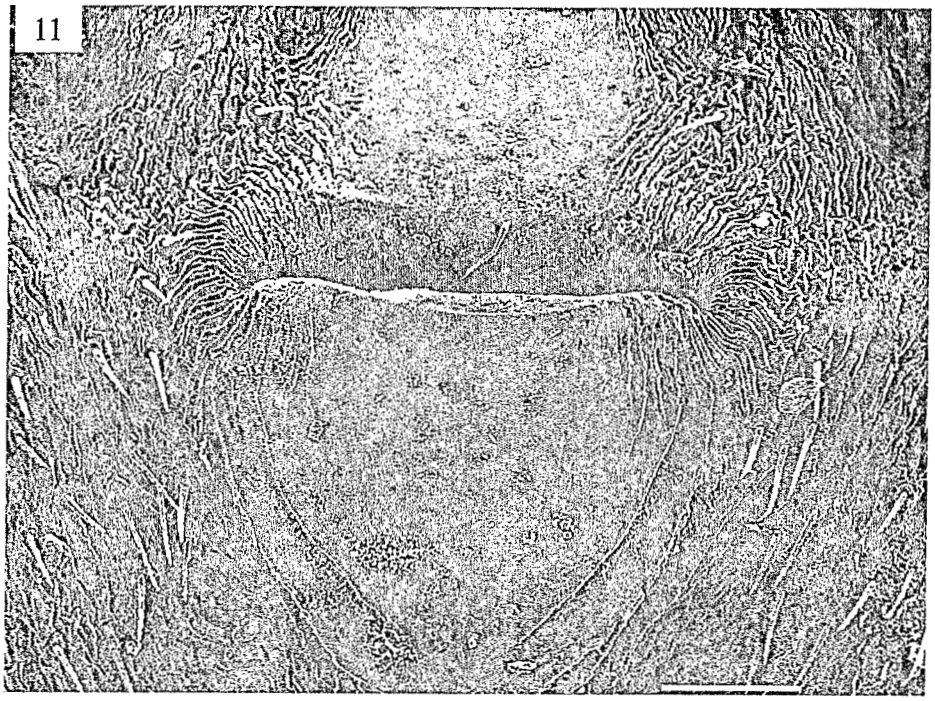


FIG. 9-10: *Alectorobius (Reticulinasus) camicasi* sp. nov., female.
9. — Dorsal view. Scale line = 1000 µm. 10. — Ventral view. g.a = genital area, SP = spiracular plate. Scale line = 1000 µm.



