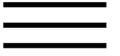


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Monophyly, divergence times, and evolution of host plant use inferred from a revised phylogeny of the *Drosophila repleta* species group

Deodoro C.S.G. Oliveira ^a ... William J. Etges ^f

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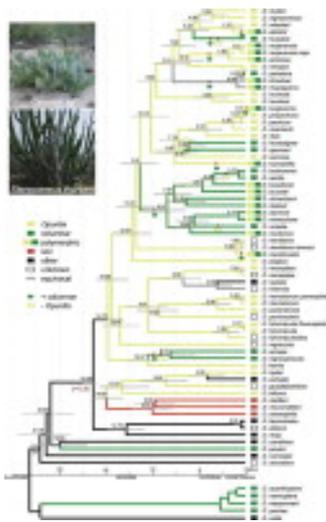
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Abstract

We present a revised molecular phylogeny of the *Drosophila repleta* group including 62 *repleta* group taxa and nine outgroup species based on four mitochondrial and six nuclear DNA sequence fragments. With ca. 100 species endemic to the New World, the *repleta* species group represents one of the major species radiations in the genus *Drosophila*. Most *repleta* group species are associated with cacti in arid or semiarid regions. Contrary to previous results, maximum likelihood and Bayesian phylogenies of the 10-gene dataset strongly support the monophyly of the *repleta* group. Several previously described subdivisions in the group were also recovered, despite poorly

resolved relationships between these clades. Divergence time estimates suggested that the *repleta* group split from its sister group about 21 million years ago (Mya), although diversification of the crown group began ca. 16 Mya. Character mapping of patterns of host plant use showed that flat leaf *Opuntia* use is common throughout the phylogeny and that shifts in host use from *Opuntia* to the more chemically complex columnar cacti occurred several times independently during the history of this group. Although some species retained the use of *Opuntia* after acquiring the use of columnar cacti, there were multiple, phylogenetically independent instances of columnar cactus specialization with loss of *Opuntia* as a host. Concordant with our proposed timing of host use shifts, these dates are consistent with the suggested times when the Opuntioideae originated in South America. We discuss the generally accepted South American origin of the *repleta* group.

Graphical abstract



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Highlights

- Added species and DNA characters resolved monophyly of the large *Drosophila repleta* group.
- Bayesian estimates of divergence times suggested the group originated in South America.
- Character mapping of host plants revealed convergent evolution across the phylogeny.
- Host cactus divergence allowed colonization of North America.



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Keywords

Drosophila repleta species group; Host plants; Molecular phylogeny; Molecular clock; Cactus; Biogeography

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common.

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