Management of Redbanded Stink Bug in MS Soybean Production Systems
PROJECT #: 39-2022
FINAL REPORT

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RATIONALE/JUSTIFICATION FOR RESEARCH Redbanded stink bugs were the most abundant stink bug species present in 2017 in Mississippi. This species is extremely damaging and often enters the fields much later than our traditional species (Green, Southern Green, and Brown). The redbanded stink bug is capable of causing severe economic damage well after stink bug sprays are recommended to be terminated for our native species (R 6.5). Because this stink bug is cyclic in nature, many producers had terminated scouting during the 2017 season and sustained substantial economic damage from this pest. There were reports of several fields that were complete losses and many others with substantial deductions at the elevator from damage due to this pest. Redbanded stink bugs are extremely damaging and harder to control with commonly used insecticides. This project will outline objectives to better understand management tactics to manage RBSB in Mississippi to ensure profitability for growers.

OBJECTIVE(S):

Objective 1: Conduct ditch bank and early cover crop surveys in legumes in the early spring to predict RBSB populations

Objective 2: Quantify the role of weather in its range expansion and contraction in Mississippi

Final Report

Our recent efforts have looked at both an overwintering assay with redbanded stink bugs and more broadly at the climatic limits to their potential range. Our overwintering assay suggests that substrates can provide thermal buffering from ambient temperatures. This is reflected when looking at overwintering temperatures for redbanded stink bugs compared to known lethal temperatures.

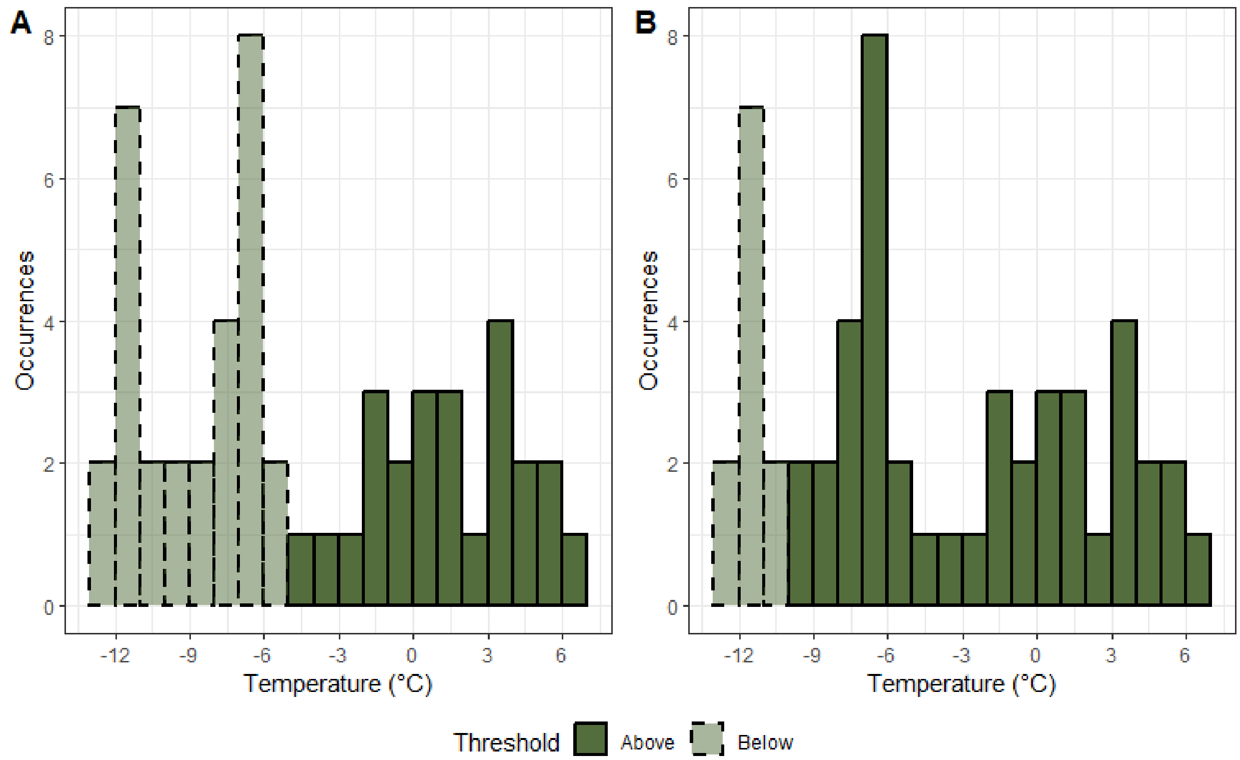

Figure 1. Minimum overwintering temperatures at locations where redbanded stink bugs were found in early spring or late winter.