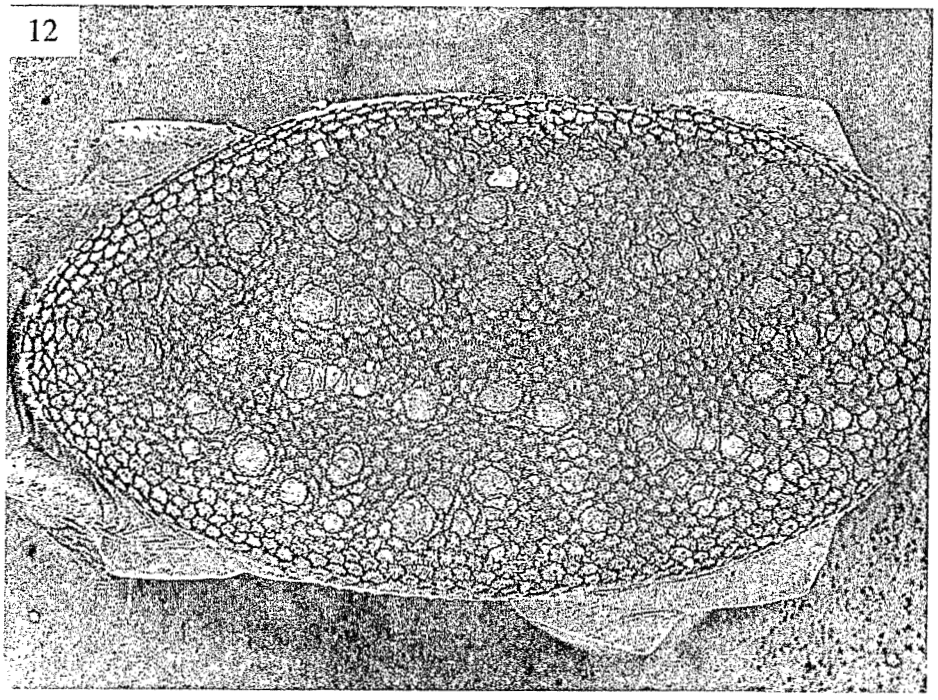
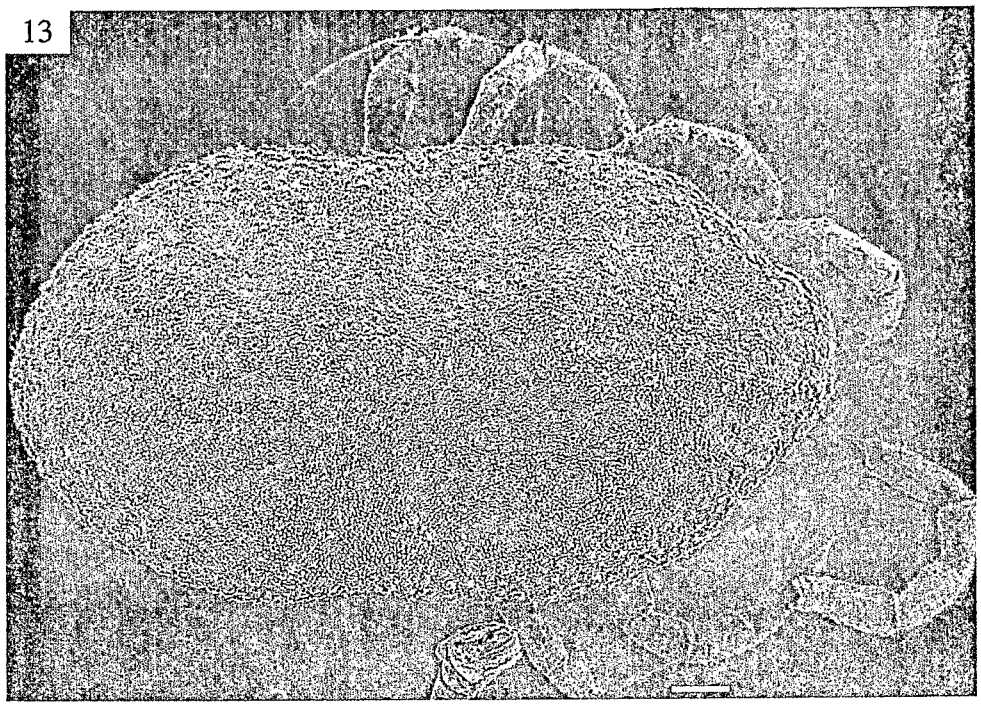


FIG. 11-12: *Alectorobius (Reticulinasus) camicasi* sp. nov.
11. — Female, Genital area. Scale line = 100 µm. 12. — Third nymph instar, dorsal view. Scale line = 100 µm.



