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Peanut Burrower Bug Project Update

The Peanut burrower bug is a native pest of peanut that feeds directly on peanut seed with piercing-sucking mouthparts and can cause severe reduction in quality, causing downgrades to seg 2 at only 3.5% injury and significant economic loss for farmers that have the pest. An increase in injury and presence of aflatoxin in harvested peanuts has drawn more attention to the pest in recent years and called for heightened research efforts. To develop a comprehensive integrated pest management (IPM) strategy, the peanut entomology team at UGA is guiding efforts to develop a better understanding of the bugs biology, ecology, and its propensity to feed on peanut. This relatively new threat to the GA peanut industry calls for improving our knowledge of the pest's biology and ecology, identification of landscape and environmental drivers of PBB presence and peanut injury, and the development of new monitoring and management tools like light and pheromone traps.

We know that this pest is difficult to observe in the field, as it spends most of its life cycle below ground. It is a generalist seed feeder and likely has a broad host range outside of peanut. We have seen high rates of injury in conservation tilled dry-land fields after dry conditions. The use of deep tillage and irrigation appears to mitigate injury to a certain extent, but there is no cure-all approach to management by use of field practices alone.

This project began with biological studies to gain an understanding of the insect's life cycle, reproductive (population growth) potential, and its behavioral ecology in a controlled environment chamber. Additionally, a large-scale modelling effort was conducted to identify landscape and environmental factors that cause peanut fields to be at greater risk for peanut burrower bug presence and injury. An effective trap design is vital to management which requires enhancement of the current traps in use. This will increase our capability to observe and sample for the pest in real-time so that growers are not surprised by what they see at the buying point in terms of PBB injury and ratings that cause downgrades and economic losses. This led to work to develop an effective trap based on a pheromone lure and to optimize a field trap design by testing the bugs' response to various wavelengths of light.

We have learned that this subterranean stink bug has five immature stages that can be delineated by head capsule width. They require about a month to develop from hatching to adulthood, and populations can burgeon quickly as females produce an average of about 80 eggs during a lifespan of about 90 days (about 3 months). Immature nymphs, particularly first instar nymphs, must come into direct contact with a female to develop at a normal rate, an unusual and interesting caveat of their developmental process.

To identify key environmental drivers of burrower bug success, we collaborated with the GA Federal State Inspection Service which shared all reports of burrower bug injured peanuts throughout the state. Model results support the idea that the riskiest landscapes for injury are comprised of high crop diversity, but not too much of any one type of crop. Additionally, not many types of seminatural habitat seem to increase risk and large peanut fields dilute injury. This may reflect the abundance of resources for the bug in diverse but largely agricultural landscapes. Edge effects of contrasting crop families, interface of peanut to seminatural habitat, and the negative effect of elevation on injury also suggest that risky landscapes lack complexity in shape and elevation. These edge effects could be related to top-down control by natural enemies. Trophic interaction of natural enemies was not tested due to the absence of necessary data. The effect of field flatness could be related to bugs' ability to disperse and move through fields without obstruction.

Then, what makes a *particular field* vulnerable? Larger fields have less injury, and fields with high organic matter and low clay make it easier for bugs to burrow through the soil and access peanut pods. Low moisture in the summer (and lack of irrigation) might drive bugs to do more peanut feeding as developing pods are high in water content. Therefore, the perfect storm for economic injury is where we have a risky landscape, a vulnerable field, summer drought, and no relief from irrigation.

A putative male sex pheromone was produced by the USDA and tested in a Y-tube olfactometer to test the level of attractiveness of multiple pheromone lures. There was not an overwhelming laboratory test result to suggest we have found an effective pheromone, and field testing of the lure was unsuccessful. Therefore, optimization of current experimental compounds or exploration of new compounds is necessary.

Wavelength response tests showed that both black and white (warm, bright, and white) fluorescent lights performed well in attracting peanut burrower bug. But, bugs were consistently more attracted to white fluorescent bulbs when each type of white light was compared to the black fluorescent and LED bulbs. These data suggest that white fluorescent bulbs should be the choice bulb for future use in light traps.

We have learned a lot about burrower bug biology and ecology through these studies; however there is still a lot that we do not know. Landscape and environmental factors certainly have an influence on peanut burrower bug injury to peanut and we plan to use this information to develop a risk assessment tool for peanut farmer to use as field guidance. The continuance of chemical ecology experimentation could lead to baited management solutions in the future (e.g., attract and kill, mating disruption, etc.). Host plant resistance should be an area of focused research for the future, as well as the development and testing of new chemistries. For now, deep tillage remains the only effective management tool.