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Field-evolved resistance to Bt Crops in Latin America

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Abstract: Fall armyworm, Spodoptera frugiperda (J.E. Smith) is one of the most destructive maize pests in the tropical zone of the American Continent, causing significant yield losses under moderate-high infestations. Historical S. frugiperda management in South America relied on plant protection with synthetic insecticides, ranging from 1-10 applications per crop cycle, depending on pest pressure and crop system management. More recently, genetically modified maize plants expressing insecticidal Bt proteins gained significant role in managing this pest in the region due to its effectiveness. Nonetheless, local environment, landscape, and agricultural practices can create intense selection pressure favoring resistance development to chemistries and biotech traits, representing a significant challenge to effective long-term control of this pest. Short term financial and food security goals driving maximization of land productivity in large monoculture agricultural systems with potential extraction of two to three crops per year impose strong selection pressure through an environment biologically accelerated. Understanding regional landscape, pest ecology, insect-crop/trait interactions, and genetic variability is fundamental for deployment of effective, locally adapted practices. The utilization of a variety of control tactics is key for sustainable management and cropping systems. The biggest challenge is balancing economic, environmental, and social aspects of sustainability at the local level.

Crop pollination by nocturnal bees

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Abstract: Most bees are active during the day. However, approximately 1% of the bee species are nocturnal and forage in search for flowers during the low light intensities of the night, between sunset and sunrise. They account for about 250 species and are distributed among the families: Andrenidae, Apidae, Colletidae and Halictidae. We evaluate the role of nocturnal bees in the pollination of “cambuci”, Campomanesia phaea, Myrtaceae, and “guarana”, Paullinia cupana, Sapindaceae, both economically highly important plants of the Brazilian Atlantic Rainforest and Amazon, respectively. Furthermore we collected floral volatile from the host plants using dynamic headspace method and tested if these compounds were capable of attracting nocturnal bees in the field. Synthetic scent mixtures that contained various of the identified floral scent components, successfully attracted nocturnal bee pollinators. Our data show that cambuci and guarana attract their nocturnal bees by strong floral scents and suggest that the chemical communication between these plant and their pollinators is a key step in crop production of these economically important plant species.

Insect role in transmitting Dickeya dianthicola among potato plants

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Abstract: The blackleg bacterium Dickeya dianthicola Samson is an important pathogen of potato, Solanum tuberosum, in North America and Europe. Previous work has suggested that insects, particularly aphids, may be able to vector bacteria in this genus between plants. However, no empirical work was conducted to evaluate their epidemiological role in transmitting this disease on commercial potato fields. We tested vector potential of the two potato pests most common in most temperate growing areas: the Colorado potato beetle (Leptinotarsa decimlineata Say) and the green peach aphids (Myzus persicae Sulzer).

Olfactometry and recruitment experiments evaluated if either insect discriminates between infected and uninfected foliage. Infection was determined using visual symptoms and genus-level PCR primers for Dickeya. In the laboratory, beetles and aphids were fed infected plants and then transferred to uninfected plants to determine if bacteria would be transmitted between plants. In the field, insect densities were manipulated to correlate them with the incidence of the disease.

Neither Colorado potato beetles nor green peach aphids were attracted to infected foliage in either olfactometry or recruitment experiments. To the contrary, presence of butanediol, which is product of Dickeya fermentation, significantly reduced beetle attraction to the odor of potato foliage. Green peach aphids preferred uninfected foliage, but only when conspecifics were present. Neither Colorado potato beetles nor green peach aphids acquired and transmitted D. dianthicola through feeding on infected plants in the laboratory. In the field, neither insect’s abundance correlated significantly with the spread of this disease. Therefore, controlling these pests is unlikely to prevent blackleg outbreaks in potato fields. Instead, the efforts to limit spread of this disease should focus on sanitation, water management, and seed screening.