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A NEW LOCATION AND TYPE OF PSEUDOCELLI IN *ONYCHIURUS* SPP. (COLLEMBOLA, ONYCHIURIDAE)

by

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SUMMARY

A simple, new type of pseudocelli was found in *Onychiurus armatus* and *O. granulosus*. It is located on trochanter of each pair of legs. The trochanteral pseudocellus differs from pseudocelli on other parts of body by the smaller size, by the missing circular furrow separating it from the surrounding integument, and by the missing endocuticular ring. The morphology of these pseudocelli is derived from the primary granulation of the integument. The pseudocellar ribs are longitudinally enlarged primary granules and the pseudocellar lid is formed by the enlarged inner surface of the polygons of primary granulation. The pseudocellar medial groove has its origin in the reduced primary granules and their connectives and has a predisposition to split. No pseudocelli were found on the legs in *Tetrodontophora bielanensis*, *Mesaphorura hylophila* and *Paratullbergia callipygos*.

INTRODUCTION

At the IVth Colloquium on Apterygota at Mogilany in 1979 RUSEK and WEYDA (1981) described the outer morphology of different known types of pseudocelli in Onychiuridae and their ultrastructure in *Onychiurus armatus*. The morphology of these secretory organs is most complex in members of the subfamilies Onychiurinae and Tetrodontophorinae, where the pseudocelli are sharply separated by a circular deep furrow with primary or low secondary granules from the surrounding integument covered with coarse secondary granules. The pseudocellar lid of this type of pseudocelli is without granules and bears 6 + 6 to 20 + 20 ribs which touch the medial shallow groove.

The location of pseudocelli on the body surface and their numbers are well known in the taxonomic literature (STACH, 1954; GISIN, 1960). They are present at the base of antennae, the dorsal and ventral surfaces of head, thorax and abdomen and the base of legs where there are located on the anapleurite. In Paleotullbergiinae and Pachytullbergiinae the pseudocelli are probably missing. Their number is low in Tullbergiinae, where they are present only on the dorsal side of body and are entirely missing on the ventral side and on the base of the legs. In Tetrodontophorinae their number is higher and in Onychiurinae some species have the highest number of all.

The pseudocelli have a much simpler outer morphology in Tullbergiinae than in Onychiurinae and Tetrodontophorinae. These secretory organs are not separated

by a circular deep furrow from the surrounding integument in Tullbergiinae. In Tetrodontophorinae and Onychiurinae only pseudocelli surrounded by a circular furrow are known which form a sharp border distinguishing them from the surrounding coarse granulated integument. They have an endocuticular ring (RUSEK and WEYDA, 1981) visible with the light microscope. In the same species or genus we know only the identical type of pseudocelli. Two types of pseudocelli never occur in the same species.

MATERIAL AND METHODS

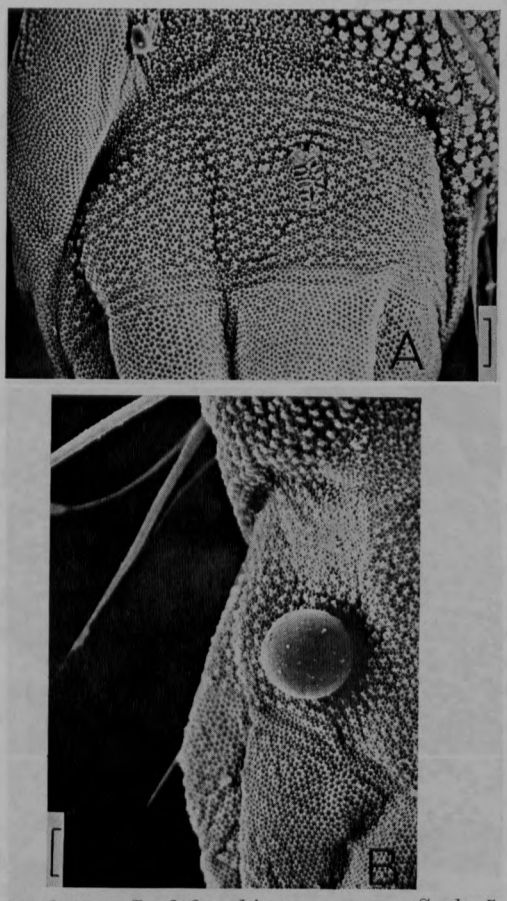
Onychiurus armatus (TULLBERG, 1869) GISIN, 1956, *Onychiurus granulosus* STACH, 1930, *Tetrodontophora bielanensis* (WAGA, 1842), *Mesaphorura hylophila* RUSEK, 1982 and *Paratullbergia callipygos* (BÖRNER, 1902) were obtained from soil samples from a spruce and beech forests at Jevany, about 30 km east of Praha. After extraction of soil samples in the Tullgren apparatus the animals were fixed in 96 % ethyl alcohol. The SEM micrographs were obtained from critical-point dryed and gold coated specimens using Tesla SEM BS 300.

