UF | IFAS Research
UNIVERSITY of FLORIDA

NATURAL RESOURCES

AGRICULTURE

HUMAN SYSTEMS

PESTS AND DISEASES

The same climatic conditions that make Florida a great place for people – sunshine, mild winters, abundant rainfall – can also help non-native pests survive and reproduce here. Many species have done so already, including vertebrate animals, invertebrates, plants, bacteria, viruses and fungi.

New organisms reach Florida each year, most of them arriving unnoticed with international travelers or shipments of goods. A small percentage become so well-established that they create problems by altering natural environments, damaging crops or creating health issues for people and livestock. Notable examples include the Burmese python and citrus greening disease, which is caused by a non-native bacterium and spread by an invasive insect.

Researchers with the University of Florida Institute of Food and Agricultural Sciences are not only addressing the challenges that invasive pests and emerging pathogens pose today, they are working to prepare the state for unknown future challenges. Their studies investigate better methods for detecting pests and pathogens, applying pesticides, improving crop-management regimes and managing destructive organisms with minimal cost and environmental impact.

Ongoing Research

INVASIVE PLANTS

Managing invasive plants in Florida would be more efficient if scientists could make accurate long-term predictions about which species are likely to become established and persist at specific sites. Such predictions generally require a historical perspective, but present-day land managers often lack detailed records indicating when and where past plant invasions developed, said ecologist Luke Flory, an assistant professor with the UF/IFAS Agronomy Department. Flory is part of a team studying factors that influence plant invasion dynamics over time, such as the role pathogens might play in promoting or suppressing the spread of an invasive species. Team members hope to develop more reliable tools for predicting the long-term consequences of plant invasions, and Flory is encouraging researchers and managers to track current plant invasions to determine the ecological effects.

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HOST-PATHOGEN INTERACTIONS

In the struggle to survive, organisms constantly evolve to better defend themselves against natural enemies or thwart the defenses of their prey. Nemat Keyhani, a professor with the UF/IFAS Department of Microbiology and Cell Science, leads a team investigating this dynamic in the red flour beetle, *Tribolium castaneum*, one of the world's two most significant secondary pests of stored grains. The team showed that benzoquinone compounds secreted by the beetle discourage growth of the entomopathogenic fungus *Beauvaria bassiana*. In turn, the fungus produces an enzyme that weakly counters the beetle's defense. Keyhani believes it may be possible to identify or breed a more potent *B. bassiana* strain capable of killing red flour beetles, and use it to protect grain and grain-based food products stored in climate-controlled facilities.

HYBRIDIZATION OF TERMITE SPECIES

Two invasive species, the Asian subterranean termite, *Coptotermes gestroi,* and Formosan subterranean termite, *C. formosanus*, cause a large percentage of Florida's termite damage. In South Florida, the two species often nest in close proximity, and recent findings indicate that male Asian subterranean termites are mating with Formosan females and producing offspring, according to a research team led by entomologist Nan-Yao Su, a distinguished professor with UF/IFAS' Fort Lauderdale Research and Education Center. Research is under way to determine whether the hybrids can reproduce and form new colonies, a critical issue for determining the potential threat the insects pose. Hybrid organisms often surpass both parent species in dimensions such as reproductive potential and defensive capabilities, meaning that the hybrid termites might prove more destructive than Asian or Formosan subterranean termites.

Research with Impact

CITRUS GREENING

The bacterium responsible for citrus greening disease, *Candidatus* Liberibacter asiaticus, is transmitted into citrus trees through new shoots, a consequence of feeding activities by the Asian citrus psyllid, *Diaphorina citri*. Therefore, scientists believed that early-stage greening disease primarily affected the citrus canopy. UF/IFAS research showed that the roots of infected trees actually suffer the greatest initial damage, said soil microbiologist Jim Graham, a professor with the UF/IFAS Citrus Research and Education Center in Lake Alfred. Based on his research team's findings, Graham urged growers to adopt management practices to optimize root health, such as adjusting the pH of irrigation water. Although these practices cannot cure greening, they may slow its progression, and Graham said groves of infected trees have shown impressive recovery within three seasons after growers took remedial action.

ROSE ROSETTE DISEASE

Florida is the nation's fourth-largest producer of roses, and UF/IFAS researchers recently helped the state's growers avoid a potentially devastating bout with rose rosette disease, a viral malady that is the most significant threat to U.S. rose production. In late 2013, reported signs of the disease spurred immediate response from a research team led by Mathews Paret, an assistant professor with the UF/IFAS North Florida Research and Education Center in Quincy. The scientists issued alerts, helped identify infected plants and held training sessions to educate industry and Extension personnel about the disease and appropriate responses. The rapid response led to the eradication of infected plants in Florida and no outbreaks have been reported in the state since 2014. The team is developing a preventive strategy for producers and a test capable of detecting the virus in non-symptomatic plants.

WEST NILE VIRUS

The Southern house mosquito, *Culex pipiens quinquefasciatus*, is notorious for transmitting West Nile virus to humans and other vertebrates. However, genetic variations can cause some females to vector the pathogen more effectively than others. Chelsea Smartt, an associate professor with the UF/IFAS Medical Entomology Laboratory in Vero Beach, investigated by feeding infected blood to female mosquitoes from two geographically distinct populations, and then analyzed selected genes associated with immune response. Mosquitoes from one population displayed less gene activation in response to the pathogen, and their ovary development was barely impacted. These findings suggest that genetically determined "priorities" for energy allocation may help determine vector competence in arthropods. Smartt will design bait products to increase mosquitoes' resistance to West Nile virus and, ideally, prevent the insects from becoming vectors.

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