

Further information on the morphology of the labrum in Italian trichopteran larvae

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Abstract. In this study the morphology of the labrum of larvae of 25 species of Trichoptera was examined using SEM. The species are from every Italian Trichopteran family and belong to different feeding regimes. The dorsal surface shows differences in the anterior border which is more or less concave, rich in setae and tegumental formations. The ventral surface has different types of structures such as setae, spines, series of slightly raised crests and sensilla. It is thought that the morphological differences may be related to the different types of dietary regimes of the larvae of these insects.

Key words: Labrum, morphology, scanning electron microscopy.

Introduction

The larvae of Trichoptera have a masticatory-type mouth apparatus. The labrum is part of the cranium (GRANDI 1984) but since it covers the intergnatal cavity dorsally, it is generally considered to be part of the mouth apparatus. The morphology of the mouth apparatus is different in each species (SPINELLI & MORETTI 1992). This study shows modifications of the labrum and aims to establish whether morphological analysis can lead to a correct interpretation of the diet of the larvae of these insects.

Material and Methods

Larvae were collected in different Italian sites, particularly in some Umbrian water courses (R. Tevere, R. Nera, R. Topino). Each larva was fixed in alcohol, the labrum removed, put in oxygenated water and then dehydrated in alcohol, coated with gold and observed in a SEM Philips XL30.

Results and Discussion

The shape of the labrum is usually transverse-elliptical. However in *Silo nigricornis* PICTET (Pl.I,1), it is quadrangular, in *Catagapetus nigrans* MCLACHLAN (Pl.I,2) subrectangular and in *Hydropsyche pellucidula* CURTIS and *Wormaldia mediana* MCLACHLAN (Pl.I,3-4) trapezoidal. The dorsal surface can be smooth (Pl.I,6) or rich in tubercles as in *S. nigricornis* or sculptured as in *Sericostoma pedemontanum* MOSELY (Pl.I,8). There are 4 or 6 macrochetes pointing forwards and laterally and 2 more setae (4 in *S. pedemontanum*) near the medial zone of the anterior border converging towards the centre. The latter setae vary in size but are usually short and robust. In *Odontocerum albicorne* SCOPOLI they are spatula-like (Pl.I,7).

The lateral lobes are covered with dense flexible setae whose arrangement varies in different species.

In *Triaenodes bicolor* CURTIS (Pl.II,1), *Leptocerus tineiformis* CURTIS, *Beraeodes minutus* LINNAEUS and *O. albicorne* (Pl.II,2) however tufts of setae are inserted in the inferior surface.

In *H. pellucidula* (Pl.II,4,5) and *Cheumatopsyche lepida* PICTET (Pl.II,6) the setae have a characteristic comb-like shape. *W. mediana* (Pl.II,7) is an exception because it has a completely fleshy labrum divided into two lobes in which there are 4 parallel transverse rows of setae (Pl.I,5), 3 of these rows have flexible, thin setae and there is one proximal row with sparse, rigid setae.

The internal lobes have a brush of thin flexible setae. The anterior border of the medial part has a recess which is very pronounced in *Polycentropus mortoni* MOSELY (Pl.III,1) and *Plectrocnemia geniculata* MCLACHLAN, wide