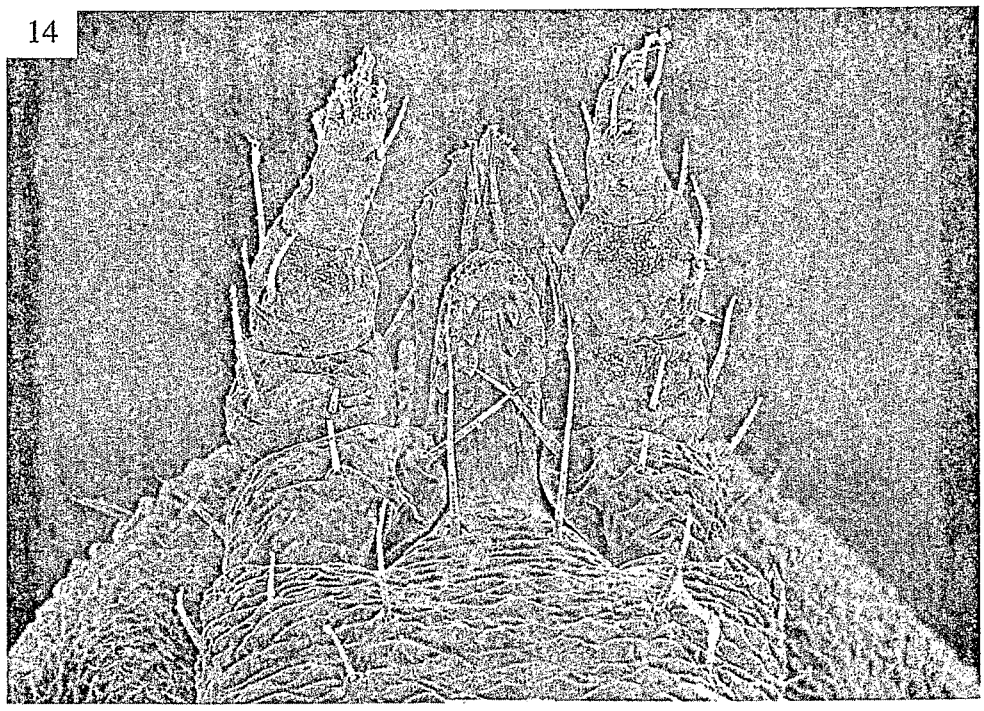


FIG. 13-14: *Alectorobius (Reticulinasus) camicasi* sp. nov., 1st nymphal instar.
13. — Dorsal view. Scale line = 100 µm. 14. — Capitulum, ventral view. Scale line = 100 µm.

