

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 Haller'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 pleomorphs. A small lateral chamber is developed for internal sensillae. The different evolutionary trends in protection of internal sensillae in *Antricola* and *Parantricola* support the opinion about the different phyletic origin of these two genera.

Recent comparative studies of Haller's organ and adjacent setae in argasid ticks (Balashov and Leonovich 1977, Leonovich 1979, 1980, Clifford et al. 1983, Hoogstraal et al. 1983, 1984, Roshdy 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 Haller's organ correspond well with the present views on the systematics and evolution of the family Argasidae.

In the dendrogram of the superfamily Ixodoidea 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 Nothoaspininae and Otobinae.

The Haller'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 Haller'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 Haller's organ in general.

MATERIALS AND METHODS

The Haller'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. Habana, Cuba.
Antricola naomiae Cruz, 1978, collected in Cueva de Santa Catalina, Camarioca, prov. Matanzas, Cuba.
Antricola cernyi Cruz, 1978, collected in Cueva de Castellanos, Rodas, prov. Matanzas, Cuba.
Antricola occidentalis Cruz, 1978, collected in Cueva de Los Majaes, San Andrés de Caguánabo, prov. Pinar del Rio, Cuba.

Antricola sp. (probably an undescribed species), collected in Cueva de la Patana, Maisi, prov. Guantánamo, Cuba.

Parantricola marginatus (Banks, 1910), collected in Cueva de la Patana, Maisi, Guantánamo, 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 glue Herkules (Druchema Praha) according to the method of Corwin et al. (1979). Material coated with gold was examined in SEM Tesla BS 300. 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 *Parantricola*.

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 formula 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 sensillae can be observed by light microscope inside the capsule (Fig. 2 A).

Genus *Parantricola* 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

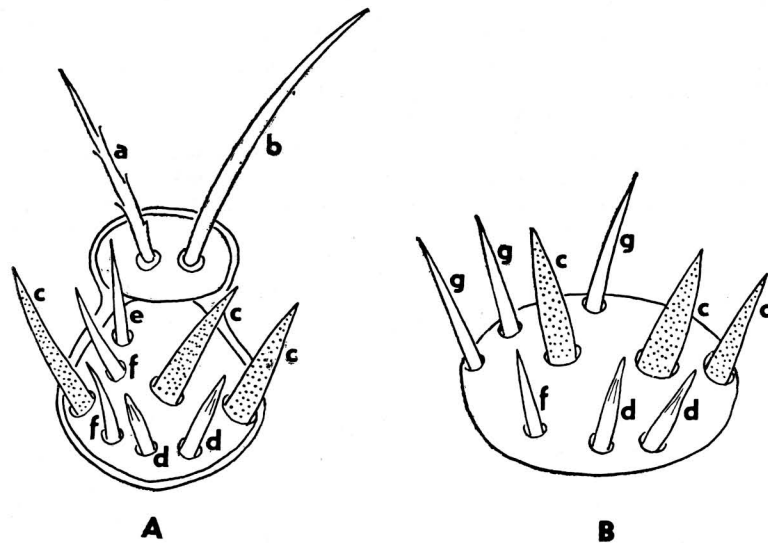


Fig. 1. Setal types in anterior pit of Antricolinae. A — genus *Antricola*, B — genus *Parantricola*. a — serrate, b — setiform, c — porose, d — grooved, e — conical, f — fine, g — not differentiated 1seta.

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 sensillae can be observed in a small lateral chamber of the capsule in light microscope (Fig. 2 B).

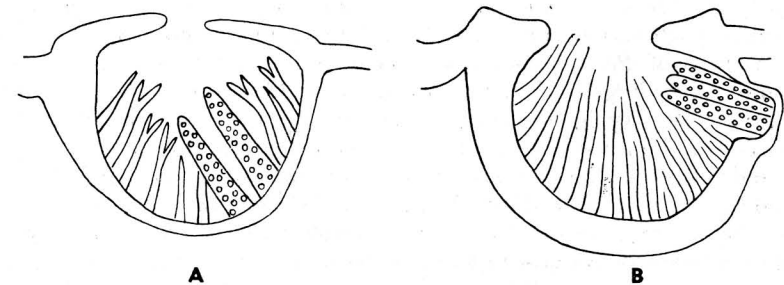


Fig. 2. Generalized structure of Haller's organ capsule in Antricolinae. A — genus *Antricola*, B — genus *Parantricola*.