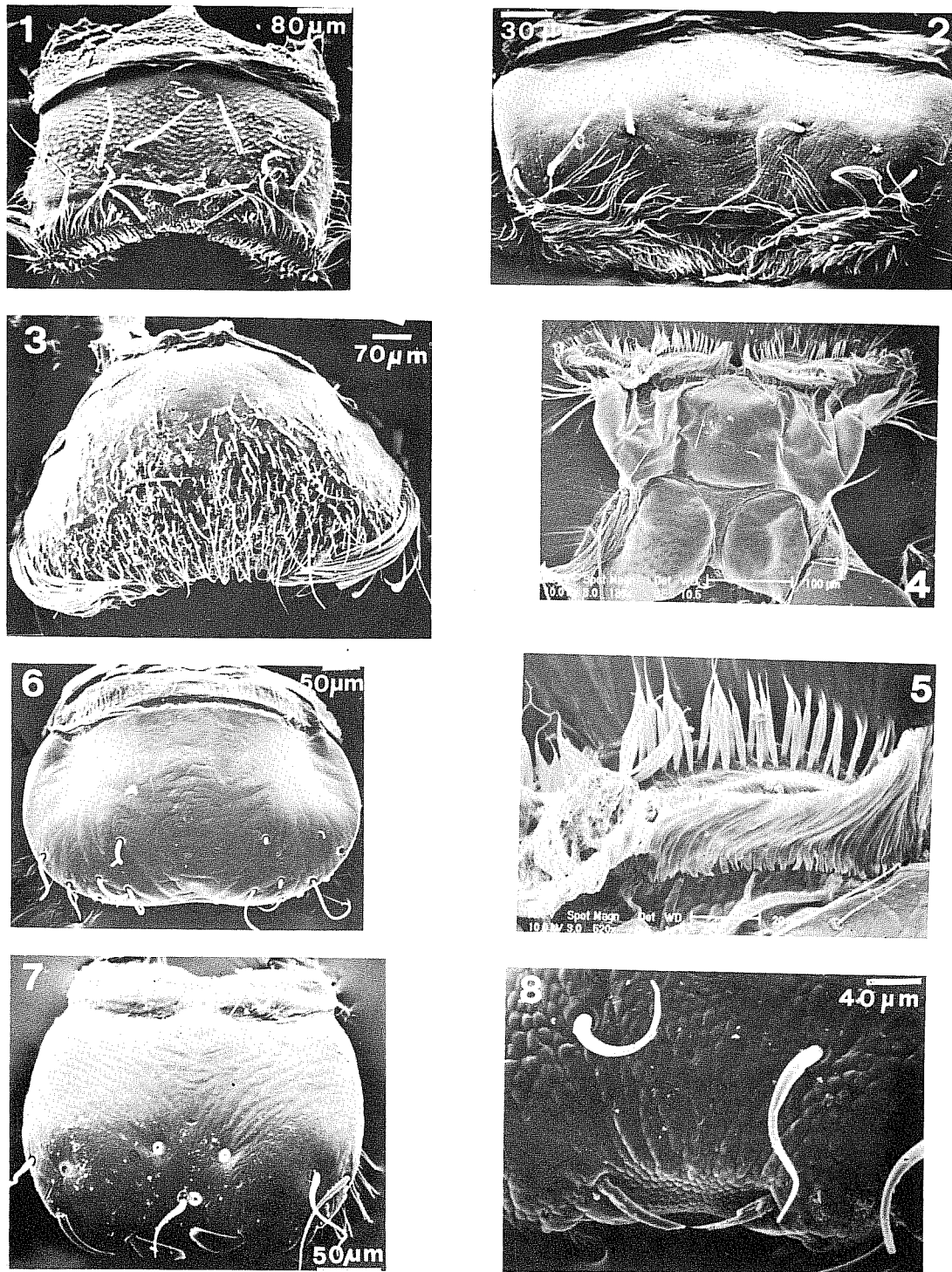


Plate 1 - Labrum, dorsal view : 1) *Silo nigricornis* PICTET. 2) *Catagapetus nigrans* MCLACHLAN. 3) *Hydropsyche pellucidula* CURTIS . 4) *Wormaldia mediana* MCLACHLAN . 5) *W. mediana*, setae of the anterior border. 6) *Tinodes waeneri* LINNAEUS . 7) *Odontocerum albicorne* SCOPOLI. 8) *Sericostoma pedemontanum* MCLACHLAN.

in *H. pellucidula*, *S. nigricornis* and *Brachycentrus montanus* KLAPÁLEK (Pl.III,2) and almost absent in *Rhyacophila italica* MORETTI (Pl.III,3) and *Catagapetus nigrans* MCLACHLAN. Numerous densely- packed setae are inserted in this border (Pl.III,4,5). Although these setae are of different sizes in the various species, they are always shorter than those of the lateral lobes and, in some species, have a truncated apex (Pl.III,6).

