2002 BELTWIDE COTTON CONFERENCES, ATLANTA, GA – JANUARY 8-12

# LONGEVITY OF OVERWINTERED BOLL WEEVILS ON PRE-FRUITING COTTON

**J.F. Esquivel, D.W. Spurgeon and C.P.-C. Suh**
**USDA, ARS**
**Areawide Pest Management Research Unit**
**College Station, TX**

## Abstract

Previous investigations of the longevity of overwintered boll weevils on pre-fruiting cotton have yielded variable results. However, environmental conditions were generally not controlled in these studies. We re-examined the longevity of overwintered boll weevils fed pre-fruiting cotton under controlled conditions. Trap-captured overwintered boll weevils were held at 24±1°C and were supplied water alone, cotyledon stage, or four-leaf stage cotton seedlings. Mean longevities of males and females were similar. Overwintered weevils survived an average of ~7 days on water alone, 81 days on cotyledon stage plants, and 62 days on four-leaf stage plants. Maximum observed longevity was 157 days. Our results indicate substantially longer longevities on pre-fruiting cotton than have been previously reported.

## Introduction

Boll weevils typically begin emergence from overwintering sites before fruiting cotton is available. Early-season cultural control practices such as delayed planting rely on limited survival of overwintered boll weevils infesting pre-fruiting cotton (White and Rummel 1978; Rummel and Carroll 1983, 1985). Longevity of overwintered boll weevils on pre-fruiting cotton has been examined by several investigators (Fenton and Dunnam 1927, 1929; Fye et al. 1959; Hunter and Hinds 1905) but results varied considerably among studies. Differences in results among previous studies may have resulted from corresponding differences in methodologies or from the absence of control over environmental conditions. Our objective was to examine the longevity of overwintered boll weevils fed pre-fruiting cotton under controlled temperature conditions.

## Materials and Methods

Between 9 April and 7 May 2001, overwintered boll weevils were collected daily from pheromone traps placed adjacent to overwintering habitats. Captured weevils were sexed using the tergal notch method (Sappington and Spurgeon 2000). Mixed sex cohorts of 19-20 weevils were assigned to each treatment. Except for the first replication, each cohort was represented by equal numbers of the sexes from a single capture date. Because the earliest boll weevil captures were extremely low, three consecutive capture dates were represented in the first replicate. Experimental treatments included cotyledon stage plants, four-leaf stage plants, and an unfed control. Cotyledon stage plants were provided at the rate of one plant per weevil. Four-leaf stage plants were provided at the rate of one plant per two weevils. For all treatments, water was provided in a plastic cup equipped with a cotton wick. Cohorts of each treatment were held in plexiglass cages (8" wide × 12" deep × 14" tall) at 24±1°C and a 12:12 [L:D] h photoperiod. In total, 7 replicates were included corresponding to weevil collections on 9-11, 13, 16, and 30 April, and 7 May. Two replicates were established on both 13 and 16 April; single replicates were established on the remaining dates.

Boll weevil survival was recorded three times per week (Monday, Wednesday and Friday). Dead weevils were removed and sexed. Cotyledon stage and four-leaf stage plants were replaced on each inspection date, and the numbers of plants were adjusted to maintain the desired numbers of plants per weevil. Longevity data (days) were examined by ANOVA using the PROC GLM procedure (SAS Institute 2001). The ANOVA model contained terms for the main effects of replicate, sex, feeding treatment, and their interactions. The REGWQ option of PROC GLM was used to detect differences in main effect means (SAS Institute 2001).

## Results

Availability of pre-fruiting cotton significantly increased the mean longevity of overwintered boll weevils compared with the unfed control ($F$=315.55; df=2, 366; $P$<0.0001). Weevils fed cotyledon stage plants exhibited the highest mean longevity (81.1 d). Mean longevity in the four-leaf stage treatment was significantly lower (62.0 d) than that of the cotyledon stage treatment, but was higher than that of unfed weevils (6.8 d). Observed maximum longevities for the unfed, cotyledon stage, and four-leaf stage treatments were 26, 157, and 140 d, respectively.

Although overall mean longevity in the cotyledon stage treatment was higher than that in the four-leaf stage treatment, the replicate by treatment interaction ($F$=5.03; df=12, 366; $P$<0.0001) indicated this relationship was not consistent among

replicates. Mean longevities for weevils fed four-leaf stage plants were numerically higher than on cotyledon stage plants in two of the replicates. Unfed weevils had consistently lower mean longevities than weevils fed pre-fruiting cotton.

Mean longevities of males (51.0 d) and females (47.8 d) were similar ($F$=1.42; df=1, 366; $P$=0.2336). A significant replicate effect ($F$=5.61; df=6, 366; $P$<0.0001) was observed. However, no consistent trend in mean longevity was evident for date of replicate establishment. The seventh (7 May) and fifth (16 April) replicates exhibited the lowest and highest mean longevities (40.4 d and 60.2 d, respectively).

## Discussion

In field studies under various ambient conditions, Fenton and Dunnam (1927) and Fye et al. (1959) observed mean longevities of 8 and 22 d, respectively, for overwintered boll weevils caged on pre-fruiting cotton in the field. Hunter and Hinds (1905) observed a mean longevity of 45 days for overwintered boll weevils fed terminal portions of young cotton stems in the laboratory. Based on laboratory and field feeding studies, Rummel and Carroll (1985) concluded that overwintered boll weevils did not greatly utilize seedling cotton as a food source. In contrast, our results indicate that overwintered boll weevils can obtain substantial nutritional resources from pre-fruiting cotton, and that those resources are sufficient to permit extended longevity. Continued experimentation to distinguish the respective roles of nutrition and environment on survival of early season overwintered weevils may provide additional insight into this important aspect of boll weevil ecology.

## Disclaimer

Mention of trade names or commercial products in this article is solely for the purpose of providing specific information and does not imply recommendation or endorsement by the U.S. Department of Agriculture.

## References

Fenton, F. A., and E. W. Dunnam. 1927. Winter survival of the cotton boll weevil at Florence, S. C. J. Econ. Entomol. 20: 327-336.

Fenton, F. A., and E. W. Dunnam. 1929. Biology of the cotton boll weevil at Florence, S. C. U. S. Dept. Agric. Tech. Bull. 112, 75 pp.

Fye, R. E., W. W. McMillian, A. R. Hopkins, and R. L. Walker. 1959. Longevity of overwintered and first generation boll weevils at Florence, S. C. J. Econ. Entomol. 52: 453-454.

Hunter, W. D., and W. E. Hinds. 1905. The Mexican cotton boll weevil. U. S. Dept. Agric. Bureau of Entomology, Bull. 51, 173 pp.

Rummel, D. R., and S. C. Carroll. 1983. Winter survival and effective emergence of boll weevil cohorts entering winter habitat at different times. Southwest. Entomol. 8: 101-106.

Rummel, D. R., and S. C. Carroll. 1985. Longevity of overwintered boll weevils (Coleoptera: Curculionidae) following emergence in spring and early summer. Environ. Entomol. 14: 127-130.

Sappington, T. W., and D. W. Spurgeon. 2000. Preferred technique for adult sex determination of the boll weevil (Coleoptera: Curculionidae). Ann. Entomol. Soc. Amer. 93: 610-615.

SAS Institute. 2001. SAS, Release 8.02. SAS Institute. Cary, NC.

White, J. R., and D. R. Rummel. 1978. Emergence profile of overwintered boll weevils and entry into cotton. Environ. Entomol. 7: 7-14.