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A COMPARISON OF SOME DIAGNOSTIC FEATURES OF HOPLOPLEURA ACANTHOPUS AND H. EDENTULA (ANOPLURA: HOPLOPLEURIDAE) UNDER SCANNING ELECTRON MICROSCOPE

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Abstract. The surface diagnostic features of *Hoplopleura acanthopus* (Burmeister, 1839) and *H. edentula* Fahrenholz, 1916 were studied under SEM. Differences in morphology of particular paratergal plates were demonstrated and described. The most discernible and reliable diagnostic features were found to be the differences in the shape of particular paratergal plates and in the length and thickness of setae on them. No differences were detected in the morphology of the paratergal plates 7 and 8 and the sternal plate in both sexes. On the basis of results obtained the well-founded existence of *H. edentula* as a distinct species was confirmed.

The lice of the genus *Hoplopleura* parasitizing rodents of the genus *Microtus* (Microtinae) are morphologically closely related. This fact has been the reason why until recently, the louse parasitic on the voles *Microtus arvalis* and *M. agrestis*, has been considered to be the identical species with that occurring on the bank vole *Clethrionomys glareolus*. It was not until 1966 that Beaucournu, after studying in detail its morphology, demonstrated *Hoplopleura edentula* parasitic on the bank vole to be a distinct species. Until then this species was considered as a subspecies of the species *Hoplopleura acanthopus* described by Fahrenholz in 1916. The occurrence of the species *H. edentula* in the territory of Czechoslovakia was reported by Černý (1971).

H. edentula is a boreo-alpine species (Beaucournu 1968, Mahnert 1971) which is a dominant louse on *C. glareolus* in higher altitudes in Czechoslovakia. In lower altitudes, however, it is rarely encountered and is partly substituted by *H. acanthopus* (Kohn 1980). With regard to their possible joint occurrence on hosts and to the fact that morphological differences are slight, a reliable differentiation of the two mentioned species is very important. Such a differentiation has been the main purpose for comparing the morphological diagnostic features under SEM, as described in the present paper.

MATERIALS AND METHODS

The material of *H. edentula* species was obtained from the hair of *C. glareolus* trapped in the higher elevated localities in the district of Tachov (Western Bohemia): Apolénský vrch, Pořejov. The *H. acanthopus* material was collected from the hair of *M. arvalis* trapped in the same district at the Sytno locality.

The collected lice were put in test tubes with 80 % alcohol and later identified under optical microscope.

The material fixed in 80 % alcohol, intended for our studies under SEM, was transferred to 100 % alcohol and then to 100 % acetone. The dehydrated specimens were dried up by method of critical point of CO_2, stuck to discs, gold-coated and examined under the scanning electron microscope Tesla BS 300.

RESULTS

Beaucournu (1968) reported as main diagnostic features the structure of the male copulatory organ and the shape of some paratergal plates in both sexes. However, we observed no marked differences in the surface structure of the male copulatory organ to be of any use for practical determination.

The sternal plate in the two species and both sexes appeared rather variable as far as the shape and dimensions were concerned, only in the female of *H. edentula* it was somewhat wider than in *H. acanthopus*. The ratio of width to length in specimens studied was 1 : 2.3 for *H. acanthopus*; 1 : 2.1 for *H. edentula*. Due to the fact that this difference was difficult to demonstrate, neither the shape nor the size of the sternal plate could be used as a reliable diagnostic feature for determination.

The most discernible and most reliable diagnostic features were found to be the differences in the shape of particular paratergal plates and in the length and thickness of setae on them.

Below is a survey of differences in the morphology of paratergal plates visible under SEM, showing especially in the shape of caudal projections on the dorsal and ventral sides (Plates I—IV):

