Biological Control of Chinch Bug. Research Results. 2004-2007

Executive Summary

Hairy Chinch bugs (*Blissus leucopterus hirtus Montandon*) are destroying lawns in New Brunswick and elsewhere. This three year, RIP-funded project, carried out by Maritime MicroBiologicals Inc., the New Brunswick Horticultural Trades Association and NBDAFA staff, has explored control options for these insects that do not depend upon synthetic chemical insecticides. Focus was on biological controls ("biocontrols"). Results and interpretations have been presented in the final reports for Years 1, 2 and 3.

One much-discussed biocontrol involves using "endophyte-enhanced" seeds. In these associations, endophytic (i.e. leaf-inhabiting) fungi grow from the seed, through the stem and into the leaf, where they can make compounds that inhibit the insects. Emphasis was on endophyte-enhanced fescues, since some fescues show potential for use on lawns in this region. Unfortunately, the fungi did not persist well in the seeds or in the plants after planting. Even when they did persist, the amount of fungal tissue in the leaf blade was low, and there was no evidence that it inhibited the insects. Vendors of these seeds should justify their use of the word 'enhanced' before these are marketed as a chinch control option, especially if they charge a premium for the seeds.

Another biocontrol relies on entomopathogenic (i.e. insect disease-causing) fungi (EF) that reside in the soil. Soil samples representing sites with and without chinch problems were assessed for two genera of EF (*Beauveria* sp. *Metarhizium* sp) that have been reported to kill chinch. These were consistently present in soil from a site where chinch bugs were not a problem. They were however also sometimes present in soils from sites with chinch. They were generally absent from manufactured topsoils. There were qualitative differences in the types of EF present in the various soils, but it was not clear if these related to chinch prevalence. These finding are consistent with EF being a factor that helps differentiate chinch-susceptible from chinch-resistant lawns, but other factors are also important.

Spores (conidia) were produced from various EF obtained from culture collections or from EF-killed chinch bugs. In-vitro testing confirmed that some *Beauveria bassiana* strains killed chinch bugs relatively rapidly (within a week), a commercial strain (GSA) and an isolate from a dead chinch bug having similar virulence. Younger insects (1^{st} – 4^{th} nymphal instars) were killed more rapidly than adults.

EF conidia remained viable in various types of soil for at least several months, regardless of temperature or presence of fertilizers or pesticides. The effect of insecticidal soaps, essential oils and compost on EF conidial suspensions was also assessed. Providing the concentrations were not too high, survival was good, suggesting these materials might be uses as synergists in spray-able EF formulations.

Chinch bugs died more rapidly in soil containing *B. bassiana* conidia than in EF-free soil. They also died more rapidly in conidia-containing pots of grass growing under growth room conditions. However, in analogous tests made in *outdoor*, microplots, the results

were disappointing, there being little effect of inoculation. This may have been due to low soil temperature in the microplots, since testing started late in the season. These tests will be re-done earlier in the season and extended for a longer period so there is the possibility of the *Beauveria* infecting non-adult chinch.

To assess the effect of edaphic and various cultural factors on chinch, field plots were established at the Fire Hall in Rothesay N.B., the lawn there being infested. For purposes of comparison, positive controls plots were treated with the insecticide Sevin™ (carbaryl). Treatments included shading, watering, fertilizing with various fertilizers, or top-dressing with compost. In addition, sods composed of Kentucky blue grass or sods cut from Angelview park (a mixture of grass species) were planted to see if chinch would migrate into them.

The Sevin™ killed the chinch along with most other insects in the plots. Live insects migrated into the plots a few weeks after spraying, showing there was little residual insecticidal activity. Good chinch control was obtained by top-dressing with compost, with no chinch being recovered from these plots for at least two months. Watering had relatively little effect, although the water-holding capacity of the soil the site was such that watering did not raise its water content for more than a few hours. However, there was not response to watering in the microplot tests either where the soil held a lot of water substantiating that watering had little effect on chinch. Fertilizing the plots had variable effects. Interestingly, some organic fertilizer products *increased* chinch numbers, presumably by attracting them. Other organic fertilizer had little effect. Soluble NPK fertilizer decreased chinch. Shading also decreased them. At least some chinch migrated into both the Kentucky bluegrass sod and the mixed grass species from Angelview park, this site being chinch-free. This suggests that grass species may not be a critical factor. This experiment only lasted during August and September. Longer-term effects may become evident next season.

The results have some practical implications. First, lawns should be grown on "good" soil with adequate nutrient and water content and active populations of beneficial micro-organisms. Providing shade (e.g. trees) and top dressing with compost will help. These simple steps may go a long ways towards eliminating the chinch problem. Using endophytic-enhanced grass *might* help, but not unless fungus-grass associations that are active under New Brunswick conditions can be identified.

The results with EF (*Beauveria bassiana*) inoculation were encouraging, but more work is needed. It seems probable that if spores of a virulent *B. bassiana* strain were applied early enough so that younger, more susceptible stages of the chinch were present, chinch control could be attained. EF formulations might be improved by adding insecticidal soaps, essential oils and/or other insect-stressing ingredients, but these possibilities need further development before they can be recommended.