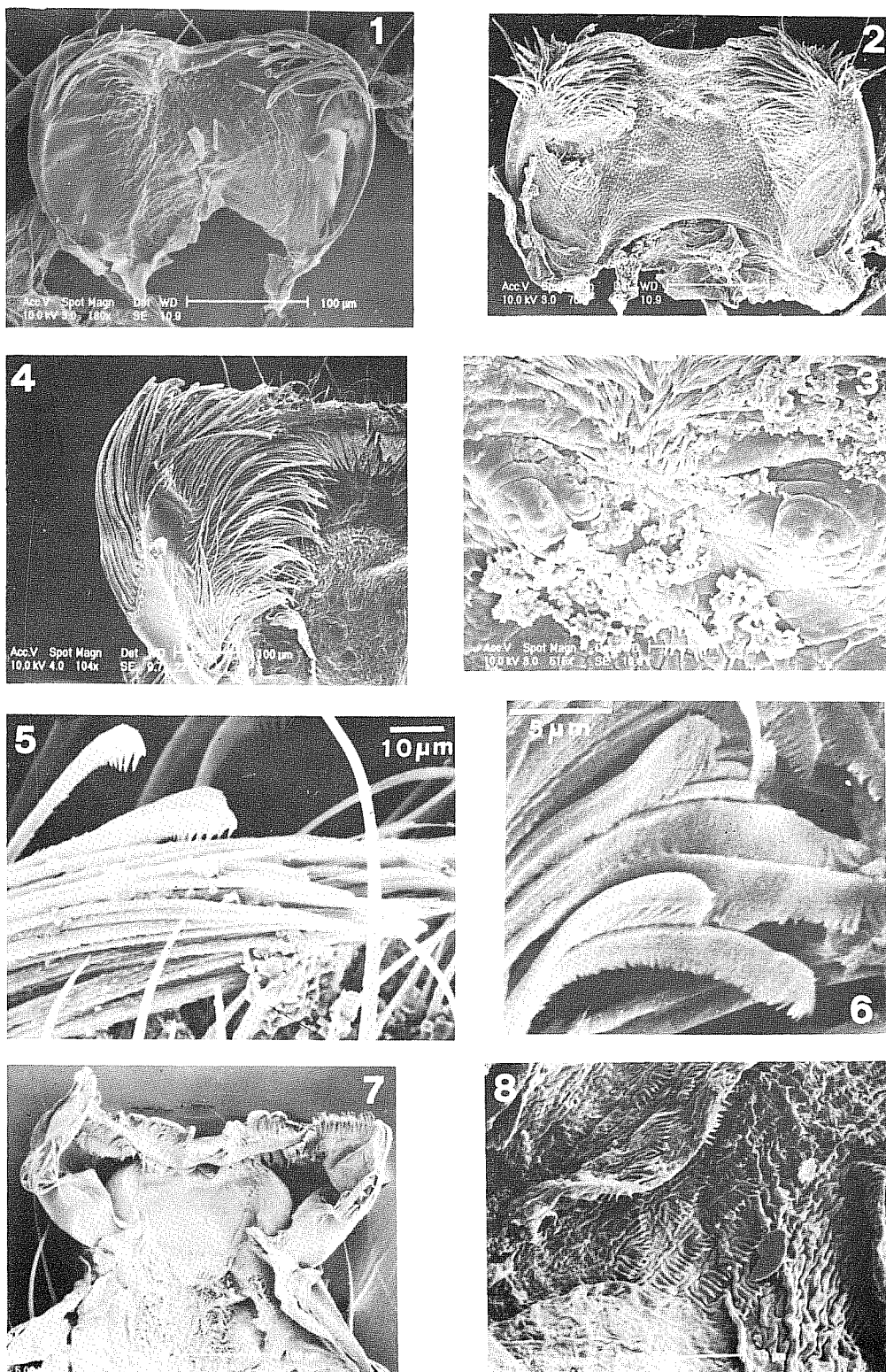


Plate 2 - Labrum, ventral view : 1) *Triaenodes bicolor* CURTIS. 2) *Odontocerum albicorne* SCOPOLI. 3) *O. albicorne*, sensilla. 4) *Hydropsyche pellucidula* CURTIS. 5) *H. pellucidula* detail of the comb-like setae. 6) *Cheumatopsyche lepida* PICTET, comb-like setae. 7) *Wormaldia mediana* MCLACHLAN. 8) *W. mediana*, comb-like series.