Females

Dorsal part of paratergal plates

	H. acanthopus	*H. edentula*
1st	paratergal plate has the shape of an elongated triangle, the ratio of the shortest to longest side being about 1 : 2.7 (Plate I, Fig. 1)	— the triangle-shaped 1st paratergal plate is less elongated. The ratio of the shortest to longest side is 1 : 2.2 (Plate I, Fig. 2)
2nd	paratergal plate — caudal projection long, thin, straight (Plate I, Fig. 1)	— caudal projection shorter, wider, with blunt end, and somewhat bent (Plate I, Fig. 2)
3rd	paratergal plate — caudal part in the shape of a slim tooth; long, tapered to point; seta in its central part stout, short, reaching about two thirds of length of caudal part of paratergal plate (Plate I, Fig. 3)	— caudal part wide, obliquely cut at end; seta stout, long, exceeding in length the caudal end of paratergal plate (Plate I, Fig. 4)
4th	paratergal plate — caudal part somewhat narrowed at base, its posterior margin dentated, elongated below into a short projection (Plate II, Fig. 1)	— caudal part evenly wide, its posterior margin almost smooth, also elongated below into a short projection (Plate II, Fig. 2)
5th	paratergal plate — posterior margin of caudal part obliquely cut and passing more or less continually into a pointed projection (Plate II, Fig. 1)	— caudal part distinctly wider, its posterior margin running more than two thirds as the perpendicularly cut margin to outer margin, ending with a pointed projection (Plate II, Fig. 2)
6th	paratergal plate — caudal part shaped as an elongated triangle, seta in central part stout, long, reaching as far as the top of the said triangle (Plate II, Fig. 3)	— caudal part in the form of trapezium; seta in central part thin, short, at most reaching the half of trapezium-like part of paratergal plate (Plate II, Fig. 4)

Ventral part of paratergal plates

2nd	paratergal plate — its thorn-like elongated part arching toward ventral side and altogether somewhat longer than that in *H. edentula* (Plate III, Fig. 1)	— thorn-like elongated part almost straight, following anterior margin of 3rd paratergal plate; on the whole it is shorter (Plate III, Fig. 2)
3rd	paratergal plate — its caudal end moderately concave, similarly as in males (Plate III, Fig. 3)	— distal end without any concave shape (Plate III, Fig. 4)
4th	paratergal plate — its caudal part elongated below into a projection which is about as long as caudal part is wide; seta in central part stout (Plate III, Fig. 3)	— the projection is as long as the half width of caudal part; seta in central part is thin (Plate III, Fig. 4)
5th	paratergal plate — its caudal part in the shape of trapezium; seta in central part considerably stout (Plate III, Fig. 5)	— posterior margin concave and elongated below; central seta thin, needle-like (Plate III, Fig. 6)

6th paratergal plate—the differences are similar to those on the dorsal part of paratergal plates (Plate III, Figs. 5,6)

Males

Dorsal part of paratergal plates

	H. acanthopus	*H. edentula*
1st	paratergal plate—the differences are similar to those in females (see above). In the morphology of the remaining paratergal plates viewed from dorsal side no marked differences are seen.	

Ventral part of paratergal plates

2nd paratergal plate—the differences are quite similar to those in females (see above)

3rd	paratergal plate — its caudal end moderately concave, in form reminding of fish tail (Plate IV, Fig. 1)	— caudal end is obliquely cut, no concave shape is seen (Plate IV, Fig. 2)
4th	paratergal plate — its caudal end only slightly concave symmetrically; seta in central part stout, pole-like, almost reaching the caudal end (Plate IV, Fig. 1)	— indentation in caudal end is deeper and asymmetrically placed, shifted toward the bottom margin; seta in central part thin, needle-like, not reaching the caudal margin (Plate IV, Fig. 2)
5th	paratergal plate — the seta is stout, tapered to end, long, reaching as far as the end of elongated bottom part of paratergal plate (Plate IV, Fig. 3)	— the seta thin, needle-like, reaching only the half or two thirds of elongated bottom part of paratergal plate (Plate IV, Fig. 4)
6th	paratergal plate — its bottom part in the form of elongated projection	— paratergal plate terminated in triangle-like projection gradually tapering

which is obliquely cut; seta stout, very long, considerably exceeding the caudal part of paratergal plate (Plate IV, Fig. 3)

to tip from base; seta thin, needle-like, reaching about the half of projection (Plate IV, Fig. 4)

DISCUSSION

Detailed morphological studies of the form of paratergal plates have shown a number of differences between the specimens of the species *Hoplopleura acanthopus* and those of *H. edentula*. According to our observations the diagnostic features are on the whole constant and within the framework of one species only negligible deviations have been seen.

Unlike the Beaucournu's study (1968), carried out under optical microscope and presenting only a general characterization of paratergal plates for both sexes, we observed differences in the form of almost all paratergal plates in females as well as males. However, the scale-like structure of caudal ends of some paratergal plates in *H. edentula* females, as emphasized in the drawings, cannot be confirmed. According to our observations the scale-like structure of paratergal plates is developed all over their area and in both species. It is likely not discernible under optical microscope, but electron-microscopic photographs testify to its development.

