HALLER'S ORGAN AND ANTERIOR PIT SETAE IN THE GENERA ANTRICOLA AND PARANTRICOLA (IXODOIDEA: ARGASIDAE)

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Abstract. The number of anterior pit setae in the genus Antricola is constant in all species examined and consists of 2 ± 8 setae arranged in anterior and posterior sections. The capsule of Haler's organ is completely closed with a circular integumental roof with small central opening. In Parantricola, the number of anterior pit setae varies between 8–10 and the capsule is entirely open and filled with numerous hairlike pleurocrysts. A small lateral chamber is developed for internal sensilla. The different evolutionary trends in the protection of internal sensilla in Antricola and Parantricola support the opinion about the different phylogenetic origin of these two genera.

Recent comparative studies of Haler's organ and adjacent setae in argasid ticks (Balashov and Leonovich 1977, Leonovich 1979, 1980, Clifford et al. 1983, Hoogstraal et al. 1982, 1984, Roskdy et al. 1984) demonstrated that these structures vary only slightly among species of one genus or subgenus and that there exist relatively clear structural differences on subgeneric or generic level. The main evolutionary trends in the structure of the capsule of Haler's organ correspond well with the present views on the systematics and evolution of the family Argasidae.

In the dendrogram of the superfamily Ixodoides Hoogstraal and Aeschlimann (1982) and Hoogstraal (1985) separate the genus Antricola (including Parantricola as a subgenus) in the subfamily Antricolinae, the position of which in the dendrogram is close to the subfamilies Nothospiracae and Otobinacae.

The Haler's organ roof and anterior pit setae of the genera Antricola and Parantricola, the curious and highly specialized inhabitants of bat guano in hot cave chambers, have not been studied up to now. This paper is therefore a contribution to the knowledge on the Haler's organ structure in these two genera which can help to elucidate their systematic position within the family Argasidae, the relationship between these genera and the evolution and evolutionary trends in the structure of Haler's organ in general.

MATERIALS AND METHODS

The Haler's organ of nymphal, male and female specimens of following species was studied in SEM and light microscope:

- Antricola habanensis Cruz, 1976, collected in Cueva del Mudo, Catalina de Guines, prov. Havana, Cuba.
- Antricola eurynoma Cruz, 1976, collected in Cueva de Santa Catalina, Marianas, prov. Matanzas, Cuba.
- Antricola sp. (probably an undescribed species), collected in Cueva de la Patana, Maús, prov. Guantanamo, Cuba.
- Parantricola monteiri (Banks, 1910), collected in Cueva de la Patana, Maús, Guantanamo, Cuba.

Ticks were collected from natural populations and conserved in 70% ethanol. For the SEM observations the material was dehydrated in alcohol series, then transferred into alcohol-chlorophorme
for 12 hours, cleaned with ultrasound and air-dried. Additional cleaning was made by dispersion clue Horkulus (Drumحيا Prada) according to the method of Corvin et al. (1979). Material coated with gold was examined in SEM Tesla BS 360. For the observations in light microscope, the tarsi I were dissected and mounted in medium of Swan and Hoyer.

RESULTS

No essential differences were found between sexes or among species within the genus in the structure of Haller’s organ roof and number and form of anterior pit setae. On the other hand, great differences were observed in the structure of these organs between the genera Antricola and Parantaricola.

Genus Antricola Cooley et Kohls, 1942

Anterior pit setae: In all species and sexes studied, ten setae of anterior pit are developed and arranged in anterior group of two setae (1 serrate and 1 setiform) and a posterior group of eight setae (1 conical, 3 porose, 2 fine and 2 grooved) (Fig. 1 A). The general form of anterior pit setae is therefore 2 + 8 but combinations, such as 2 + 7 or 3 + 8, were observed in exceptional cases (Pl. I, Figs. 3-6).

Haller’s organ: The capsule roof is solid, rounded, circularly grooved, open by small circular central orifice (Pl. I, Figs. 1—2). Numerous hairlike, simple or slightly bifurcated at the tip pleomorphs together with capsular sensilla can be observed by light microscope inside the capsule (Fig. 2 A).

Genus Parantaricola Černý, 1966

Anterior pit setae: No differences were observed in anterior pit setae between both sexes or nymphal stages. These setae number 8—10 in each stage studied and the anterior pit is not divided into anterior and posterior sections (Fig. 1B). Two grooved, 3 porose, 1 fine and 2—4 smooth, not differentiated setae are developed in the anterior pit (Pl. II, Figs. 3—6).

Haller’s organ: The capsule of the Haller’s organ is completely open, broadly rounded, with strong pronounced rim on the border (Pl. II, Figs. 1—2). Numerous hairlike simple pleomorphs fill completely the capsule. Three porose inner sensilla can be observed in a small lateral chamber of the capsule in light microscope (Fig. 2 B).

Fig. 2. Generalized structure of Haller’s organ capsule in Antricolineae. A — genus Antricola, B — genus Parantaricola.

