

# DEVELOPING A STABLE CLASSIFICATION OF THE GLASSY-WINGED SHARPSHOOTER GENUS *HOMALODISCA*

## Project Leader

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## INTRODUCTION

The glassy-winged sharpshooter (GWSS), the leafhopper principally responsible for the spread of Pierce's disease on grape in California, is the species *Homalodisca coagulata*. This special capacity relates to the tissue upon which all sharpshooters (leafhopper subfamily Cicadellinae) feed: xylem, and the invasive status of the GWSS in California. It is noteworthy that of the 19 species in the genus, only one other species occurs in California and 18 species occur outside the USA (6 of these also occur in the USA). The genus is common in Mexico and also occurs southward through Central America, northern South America, and southeastern Brazil and Paraguay. That is, most species of *Homalodisca*, were they to reach California, have a destructive potential equal to the GWSS regarding the grape industry. The genus *Homalodisca* contains two other species that are already known to vector phytopathogens and it is practically expected that all species in the genus have the capacity to be, or become, serious vectors. Clearly, in a situation like this, we need to be clear about which species we are studying. The genus has never been revised.

Words are the tools of efficient communication and taxonomy is the vocabulary of species. By linking information to genus and species names, a classification of species becomes at once a very efficient system for storage and retrieval of information, and hence for meaningful communication, and a predictive tool, provided that classification is sound. Linking that information to species names that may be based on misidentifications, or belong to entirely different genera, will only add confusion to vector studies. In order to communicate effectively about the GWSS and its congeners, it is essential that everybody use the same names for the same species.

Access to all information on any group of organisms, including *Homalodisca*, is severely impeded by arbitrary generic limits, multiple names for some species and no name for others, or the absence of authoritative identification tools, or all three factors. The status of *Homalodisca* in this regard is below acceptable levels for a group of such economic importance.

## OBJECTIVES

Broadly, the objective of the proposed research is to stabilize the classification of the genus *Homalodisca* so that all other information gathered (host plants, ecology, physiology, genomics, etc., which are all identified as priorities in the PD research program) can be linked to the correct names for meaningful communication. This will be accomplished through three major objectives:

1. Establish the limits of the genus *Homalodisca* through comparison to closely related genera, and the limits of all species in the genus, determine their valid names, and describe new species as necessary.
2. Characterization of brochosome structure and related behavior to allow identification of egg masses and females for most species.
3. Provide authoritative and electronically accessible identification aids and distribution data for all species, in addition to a hardcopy publication of the *Homalodisca* revision.

Also important for a revision is determining the relationship of *Homalodisca* to closely related genera. This is presently being addressed by a Ph.D. student and proposal cooperator Daniela Takiya, with outside funding for four years and is consequently not a major objective of this project.

## RESULTS AND CONCLUSIONS

This is an incipient, two-year project involving both lab and field work. The revision of *Homalodisca* (Objective 1) has begun. In addition to the specimens held by the National Museum of Natural History, over 1,000 specimens have been borrowed from about one dozen institutions, locality data has been extracted and converted to decimal degree geographic coordinates for 1,500 specimens, and characterization of species and intra- and interspecific variation has begun. The closest genera to *Homalodisca* are *Phera*, *Pseudophera*, and *Oncometopia* (which also contain known phytopathogen vectors), but the distinctions are not satisfactorily established. At present there are 26 names in the genus *Homalodisca*, thought to pertain to 19 species. The most comprehensive study of *Homalodisca* to date was by Young (1968) and was limited to the seven species occurring in the United States. As noted above, however, the genus is more common in Mexico and further south, including Central America, northern South America, southeastern Brazil and Paraguay. The morphology of *Homalodisca* species, incorporating characters of the head, thorax (including wings and legs), abdomen, male and female genitalia, and integumental fine-structure are being analyzed.

To allow identification of egg masses and females (Objective 2), brochosome structure and related behavior is being characterized for as many species as possible, at present for six species. Brochosomes are hydrophobic secretions of malpighian tubules that are found only in leafhoppers. At moulting, nymphs and adults spread the brochosomes over their bodies, presumably to stay dry in wet conditions. In *Homalodisca* and a few related genera, females coat egg masses with these brochosomes, which vary in structure among species. This objective is most important for quarantine purposes, especially with regard to the grape crops.

For Objective 3, an on-line, image-driven key will be produced and placed on the USDA/ARS Systematic Entomology Laboratory server to maximize access and utility. A traditional key to species will accompany the hardcopy generic revision.

Foreign expeditions to support all three objectives are being planned for Mexico, Costa Rica, and Venezuela and will consist of examining existing collections (at the Universidad Nacional Autónoma de México, Instituto Nacional de Biodiversidad, and Museo del Instituto Agrícola, Maracay, respectively), making new collections of *Homalodisca* and associated organisms, such as host plants or natural enemies, and observing oviposition behavior in additional species. All expedition team members are leafhopper specialists with ample fieldwork experience. Collecting in Mexico and Venezuela may reveal males for two of the three *Homalodisca* species presently known only from females (the third species, *H. ignota*, occurs only in Brazil) and will undoubtedly yield new locality records. Obtaining more complete geographic coverage may result in revealing additional variation, which would impact species delimitation, or even new species. Specimens will be shared with collaborating foreign institutions in accordance with host country regulations; all specimens brought to the United States will be deposited in the National Museum of Natural History, Smithsonian Institution.

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