On the whole, there is a number of more marked diagnostic features to be seen on paratergal plates of females. The characters recorded on the copulatory organs of males are indiscernible under SEM; to utilize these diagnostic features it is necessary to examine the cleared microscopic preparations under optical microscope because surface structures are not involved here.

A large number of the demonstrated differences, their constancy as well as the differences in ecology prove the well-founded rank of *H. edentula* as a distinct species.

According to the data obtained by us the best diagnostic features applicable for practical differentiation of both species is the morphology of caudal part of paratergal plates 3—6 and the setae on them. While in females the ventral as well as dorsal sides of body can be used for determination, in males the salient differences are discernible only on the ventral surface.

СРАВНЕНИЕ НЕКОТОРЫХ ПРИЗНАКОВ У ВИДОВ *HOPLOPLEURA ACANTHOPUS* И *H. EDENTULA* (ANOPLURA: HOPLOPLEURIDAE) В СКАНИРУЮЩЕМ ЭЛЕКТРОННОМ МИКРОСКОПЕ

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Резюме. В сканирующем электронном микроскопе изучали поверхностные признаки видов *Hoplopleura acanthopus* (Burmeister, 1839) и *H. edentula* Fahrenholz, 1916. Обнаружены и описаны разницы в морфологии отдельных паратергальных пластинок. Лучше всего видимыми и самыми достоверными признаками являются различия в форме отдельных паратергальных пластинок и в длине и толщине вырастающих на них щетинок. Однако, не были обнаружены различия в морфологии седьмого и восьмого паратергальных пластинок и стернальной пластинки у обоих полов. На основании полученных результатов была подтверждена обоснованность существования вида *H. edentula* в качестве самостоятельного вида.

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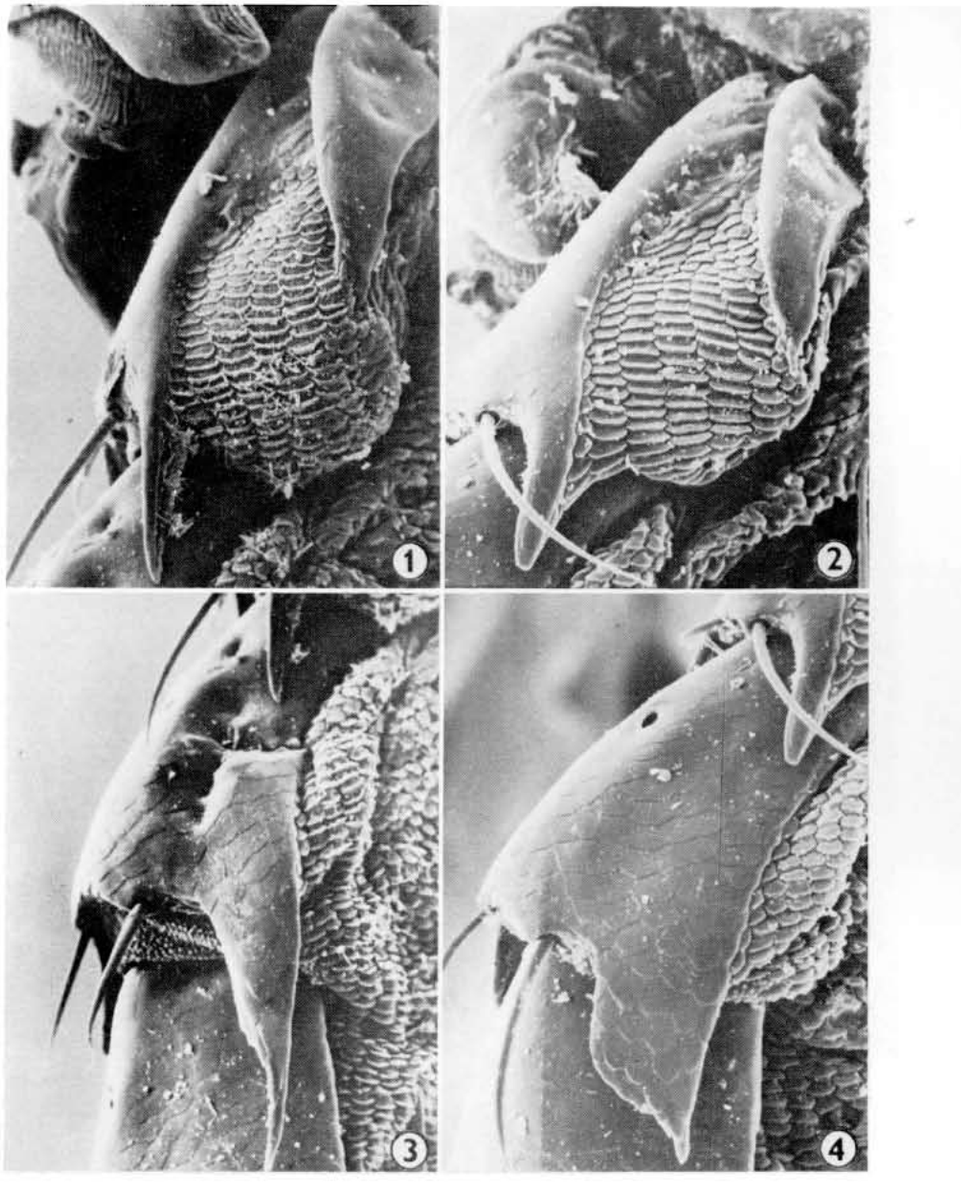

