Resistant Turfgrasses for Improved Chinch Bug Management on Golf Courses

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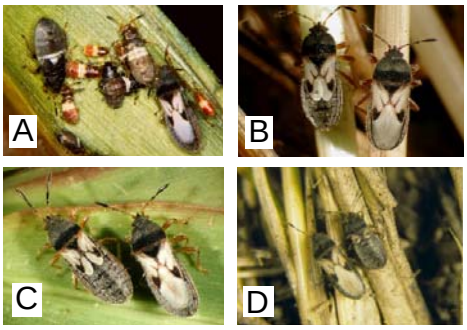
Objectives:

1. Evaluate selected cool- and warm-season turfgrasses for resistance to chinch bugs in the *Blissus* complex.
2. Characterize the categories (antibiosis, antixenosis, and tolerance) of chinch bug-resistant turfgrasses.
3. Investigate the underlying biochemical and physiological mechanisms responsible for chinch bug resistance.

Start Date: 2003
Project Duration: three years
Total Funding: $20,000

Plant resistance to insects offers a promising approach for managing chinch bugs and other insect pests affecting turfgrasses because it is sustainable and environmentally responsible. The overall goal of this research is to identify insect-resistant turfgrasses and investigate the mechanisms of this resistance. Knowledge of specific resistance mechanisms would be valuable for identifying biochemical and physiological markers for use in germplasm enhancement programs, and for characterizing plant defense strategies to insect feeding.

Selected cool- and warm-season turfgrasses were evaluated for resistance to chinch bugs in the *Blissus* complex under greenhouse conditions. These studies have identified three vegetative buffalograsses with moderate to high levels of resistance to *B. occiduus*. Several zoysiagrasses and bermudagrasses were shown to exhibit moderate resistance to chinch bugs. The zoysiagrass 'Emerald' and bermudagrass 'Mini Verde' displayed the highest level of resistance; while the zoysiagrasses 'Meyer', 'Zenith', and 'DeAnza', and the bermudagrasses 'Jackpot' and 'Tifway' were moderately susceptible to chinch bug feeding. All fine fescues evaluated were moderately to highly susceptible to *B. l. hirtus*. This research demonstrates useful variation to chinch bug feeding among buffalograss, zoysiagrass, and bermudagrass germplasm, and suggests the potential to improve the resistance of these turfgrasses to *B. occiduus* and other chinch bug species.



The Blissus *Complex:* B. l. leucopterus *(A),* B. l. hirtus *(B),* B. insularis *(C), and* B. occiduus *(D). Studies are currently underway to explore the feeding mechanisms of these chinch bugs on the different turfgrass species.*

Another component of this research is to determine if cool- and warm-season turfgrasses with resistance to *B. leucopterus hirtus* and *B. insularis* are also resistant to *B. occiduus*. Results from these studies suggest that cool- and warm-season turfgrasses with resistance to *B. l. hirtus* and *B. insularis* are also resistant to *B. occiduus*. Furthermore, chinch bug-susceptible St. Augustinegrasses and fine fescues were moderately to highly resistant to *B. occiduus*.

B. occiduus-resistant ('Prestige', formerly NE91-118) and -susceptible ('378') buffalograsses were susceptible to all other chinch bug species. This research clearly demonstrates multiple resistance among turfgrasses to chinch bugs and suggests different feeding mechanisms among the chinch bug complex.

Studies are currently underway to explore the feeding mechanisms of these chinch bugs on the different turfgrass species. Specific studies include examining the morphological features of chinch bug mouthparts, documenting probing behaviors, and identifying chinch bug feeding sites. Preliminary observations suggest that no obvious differences in the mouthpart morphology exist among *Blissus* species and subspecies.

Although the mechanisms associated with chinch bug resistant turfgrasses are not well understood, photosynthetic measurements and enzyme kinetics experiments suggest photosynthetic compensation in resistant turfgrasses. Resistant turfgrasses may be able to tolerate chinch bug feeding by increasing their peroxidase activity.

Resistant turfgrasses (left) may be able to tolerate chinch bug feeding by increasing their peroxidase activity compared to susceptible turfgrasses (right).

Summary Points

- This research, which brings together a strong multidisciplinary team of entomologists, turfgrass physiologists and breeders, and plant biochemists will contribute to our basic understanding of chinch bug resistance in turfgrasses.
- Several cool- and warm-seasons turfgrasses with resistance to chinch bugs in the *Blissus* complex have been identified.
- Significant progress towards identifying the biochemical and physiological mechanisms responsible for chinch bug-resistance have been made.
- The identification of protein-mediated markers for insect resistance provides a novel approach for screening insect-resistant germplasm. Ultimately, molecular markers identified from this research will provide a set of tools for screening turfgrasses for resistance to chinch bugs and furnish a starting point for characterizing additional protein-mediated markers specific to insect resistance.
- Knowledge gained from this project will benefit turfgrass sod producers, golf course superintendents and other turfgrass managers by furnishing turfgrasses with improved resistance to chinch bugs.