Determining the Reproductive Phenology of Emerging Overwintering Annual Bluegrass Weevil Populations

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Objectives:

1. *Describe the reproductive phenology of emerging ABW populations (maturity of reproductive systems, mating, and reproductive longevity)*
2. *Determine the incidence of adult feeding in natural populations*
3. *Determine the adult reproductive longevity, female fecundity, and time sequence of egg deposition in controlled experiments*

The annual bluegrass weevil (ABW), Listronotus maculicollis, is the most destructive insect pest of golf course turf in the northeastern and mid–Atlantic United States and eastern Canada. Most management programs seek to prevent damage by controlling overwintering adult weevil populations as they move onto short mown playing surfaces in Spring. The variability in emergence and threat of turf loss to high–valued turf often results in multiple insecticides applications. Studies of natural populations and caged mating studies were initiated to determine the timing of biological events of populations to better target controls and determine whether new strategies can minimize larval damage.

ABW populations were vacuum–collected from greens/collars bi–weekly (NY) and fairways and roughs (MA) weekly during the period between overwintering adult emergence (spring adults) and 1st generation adult emergence (summer adults). Populations differed in the timing of peak density (120 DD – NY; 220 DD – MA). A second smaller peak was observed in NY (150 DD – April 30th) coinciding with the "half green/half gold stage of Forsythia.

Dissections revealed a low percentage of adults collected from roughs had recently fed (< 10%). Feeding incidence from greens/collars (NY) was less than 50% prior to the first adult peak, though steadily increased to greater than 90% following the second peak in density.

Most females collected from greens/collars (NY) were reproductively mature, though only moderate percentages were mature in rough and fairway collections (MA). High percentages of males arriving on greens/collars had immature reproductive systems, though the proportion of mature males increased steadily over several weeks until all males were reproductively mature (147 DD; coinciding with the 1st peak in adult density).

Figure 1. Annual bluegrass weevil eggs are generally three different colors.

The incidence of mating (as determined by the presence of sperm in the spermatheca) revealed that, at any given sampling time, only low to moderate percentages of females had been mated (range 0 to 50%). This may explain the extended

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oviposition period observed in Spring and resulting overlapping larval stages during the spring and summer months.

Adult longevity, fecundity, and ovipositional pattern were examined in mating enclosures (50 mL conical tubes + Poa annua turf core). Adults were collected from overwintering sites prior to emergence were held in mating pairs (1 male + 1 female). Adult mortality and the number of eggs laid were checked every 7 d and live adults were moved to fresh Poa annua cores. Mating pairs (45) were observed weekly until the last cohort expired (15 weeks after the start of the experiment). Approximately 50% of males were capable of surviving for seven weeks in mating enclosures, and 50% of the females nine weeks. On average, females laid 92.6 eggs (+/− 12.7 eggs SE; median = 74 eggs) which is considerably higher than what had been assumed based on previous laboratory experiments. Egg production was strongly correlated (R2 = 0.98) to degree−day accumulations for the first seven weeks of the study, with females averaging between 1 and 3 eggs per day during this period. After the seven weeks, egg production steadily declined, though surviving females were still capable of producing eggs through the 14th week of the study.

We will continue the vacuum collection studies in 2013 to determine the timing of ABW biological events relative to degree day accumulations and describe the degree of similarity between populations across the region. Egg laying (cohort) studies will also be repeated to assist in the development of an ovipositional model relative temperature accumulation.

Summary Points

- **Emergence** – The timing in peak adult densities differed between the two ABW populations studied. In the NY study, overwintered adult population densities peaked at 120 DD, followed by a second peak at 150 DD, whereas the MA population demonstrated a single peak at 220 DD.
- **Reproductive Maturity** – Moderate (MA) to high percentages (NY) of females arrived on playing surfaces with mature reproductive systems, whereas male reproductive maturity did not occur until after the first peak in adult densities.
- **Mating** – Low to moderate percentages of females were observed with sperm in their spermatheca at a given sampling date.
- **Feeding** – Adult feeding incidence in roughs was relatively low (< 10%)throughout the study (MA), and was found to be low on both studies of short mown areas (less than 50%). The incidence of feeding remained low until after the second peak in adult density.
- **Fecundity** – On average, caged ABW females laid more than 90 eggs over an 8 week period. Egg production was strongly correlated with degree day accumulations over the first seven weeks.

Figure 2. Mating pairs (45) were observed weekly until the last cohort expired. On average, females laid 92.6 eggs which is considerably higher than lab studies.

Figure 3. Spermatheca, egg sacs, and ovarioles removed from annual bluegrass weevil female. Moderate to high percentages of females arrived on playing surfaces with mature reproductive systems.

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