Fig. 1. *Hoplopleura acanthopus* female, dorsal part of paratergal plates 1 and 2 (× 700). **Fig. 2.** *Hoplopleura edentula* female, dorsal part of paratergal plates 1 and 2 (× 700). **Fig. 3.** *Hoplopleura acanthopus* female, dorsal part of paratergal plate 3 (× 700). **Fig. 4.** *Hoplopleura edentula* female, dorsal part of paratergal plate 3 (× 700).

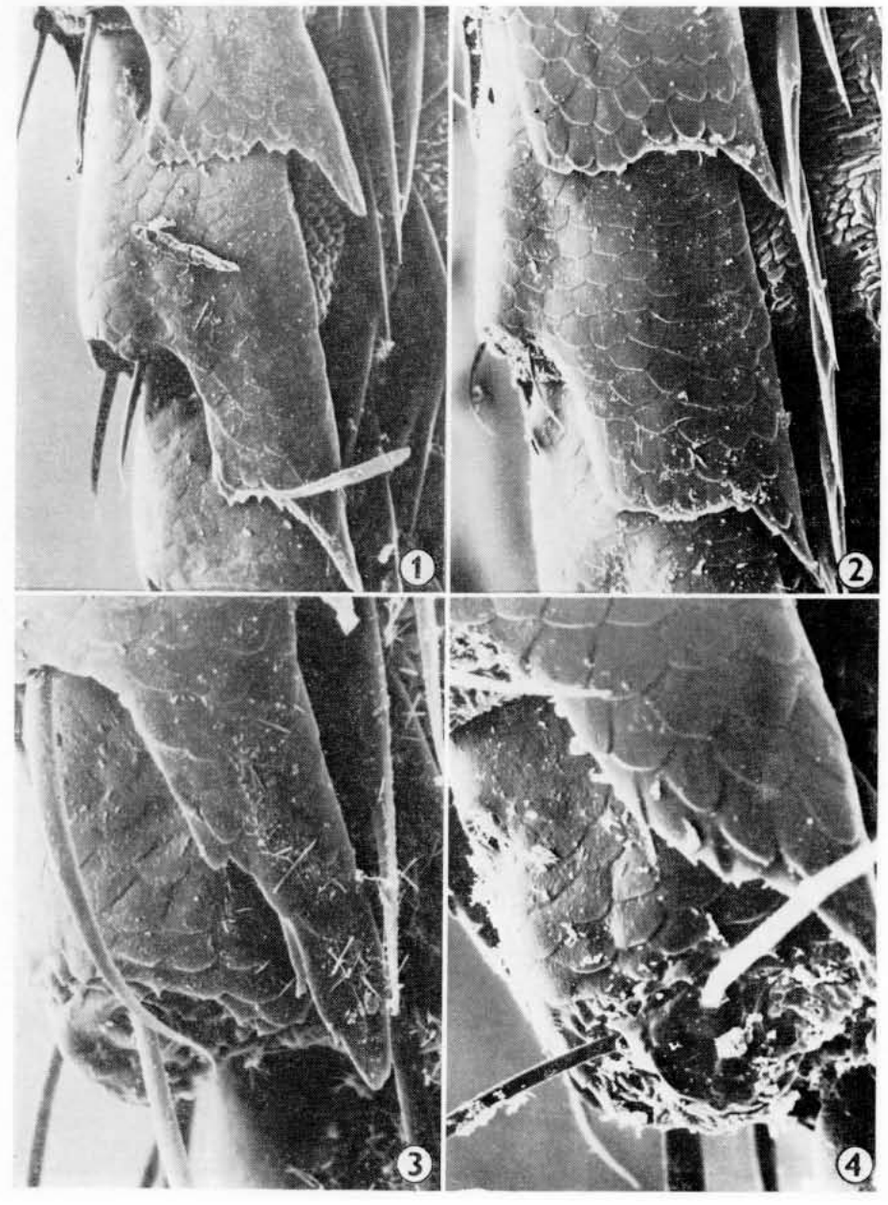

Fig. 1. *Hoplopleura acanthopus* female, dorsal part of paratergal plates 4 and 5 (× 650). **Fig. 2.** *Hoplopleura edentula* female, dorsal part of paratergal plates 4 and 5 (× 650). **Fig. 3.** *Hoplopleura acanthopus* female, dorsal part of paratergal plate 6. (× 1,300). **Fig. 4.** *Hoplopleura edentula* female, dorsal part of paratergal plate 6 (× 1,250).