In many species there is a tile-like area behind these setae as in *P. geniculata* (Pl.III,7), *Leptodrusus budtzi* ULMER, *Helicopsyche sperata* MCLACHLAN (Pl.III,8) and *S. pedemontanum*. It is thought that this part of the

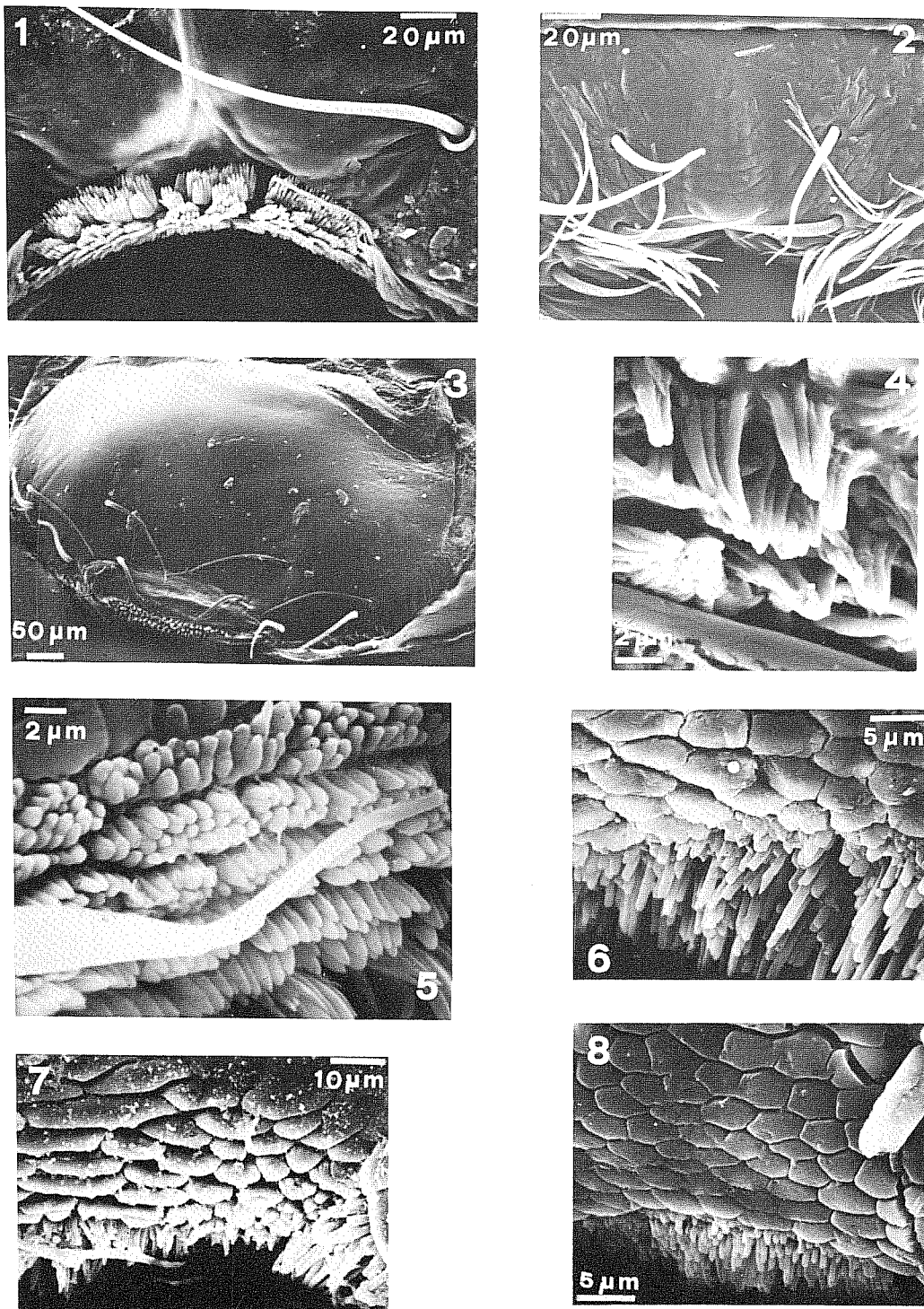


Plate 3 - Labrum, anterior border : 1) *Polycentropus mortoni* MOSELY. 2) *Brachycentrus montanus* KLAPALEK. 3) *Rhyacophila italica* MORETTI. 4) *R. italica*, detail of the setae: 5) *Tinodes waeneri* LINNAEUS, setae of the oral border. 6) *Leptodrusus budtzi* ULMER, idem. 7) *Plectrocnemia geniculata* MCLACHLAN, tile-like area. 8) *Helicopsyche sperata* MCLACHLAN, idem.

labrum has a certain mobility and that the setae probably have a sensorial function and serve to retain or brush the food towards the mouth. Generally in the medial anterior part there are placoidea sensilla.

