Illuminating the Lanternfly Tree: Phylogenetic Investigation of the Planthopper Families Fulgoridae and Dictyopharidae

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The planthopper families Fulgoridae and Dictyopharidae (Hemiptera: Auchenorrhyncha: Fulgoroidea) form a monophyletic, widely distributed, iconic, and yet systematically neglected lineage of phloem-feeding herbivores. Approximately 1,050 species are described in ~265 genera across these two families, but biodiversity estimates suggest that the true number of extant species may be much higher. In general, much remains unknown about the basic biology and evolution of Fulgoridae and Dictyopharidae; what little has been published suggests that these sister lineages show interesting contrasts. Dictyopharidae tend to be associated with non-tree host plants (i.e., grasses, sedges, and shrubs), oviposit in the soil at the base of their host plants, and cover their eggs with debris (Emeljanov, 1979). Conversely, Fulgoridae are typically arboreal, most often associated with large tropical trees, and deposit their eggs higher up on their host plant, covering the eggs with a waxy substance (Emeljanov, 1979; O'Brien & Wilson, 1985). Although dictyopharids are most diverse in tropical and subtropical regions worldwide, more than 35 species occur in the Nearctic region, and more than 200 occur in the Palearctic (Metcalf, 1946). The distribution of Fulgoridae is primarily constrained to tropical and subtropical regions worldwide, with only 17 species recorded from the Nearctic, and no species recorded from the Palearctic (Metcalf, 1947). Dictyopharidae are relatively small (<30 mm) and cryptic, often with green or brown bodies and clear wings, and generally do not exhibit a striking level of morphological diversity (in head shape, wing venation, wing shape, etc.). In contrast, Fulgoridae are typically large-bodied (as long as 95 mm), have pigmented, often brightly colored wings (O'Brien & Wilson, 1985), and exhibit comparatively exaggerated morphological diversity with respect to head shape, wing venation, wing shape, wax plume production, etc.

No phylogenetic hypothesis has been published for Dictyopharidae. Emeljanov (1979; 2004) noted considerable difficulty in distinguishing Fulgoridae from Dictyopharidae, and further proposed a novel classification in which certain dictyopharid subfamilies (Aluntiinae, Dorysarthrinae, Dichopterinae, and Lyncidinae) were included within Fulgoridae. Moreover, Emeljanov (1979) hypothesized that the fulgorid subfamily Zanninae was affiliated with at least one of these previously dictyopharid subfamilies. It seems clear that Emeljanov recognized some intergradation at the base of the Fulgoridae + Dictyopharidae phylogeny, but those relationships remain unresolved. Results of the first-ever phylogenetic analysis of Fulgoridae (Urban & Cryan, 2009) indicated that Fulgoridae and Dictyopharidae are not monophyletic sister groups as currently defined and long accepted. Specifically, these data supported the placement of the genus Zanna outside of Fulgoridae, either as sister to Dictyopharidae (in Bayesian and maximum likelihood analyses) or as sister to Fulgoridae + Dictyopharidae (maximum parsimony analysis).

I will present results of an ongoing phylogenetic investigation of Fulgoridae + Dictyopharidae based on DNA nucleotide sequence data from five genes (18S rDNA, 28S rDNA, H3, Wg, and COI) generated from more than 175 exemplars of Fulgoridae and Dictyopharidae collected from throughout the world, including representatives of the lineages Emeljanov (1979, 2004) moved into Fulgoridae from Dictyopharidae. With these results, I will discuss: the phylogenetic position of Zanna and the placement of other lineages at the base of the Fulgoridae + Dictyopharidae phylogeny; support for the current higher classifications of Fulgoridae and Dictyopharidae; and biogeographic patterns in the distribution of extant species.

References

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