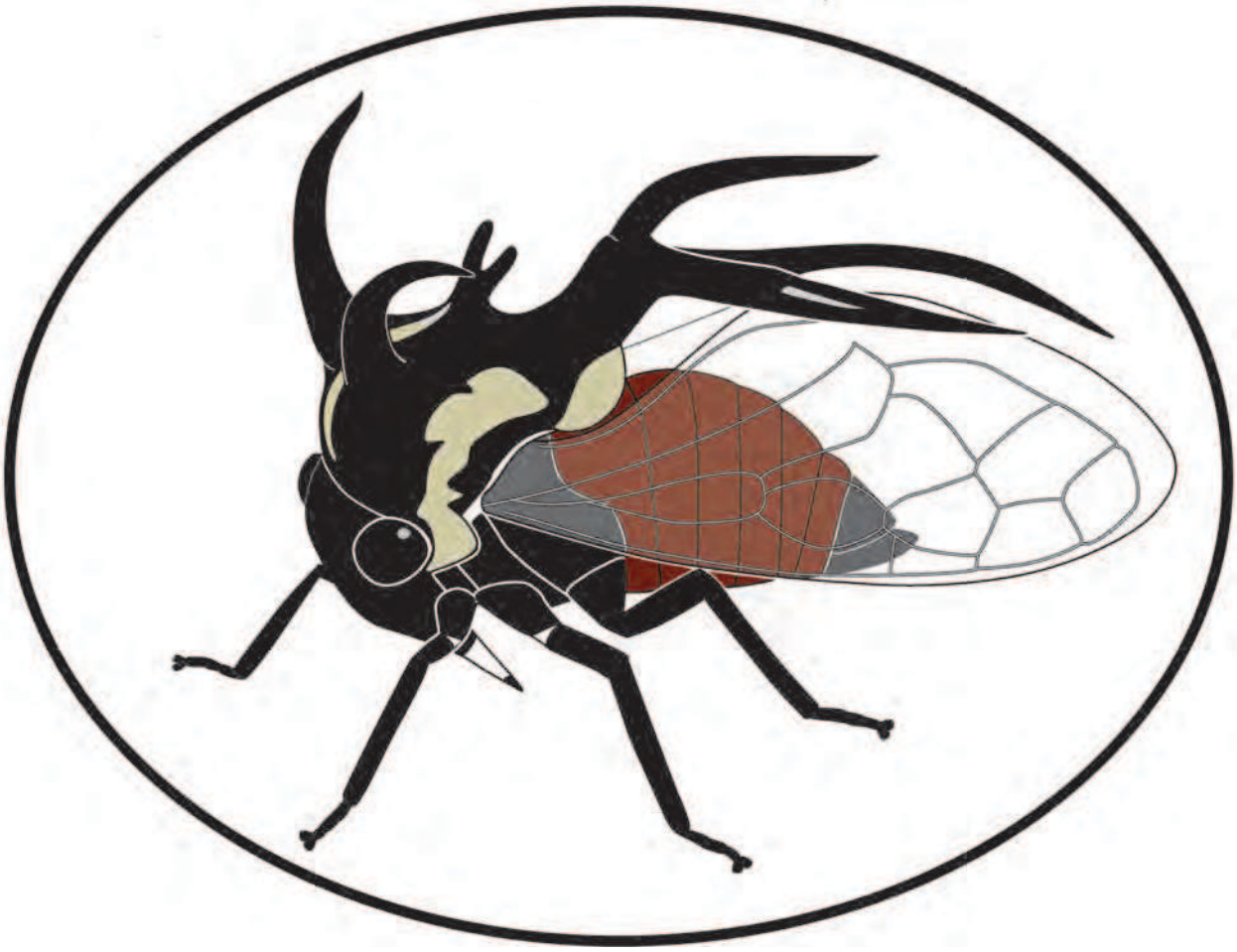
XV International Auchenorrhyncha Congress



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ABSTRACTS BOOK

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Hopperity of inclusions in the Cretaceous Burmese amber

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Burmese amber (amber from northern Myanmar) contains the most diverse biota in amber from the Cretaceous. During the last 100 years, Burmese amber has received worldwide scientific interest and more than 250 families of arthropods plus diverse plants have been reported. In addition, a variety of other invertebrates, fungi and even rare vertebrate remains have been recorded (Xia *et al.* 2015, Wang *et al.* 2017). The age of 98.79 ± 0.62 Ma can be used as a maximum limit for the burmite (either at or after), establishing an earliest Cenomanian age for the fossilized inclusions (Shi *et al.* 2012).