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 sensillae 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 subgenera *Ornithodoros* s. str. and *Theriodoros* of the genus *Ornithodoros* s. lato in which also 9-10 sensillae 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 *Parantricola* differs from that of the genus *Antricola* in some respects. Besides 3 porose, 2 grooved, and 1 fine setae, 2-4 sensillae 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 *Parantricola* 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 *Parantricola*. While in *Antricola* the inner sensillae surrounded by simple or slightly bifurcated pleomorphs can be observed on the bottom of the capsule, in *Parantricola* the inner sensillae 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 sensillae can be observed in *Ornithodoros*

s. str. and *Parantricola*. In both of them the inner sensillae are situated in a separate lateral chamber and the main chamber is densely filled with numerous pleomorphs. While in *Ornithodoros* s. str. the growth of pleomorph density acts via their multiple dichotomy, in *Parantricola* 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 *Ogadenus* of the genus *Argas* (Hoogstraal et al. 1984). Similarly as in *Parantricola*, the capsule in *Ogadenus* contains a dense maze of fine hairlike pleomorphs. The microhabitat of the only known species of the *Ogadenus*, *Argas* (*O.*) *brumpti* Neumann, 1907, the East-African parasite of terrestrial mammals (mostly *Procavia* spp.), is in soil. Thus, the soil habitat of *Ogadenus* and bat guano habitat of *Parantricola* may cause the convergent evolution of Haller's organ capsule. According to Hoogstraal 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 sensillae of capsule by formation of solid capsule roof from surrounding integument without participation of pleomorph's anastomosis can be observed in *Carios* or *Alectorobius*, 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 *Antricola* and unique among argasids.

Cruz (1974) considers the genera *Antricola* and *Parantricola* to be of different phyletic origin. The common characteristics, such as presence of 3 pairs of postcoxal 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 sensillae of the capsule, supports this opinion. In this respect the genus *Parantricola* appears to be phylogenetically more primitive.

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ОРГАН ГАЛЛЕРА И ПЕРЕДНЯЯ ГРУППА СЕНСИЛ У РОДОВ *ANTRICOLA* И *PARANTRICOLA* (IXODOIDEA: ARGASIDAE)