DISCUSSION

The number of anterior pit setae in the family Argasidae is relatively constant on generic or subgeneric level, although some exceptions exist. The number of 10 sensilla in anterior pit which is characteristic for the genus Antricola resembles the Old World bat parasitizing subgenus Carios in which 3 porose setae also occur (Roshdy et al. 1984). Three porose setae are frequent also in subgenus Ornithodoros s. str. and Theridiosoma of the genus Ornithodoros s. lat. in which also 9—10 sensilla occur in anterior pit (Balashov and Leonovich 1977, Leonovich 1980), but the serrate and setiform setae are never separated in an anterior section of anterior pit as in the genus Antricola.

The anterior pit of the genus Parantaricola differs from that of the genus Antricola in some respects. Besides 3 porose, 2 grooved, and 1 fine setae, 2—4 sensilla without any discernible structure can be distinguished in the anterior pit. The number of setae varies between 8 and 10 and the anterior pit is never divided into anterior and posterior sections.

The structure of Haller’s organ capsule of the genus Antricola is strongly different from that of Parantaricola and structure of both is unique among all argasids. In both genera the capsule is broadly rounded, nearly completely taped by circular roof with a small opening in the centre in Antricola, and entirely open and surrounded by strong integumental band in Parantaricola. While in Antricola the inner sensilla surrounded by simple or slightly bifurcated pleomorphs can be observed on the bottom of the capsule, in Parantaricola the inner sensilla are situated in a small lateral chamber and the main capsule chamber is completely filled with simple hairlike pleomorphs.

Leonovich (1980) described the main evolutionary trends in the structure of the capsule of Haller’s organ in different genera and subgenera of argasids. Common trends to protect the delicate internal sensilla can be observed in Ornithodoros.
s. str. and Parastricola. In both of them the inner sensilla are situated in a separate lateral chamber and the main chamber is densely filled with numerous pleomorphs. While in Ornosthodors s. str. the growth of pleomorph density acts via their multiple dichotomy, in Parastricola the multiplication of simple, fine and hairlike pleomorphs takes place.

A large, virtually unroofed opening of Haller's organ capsule with somewhat thickened margins is present in the subgenus Opadenus of the genus Argus (Hooogstraal et al. 1984). Similarly as in Parastricola, the capsule in Opadenus contains a dense maze of fine hairlike pleomorphs. The microhabitat of the only known species of the Opa-
denus, Argus (O.) brumpti Neumann, 1907, the East-African prasite of terrestrial mammals (mostly Procaica spp.), is in soil. Thus, the soil habitat of Opadenus and bat guano habitat of Parastricola may cause the convergent evolution of Haller’s organ capsule. According to Hooogstraal et al. (1984) the unroofed Haller’s organ capsule is probably phylogenetically primitive and the soil habitat and unroofed Haller’s organ may be interrelated phylogenetic and biological factors.

The tendency toward the protection of inner sensilla of capsule by formation of solid capsule roof from surrounding integument without participation of pleomorph’s anatomy can be observed in Carus or Alocertus, but in both of these subgenera this process proceeds in antero-posterior direction resulting in the formation of a slitlike transverse fissure as the capsule opening (Leonovich 1980, Roshdy et al. 1984). Solid circular roof with a small opening in the centre is typical for Atricola and unique among argasids.

Cruz (1974) considers the genera Atricola and Parastricola to be of different phylectic origin. The common characteristics, such as presence of 3 pairs of postero
central setae in larvae, presence of marginal tubercles, no functional hypostome and similar structure of chelicerae etc. in adults and nymphs can represent the adaptive convergence only due to the similar mode of life (Cruz 1973). The different structure of Haller’s organ in these two genera, especially different evolutionary trends in protection of inner sensilla of the capsule, supports this opinion. In this respect the genus Parastricola appears to be phylogenetically more primitive.

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Figs. 1—6. Haller’s organ roof and anterior pit setae in the genus Anstricola. Fig. 1. Haller’s organ area on tarsus I of *A. occidentalis* male (×540). Fig. 2. Haller’s organ roof of *Anstricola* sp. male (×1,200). Fig. 3. Anterior pit setae (formula 2 + 8) of *A. occidentalis* male (×1,170). Fig. 4. Porose setae of *Anstricola* sp. male anterior pit (×5,800). Fig. 5. Anterior pit setae (formula 2 + 8) of *Anstricola* sp. male (×975). Fig. 6. Grooved setae of *A. occidentalis* male anterior pit (×4,300).

Figs. 1—6. Haller’s organ capsule opening and anterior pit setae in *Parastricola marginita*. Fig. 1. Haller’s organ area on male tarsus 1 (×210). Fig. 2. Opening of Haller’s organ capsule of nymph (×390). Fig. 3. Female anterior pit bearing eight setae (×430). Fig. 4. Porose setae of female anterior pit (×2,500). Fig. 5. Nymphal anterior pit bearing nine setae (×500). Fig. 6. Grooved setae of nymphal anterior pit (×2,500).