There is an immense variety of insects entombed in the Burmese amber, the Diptera, Coleoptera, Hymenoptera, and Hemiptera are the most diverse orders, but only a small fraction is elaborated and formally described for now. A few striking examples of recent findings of planthoppers, leafhoppers, cicadas and their relatives are given below.

Firstly, however, the term "hopperity" should be explained – it is play of words, one-word descriptive term covering taxonomic diversity, morphological disparity, good quality and relatively high quantity of the inclusions of the hoppers among the Burmese amber inclusions.

Fulgoromorpha, planthoppers: variety of families, including extant – Cixiidae and Achilidae – and extinct ones Lalacidae, Mimarachnidae, Neazoniidae and Perforissidae can be found. A preliminary overview of the inclusions deposited in various institutions and available for study revealed maybe ten or more taxa deserving familial status. The most troubling are the inclusions which could be placed in Cixiidae-like lineage. These lead to the questions of family monophyly, definition and diagnostic characters, its content and classification. Similar questions aroused in respect to Achilidae – some fossils identified preliminary as Achilidae put a challenge to present classification scheme and evolutionary reconstruction. In respect to fossil lineages, Neazoniidae seems to be quite abundant and diversified, well preserved Mimarachnidae are rare, due to taphonomic reasons rather (relatively huge size), and only a few remains of Lalacidae were found so far. Regarding the morphological disparity it seems during Mid-Cretaceous it was at least as high or even higher than at present times. Some forms superficially resembling dictyopharids, tropiduchids or issids were found, as well as odd forms, not comparable with the modern ones.

Cicadomorpha: the representatives of Cicadidae were described based on nymph (Poinar & Kritsky 2012), supposed minute Tettigarctidae were identified. These are extremely rare among the inclusions probably due to taphonomic reasons of preservation as inclusions, not their scarcity in the biota. Similar reasons could limit the number of Hylicellidae preserved as inclusions, but this extinct lineage of Clypeata cicadomorphans, believed to be ancestral to modern cicadas, froghoppers, leafhoppers and their relatives has its latest representatives among the Burmese amber inclusions. Very recently the inclusion of Sinoalidae – a family known from

the Middle Jurassic Daohugou Biota placed in Cercopoidea – was found and is under elaboration now (Chen *et al.* in prep.). Not described Aphrophoridae were reported from the Burmese amber, but presence of this family among inclusions needs to be re-investigated and confirmed. Leafhoppers – Cicadellidae – are also present among the inclusions in Mid-Cretaceous Burmese amber, these are not so abundant, but these fossils are crucial for understanding the formation and early evolution of the modern lineages of leafhoppers. For the moment we have only a few sedimentary rock records of Cicadellidae from the Cretaceous, mostly tegmina, so the whole bodied fossils entombed in amber will give a new light on the morphological characters of the early forms and leafhopperization process postulated by Shcherbakov (2012).

The period documented by Burmese amber biota was the most crucial for understanding the evolution of modern planthoppers, froghoppers and leafhoppers. It was the time of the reorganization and modernization of terrestrial ecosystems; the period when angiosperms experienced an explosive radiation and for the first time achieved widespread floristic dominance; during this period significant morphological innovation, rapid and sharp increase in the vein length density, leading to the greatly increased photosynthetic and transpiration capacities of angiosperms, which exceeded those of non-angiosperms. These changes severely and spectacularly affected the Mesozoic lineages of hoppers, resulting in extinctions of some, particularly those feeding on gymnosperms (*e.g.* Palaeontinidae), appearance of shortly-present taxa, endemic to the Cretaceous period (*e.g.* Perforissidae), and origination and rapid evolutionary adaptations of the modern lineages of Fulgoroidea, Cicadoidea, Cercopoidea and Membracoidea.

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