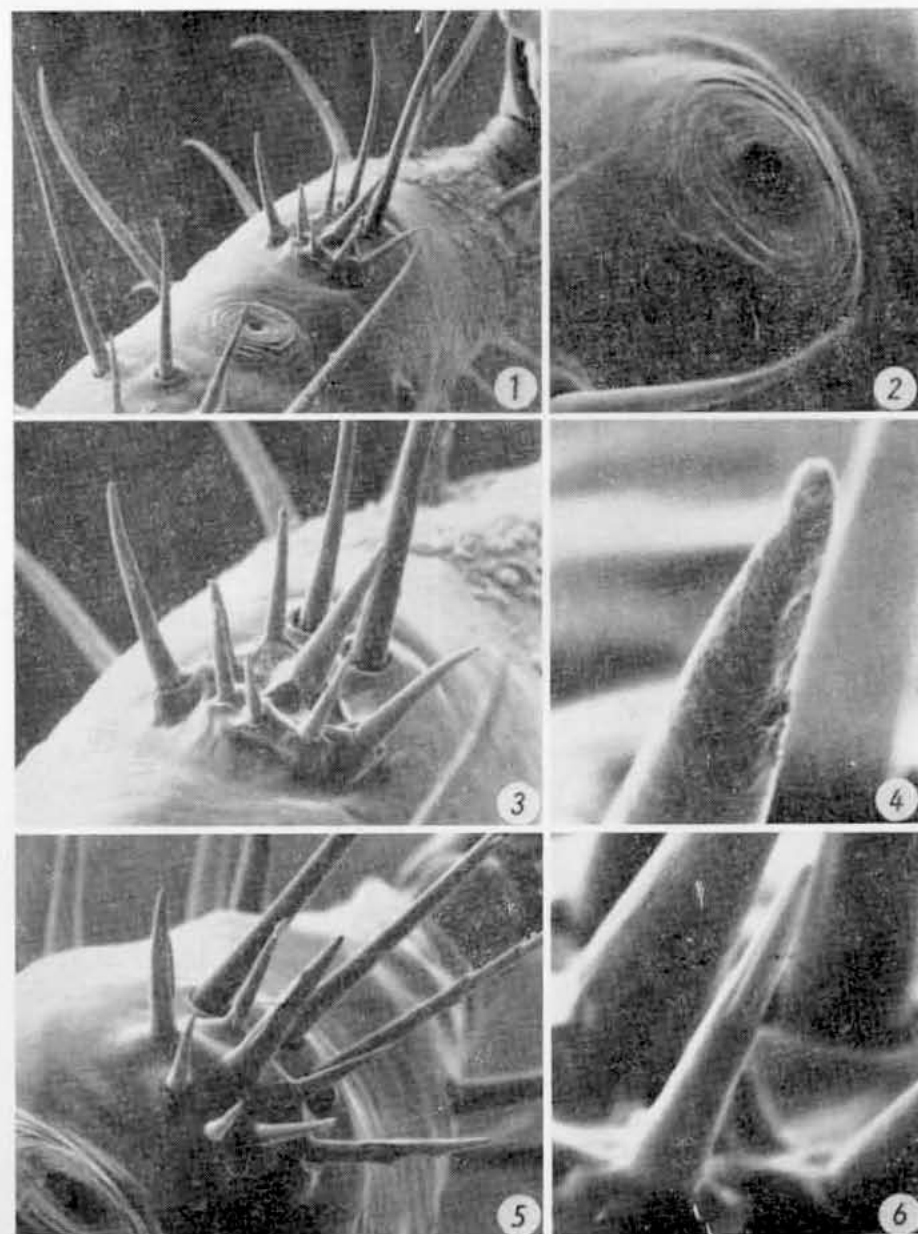
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Резюме. Количество сенсилл передней группы у рода *Antricola* одинаковое у всех изучаемых видов и состоит из 2 + 8 сенсилл, размещенных в передней и задней частях. Капсула органа Галлера полностью закрыта круглой интегументальной крышкой с небольшим центральным отверстием. У *Parantricola* 8—10 сенсилл передней группы и капсула вполне открыта и выполнена многочисленными волосовидными плеоморфами. Внутренние сенсиллы находятся в небольшой латеральной камере. Разные направления эволюции защиты внутренних сенсилл у родов *Antricola* и *Parantricola* поддерживают предположение о разном филогенетическом происхождении этих двух родов.

