

Veterinary Entomology Research Laboratory New Mexico State University

Mission

Our mission at the Veterinary Entomology Research Laboratory (VERL) is to conduct research, both basic and applied, that results in applicable and adoptable pest control recommendations for livestock and domestic animal producers of New Mexico (NM). The major areas of research include:

- 1) Characterization of insecticide resistance in the horn fly, *Haematobia irritans* (L.) and documentation of cross-resistance, evaluation of biochemical, physiological, and behavioral mechanisms, and defining ecological parameters influencing the evolution of resistance.
- 2) Biology, ecology, distribution, and population dynamics of arthropods influencing livestock production management strategies.
- 3) Design and implementation of model, integrated pest management (IPM) programs for livestock using an interdisciplinary approach involving nutritionist, parasitologist, veterinarian, and economist.
- 4) Vector-borne diseases and vector-blood feeding behavior as it relates to transmission of pathogenic agents to animals.

Importance

The total costs of arthropods affecting livestock and other animals is staggering when one considers that the losses associated with the two primary pests of cattle, the stable fly, *Stomoxys calcitrans*, and the horn fly, *Haematobia irritans*, regularly exceed \$2 billion annually in the U.S. These costs are ever-increasing as conventional arthropod management tactics, such as the use of insecticides, has led to resistance expression and control failures in many livestock systems. This problem is compounded by human population growth into historically rural and agricultural areas, where arthropod dispersal at the urban-agriculture interface can result in disease transmission and litigation. Recently, the potential for disease transmission by the house fly, *Musca domestica*, has been surmised due to its mechanical transmission of *Echerichia coli* O157:H7, the causal agent of hemorrhagic gastrointestinal infections. These costs are particularly disconcerting for NM, where livestock, poultry, and other animal production accounts for over 70% of the state's total agricultural output. Therefore, continued research to understand the biology, ecology, and characteristics of resistance development in these pests is imperative to future control program success, and ultimately, the reduction of disease transmission.

There are a number of other pests having veterinary and medical importance in NM, including ticks and mosquitoes. Since its arrival in 2003, there have been over 430 human cases of West Nile virus, resulting in 15 fatalities. During this time, there also have been over 500 infections in horses, many of which have led to animal euthanasia. Continued research concerning the seasonality and preferred habitats of the primary West Nile virus vectors is critical to avoid wasteful insecticide use and assist mosquito control district decisions regarding the timing of insecticide applications. The brown dog tick, *Rhipicephalus sanguineus*, has also gained national attention due to the ineffectiveness of chemical insecticides used against it. Furthermore, the brown dog

tick is known to vector disease-causing pathogens, such as those that cause babesiosis in dogs and Rocky Mountain spotted fever in humans. The danger of disease transmission is greatly accentuated due to the ability of this tick to infest and proliferate in human-occupied dwellings. Therefore, timely research concerning the resistance mechanisms and alternative management strategies are needed to prevent further infestations and reduce the potential of disease associated with this pest.

Research.

The research conducted at the VERL has had a significant impact on basic and applied information for parasites of medical and veterinary importance. These arthropods have included house flies, face flies, stable flies, horn flies, horse flies, mosquitoes, culicoides, lice, mites and ticks, as well as several pathogens they vector including Anaplasmosis, Dog Heartworm, Vesticular Stomatitis and West Nile virus. Projects with collaborators from State Agricultural Experiment Stations, USDA and the Animal Health industry have resulted in the development of new and improved control strategies for these pests.

At the request of several animal health companies, our lab has conducted numerous projects to investigate the physiological, biochemical and behavioral mechanisms of insecticide resistance in the horn fly. Significant progress has been made in understanding the toxicology and delivery system interactions for this pest. Many of the theories and concepts developed at VERL have been adopted by other university scientists, the animal health industry, and cattle producers. Our research efforts in this area have resulted in the development of new bioassay techniques for detection of insecticide resistance, specific management strategies for preventing/delaying the development of insecticide resistance, and the conception and marketing of a synergized pyrethroid impregnated cattle ear tag for horn fly control.

Future Research.

New Mexico provides a unique opportunity to assess arthropod pests under various facility and environmental conditions. Our research will continue to provide pest management solutions for livestock and domestic animal producers in NM, with a major goal of developing adoptable IPM programs for those systems.