

Project Summary

RIG: Towards a systematic and evolutionary synthesis of the Neotropical *Exophthalmus* genus complex (Coleoptera: Curculionidae: Entiminae)

Weevils (Coleoptera: Curculionoidea) are the most diverse lineage of herbivorous beetles, and their interactions with plants are highly relevant to applied research worldwide. Weevil larvae and adults feed and reproduce on a broad range of host plant tissues, including roots, stems, living or dead wood, leaves, floral buttresses, pollen, fruits, and seeds. These associations are often specialized and are thought to have promoted the diversification of both interactors. However, powerful analyses of specialization and diversification are unattainable for most weevil taxa due to the absence of an adequate taxonomic and phylogenetic framework. This holds true in particular for the colorful "broad-nosed" weevils in the *Exophthalmus* genus complex, a major Neotropical radiation with many species endemic to the West Indies. *Exophthalmus* and relatives are noted most for attacking citrus trees. Several species have acquired pest status in different regions, including *E. vittatus* in Jamaica, *E. quadrivittatus* in Haiti, and the citrus root weevil *Diaprepes abbreviatus* in Florida. The group is in great need of revision, as taxonomic challenges persist at various levels ranging from unreliable species hypotheses to tribal placements of genera without modern phylogenetic underpinning. These circumstances impede meaningful evolutionary analyses of their host plant ranges, patterns of endemism, and unique mating strategies involving three types of intrasexual mounting.

Intellectual merit. The proposed research will prepare the stage for a comprehensive systematic and evolutionary synthesis of the *Exophthalmus* genus complex. Redescriptions of critical type taxa will generate abundant new character information and help delimit seemingly overlapping genera such as *Exophthalmus*, *Diaprepes*, and *Compsus*. Frequent and well organized field work in Puerto Rico, the Dominican Republic, Jamaica, and Guadeloupe will provide a large pool of fresh specimens for morphological and molecular study. New and existing information on the weevils' distributions, host plant ranges, and reproductive behaviors will be synthesized and published on-line. A morphology-based cladistic analysis of *Exophthalmus* will be prepared including 70 or more suitable ingroup and outgroup taxa. Combined with an exploratory molecular study using the Cytochrome Oxidase subunit I and Elongation Factor 1- α loci, the analysis will establish the necessary phylogenetic structure for recognizing major clades of genera and species in the complex. Together these efforts will remove numerous taxonomic hurdles related to *Exophthalmus* and provide the necessary preconditions for a joint follow-up proposal aimed at revising the entire Neotropical lineage.

Broader impacts. The proposed activities will revitalize a longstanding research tradition in Neotropical insect systematics at the PI's University of Puerto Rico at Mayagüez. Participating undergraduate and graduate students from Puerto Rico and Latin America will be the most immediate beneficiaries. These students will be trained a broad spectrum of modern systematic skills including advanced field collecting methods, digital imaging and scientific illustration, morphological character analysis, molecular phylogenetics, and classification. The taxonomic focus on weevils addresses an urgent mandate to build up young specialists on a megadiverse and economically important lineage of insects.

The phylogenetic framework will facilitate collaborative efforts to explain insect diversification in the Caribbean region using both biogeographic and host plant data. It will provide excellent preconditions for comparative studies on the evolution of a unique set of reproductive strategies, including the origin of intrasexual mating behaviors. The results will also aid applied entomologists in the identification of species attacking cultivars in numerous countries, and foster an understanding of the occurrence of species with pest status based on a phylogenetic ordering of relevant biological variables.

The research products will be disseminated through articles in peer-reviewed journals, paper presentations at national and international meetings, and the existing Caribbean Insect & Plant Database. The latter will be strengthened as the primary digital repository for information on Caribbean insects, thus paving the way for other contributions and future structural database improvements such as the incorporation of taxonomic concepts.