

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 United States and Canada. Despite ABW's expanding range and pest status, there is a fundamental lack of understanding of key biological events, which hinders the timing of controls and leads to increased insecticide usage. We sought to describe the reproductive development of emerging ABW populations, determine when feeding and mating occur, and when adults cease to oviposit.

Adult ABW were vacuumed–collected weekly from short mown turf areas (greens, tees and collars) on an untreated golf course in upstate NY over a two year period (2012 – 2013). The sampling period began prior to when traditional plant phenological indicators (*Forsythia* spp.) indicated adult movement from overwintering sites. Adults were dissected to examine reproductive system maturity, feeding, and mating status (sperm in spermatheca). Degree–day accumulations, calculated by on–site weather stations, were recorded to determine if key biological events occur during discrete periods.

Adult emergence by calendar date was substantially different between 2012 and 2013 (March 18, April 30, respectively), though degree day accumulation ranges were similar (24 and 75 DD). Two peaks in adult density were observed in each year. The first (and most dense) peak occurred around similar temperature ranges (122

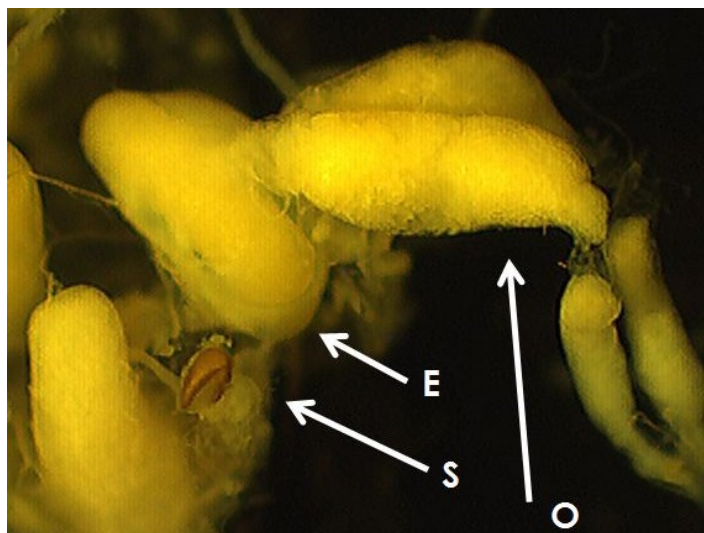


Figure 1. Mature female reproductive tract showing the spermatheca (S), fully developed eggs in the calyx (E), and the ovarioles (O)

and 139 DD) despite differing by approximately 3 weeks.

Males and females collected on playing surfaces following emergence differed in their reproductive maturity. In 2012, all initial female captures were observed to be reproductively mature upon arrival to the short mown areas. Moderate percentages of females (45–80%) were reproductively mature in the first two weeks after emergence in 2013, with 100% demonstrating maturity by the third week. Low to moderate percentages (0–60%) of males demonstrated reproductive maturity for the first 3

and 4 weeks in 2013 and 2012, respectively. At any one sampling date during the study, only low to moderate percentages of females were found to have sperm in their spermatheca. The highest percentage of inseminated females (40–50%) were detected after the second adult density peak (~ 340–460 DD). Similarly, the incidence of adult feeding (as determined by fresh food in the gut) was low post-emergence, though rapidly increased throughout both seasons, with the highest incidence occurring after the second peak.

Mating pairs (1 male + 1 female) were caged on *Poa annua* plugs (30 mm diameter) in 2012 and 2013. Survivors were moved to fresh cores weekly while the number of eggs laid during the week was counted. Females were found capable of laying up to 3 eggs per day per female with maximum fecundity of 130 eggs laid over a 15 week period. However, differences were observed in average female longevity (5 vs. 8 weeks) and fecundity (92.6 +/- 12.7, 62.9 +/- 7.05 eggs) in 2012 and 2013. Strong correlations were found between degree-day accumulations and average eggs laid per female over the female average lifespan ($r^2 = 0.98, 0.81$). Pooling datasets resulted in a strong correlation over the first 5 weeks of egg laying ($r^2 = 0.83$).