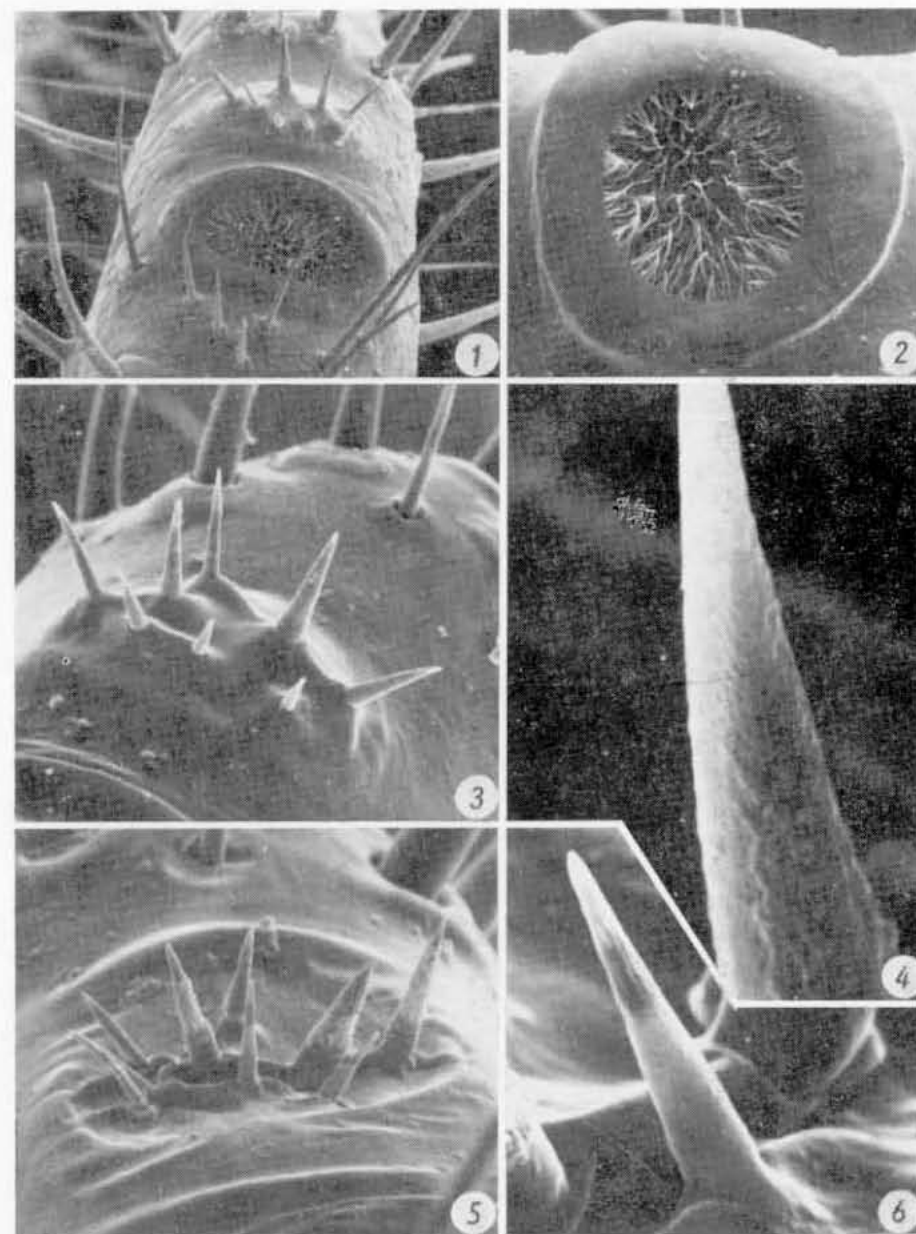
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Figs. 1—6. Haller's organ roof and anterior pit setae in the genus *Antricola*. Fig. 1. Haller's organ area on tarsus I of *A. occidentalis* male ($\times 540$). Fig. 2. Haller's organ roof of *Antricola* sp. male ($\times 1,200$). Fig. 3. Anterior pit setae (formula 2 + 8) of *A. occidentalis* male ($\times 1,170$). Fig. 4. Porose seta of *Antricola* sp. male anterior pit ($\times 5,850$). Fig. 5. Anterior pit setae (formula 3 + 8) of *Antricola* sp. male ($\times 975$). Fig. 6. Grooved seta of *A. occidentalis* male anterior pit ($\times 4,300$).



Figs. 1—6. Haller's organ capsule opening and anterior pit setae in *Parantiricola marginatus*. Fig. 1. Haller's organ area on male tarsus I ($\times 210$). Fig. 2. Opening of Haller's organ capsule of nymph ($\times 390$). Fig. 3. Female anterior pit bearing eight setae ($\times 430$). Fig. 4. Porose seta of female anterior pit ($\times 2,500$). Fig. 5. Nymphal anterior pit bearing nine setae ($\times 590$). Fig. 6. Grooved setae of nymphal anterior pit ($\times 2,500$).