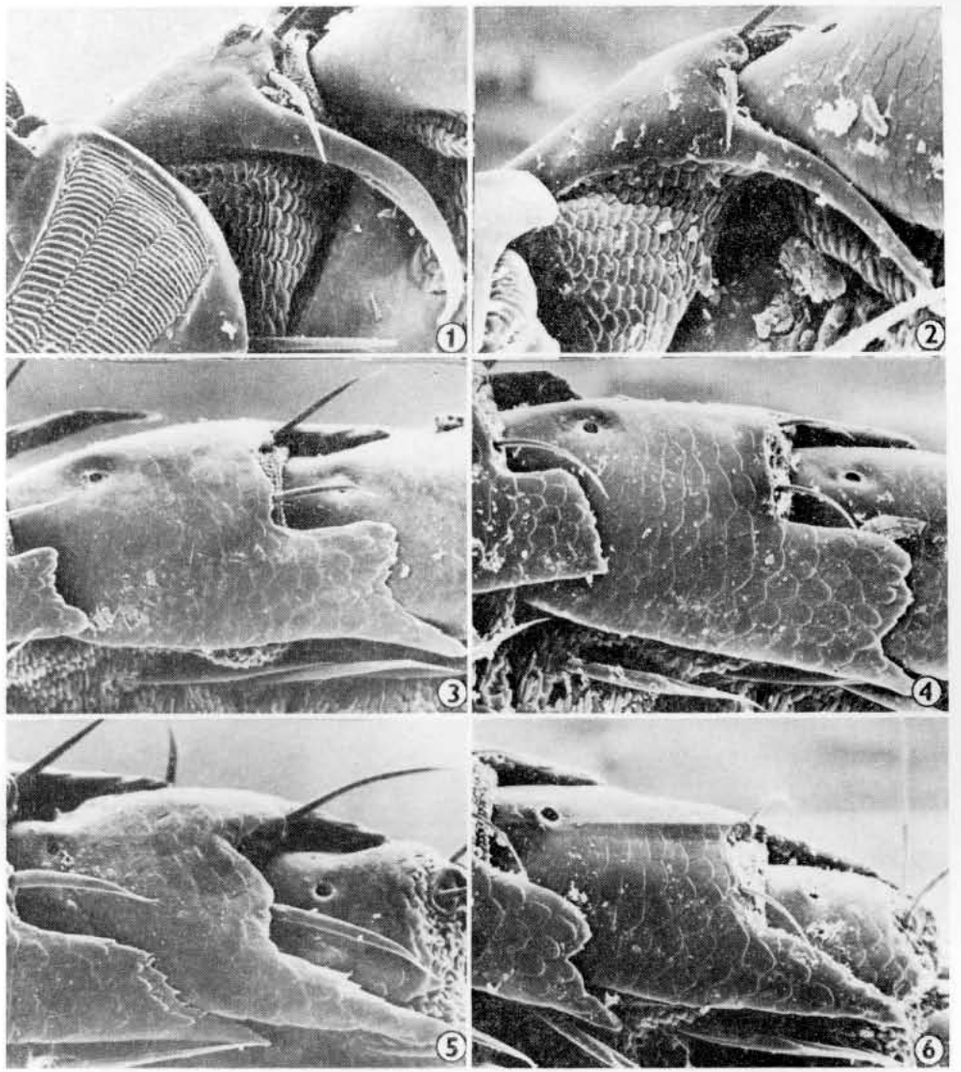

Fig. 1. *Hoplopleura acanthopus* female, ventral part of paratergal plate 2 (× 770). **Fig. 2.** *Hoplopleura edentula* female, ventral part of paratergal plate 2 (× 850). **Fig. 3.** *Hoplopleura acanthopus* female, ventral part of paratergal plates 3 and 4 (× 580). **Fig. 4.** *Hoplopleura edentula* female, ventral part of paratergal plates 3 and 4 (× 650). **Fig. 5.** *Hoplopleura acanthopus* female, ventral part of paratergal plates 5 and 6 (× 770). **Fig. 6.** *Hoplopleura edentula* female, ventral part of paratergal plates 5 and 6 (× 690).