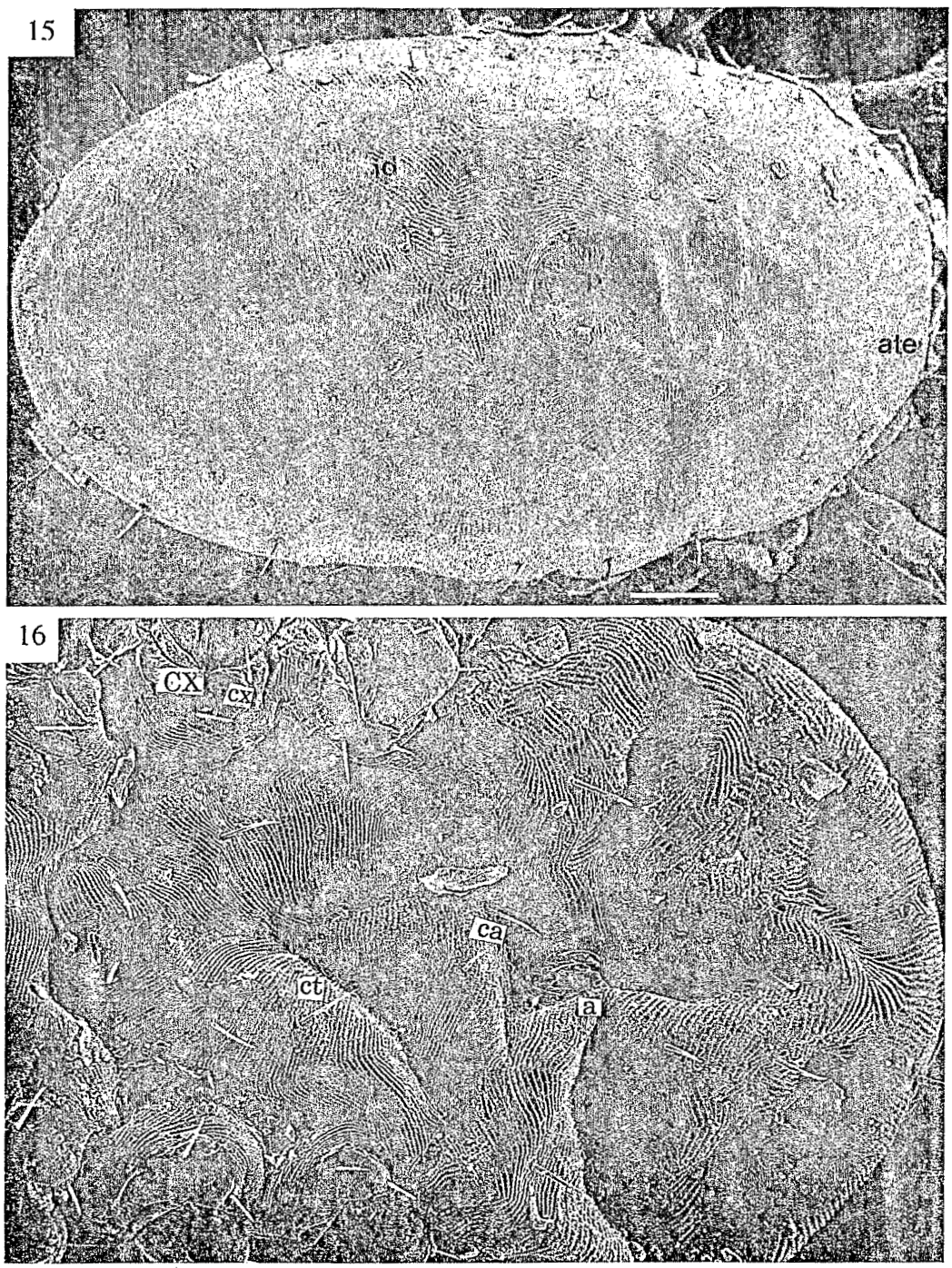


FIG. 15-16: *Alectorobius (Reticulinasus) camicasi* sp. nov., larva.

15. — Dorsal view. ate = antero-external setae, p = dorsal plate, pte = postero-external setae, id = idiosoma. Scale line = 100 µm. 16. — Ventral view. a = anus, ca = circumanal setae, ct = central setae, CX = coxa, cx = coxal setae, pte = postero-external setae. Scale line = 100 µm.

before broad posterior margin of body; 1 pair of anal setae (an) located on the two anal valves. The last 8 pairs are median, distributed from level of coxae I to posterior margin of body. Anus is situated on posterior half of ventral surface, nearer of coxae III than posterior margin of body.

FIG. 17: *Alectorobius (Reticulinasus) camicasi* sp. nov., larva. Hypostome. Scale line = 10 μm.

The capitulum is terminal composed of a basal part, basis capituli, and a distal part, the rostrum. Basis capituli subrectangular, articulated with idiosoma at level of anterior margin of body. Ventrally with two pairs of short post-hypostomal setae. Hypostome elongate, approximately 0.12 in length and 0.05 in width. Apex broad, dental formula 2/2, outer file is more robust, with 6 denticles, inner file with 5 denticles; corona of average 6 denticle rows arranged in 3/3 formula (Fig. 17). The hypostome is the ventral portion of rostrum, the chelicerae are located dorsally and move in a sheath. Lateral to the hypostome are the 4-segmented palpi. The first three articles are stout, subequal in length and width, the fourth article is narrower than the others, bearing a tuft of 7 apical setae, 3 on ventral surface, 2 on dorsal surface. Palpal length varies from 0.14 to 0.16.

Legs are long and stout, measuring 4/5 of body length excluding capitulum. Tarsus I with Haller's organ composed by an anterior circular pit located on a hump. The anterior pit is approximately 25 μm in length and 20 μm in width, containing a total of seven setae which differ in their length and basal diameter (1 anterior long, 2 medium and lateral, and 4 short setae in a central position). The capsule arises near the longitudinal axis of tarsus I with a transverse slit of average 15 μm (Fig. 18). Three short setae arise in a straight line (lateral setae are the longest). On either side of that tuft (HT), paramedian capsular pair PC arises dorsally, immediately posterior of the capsule. Posteriorly of HT appears a single posteromedian seta (PM). Dorsobasal pair follows PM seta. Ventrally, is located the ventrobasal pair (VB). At the anterior extremity of tarsus I are situated: the dorso-apical pair (A), the apicolateral pair (AL), the apicoventral pair (AV). In a ventral position, at the level of the capsule, appears the midventral pair (MV).

Distomedian seta (DM) arises at anterior extremity of the pit. Tarsus I on its extremity bears a pulvillus and two curved claws that are twice as long as the pulvillus.

ETHYMOLOGY

This species is dedicated to Dr Jean-Louis CAMICAS (medical entomologist, O.R.S.T.O.M., Montpellier) in recognition of his excellent contributions to the knowledge of ticks in Senegal, where he has been working for more than twenty years.

DIAGNOSIS AND SPECIES RELATIONSHIPS

The morphological characters differentiating *A. (R.) camicasi* from the two other African species, *A.*