RESULTS AND DISCUSSION

During SEM morphological studies of Onychiuridae a new type of pseudocelli was found on a surprising area of *Onychiurus armatus* and *Onychiurus granulosus*. These pseudocelli are the simplest known in Onychiurinae and they are located on the outer side on the trochanter I-III (Pl. I, A). They are not as clearly visible as the normal type of pseudocelli located on the other parts of body and only the exuded spherical drops on one specimen (Pl. I, B) led to their discovery. These pseudocelli have a simpler morphology than the normal ones and they are not separated from the surrounding integument by a circular furrow. The internal ultrastructure may also exhibit a simpler composition. These pseudocelli lie almost in the centre of the outer side of each trochanter.

In *Onychiurus armatus* the rochanter has simpler granulation than the basal part of legs (Pl. I, A). Only 2-4 from the 6-7 primary granules arranged into hexa- or heptagonal patterns are slightly enlarged. On the femora only small primary granules occur (Pl. I, A) while all of the hexa- and heptagonal patterns on the trochanter have no enlarged primary granules. The pseudocellus on the trochanter is elliptical, 4.2 - 5.7 μm long and 3 μm wide (Ps. I A, II A) and it is not separated from the surrounding primary granulated integument by any furrow as in the normal type of pseudocelli. The pseudocellar lid bears 7 + 7, 8 + 8 or 7 + 8 ribs. This simple type of pseudocelli allows us to explain the origin of the ribs, as well as the surface morphology of the pseudocelli. The ribs have their origin in the primary granules. The granules have been enlarged in one direction only (Fig. 1 B). This is different from the case of regularly enlarged triangular granules (Fig. 1 C). The longitudinal enlargement of some primary granules resulted in enlargement of the inner surface of the polygons. The same process occurred with the opposite and some adjoining polygonal patterns. Where the opposite patterns touch each other a shallow medial groove arises from the connectives and the reduced primary granules. It is in this way that the most primitive pseudocellus in *Onychiurus* has developed. The medial groove has a predisposition to split (Pl. II, A) in the same way as the normal type of pseudocelli, but the ruptures of the trochanteral pseudocelli precede those on the body.

PLATE I

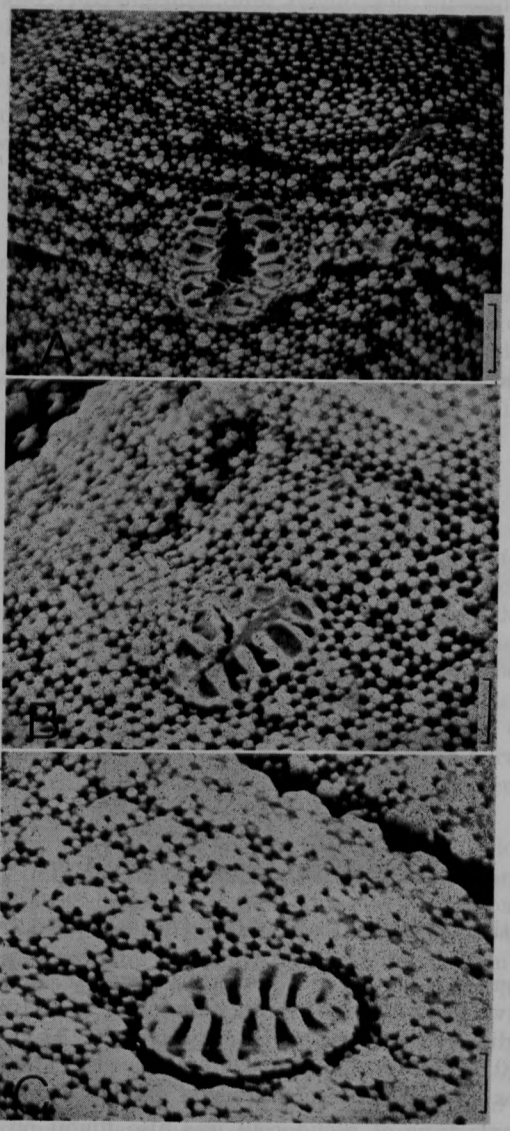


A : pseudocellus on trochanter I of *Onychiurus armatus*. Scale 5 μm. B : exuded drop of excretion on trochanter II of *Onychiurus armatus*. Scale 5 μm.

