Ecology & Evolution of Cycad-Feeding Lepidoptera

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Abstract

Cycads are an ancient group of tropical gymnosperms that are toxic to most animals—including humans—though the larvae of many moths and butterflies (order: Lepidoptera) feed on cycads with apparent immunity. These insects belong to distinct lineages with varying degrees of specialization and diverse feeding ecologies, presenting numerous opportunities for comparative studies of chemically-mediated eco-evolutionary dynamics. This review presents an evolutionary evaluation of cycad-feeding among Lepidoptera along with a comprehensive review of their ecology. Our analysis suggests that multiple lineages have independently colonized cycads from angiosperm hosts, yet only a few clades appear to have radiated following their transitions to cycads. Defensive traits are likely important for diversification, as many cycad specialists are warningly colored and sequester cycad toxins. The butterfly family Lycaenidae appears to be particularly predisposed to cycad-feeding and although aposematism is otherwise rare in this family, several cycad-feeding lycaenids are warningly colored and chemically defended. Cycad-herbivore interactions provide a promising but underutilized study system for investigating plant-insect coevolution, convergent and divergent adaptations, and the multi-trophic significance of defensive traits, therefore the review ends by suggesting specific research gaps that would be fruitfully addressed in Lepidoptera and other cycad-feeding insects.

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