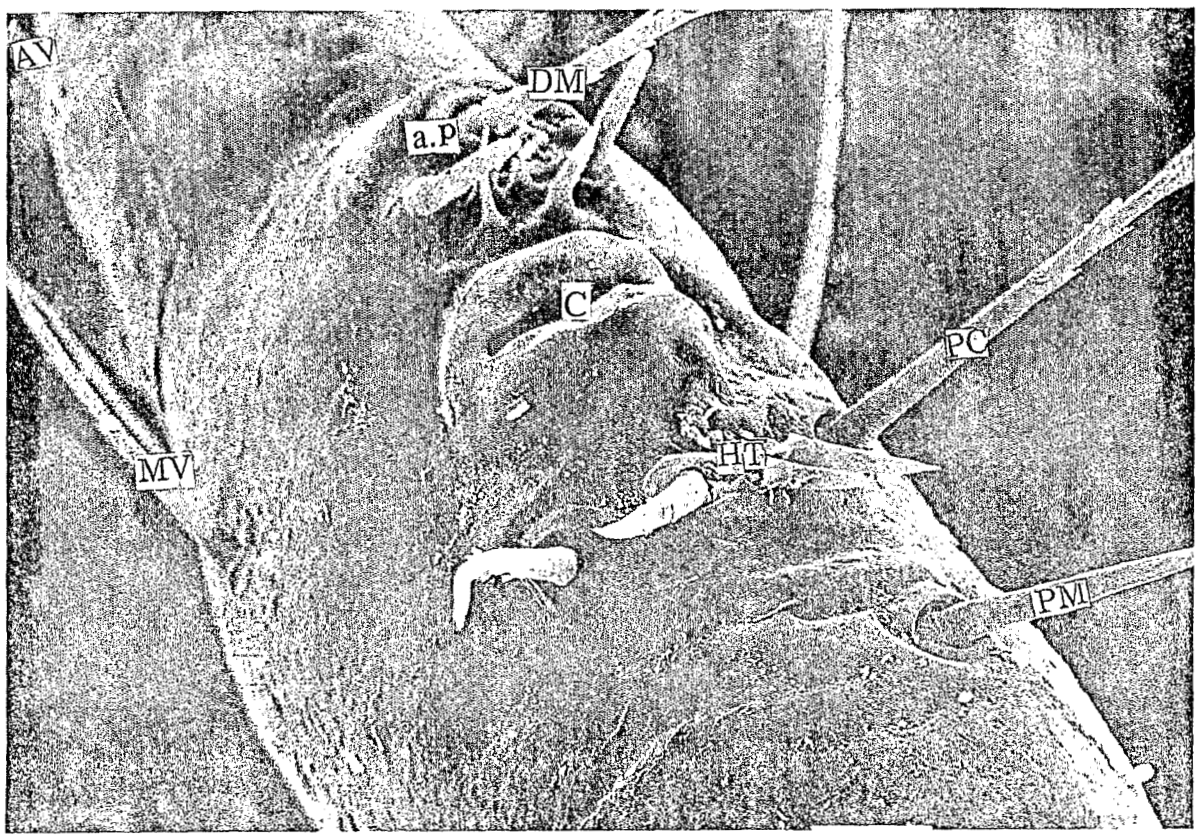


FIG. 18: *Alectorobius (Reticulinasus) camicasi* sp. nov., larva. Tarsus I: (Haller's organ). a.p = anterior pit, AV = apicoventral, C = capsule, DM = distomedian, HT = hair tuft, MV = midventral, PC = paracapsular, PM = posteromedian. Scale line = 10 μm.

(R.) salahi Hoogstraal, 1953 of Egypt and *A. (R.) faini* Hoogstraal, 1960 of Zaïre are given in Table 1. The dorsal surface of adult *A. (R.) camicasi* shows discs that are more numerous and conspicuous than in *A. (R.) salahi.* Posterior margin of basis capituli beginning at level of middle of basal half of trochanter I in *A. (R.) salahi*, whereas in *A. (R.) camicasi* it begins very near coxae I. Adult *A. salahi* has an elongate hypostome with denticles distributed on the apical half (HOOGSTRAAL, 1953), *A. camicasi* has a convex hypostome with denticles distributed on apical 2/3.

salahi	*faini*	*camicasi*
Anterior margin of body rounded.	Anterior margin of body narrow, bluntly rounded.	Anterior margin of body broadly rounded, with a large continuous depression.
Camerostome entirely obscured by antero-lateral margins of body.	Camerostome near antero-lateral margins of body.	Camerostome enveloped by antero-lateral margins of body, even in unengorged specimens.
Body oval, elongated.	Body wide at level of preanal groove. Lateral margins converging gradually in direction of anterior margin of oval, elongated body.	Lateral margins of body parallel.
Dorsal discs inconspicuous.	Dorsal discs conspicuous, those of anterior area parallel, those of posterior area arranged in radiating rows.	Dorsal discs very conspicuous, most larger and reticulated. Those of anterior area with two curved lines arranged in direction of lateral margins of body, those of posterior area in radiating rows.

