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Morphology and modification of the labial segments in the Fulgoromorpha with notes on the phylogenetic characteristics

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Abstract: The labium of Fulgoroidea (Hemiptera: Euhemiptera: Fulgoromorpha) is strongly variable in its shape, but presents distinct patterns within families. Existing data have demonstrated the morphological heterogeneity of the external labial structures across a few different fulgormorphan groups. Patterns observed seems to be useful for resolving phylogenetic relationships among higher lineages of planthoppers. Examination of labial structures of 27 species of 13 planthoppers families obtained using SEM and light microscopy, allowed to review distinguished shapes and sizes of these elements. Several inconsistencies as well as several congruencies between previous descriptions of the external characters of the labium of the Fulgoroidea were revealed. Several new, internal and external morphological characters were identified.

Three morphologically distinct forms of the labium have been identified: three segmented (Cixiidae, Delphacidae, Meenoplidae, Derbidae, Tropiduchidae, Lophopidae, Flatidae, Ricaniidae, Issidae and Tettigometridae), four segmented (Nogodinidae and Dictyopharidae) and five segmented (Fulgoridae). Subsequent segments of the labium (I, II, III, and IV or V) are shaped similarly in all investigated taxa but carry individual characters in some families. Additionally, three various types of the division on the ventral side of the first and second segments are interpreted as the new characters. The first type is characterized by presence of small and narrow band of the membrane (Cixiidae, Delphacidae, Meenoplidae, Derbidae, Lophopidae, Nogodinidae and Flatidae). In the second type a thick, undulated layer of the membrane is visible in Ricaniidae, Issidae, Tropiduchidae and Tettigometridae. The third type: membranous connection reinforced by two lateral small sclerites, is treated as the most specialized and it is characteristic for Dictyopharidae and Fulgoridae.

The presence of the apodemal labial process on the distal edge of the first segment and connection with the head has been reanalysed. The evaluation of these characters has revealed characteristic homologies for the labium in Fulgoroidea in relation to the mandibulate insects.