

## Bundy Research Program Summary

**Overview.** Insects have a tremendous impact on our lives, causing extensive agriculture and environmental losses. The research in my laboratory has two primary foci: **1)** the integrated pest management of arthropods impacting field crops in NM. **2)** Insect biology, bionomics and taxonomy.

**Impact:** Insects are an ever-present threat to agriculture, and losses and control costs have a tremendous economic impact, costing hundreds of billions of dollars a year. In US cotton alone, for example, losses and management costs attributable to insects total well over \$1 billion in a single year. Alfalfa, New Mexico's number one cash crop and the most important forage crop in the world, is impacted by several important arthropod pest species that result in losses of hundreds of millions of dollars each year. Alfalfa is also a refuge for many beneficial species of arthropods. These important predators and insect parasitoids often inundate surrounding crops and aid in reducing pest populations. However, biological information for many of the pest and beneficial arthropods in New Mexico is incomplete or completely unknown; this leads to inefficient control methods and poorly-timed insecticide applications, impacting NM economics and the environment. A critical component of pest management is proper identification of pest and beneficial species. With nearly one million described species and estimates by some scientists of 30 million species inhabiting the planet, it is extremely important to differentiate among the various species impacting crops, from their associated predators, parasitoids, and from the myriad of non-economic species. As an example, there are nearly 200 species of the blister beetle genus *Epicauta* in North America. Many of these species may cause economic damage to several crops. However, only a relatively few species produce concentrations of cantharidin that are life-threatening to livestock. Therefore, it is extremely important to be able to accurately differentiate among species, and little is known about the species in New Mexico. The Heteroptera, or true bugs, is another group that remains understudied in the state, though it contains many economically-important members that are pests, beneficials, and disease vectors. Information on the biology and ecology of our species can fill gaps in our understanding of these understudied taxa of insects.

**1. Arthropod IPM of Field Crops** My laboratory is working on the seasonal biology, management, and injury impact of the key insect pests and the biology of beneficial arthropods that impact row crops in New Mexico.

**Alfalfa Insect Management.** Our research focus in alfalfa has been on the alfalfa weevil. We have worked in collaboration with Steve Hanson (NMSU) and Mike English (NMSU, now retired) using mitochondrial DNA to determine that all three strains of the alfalfa weevil are present in New Mexico (often two strains within a single field), a condition possibly unique to this state. Our data altered the theoretical map of strain distribution in the US to fit what is now known for NM and show a shift in strain movement. This has important implications for management. Weevil strains exhibit many important biological and behavioral differences, which may impact management. Therefore, a proper understanding of activity of the strains of

the alfalfa weevil under the unique conditions of New Mexico is necessary to effectively manage this pest in the state.

**Cotton Arthropod Management.** Our research in cotton has studied the impacts of several pest and beneficial species of arthropods. In cooperation with Brad Lewis (NMSU) we have evaluated the potential effects of an insecticide (Lorsban) used as part of a pink bollworm eradication project on non-target pest and beneficial species. In a project with David Richman (NMSU) and Robert Steiner (NMSU) we surveyed the spiders of cotton in New Mexico. This was the first evaluation of the spiders of cotton in New Mexico. We found 42 genera representing 19 families present in conventional, transgenic Bt, and organic cotton in the state. We discovered a few consistently abundant species that have strong potential as biocontrol agents for pest insects in the state. We have also evaluated the western tarnished plant bug, *Lygus hesperus*, documenting the symptoms of feeding injury to cotton by both nymph and adult plant bugs on various ages of squares and bolls. These data are important to both field scouts and researchers to allow better detection of injury in the field, which allows for more educated decision making in applying management tactics such as insecticides. We have worked closely with Paul Funk (USDA) to determine the impact of thermal defoliation on late-season insect pests causing “sticky” cotton.

**Chile Insect Management.** In cooperation with Rebecca Creamer (NMSU) and Jill Schroeder (NMSU) we have determined the seasonal phenology of the beet leafhopper, the vector of curly top virus, on weed hosts in NM. This research has important implications for proper management of this pest and its virus. With Brad Lewis (NMSU), we evaluated the injury potential of *Lygus* on NM chiles. We also are currently working on the impact of flea beetles on seedling chile in the state.

**2. Insect Biology and Taxonomy.** Our research emphasis here is the taxonomy and ecology of the Heteroptera, primarily the Pentatomoidea and Reduviidae. We also are working on the blister beetles (Coleoptera: Meloidae) of New Mexico.

**Current Research.** In collaboration with J.E. McPherson (Southern Illinois University) we have documented host species, egg and reproductive morphology, and determined laboratory immature developmental periods for the only two U.S. species (*Mecidea major* and *M. minor*) of a poorly-studied tribe of stink bugs (Pentatomidae). We have also described the immature stages of *Corimelaena incognita* (Thyreocoridae), and we are evaluating the species complex of Heteroptera impacting cotton in the state. My lab also is developing a species list of the blister beetles of New Mexico and evaluating the relative concentrations of blistering agent (cantharidin) in the blood of common species that may impact alfalfa. Very little is known about these and other related taxa. Work continues to be needed in this area to provide biological and taxonomical data on these understudied organisms in NM.