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Biodiversity during the preangiospermous mesozoic: Plant hosts, insect herbivory, pollination and mimicry

Conrad C. Labandeira

National Museum of Natural History, USA

Abstract

The Mesozoic Era before flowering plants was a time when the terrestrial realm became modern, particularly for associations between insects and plants. After the end-Permian crisis 252 million years (m.y.) ago, plant lineages and their insect herbivores diversified, initially in Gondwana during the Late Triassic, 225 m.y. ago. This first ecological expansion of interactional diversity included elevated levels of external foliage feeding, piercing-and-sucking, leaf mining, galling, seed predation, and ovipositional damage abundantly recorded from the varied habitats of the Molteno Formation, South Africa. Pollination is sparse during the Late Triassic, but mutualisms are evident during the late Middle Jurassic (165 m.y. ago) to mid Early Cretaceous (125 m.y. ago) in Eurasia. A variety of evidence indicates that minimally ten lineages of long-proboscid insects were present throughout this interval: flies, scorpionflies, lacewings, and perhaps early moths. Pollinator hosts included certain ginkgophytes, cheirolepidiaceous conifers, seedferns, bennettitaleans, and gnetaleans that bore tubular structures accompanied by fluid rewards, resulting in insect-mediated pollen transfer. Evidence for mandibulate insects, such as borings, suggests bennettitaleans and cycads engaged in a very different pollination mode. Herbivory from Eurasian biotas indicate preferential targeting of bennettitaleans and seedferns. These deposits also provide evidence for advanced mimicry, such as a scorpionfly co-occurring with facsimile ginkgoalean leaves. While angiosperms and more derived lineages of holometabolous insects structured the biota during the past 125 million years, earlier clades during the interval from 225 to 125 m.y. ago were represented by ferns, gymnosperms and more ancestral lineages of holometabolous insects.

Biography

Conrad Labandeira received a Ph.D. in the Department of the Geophysical Sciences from The University of Chicago, and completed postdoctoral studies in the Department of Plant Biology at the University of Illinois at Urbana-Champaign. He has been at the Smithsonian's National Museum of Natural History since 1992, served as department Chair, and currently is Senior Scientist and Curator of Fossil Arthropods. He has published 90 papers in peer-reviewed journals and books, 20 papers in the popular press, and serves as subject editor for the Ecological Society of America.