Some measurements of the morphological structures on trochanter in *Onychiurus armatus* give the following results : diameter of polygons of primary granulation 0.75 μm, diameter of small primary granules 0.13 μm, diameter of enlarged primary granules 0.38 - 0.50 μm, lenght of pseudocellar ribs 0.60 - 0.90 μm, width of pseudocellar ribs 0.25 - 0.30 μm, diameter of exuded drops 7.8 - 8.1 μm.

The same simple type of pseudocelli was also found on the trochanter I-III in *Onychiurus granulosus*. They occur in the centre of the outer side of the trochanter and they are not separated from the surrounding primary granulated integument by a circular furrow (Pl. II, B). The pseudocellus is almost circular, 5 μm in diameter, and it is smaller than the pseudocelli on the body surface with a diameter 6.6 μm. The trochanteral pseudocelli bear 5 + 5, 6 + 6 or 5 + 6 wide ribs on the lid. The ribs in this Onychiurus species also have their origin in the primary granules, but in the enlarged rather than the small ones (Fig. 1 C, D). The ribs are from this reason wider (0.20 - 0.55 μm) than in *Onychiurus armatus* (0.25 - 0.30 μm). The pseudocellus is surrounded also in *O. granulosus* by pentagonal-heptagonal

PLATE II



A : split pseudocellus on trochanter II of *Onychiurus armatus*. Scale 2 μm. B : trochanteral pseudocellus of *Onychiurus granulosus*. Scale 2 μm. C : pseudocellus from the anapleurite II of *Onychiurus granulosus*. Scale 2 μm.

patterns of primary granulation, but most of the primary granules are enlarged in this species (Pl. II). The origin of the trochanteral pseudocelli is the same as in *O. armatus*. The pseudocelli on the body surface and on the base of the legs (Pl. II C) are larger and are separated from the surrounding secondary granulated integument by a deep circular furrow with primary granulation.

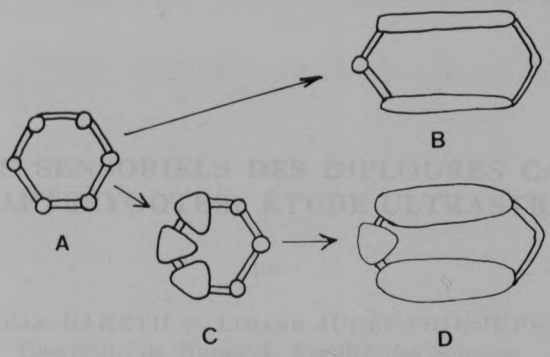


Fig. 1. — Origin of the pseudocellar ribs from the small primary granules (A → B) or enlarged primary granules (C → D).

Some measurements of the morphological structures on trochanter in *Onychiurus granulosus* give the following results : diameter of polygons of primary granulation 1 μm, diameter of small primary granules 0.20 μm, diameter of enlarged primary granules 0.45 μm, lenght of pseudocellar ribs 1.5 μm, width of pseudocellar ribs 0.20 - 0.55 μm.

The trochanteral pseudocelli were not found in *Tetrodontophora bielanensis*, *Mesaphorura hylophila* and *Paratullbergia callipygos*.

The inner ultrastructure of the trochanteral pseudocelli was not studied, but from observations with the light microscope the absence of the endocuticular ring was observed. The drops of exuded fluid indicate their excretory function, as was shown for the normal type of pseudocelli (Rusek and Weyda, 1981).

CONCLUSION

A simple type of pseudocelli was found on trochanter I-III in *Onychiurus armatus* and *Onychiurus granulosus*. The simple morphology of these pseudocelli has allowed to explain the phyletical origin of some external pseudocellar structures. External morphology of pseudocelli is derived from the primary granulation of integument. The pseudocellar ribs are longitudinally enlarged primary granules and the pseudocellar lid is derived from the enlarged inner surface of the polygons of primary granulation. The pseudocellar medial groove has its origin in the reduced primary granules and their connectives. The basic external structures of the more complicated pseudocelli on the body surface of *Onychiurus* spp. and *Tetrodontophora bielanensis* have also the same origin as the described simple trochanteral pseudocelli. No pseudocelli were found on the legs in *Tetrodontophora bielanensis*, *Mesaphorura hylophila* and *Paratullbergia callipygos*.

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