STUDY OF CHELICERAE IN THE TICK AMBLYOMMA CAJENNENSE (FABRICIUS 1787) BY SCANNING ELECTRON MICROSCOPY

M. Ansel and M. Thibaut

The structure of the chelicerae was studied with scanning electron microscope in the tick Amblyomma cajennense *(Fabricius, 1787). Lamellar organs were seen at the basis of the digits of the chelicerae. Considerations on the palaeontologic origin of ticks and Acari are made with reference to literature.*

The use of scanning electron microscope not only enables to complete the description of well-known species and to define their spacial configuration more precisely, as was done by ourselves and others for the cephalic formations of Nematodes (1,2,3), but also discloses new formations, as shown by Wooley (7,8) for the sense organs and respiratory apparatus of ticks. While trying to define more precisely the chetotaxia of the palps and the morphology of the chelicerae, we were led in examining various specimens of *Amblyomma cajennense* to discover the existence of formations undescribed hitherto (4). They seemed to bring arguments on the one hand for the conception of homology of the chelicerae with the mouth parts of mandibulate or the other hand for the possibility of considering Acari as the most primitive forms of Arachnids.

MATERIALS AND METHODS

Specimens of *Amblyomma cajennense* were fixed for 48 hours in the ethanol/chloroform/diethyl ether/acetic acid mixture. They were carried over to aluminium slide-cylinders and stuck on them with silver lacquer to secure the conductivity of the electrons. The samples were placed in a vacuum evaporator where they were first coated with a film of carbon, then plated with gold. Then they were examined with the Cameca MEB 07 scanning electron microscope. To make the photographing of the medial aspect of the right chelicera easier, the digits of the left chelicera were removed.

RESULTS

Investigations with the scanning electron microscope enabled us to observe facts of several orders.

The right pedipalp show long setae and the terminal cupule contains the 4th article with very short sensilla (Fig. 1). The hypostome comprises two clearly visible parts (Fig. 2 and 3). The arrangement of the large denticles in three rows is quite clearly visible (Fig. 3). The digits of the

Laboratoire de Parasitologie, U.E.R. Cordeliers 15, rue de l'Ecole de Médecine, 75, PARIS VIe, FRANCE.
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chelicerae show a relative complexity (Fig. 4). Figure 5 shows, besides a lateral inferior digit with a small blunt tranverse basal apophysis, a long, more anterior digit in medial position, that shows two points, as confirmed by Fig. 4.

The interest of this examination lies especially in the finding and observation of three lamellar formations. They start from the basis of the digits, at the extremity of the stalk or first article of the chelicerae, surrounded by the sheath of the latter.

1. In the medial part, there is a sheath or large medial lamella, whose lateral surface is hollowed in a groove which accomodates the basis of the long anterior digit that it covers dorsally. Its anterior inferior margin also ends in the form of a hook (Fig. 2, 4, 5). This medial lamella is almost entirely smooth. It shows only tiny, very thick denticles.

2. A middle lamella insinuates itself between the sheath or medial lamella and the lower part of the digits. This lamella appears to be hollowed in a groove in its medial part. It bristles with fine linear rugosities.

3. A short lower lamella spreads at the basis of the long medial digit and covers it. This lower lamella, lateral in relation to the other two, shows a surface bristling with fine, regularly scattered rugosities. It is characterized in particular by its margin, that carries denticles ending in spines, that are longer medially and decrease in size outwards.

DISCUSSION

1. It seems to us that the morphology of the chelicerae should complete the description of the species. If we refer to the latter such as it was given by Robinson, in 1926 [5] in his monograph on the genus *Amblyomma*, we must agree that the use of the morphology of the chelicerae would contribute usefully to the distinction of species. It would add to the use that could also be made of the morphology, number and distribution of the sensilla of the 4th article, that were described very well by Wooley [7,8]. As far as the digits are concerned, their relative length and the shape and number of denticles are worth noting. As regards the lamellar formations, it would be advisable to compare them between species in the same genus or between different genera.

2. If we compare the morphology of the chelicerae with that observed in scorpions, spiders or other Acari, we cannot but see to which extent the adaptation to the parasitic mode of life changed the primitive disposition in two opposing pincers. Here, the digits of the pincers became juxtaposed on the one hand and eversed laterally on the other hand. This supposes a double torsion, the former of which is that of the second article with its apophysis which primitively direct inwards rotated secondarily outwards. But, since the third article, that forms a mobile pincer and is normally directed outwards, is inserted on the second one, the torsion of the latter would have rotated it inwards. It therefore had to undergo in turn a torsion to resume its lateral position and add its action to the fixed digit of the second article, in order that, instead of being opposed, it should be juxtaposed and add its clinging action to that of the latter. This evolution towards specialization may make Ixodoidea appear as recently evolved forms.

3. However, the presence of lamellar formations at the basis and medial surface of the digits appears to us to be a primitive character subsisting in ticks, that would permit two orders of considerations.

First, these lamellar formations are reminiscent of the primitive arrangement of the appendices of Arthropode, with their exopodit and endopodit, such as it is present in primitive Arthropode of the Cambrian [6]. Because of the torsion, what appears to us to be in medial position would rather represent remnants of exopodit. Thus the homology of the chelicerae with the mouth parts of the crustaceans and insects seems to be more probable than with the antennae.