We looked at 53 redbanded stink bug occurrences in the southeastern United States from the months of January through April. We then looked at daily minimum temperature data for the winter preceding when each bug was found, starting with October 1st of the previous year. We then grouped occurrences by those which overwintered in places which stayed above lethal temperature thresholds (dark green) and those which fell below lethal temperature thresholds (light green). We first used a threshold of -5 °C (**A**), based on previously published literature (Bastola and Davis 2018), and then we adjusted it for potential effects of leaf litter at -10 °C (**B**), assuming that redbanded stink bugs may seek out overwintering refuge which is warmer than ambient temperature (**see Figure 2**).

We found that, at a threshold of -5 °C, more than half (53%) of stink bugs occurred in places colder than the threshold where we would have expected survival, but when we adjust the threshold, only 21% of stink bugs occurred in places where we would expect winter temperatures to cause mortality. **These data support our hypothesis that cold winter weather and overwintering survival are major drivers of redbanded stink bug persistence in more northernly locations like Starkville, MS.**

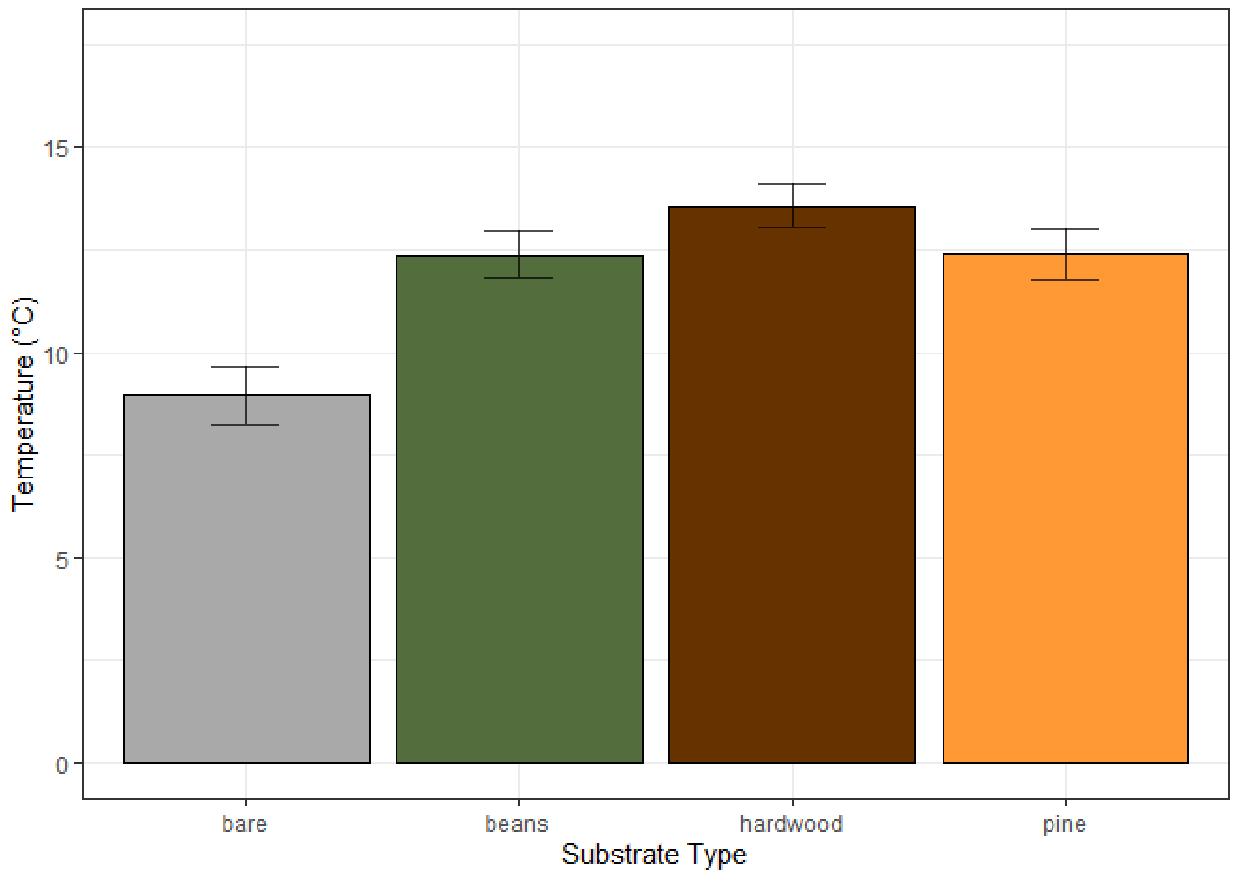

Figure 2. Mean temperatures for substrates at coldest times of day in overwintering assay.

We placed stink bugs and temperature loggers in boxes from October through January and tracked stink bug survival and temperatures within different substrate types. **We found that temperatures differed significantly from bare soil (ambient) temperatures when substrate was present**. Temperatures in all substrate types were significantly warmer than bare soil temperatures when at the coldest time of day – the time when the daily minimum temperature occurred in the bare soil (Tukey's test: all $t > 3.92$, $p < 0.001$). Substrate temperatures were not significantly different (Tukey's test: all $t < 1.41$, $p > 0.497$).

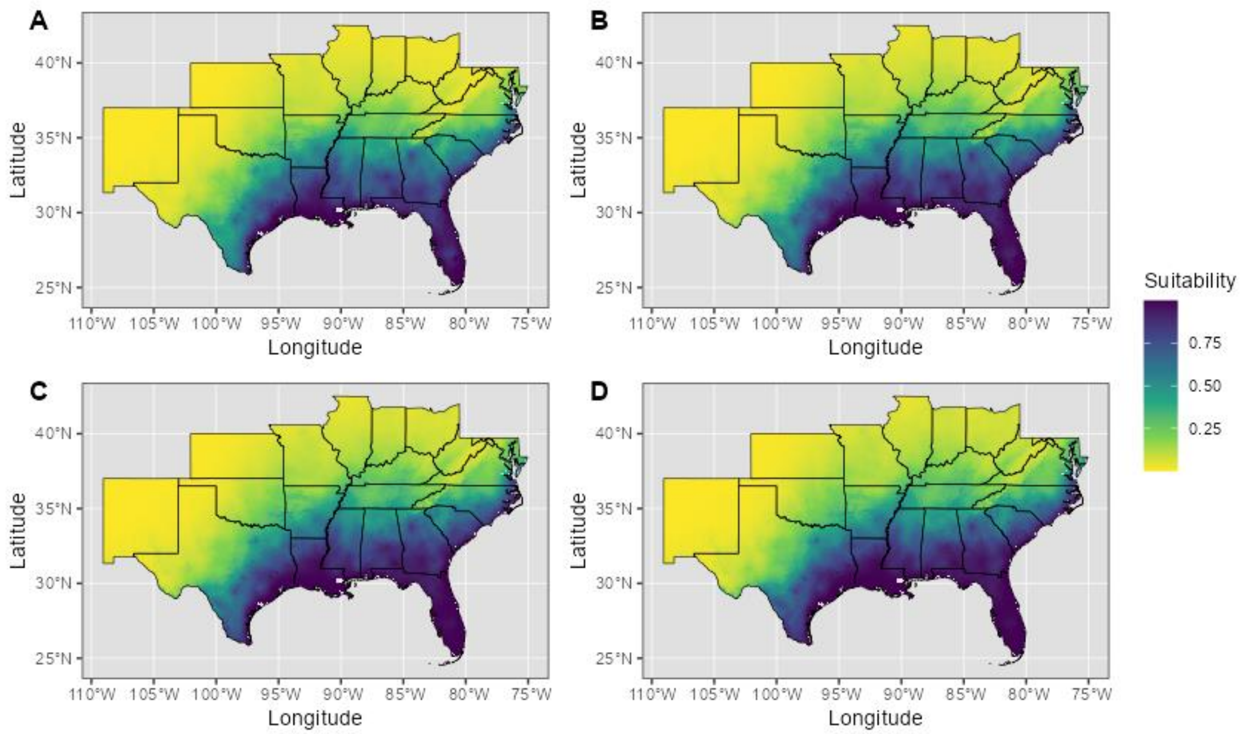

Figure 3. Projected future climatic suitability for redbanded stink bugs in the southeastern United States, based on overwintered stink bugs.

