



# 15<sup>th</sup> International Auchenorrhyncha Congress and 10<sup>th</sup> International Workshop on Leafhoppers and Planthoppers of Economic Importance

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## Biogeographic history of grassland Auchenorrhyncha

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Although grasslands cover a significant portion of the Earth's terrestrial surface little is known about the historical biogeography of grassland restricted lineages. Previous work has focused on large mammals, and while these studies have pointed to some general patterns of origin and dispersal of grassland animals, these may not be applicable to less studied groups of organisms due to natural history traits of these species such as dispersal limitations. The historical biogeography of three tribes of Deltocephalinae leafhoppers (Hecalini, Paralimnini, Deltocephalini) and Caliscelinae, a subfamily of planthoppers, were inferred and compared to biogeographic patterns observed in other grassland restricted lineages. In order to correctly infer biogeographic patterns accurate phylogenies of each lineage are required. Using molecular sequence data from multiple genes, phylogenies were inferred for each Auchenorrhyncha lineage sampling the diversity of each clade and including representatives from all major grasslands of the world. These phylogenies were used to both infer biogeographic patterns and to estimate divergence time.

Grass feeding itself in Deltocephalini was inferred to be Palearctic in origin, and Old World origins were inferred for each lineage. Hecalini and Paralimnini were inferred to be Palearctic in origin, while Deltocephalini + Tetartostylini was more widespread and Caliscelinae was inferred to be Ethiopian. All three leafhopper lineages were estimated to have diverged from their sister tribes around 50 MYA while Caliscelinae was inferred to be significantly older at 71 MYA. These lineages therefore predate the formation of large contiguous grasslands, but as grasses were present for tens of millions of years prior to climatic conditions favoring grassland formation these dates are reasonable. Each group was inferred to have invaded the New World and in many lineages this occurred approximately 40 MYA (with New World Caliscelinae again predating the Deltocephalinae). All lineages underwent periods of radiation corresponding to the rise of grasslands and the diversification of C<sub>4</sub> grasses. In general these insect lineages show different biogeographic patterns compared with other lineages for which grassland biogeographic patterns have been inferred. Both horses and camels were inferred to have originated in the New World and then spread to the Old World, while bovids showed a similar Old World to New World dispersal. These patterns are similar to those found in the Chiasmini, a related tribe of grassland Deltocephalinae, which a previous study suggested to have originated in the Old World and then spread to the New World.