

Preliminary notes on the external proprioceptor organs of Cicadomorpha

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Abstract

The hair sensilla and the campaniform sensilla, grouped together in well definite sensorial areas in 12 species of Cicadomorpha (Insecta Hemiptera), are investigated. We reported 31 external proprioceptor organs (EPO), 17 with hair sensilla and 14 with campaniform sensilla. In Cicadomorpha only 5 of the 31 EPOs (16.1%) are conserved in all examined species: two organs with hair sensilla on the legs and three organs with campaniform sensilla (two on the legs and one at the base of the hindwings). Often the EPOs are reduced and in some taxa (species, genera or family) the degree of the reduction led to the disappearance of the organ.

Key words: Mechanoreceptors, Cercopidae, Cicadidae, Membracidae, Cicadellidae.

Introduction

The external proprioceptor organs (EPO) are formed by mechanoreceptors type I with an external cuticular apparatus: hair sensilla and campaniform sensilla, grouped together in well definite sensorial areas.

The EPOs are located in or near the joint membranes or in cuticular areas of parts of the body which come into contact to other portions during the movements. They monitor the relative positions of various parts of the body in relation with the gravity, the modifications of their mutual positions, or the contact of the one with the other by distortions of the cuticle (campaniform sensilla) or the movement of the seta (hair sensilla). The EPOs are called "hair plates" (HP) or "hair rows" (HR), if the hair sensilla are grouped respectively in circular or oval areas, or arranged in rows. Although according to Gnatzy *et al.* (1987), a group of campaniform sensilla is formed at least by 3 very close sensilla, we consider as EPOs not only the group of 3 or more both campaniform and hair sensilla (not more than 100 μm apart), but also if 1 or 2 sensilla are present in the same positions where other species show organs with higher number of sensilla. All the studied orders of Insects have EPOs. Up to now, in Auchenorrhyncha, Müller (1941) reported a hair plate on the IX valvifer of some species and D'Urso and Ippolito (1988) investigated the EPOs occurring all along the body of *Cicadella viridis* (L.); the results of a PhD thesis on EPOs of the Auchenorrhyncha are here partially reported (Chiarenza, 2006).

Materials and methods

Male and female adult specimens of 5 species of Cercopidae, 1 species of Cicadidae, 1 species of Membracidae, 6 species of Cicadellidae were treated with 10% KOH solution; some specimens were tried for the observation by light microscopy and other by SEM. The EPOs present all along the body are identified.

Results and discussion

EPOs with hair sensilla and campaniform sensilla are present in all the examined species. The HP and the HR near the joints are stimulated by the folds of the articular membrane during the movements and are involved in their control. Those located far from the joints, are stimulated by cuticular areas which come into contact with them. The EPOs with campaniform sensilla are located in cuticular areas subject to tractions and deformations, as a consequence of the articular movements.

The hair sensilla observed have an external apparatus consisting of a seta joined to a raised cuticular ring; sometimes at the base the seta the opening of the ecdysial canal is visible. The lengths of the hair sensilla observed in Cicadomorpha range between 10 and 68 μm . Within the same hair plate sensilla of different length can be present, in the hair rows they are almost of the same length.

The campaniform sensilla, show a cuticular apparatus with a convex cap surrounded by a cuticular ring (collar). The cap can be either raised or almost flat and shows a central depressed area with the opening of the moulting canal connected to dendrite below. These sensilla have a round (type A) or an ovoid shape (type B). The diameter of campaniform sensilla range between 5 μm (type A) and 25 μm (type B, wider diameter).

The locations of EPOs, and the number of sensilla do not differ significantly in both sexes with exception of those of the genital region. As the number of sensilla is concerned, each type of EPO has a different range of individual variability, larger for the EPOs of the wings and of the genital regions, but of the same degree in males and females.

In Cicadomorpha we reported 31 EPOs, 17 with hair sensilla and 14 with campaniform sensilla. The greatest number of EPOs is present on the legs (13), followed by that on the wings (8) (table 1).

Our observations, integrated with the scarce data from the literature, show that some EPOs are always present in all examined species of Cicadomorpha. They are the hair plate icoxHP on the coxae and trHP on the tro-

chanters of all legs (trHP is reduced only in Typhlocybinae). Among the EPOs with campaniform sensilla only trCS1 and trCS3 on the trochanters of all legs and hwCS2 located at the base of the hindwings, are always present.

Table 1. List of the EPOs of Cicadomorpha localized on the coxa (cox), trocanther (tr), fore wing (fw), hind wing (hw), abdomen (ab), paramera (p), male genital block (g), second valvifer (v2), anal tube (at), dorsal valva of XI segment (XIs); + presence in all taxa; * presence in some taxa; - absent. The EPOs of the 3 pairs of legs in the three columns are indicated.

	HP and HR			EPO with CS			
icoxHP	+	+	+	trCS1	+	+	+
ocoxHP	*	*	*	trCS2	*	*	*
coxHP1	-	-	*	trCS3	+	+	+
coxHP2	-	-	*	fCS1	*	*	*
coxHP3	-	-	*	fCS2	-	-	*
trHP	+	+	+	tCS	*	*	*
tHP2	-	-	*	fwCS1	*		
fwHR			*	fwCS2	*		
hwHP			*	fwCS3	*		
abHR			*	fwCS4	*		
abHR1			*	hwCS1	*		
abHP			*	hwCS1dors.	*		
pHP♂			*	hwCS2	+		
gHP			*	v2CS	*		
v2HP			*				
atHP			*				
XIsHP			*				

Some EPOs, as the hair plate coxHP1, coxHP2, coxHP3 on the coxae of the 3rd legs and hwHP on the hindwings, are exclusive to the family Cicadellidae.

In conclusion only few EPOs are present in all examined species of Cicadomorpha; often the EPOs are reduced and in some taxa (species, genera or family) the degree of the reduction led to the disappearance of the organ. In Cicadomorpha only 5 of the 31 EPOs (16.1%) are conserved in all examined species.

References

- CHIARENZA D., 2006.- Gli organi propriocettori esterni degli Auchenorrhyncha (Insecta, Rhynchota): morfologia, funzione e significato filogenetico. 159 p., *Doctoral thesis* Università di Catania, Italy.
- D'URSO V., IPPOLITO S., 1988.- Proprioceptor organs in *Cicadella viridis* (L.) (Homoptera: Cicadellidae).- *International Journal Morphology & Embriology*, 17 (4/5): 381-391.
- GNATZY W., GRÜNERT U., BENDER M., 1987.- Campaniform sensilla of *Calliphora vicina* (Insecta, Diptera) I topography.- *Zoomorphology*, 106: 312-219.
- MÜLLER H. J., 1941.- Über Bau und Funktion des Legeapparates der Zikaden (Homptera Cicadina).- *Zeitschrift für Morphologie und Ökologie der Tiere*, 38 (3): 534-629.

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