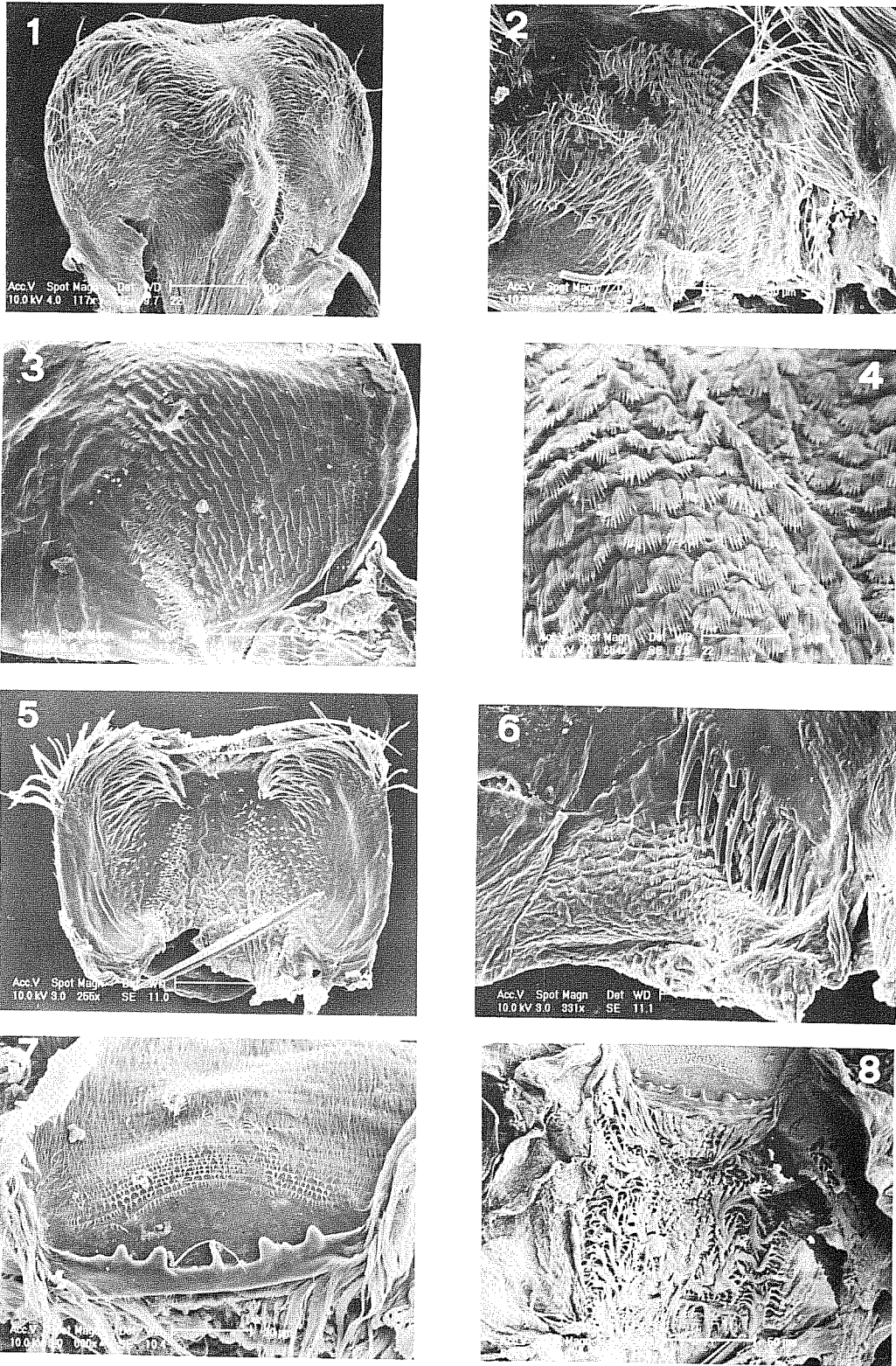


Plate 4 - Labrum, ventral view : 1) *Tinodes waeneri* LINNAEUS. 2) *Cheumatopsyche lepida* FICHEL. 3) *Lepidostoma hirtum* FABRICIUS, raised crests. 4) *Plectrocnemia geniculata* MCLACHLAN, squamiform structures. 5) *Helicopsyche sperata* MCLACHLAN, isolated spines. 6) *Ecnomus tenellus* RAMBUR, rake-like series of teeth. 7) *Wormaldia mediana* MCLACHLAN, sclerified toothed strip. 8) *W. mediana*, setae.

The ventral surface has setae (Pl.IV,1), spines, a series of slightly raised crests and sensilla. In almost all the species examined there were two tufts of flexible setae arranged longitudinally on the sides of the labrum . In

species with both setae and spines, the setae are situated on the sides of the labrum and the spines in the central or basal part .

In some species there are lateral series of comb-like structures composed of short spines which become longer in the central part of the labrum (Pl.IV,2).

Lepidostoma hirtum FABRICIUS (Pl.IV,3) has a sequence of raised crests which are organized to form comb-like structures in the central part. In *P. geniculata* (Pl.IV,4), almost the entire ventral surface is covered with a very dense series of squamiform structures with spined anterior borders. *R. italica*, *Potamophilax inermis* MORETTI & CIANFICCONI, and *Helicopsyche sperata* MCLACHLAN have isolated spines. In the first species they are small and sparse, in the second species they are numerous and of different lengths and in the third they are sparse but clearly defined (Pl.IV,5). In *Ecnomus tenellus* RAMBUR (Pl.IV,6) there is asymmetry with setae only on the right side and a rake-like series of long teeth on the left side. In *W. mediana* the ventral surface has an anterior border rich in setae. In the pillow-shaped middle part, a series of comb-like, flexible spine structures can be