Identification of Genetic Insect and Mite Pest Resistance in Turfgrasses

Texas A&M University

James Reinert

Start Date: 1998
Number of Years: 5
Total Funding: $125,000

Objectives:

1. *Establish a Regional Center to identify genotypes of Cynodon, Zoysia, Buchloe, Paspalum, Agrostis, and Poa with genetic resistance to insects and mites (fall armyworms, black cutworm, sod webworms, greenbug and host specific eriophyid mites) for use in cooperating turf breeding programs.*
2. *Bioassay resistant line with insect diets to characterize the mechanisms of resistance and determine their biochemical nature.*
3. *Develop effective and efficient procedures to accommodate screening and identify typical breeding populations- heretofore unavailable to the plant breeder.*

The project has established a regional center to screen and evaluate turfgrass germplasm for resistance to insect and mite pests. The primary goal of this project is to identify genetic lines of several turfgrass species (bermudagrass, zoysiagrass, buffalograss, seashore paspalum, bentgrass and bluegrass) with resistance to the primary pests; caterpillars (fall armyworms, black cutworms, sod webworms), white grubs and host specific eriophyid mites, and to characterize the mechanisms of resistance. An important part of the project is the development of efficient screening procedures to effectively identify genetic resistance. A secondary goal is for the cooperative grass breeders to incorporate the resistance into new cultivars to help eliminate our dependancy on pesticides in the multi-billion dollar turf industry.

Work has continued with the elite germplasm of bermudagrass (*Cynodon* spp.) from the breeding program under Dr. Charles Taliaferro at Oklahoma State University, Stillwater. Thirty-two bermudagrass hybrids and four commercial cultivars were evaluated for resistance to newly hatched or neonate larvae of fall armyworm in no-choice feeding studies. This was a second set of experiments with many of these bermudagrasses. Among the hybrids, 3200W 1811 provided the highest mortality (25%) along with four other genotypes, and larvae fed on this genotype were the smallest (38.16 mg) when weighed as 10-day-old larvae. Larvae fed on this cultivar required 32 days from egg hatch to adult emergence which was four to five days longer than on many of the other genotypes. Small larvae weighing less than 70 mg and also taking 31 to 32 days for development from egg to adult were recorded from 3200W 70-18 and 3200W 94-2. In a second experiment, highest mortality was recorded for 4200W 56-14 and 4200W 74-3, with 16.67 and 12.50%, respectively. These two cultivars along with CCB 24-4, CCB 10-9 and Greg Normanl also produced larvae weighing less than 70 mg after 10 days feeding. Larvae feeding on CCB 24-4, 4200W 25-7 and Greg Norman I also required 31 to 32 days from egg to adult emergence. The largest larvae (>160 mg) were produced on

3200W 6-12, Tifway, 4200W 53-1 and 4200W 47-1. Larvae developed fastest on 4200W 47-1 and took only 26.51 days from egg to adult. Additional studies are planned with this germplasm base to identify potential resistance to the other important pests.

Progress has been made to identify the heritability of fall armyworm resistance in hybrids of zoysiagrass (Zoysia spp.) from the breeding program under Dr. M. C. Engelke at Texas A&M University, Dallas. In two experiments, 18 Zoysia hybrids were compared with 'Cavalier' (high antibiosis), 'Diamond' and 'Crowne' (each, parents of several of the hybrids) and' Meyer' an industry standard. Cavalier, TAES 4374 and Meyer, each provided significant mortality of the developing larvae with at least 75% mortality before adult emergence. Larval mortality on Meyer was much higher in this test than in previous experiments. Feeding on each of these grasses was significantly less than on any of the other grasses in the study. In a second experiment, Cavalier and TAES 4374 again produced the highest larval mortality. TAES4373, TAES4359 and TAES4362 also provided larval mortality greater than 95%. Surviving larvae were smallest on these five hybrids (<28 mg), while the hybrid (TAES 4355) produced the largest larvae (mean =163 mg).

These experiments have identified several hybrids of *Zoysia* with high levels of resistance to the fall armyworm. An additional form of resistance, the lengthing of the developmental period was documented. This has the added benefit of increased mortality under field conditions by longer exposure to natural predators and parasites. Additional tests are underway to confirm these results and to identify the range of resistance produced among hybrids with Cavalier as a parent. Experiments are also planned to identify additional resistance to the zoysiagrass eriophyid mite which has become a serious pest across the *Zoysia* Belt.

A third area of work was designed to identify potential resistance to white grubs (*Phyllophaga* spp.) in Texas bluegrass (*Poa arachnifera*) and its hybrids with Kentucky bluegrass (*Poa pratensis*) from the breeding program under Dr. James Read at Texas A&M University, Dallas. A two-year-old replicated planting of 36 genotypes of Texas bluegrass and three hybrids with Kentucky bluegrass was evaluated for resistance to *Phyllophaga* white grub damage. Two visual ratings and total grub population counts were made. TX 6-10 and TX 32-7 each exhibit no visual grub damage on any of the 8 replications when evaluated in April 1999. Also, TX 31-2, TX 5-6, TX 16-9 and TXKY 37-25 each exhibited visible grub damage in only one of the 8 plots/genotype during the April evaluation. These same genotypes along with TX 12-8 were rated 3.75 to 4.00 (scale 1-5; 5 = no damage) during a second evaluation in May 1999. Surprisingly, these same plots had some of the highest grub populations (means of 5.50 to 10.50 grubs per plot) feeding on their roots. The two genotypes, (TX 6-10 and TX 32-7) which ranked so high in both visual evaluations had mean populations of 7.88 and 8.20 grubs per plot, respectively. Highest grub damage was observed on TX 28-2 and TXKY 37-10 with seven and six of the 8 plots, respectively, showing grub damage, even though neither genotype had exceptionally high grub populations.

This experiment yielded rather unexpected set of results. The best looking grasses had some of the highest grub populations feeding within the roots, but these plants were still well anchored and exhibited a very solid and undisturbed root mass. This data indicates that we have discovered several genotypes of Texas bluegrass with a high level of tolerance to *Phyllophaga* white grubs. New cultivars with this form of resistance can be very beneficial in the landscape when they are made available. Additional studies are planned to confirm the tolerance resistance