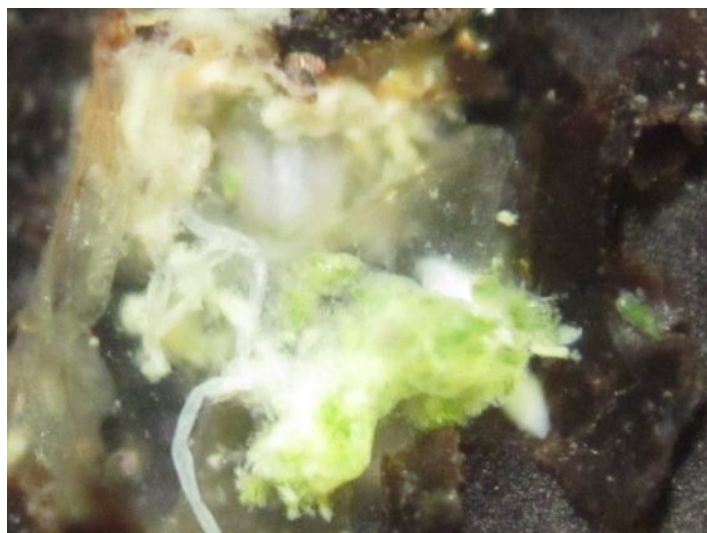


Figure 2. A dissected weevil with fresh food in the gut. The incidence of adult feeding (as determined by fresh food in the gut) was low at post-emergence, though rapidly increased throughout both seasons, with the highest incidence occurring after the second peak.

Summary Points

- Female ABW arrive on short mown playing surfaces with mature reproductive systems, whereas the majority of males are largely immature and incapable of fertilizing eggs.
- The proportion of inseminated females remained low during all observation periods. The low to moderate numbers of females with sperm in their spermatheca during any given sampling date may indicate that females take multiple matings and oviposit over several weeks to months.
- In both years of the study, only a low percentage of adults were observed to have fed prior to reaching the short mown turf areas. Adult feeding rapidly increased after the peak in adult density on short mown playing surfaces.
- Caged oviposition studies demonstrated that females are capable of laying up to 3 eggs per female per day, for a maximum of 130 eggs. Egg laying was observed over a 15 week period in both years of the study, with strong correlations to degree-day accumulations for the first 5 weeks when pooling the data between years.

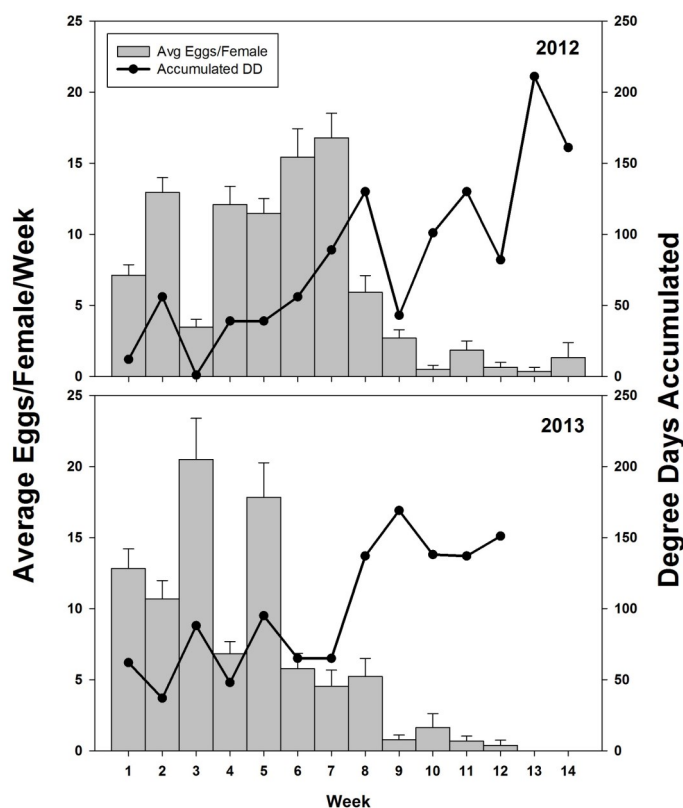


Figure 3. The relationship between average eggs laid per female per week and the degree-days (DD) accumulated during the week in caged egg laying studies (2012-13).