SCANNING ELECTRON MICROSCOPY OF THE TICKS IXODES LAGURI AND IXODES ARBORICOLA: SURFACE STRUCTURES OF HALLER’S ORGAN

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Abstract. The structure of Haller’s organ of two tick species was studied by means of scanning electron microscopy.

The structure of Haller’s organ has been studied by light microscopy by several authors. The morphology and phylogenetic importance of this organ in different tick genera was dealt with in the paper by Schulze (1941). The structure of Haller’s organ in different representatives of the genus Ixodes was described in detail by Arthur (1956). During the recent years, when the scanning electron microscopy has been applied in scientific investigations, some authors studied also finer structures and tried to explain the role of Haller’s organ and possible relationship between receptors and environment (Foelix and Axtell 1971, 1972). The surface structure of Haller’s organ in two Ixodes species of two different subgenera (Ixodes s. str. and Pholeoixodes) is described in the present paper. The structure of this organ has not yet been studied in these species.

MATERIAL AND METHODS

The specimens of Ixodes laguri and Ixodes arboricola were bred in the laboratory of the Institute of Parasitology, Czechoslovak Academy of Sciences. The ticks were fixed in 70 % ethanol, transferred through 80 %—90 %—100 % ethanol to Frigen 11 and dried in Frigen 23 using the critical point method (Cohen et al. 1968). A layer of gold (50—80 Å) was prepared using the sputtering method (Grasenik et al. 1972). The samples were examined with a Cambridge M 2 scanning electron microscope.

RESULTS

Haller’s organ consists of two main parts: anterior pit (Lees 1948), termed also accessory pit (Nuttall et al. 1908), „die Wanne“ (Schulze 1941), anterior trough (Arthur 1956) and capsule (or concavity). Several groups of sensilla are discernible; most important are the anterior pit setae and then, according to their location, the distal, lateral, posterior, medial („four-group“) and proximal ones (Foelix and Axtell 1972).

In case of Ixodes laguri larvae, there are 5 sensilla in anterior pit, arranged in two rows. In the row more distant from the capsule there is a markedly larger sensillum with blunt tip. Other four sensilla are of almost the same size, with distinctly pointed tip (Plate I,
Figs. 1, 2). The capsule is situated along the longitudinal axis of the tarsus. The capsule has a rounded outline with smooth distal part and fine finger-like projections on the proximal part. When viewed from above, one sensillum is distinctly visible inside the capsule; other sensilla are inconspicuous. Two distal setae are situated close to anterior pit. D₁ is markedly longer and stouter than D₂. Two lateral setae of the same length are situated on external sides of the elevation surrounding the anterior pit.

The anterior pit of *Ixodes laguri* nymphs contains six sensilla (Plate II, Fig. 2), one of which is markedly larger, blunt-tipped and situated aside from the others. The remaining five sensilla are of the same shape (Plate II, Fig. 3), with wider base and pointed tip. Proximally to anterior pit there is a rounded capsule (Plate II, Figs. 2, 3), which is of the same shape as that of the larva. A large blunt-tipped sensillum and several small sensilla are situated inside the capsule (Plate II, Figs. 2, 3, 4). Distal setae are four in number (Plate II, Fig. 2). Two of them, situated closer to anterior pit, are distinctly shorter and thinner, the other two, situated more distally, are large. Two lateral setae are well developed.

The nymphs of *Ixodes arboricola* possess also six sensilla inside the anterior pit. One of them differs from the others in its size and shape (Plate III, Fig. 2), but the difference is not so marked as in *I. laguri*. Other sensilla are of almost the same size, but they differ in their morphology. The largest sensillum (according to the nomenclature termed A₁) is cylindrical, tapering towards the tip and with sharply pointed tip. The capsule is situated in longitudinal direction with numerous meanders on both sides (Plate III, Figs. 1, 2). There are several sensilla inside it (Plate III, Fig. 2). Distal setae four, lateral two in number. Only one posterior seta and a group of four setae are visible in our micrographs.

The structure of Haller’s organ of *I. arboricola* male is the same as that of the nymph of the same species. In a detailed view of anterior pit the surface structure of individual sensilla is distinctly visible in this case (Plate IV, Fig. 2).

DISCUSSION

Sixl et al. (1973) studied by scanning electron microscopy the Haller’s organs of the representatives of three different tick species. They found that these organs differed in the shape of the capsule opening. The micrographs obtained by these authors and their further results show that in all representatives of the genus *Ixodes* the capsule opening has the shape of longitudinal slit, whereas in all other tick genera examined by SEM (*Amblyomma*, *Rhipicephalus*, *Dermacentor*, *Ornithodoros*) the opening of Haller’s organ has the shape of transverse slit situated proximally to anterior pit. In the species studied in the present paper the shape of capsule opening was identical in all studied stages of the same species, but different from that of the other species. Differences were also observed in the number of sensilla in anterior pit of larva and nymph of *Ixodes laguri*, where one more sensillum appeared during the development. Haller’s organ of the two species examined by us was compared with that of *Ixodes capromydis* studied by Černý et al. (1975). According to the description, Haller’s organs of *Ixodes laguri* and *Ixodes arboricola* possess more complete set of distal setae, whereas the number of sensilla in anterior pit is smaller by one sensillum than in *I. capromydis* (6—7) in the same developmental stages. Probably it will be possible to use the different morphology of parts of Haller’s organ as a criterion for differentiation of various tick species, but it will be necessary to consider also the variability of individual species (Arthur 1956).
REFERENCES


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Fig. 1. Haller's organ of Ixodes laguri larva (× 1,425).
Fig. 2. Haller's organ of Ixodes laguri larva (× 2,770).
Fig. 1. Haller’s organ of *Ixodes laguri* nymph (× 640).
Fig. 2. Haller’s organ of *Ixodes laguri* nymph (× 1,100).
Fig. 3. Haller’s organ of *Ixodes laguri* nymph (× 1,300).
Fig. 4. Haller’s organ of *Ixodes laguri* nymph (× 5,500).
Fig. 1. Haller’s organ of *Ixodes arboricola* nymph (×910).

Fig. 2. Haller’s organ of *Ixodes arboricola* nymph (×1,650).
Fig. 1. Haller's organ of *I. arboricola* male (× 780).

Fig. 2. Haller's organ of *I. arboricola* male (× 2,770).