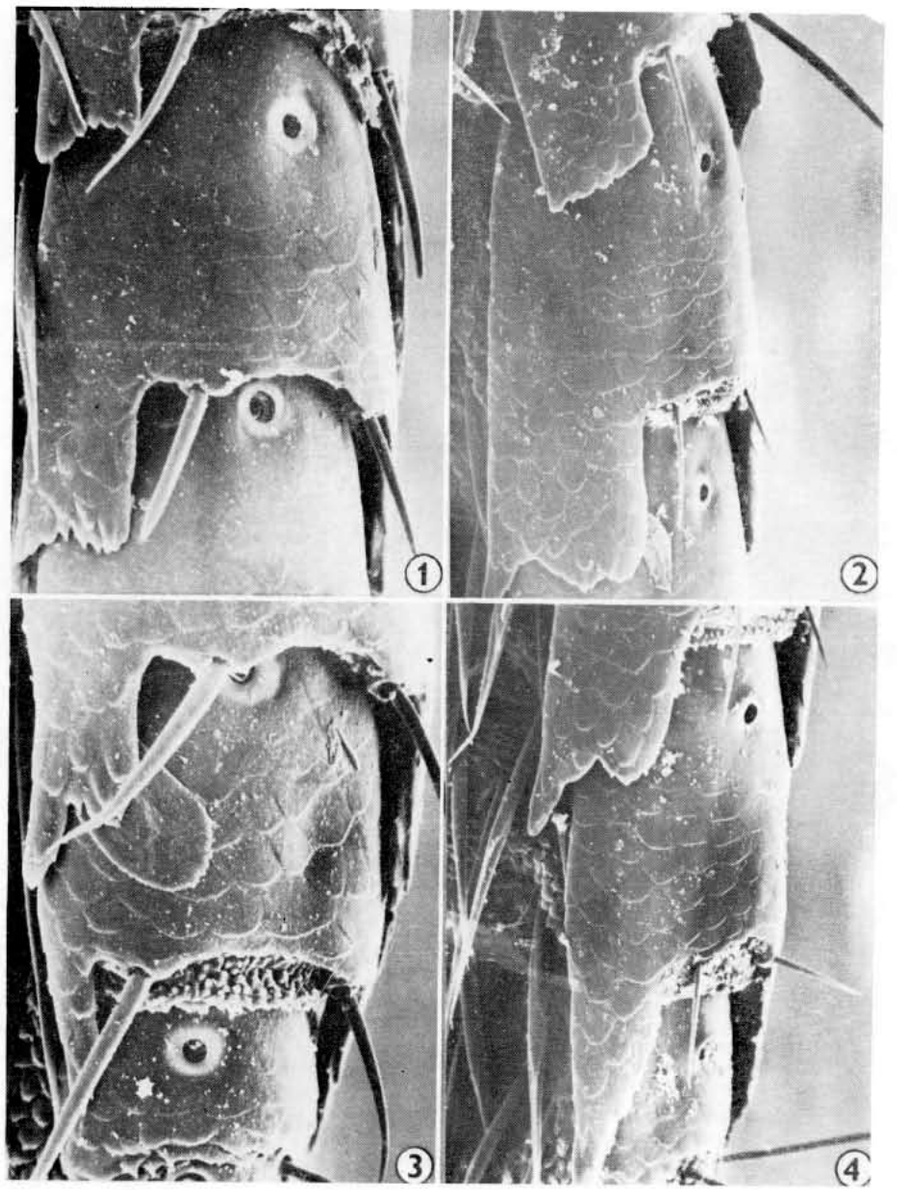

Fig. 1. *Hoplopleura acanthopus* male, ventral part of paratergal plates 3 and 4 (× 950). **Fig. 2.** *Hoplopleura edentula* male, ventral part of paratergal plates 3 and 4 (× 650). **Fig. 3.** *Hoplopleura acanthopus* male, ventral part of paratergal plates 5 and 6 (× 1,200). **Fig. 4.** *Hoplopleura edentula* male, ventral part of paratergal plates 5 and 6 (× 700).