If such was the case, this interpretation would suggest that Acari are probably

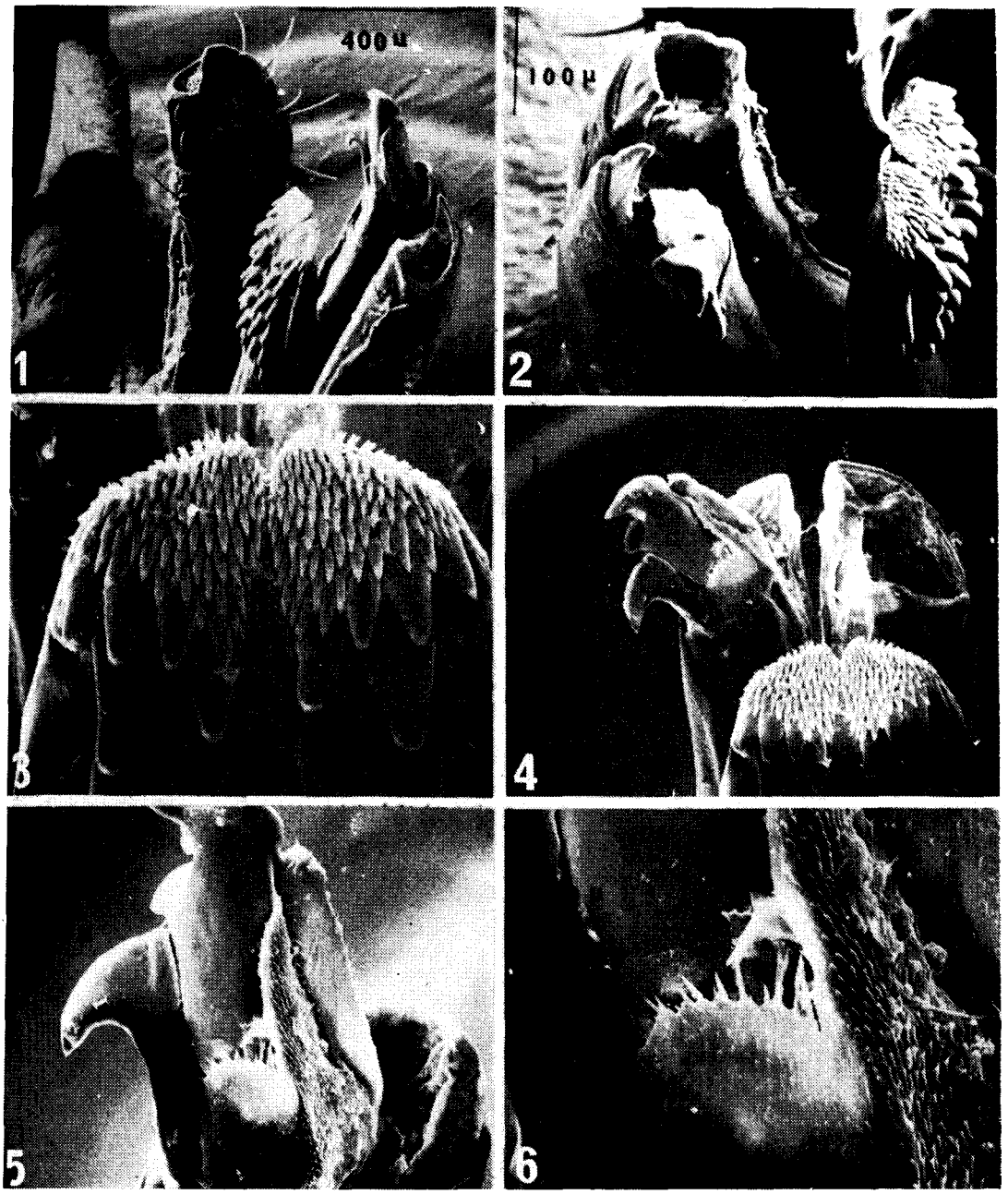

Fig. 1 — *Amblyomma cajennense*. Overall view on the left side of the extremity of the rostrum. Towards the middle, one sees the right palp with its setae and terminal cupule, in which is embedded the 4th article, some sensilla of which can be seen on the dark background of the border. More on the right and downwards, one sees the hypostome with its denticles; on the right, the two chelicerae. The digits of the left chelicerae were removed. *Fig. 2* — View on the right side of the two chelicerae and the hypostome. The digits of the right chelicera are turned down towards the bottom of the photograph. *Fig. 3* — View from the lower surface of the hypostome. *Fig. 4* — Overall view from the lower surface of the hypostome and of the two chelicerae. The chelicerae shows two digits. Three lamellar formations can be made out at the medial inferior surface. *Fig. 5* — Detailed view of the three lamellae (medial, middle and inferior) covering the basis and medial surface of the anterior digit. *Fig. 6* — Superficial ornamentation of the lamellae.

the earliest forms of Arachnids. Although scorpions are already observed in the Silurian, it is probable that that Acari preceded them and that only their small size and fragility did not allow a good preservation until now, because of metamorphism resulting from heat on the one hand and from the pressure existing in the deep layers of the earth's crust on the other hand. The small size of Acari also seems to corroborate their situation at the basis of the phylum of Arachnids since large forms are always characteristic of the end of evolution.

CONCLUSIONS

It seems that the morphology of ticks should always be completed by the description of the chelicerae. In view of the small size of the formations, the use of scanning electron microscope seems to us to be imperative. The description of the lamellar formations that we observed should be added to that of the digits if the distinction of the species is to be more precise. It was perhaps not forbidden to make apparently quite extensive considerations starting from so small morphological structures.

RESUMO

Chelicerae de Amblyomma cajennense *foram examinados em microscopia de varredura. Esta técnica mostrou detalhes não evidenciáveis ao poder de resolução do microscópio ótico.*

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