TABLE 1. Morphological criteria differentiating adults of *Alectorobius (Reticulinasus) camicasi, A. (R.) faini* and *A. (R.) salahi.*

Alectorobius (Reticulinasus) camicasi is very similar to *A. (R.) faini* but differs nevertheless from that species by the following characters. Anterior margin of idiosoma of *A. (R.) camicasi* is distinctly rounded with a large depression, whereas that of *A. (R.) faini* is bluntly rounded (HOOGSTRAAL, 1960). The lateral body margins are quite parallel in *A. (R.) camicasi* whereas in *A. (R.) faini*, the body is widest at level of preanal grooves, lateral margin gradually converging from level of these grooves to approximately level of basis capituli, thence somewhat more abruptly tapering to a narrow, bluntly rounded anterior margin (HOOGSTRAAL, 1960). Dorsal integumental discs of *A. (R.) camicasi* are very conspicuous, at least 1.5 times larger than those of *A. (R.) faini.* The supracoxal fold passes around the anterior margin of the body and joins again in *A. (R.) camicasi,* but in *A. (R.) faini* they disappear at the level of coxae I.

Larval characters for *A. (R.) camicasi, A. (R.) faini* and *A. (R.) salahi* are given in Table 2. In *A. (R.) salahi,* the coxae are elongate, triangular and each bears three subapical setae; in *A. (R.) camicasi,* the coxae are short and each bears two setae. The dorsal plate is almost square in *A. (R.) camicasi,* and larger than the one of either *A. (R.) salahi* or *A. (R.)* faini. The length of circumanal setae also gives good differential characters. Third circumanal pair CA3 measures 0.025 in *A. (R.) camicasi,* 0.059 in *A. (R.) faini.* The dental formula is 2/2 for all the three species but there is a difference in number of denticles per row: outer file of *C. salahi* with 8 denticles, inner with 7; outer file of *C. faini* with 8 denticles, inner with 7; outer file of *C. camicasi* with 6 denticles, inner with 5. Notwithstanding the brevity of nymphal descriptions of *A. (R.) faini* and *A. (R.) salahi,* we believe that differences found between larvae and adults of the three species can be considered diagnostic.

salahi	*faini*	*camicasi*
Dorsal plate l: 0.138-0.148 (2) b: 0.138 (2)	Dorsal plate l: 0.90-0.101 (3) b: 0.095-0.109 (3)	Dorsal plate l: 0.114-0.115 (2) b: 0.114-0.135 (2)
Approximate length of CA3: 0.052 (6)	Approximate length of CA3: 0.059 (5)	Approximate length of CA3: 0.025 (2)
Distance between setae ph1: 0.021 (6) ph2: 0.079 (12)	Distance between setae ph1: 0.019 (3) ph2: 0.082 (3)	Distance between setae ph1: 0.043 (2) ph2: 0.070 (2)
Approximate length of fourth palpal segment: 0.945 (9)	Approximate length of fourth palpal segment: 0.044 (5)	Approximate length of fourth palpal segment: 0.028 (3)
Hypostome bluntly narrow at level of corona. Hypostomal formula 2/2 External file with 8 denticles Internal file with 7 denticles	Hypostome bluntly narrow at level of corona. Hypostomal formula 2/2 External file with 8 denticles Internal file with 7 denticles	Hypostome slightly rounded at level of corona. Hypostomal formula 2/2 External file with 6 denticles Internal file with 5 denticles
Hosts and distribution: Parasites of fruit bats in Egypt (HOOGSTRAAL, 1953), in Israel (THEODOR & COSTA, 1960).	Hosts and distribution: Parasites of fruit bats in Congo Zaïre (HOOGSTRAAL, 1960), in Congo Brazzaville, reported also in Angola and in India.	Hosts and distribution: Parasites of fruit bats *Rousettus aegyptiacus occidentalis* in Bandia in Etiolo (12° 35 N, 12° 52 W) (Cave with *Rousettus*: MOREL; personal communication), and *Rousettus angolensis smithi* in Salemata: (CAMICAS; personal communication).

TABLE 2. Morphological criteria differentiating larvae of *Alectorobius (Reticulinasus) camicasi, A. (R.) faini* and *A. (R.) salahi.* Dimensions (in mm) followed by number of measurements (in parentheses).