seen that are arranged in parallel and horizontal alignment. The upper lateral borders of this pillow-like structure are covered by setae while the base has a sclerified toothed strip (Pl.IV,7). Below this strip, in the center there is a mass of setae (Pl.IV,8) bordered by comb-like series (Pl.II,8). Only *Hydroptila aegyptia* ULMER has a glabrous ventral surface. In almost all species there are different kinds of sensilla immediately below the medial anterior border of the ventral surface (Pl.II,3). This confirms the sensorial function of this more mobile part of the labrum. The complexity of all these structures is almost certainly related to the type and gathering of food. For example, in the filter-feeding species, the comb-like setae of *H. pellucidula* and *C. lepida* and the dense series of combs in *P. geniculata* and *P. mortoni* probably have the function of brushing the fishing net. In the scrapers, such as *S. nigricornis*, the comb-like series, together with the rowed setae in the medial of the anterior border, may be used to scrape the stones. In the more algal-eating species or those that feed on cellular juices or Diatoms, the ventral surface is less complex such as in *Tinodes waeneri* LINNAEUS, *S. nigricornis* and *B. minutus* and is even glabrous in *H. aegyptia*.

In shredders, and in predators like *R. italica*, the labrum is less complex because the mandibles play a more important role in capturing and shredding food, while the labrum serves only to transfer and store food. Since the ventral surface of the labrum is composed of a membrane which extends to the beginning of the pharynx, it should be noted that some of these structures (spines, comb-like series structures, etc.) are similar to those previously observed by SPINELLI & CORALLINI (1996) in the stomodeum.

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