Development and Implementation of IPM and Biological Control in Floriculture Production (2006-2009)

PRINCIPAL INVESTIGATOR:
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PROJECT OBJECTIVES:
To increase the adoption of IPM and biological control strategies by floriculture producers through a) a better understanding of biological characteristics of commercially available and indigenous natural enemies, b) the development of improved sampling strategies, c) the development of diagnostic keys to more quickly identify pests and potentially invasive species, and d) evaluation and use of new reduced risk pesticides that are compatible with natural enemies.

ACCOMPLISHMENTS:
Research with two natural enemies has advanced considerably under this project. We worked extensively with the native lady beetle (*Psyllobora vigintimaculata*) and now understand a great deal about its biology and development. As one of the few arthropods that feed exclusively on the powdery mildew complex, we have advanced our knowledge of mycophagy in the family Coccinelidae. Data on the ability of *P. vigintimaculata* to consume powdery mildew demonstrates that it may be a factor in controlling powdery mildew in floricultural crops.

In addition, we have screened an extensive array of fungicides for compatibility with this beetle and can now make recommendations to growers regarding what fungicides to use that will provide mildew control and allow beetle survival. Research with releases of the leafminer parasitoid *Diglyphus isaea* in conjunction with sterilized male leafminers (*Liriomyza trifolii*) have demonstrated the feasibility of using SIT (Sterile Insect Technique) together with parasitoids for leafminer control in floricultural crops. An offshoot of this work was to explore the underlying mechanism that was responsible for the synergism observed when parasitoids and SIT were used together. Carefully crafted reductionist experiments revealed that in the presence of adult leafminers, D. isaea would kill more leafminers, primarily because they would 'host feed' on more leafminer larvae. We assumed that this was due to the parasitoids ability to recognize that the presence of adult leafminers meant increased host availability in the future, and therefore they would host feed more to accumulate more nutrients used for subsequent oviposition. Such a finding has already been put into practice where commercial insectaries are packaging *Diglyphus* adults with sterilized leafminers to increase the host mortality of these parasitoids after they are released into the greenhouse.

Another major accomplishment has been the development of a morphological and molecular key for identification of pest thrips of North America. Such an effort should benefit all agriculture in the US, not just floriculture producers. The key uses morphological and molecular data in a reinforcing way and it intended for cooperate

extension specialists, county-based extension personnel, and regulatory specialists at the state and federal level. An important purpose of the key to make sure that potentially damaging 'exotic pests are stopped at our ports of entry.

TECHNOLOGY TRANSFER/IMPACT:
Through the formation of the Gerbera Pest Management Alliance (GPMA) we have effectively reached all the gerbera producers in California. Ten newsletters, highlighting research accomplishments, have been published and distributed to gerbera growers and other floriculture producers in the state. There are more than 150 growers on our mailing list. An important component of the GPMA are the two largest commercial insectaries in California and together with them, biological control has advanced significantly in gerbera production. Virtually every grower used biological control as the primary strategy for control of leafminers, whiteflies, and spider mites. Pesticides are still needed to control 'secondary' pests (e.g., mealybugs) and research is ongoing with entomopathogens to fill this void. In addition to the newsletters, regular GPMA meetings were held several times a year in California and supplemented by grower-oriented meetings sponsored by the California Ornamental Research Federation. With respect to the thrips diagnostics, training sessions focused on how to properly use the key have been held in several locations around the country.

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