ELEMENTS OF ECOLOGY

The type of parasitism in *A. (R.) camicasi* is monotropic pholeo-endophilic (monotropic = same species of host for all stages, pholeo-endophilic = host sheltering into structures such as caves). The host-parasite relationship is very specialized. Coexistence between the tick and its host has produced an ecological specificity which has evolved into a physiological specificity (CAMICAS & MOREL, 1978). During our investigations, we have caught many others bat species among which were:

Macrochiroptera: *Eidolon helvum* (Kerr, 1792); *Epomophorus gambianus* (Ogilby, 1835); *Epomophorus labiatus* (Temminck, 1837).

Microchiroptera: Nycteridae: *Nycteris macrotis* Dobson, 1876; *Nycteris thebaica* Geoffroy, 1818;

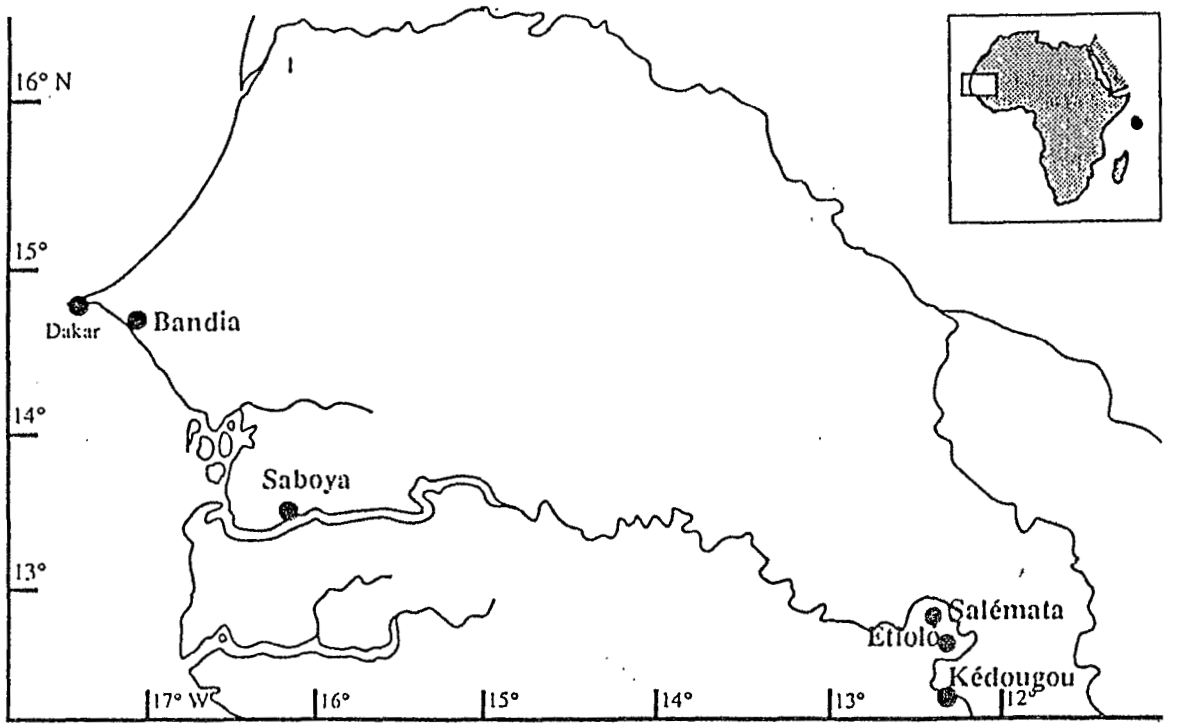


FIG. 19: Map of Senegal, indicating sites where *Alectorobius (Reticulinasus) camicasi* sp. nov. has been found.

Nycteris gambiensis (Anderson, 1912); Vespertilionidae: *Pipistrellus nanus* (Peter, 1852); *Pipistrellus rusticus* (Tomes, 1861).

None of these bats were infested with *A. (R.) camicasi*. However, besides records of numerous larvae on 70 *Rousettus aegyptiacus occidentalis* from Bandia (14° 35 N, 17° 01W) and 2 from Saboya (13° 36 N, 16° 26 W), CAMICAS (pers. comm.) has found it on *Rousettus angolensis smithi* in Ebarak, Salemata (12° 35 N, 12° 50 W) (Fig. 19). All bats examined have been caught with hoop nets during the night in plantations of *Mangifera indica*, and in front of a cave in Bandia (Thiès).

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