

A new 'cixiidae-like' planthoppers from the Lowermost Eocene Oise amber (Hemiptera: Fulgoromorpha: Fulgoroidea)

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Fulgoromorpha is a highly variable group of the Hemiptera and currently groups over 20 families including fossil ones (Szwedo & Żyła 2009)

Within Fulgoromorpha, Fulgoroidea are known in fossil record since the Jurassic, represented during this period by paraphyletic 'Fulgoridiidae' (Bourgoïn & Szwedo 2008). By the Late Jurassic Cixiidae (the oldest extant fulgoroid family) have appeared (Shcherbakov & Popov 2002). Some extant families are to be traced back to Lower Cretaceous, and several extinct families are known from this period, and some other are known since the Eocene (Shcherbakov 2007a, b; Shcherbakov & Popov 2002; Szwedo et al. 2004; Szwedo 2007, 2008, 2009).

Cixiidae are believed to represent the oldest extant fulgoroid family (Shcherbakov & Popov 2002) and believed as being direct descendants of 'Fulgoridiidae' (Shcherbakov 1996, Shcherbakov & Popov 2002). However what is Cixiidae? The family was erected by Spinola (1839) and later, several subdivisions were proposed by Muir (1923), Metcalf (1936, 1938), Emeljanov (1989, 2002). General descriptions of the family are available in various publications (Metcalf 1936, O'Brien & Wilson 1985, O'Brien 2002). Nevertheless, to summarize at least "common diagnostic" features of this family remain difficult. What Cixiidae is, is a perfect example of these many taxa erected by exclusion from other monophyletic related taxa, falling in what has been called the 'autapomorphic trap' (Bourgoïn & Cambell 2002). Indeed, Cixiidae are currently recognized by a series of character states (Emeljanov 2002), but all considered as plesiomorphic: i.e. a row-spined metatarsi, most often a median ocellus, an ensiform ovipositor, the longitudinal division of male's VIIth and VIIIth abdominal sternites, the hind end of intercubital transverse veinlet *icu* of tegmen touching the claval suture near claval apex (i.e. short claval plica), the sensory pits of abdominal wax-pore plates of nymphs lying on their fore margins. With the objective to investigate this cixiid monophyly issue, we have therefore started to assemble a first morphological character set and the phylogenetic analysis recovered the monophyly of the family (Ceotto & Bourgoïn 2008). However the results were not strongly supported, and subsequent studies dealing with various molecular datasets concluded with Cixiidae being a paraphyletic taxon by including the Delphacidae (Urban & Cryan 2007; Ceotto & al. 2008).

The finding of 'cixiidae-like' fossils in the Lowermost Eocene Oise amber (Paris Basin, France) give a new insight to the problem of definition of true Cixiidae and their relatives. These fossils superficially resemble cixiidas, share with them number of characters, however present also in other 'cixiidae-like' families. It could be placed with families having a second metatarsomere with row of apical spines, i.e. Cixiidae, Delphacidae, Meenoplidae, Kinnaridae, Achilidae, Achilixiidae, Derbidae, Dictyopharidae, Fulgoridae and most of the fossil taxa. With the first two families this extinct unit shares an ensiform ovipositor, but probably it is a plesiomorphic condition. The new extinct taxa from the Oise amber are lacking pterostigma in which separate them from 'true' Cixiidae. The stigmal area is slightly widened, but not thickened and it lacks transverse striations. Another feature of these fossils is abundant polymerization of longitudinal veins.

To summarize, this new unit is to be characterized by the mixture of features shared with various groups of extant and extinct Fulgoroidea, and their nearest relatives seems to be among paraphyletic 'Fulgoridiidae' and Cixiidae. It could be hypothesized that these fossils represent and off shot of 'Fulgoridiidae'. The other possibility is that this unit could be an

descending lineage from the times of Cretaceous explosive radiation and diversification of planthoppers. This radiation could be related to the Mid-Cretaceous biotic crisis and re-organization of the biosphere, related to the diversification, dominance and expansion of angiosperm dominated biota. These processes seriously affected not only planthoppers, but numerous other plant-feeding insects as well. Therefore the unique fossils found among Lowermost Eocene Osie amber inclusions could be still weakly known descending lineage of Mid-Cretaceous 'cixiidae-like' planthoppers, which survived to the Lowermost Eocene and very probably close to ancestral Cixiidae.

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