Budworms Implicated As Cause Of Green Bean Syndrome In Soybeans

FAYETTEVILLE, ARK.

Green bean syndrome – in which soybean plant maturity is significantly delayed and uneven – is not caused by a disease pathogen, according to exhaustive research by University of Arkansas System Division of Agriculture plant pathologists and colleagues in Louisiana and Mississippi.

Green bean syndrome (GBS) occurrences range from a few spots or strips as small as 100 square feet or, rarely, an entire field. The main GBS symptom is uneven maturity of pods on individual plants. Half of the pods on a plant may be ready for harvest and the rest are still green.

Cooperative Extension Service entomologist Gus Lorenz said extremely high populations of soybean budworms, also called corn earworms, very likely caused the significant GBS seen the last two years. His diagnosis is based on research in Arkansas and elsewhere and field observations.

Arkansas plant pathologists Yanis Tzanetakis and John Rupe say Lorenz's observation is consistent with their findings, which suggest that high levels of seed abortions and depodding, which may have occurred from heavy budworm feeding, cause physiological changes in plants that result in delayed and uneven maturity of pods.

GBS was induced in two studies by the plant pathology group where pods were removed from plants and where plants were subjected to very high populations of pod-feeding stink bugs. These and other studies have documented that any stress that interferes with the setting, filling and retention of soybean pods can cause uneven pod maturity, Tzanetakis said.

Additional experiments by the plant pathologists, including a "deep sequencing" analysis, ruled out the possible suspects of phytoplasma, viruses and other pathogens as significant GBS causal agents.

Tobacco ring spot virus and phytoplasma can cause GBS symptoms, but it is a soil-borne virus found only in small areas of a field, Tzanetakis said. Phytoplasma are specialized bacteria that have no cell wall. They are transmitted by an insect vector and infect the phloem tissue in plants. None were found in any of the many GBS plant samples collected in Arkansas, Louisiana and Mississippi.

The Arkansas Soybean Promotion Board funded the plant pathology research. Cooperators included Marites Sales, U of A; Sead Sabanadzovic, Mississippi State University; Rodrigo Valverde, Louisiana State University; and Stella Kantartzi, Southern Illinois University.

In the deep sequencing study, made possible by the sequencing of the soybean genome, plant samples with GBS symptoms from multiple Arkansas and Mississippi locations were sent to Oregon State University, which has the equipment to generate millions of base sequences, or DNA fingerprints, from each sample. The resulting base sequences were then analyzed using a super computer to compare them to all base sequences associated with known soybean disease pathogens. No matches were found that suggested GBS symptoms were caused by a pathogen, Tzanetakis said.

Future analysis of deep sequencing results can use a super computer acquired last April for the Arkansas High Performance Computing Center on the Fayetteville campus. High volume sequencing will continue to be outsourced.

Heliocoverpa zea caterpillars, which are known as soybean budworms, corn earworms and by other names depending on the crop infested, are the number one insect pest of crops in the Mid-South, Lorenz said.

Lorenz said conditions that led to very heavy and damaging budworm infestations the last two years began with late soybean planting or replanting after spring floods, which delayed blooming until the peak of the budworm population from mid-July to early August. Also, a hotter and dryer than usual summer provided favorable conditions for budworms and might have added the stress of high night heat interference with seed development.

The many GBS occurrences Lorenz observed in 2010 and 2011 in fields with severe bollworm damage implicated caterpillar damage as the main cause of GBS, he said. Δ