We developed a climatic suitability model for the redbanded stink bug from occurrences found in January through February, and we used this model to predict future suitability: (**A**) 2021-2040, (**B**) 2041-2060, (**C**) 2061-2080, and (**D**) 2081-2100. **When the model is trained on overwintered occurrences, we do not see a projected northern increase in the potential range for the redbanded stink bug. However, when we train a model on all available occurrence points (Figure 4)**, **we see an increase in the projected range of the redbanded stink bug. This further emphasizes the idea that cold winter temperatures are a limiting factor to the range of the redbanded stink bug.**

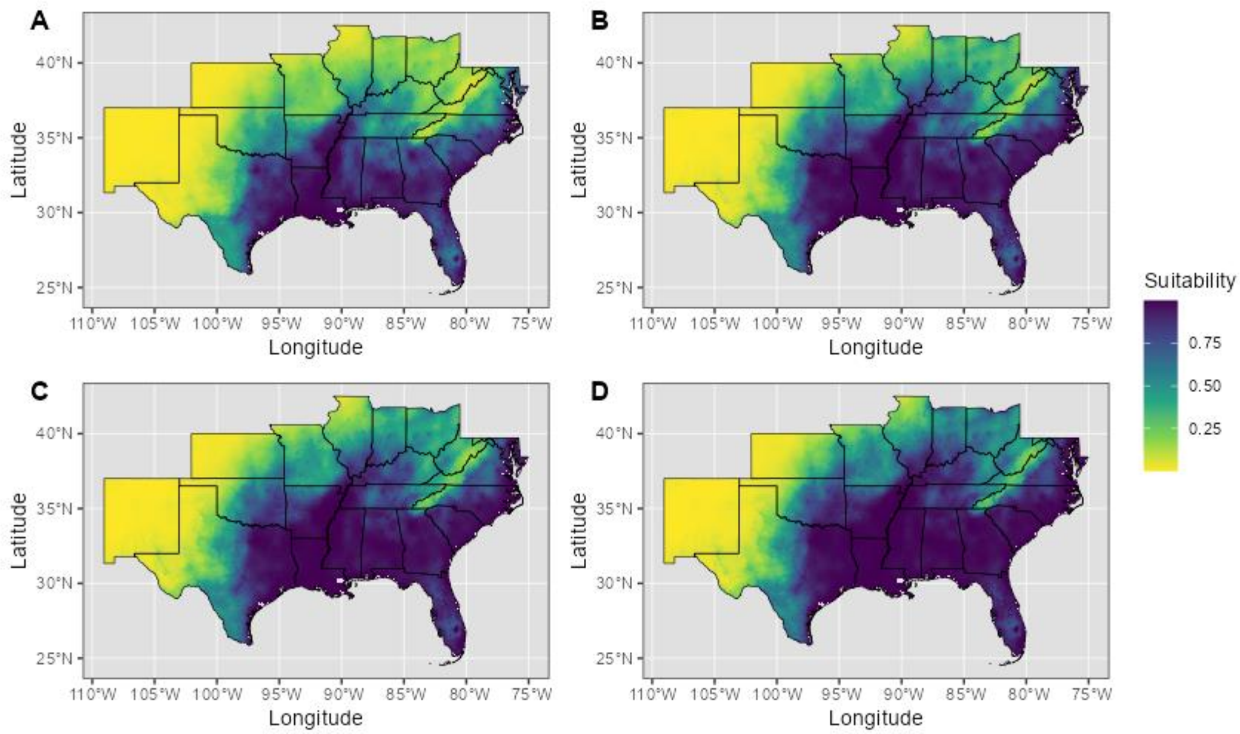

Figure 4. Future projections made the same way as **Figure 3** but including occurrences from all months of the year.