2005 Beltwide Cotton Conferences, New Orleans, Louisiana - January 4 - 7, 2005

TIMES BETWEEN BOLL WEEVIL OVIPOSITION, SQUARE ABSCISSION, AND DEVELOPMENT TO ADULTHOOD UNDER FIELD CONDITIONS

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Abstract

This study found that 6.2 ± 0.4 d elapsed between boll weevil, *Anthonomus grandis grandis* Boheman, oviposition and square abscission under field conditions in the Lower Rio Grande Valley of Texas. Oviposition to adult weevil emergence from the square took 18.5 ± 0.9 d. Although significant minimum and maximum temperature differences were detected between May and June, oviposition to square abscission and adult emergence periods were not significantly affected.

Introduction

Cotton squares abscise after boll weevils, *Anthonomus grandis grandis* Boheman (Coleoptera: Curculionidae), oviposit and second or third instars develop (Coakley et al. 1969). Only two studies, however, have reported on the time from oviposition to square abscission, an important part of the boll weevil's life cycle, which according to Hunter and Pierce (1912), affects the time of boll weevil development from egg to adult. One of the two studies concluded that an average of 9.5 d elapsed between oviposition and square abscission (Hunter and Pierce 1912). In the other study, abscission occurred 3.5–4.9 d after boll weevils eggs were artificially implanted in squares (Davich et al. 1965). The time from oviposition to emergence of the adult was determined to be 17.3 d (Hunter and Pierce 1912). Although Hunter and Pierce provided mean square abscission and adult emergence times, standard errors and other statistics were not reported, and the studies on oviposition to square abscission and adult emergence were conducted in more temperate cotton growing areas of the United States (e.g., Victoria and Dallas were the southernmost areas studied in Texas). This study was conducted to determine the time from oviposition to square abscission, and to adult emergence from the square in field conditions of the Lower Rio Grande Valley of Texas, a unique subtropical habitat for the boll weevil in the United States.

Materials and Methods

Sixty cotton (var. NK-2387) plants were flagged in a commercial field planted on 19 March 2002, Hidalgo County, TX. Squares on the flagged plants were checked daily, 17–24 May and 12–17 June. A 1-cm^2 paper tag was attached by thread to one bract of each oviposition-punctured square, and the date of the puncture and the size of the square were written on the tag. When each square dropped to the ground, the date was recorded and the square was placed alone in a 20 cm^3 cage. Cages with squares in them (n = 27) were placed in furrows that were by then largely shaded by the crop canopy. All of the squares were 5–7 mm in diameter except for three that were 2–4 mm in diameter. The cages were checked daily for adult boll weevil emergence. Ten squares in which eggs were laid in May produced adult weevils (three others died as larvae in 5–7-mm-diameter squares), and 14 squares in which eggs were laid in June produced adults. Data on boll abscission and adult emergence times were compared between the squares on which oviposition occurred in May (abscission, n = 13; adult emergence, n = 10) versus June (abscission and adult emergence, n = 14). Ambient daily minimum and maximum temperatures were recorded at a USDA-ARS weather station located ≈3 km away. Mean (±SE) minimum and maximum air temperatures recorded between first oviposition and last square abscission during the two periods 17 May – 3 June and 12–20 June, and between first oviposition and last adult emergence during the two periods 17 May – 6 June and 12 June – 9 July were compared. All comparisons were made using the two sample t-test (Analytical Software 1998).

Results and Discussion

No significant differences were detected between May and June in terms of oviposition to abscission and adult emergence times, so statistics describing pooled data are presented. Square abscission occurred 6.2 ± 0.4 (median = 6.0; range = 2–12) days after oviposition. Adult boll weevils emerged 18.5 ± 0.9 days after oviposition (median = 16.0; range = 13–26). The mean minimum temperatures that occurred from oviposition until square abscission between 17 May and 3 June, and between 12 and 20 June, were 21.0 ± 0.2 °C and 23.4 ± 0.3 °C (t = 2.9, df = 1, 25, P = 0.0074), respectively, and the mean maximum temperatures between 17 May and 3 June, and between 12 and 20 June, were 31.9 ± 0.4 °C and 36.0 ± 0.4 °C (t = 4.89, df = 1, 25, P < 0.0001), respectively. The mean minimum temperatures that occurred from oviposition until adult emergence between 17 May and 6 June, and between 12 June and 9 July, were 21.4 ± 0.2 °C and 23.8 ± 0.3 °C (t = 4.5, df =

1, 47, P < 0.0001), respectively, and the mean maximum temperature between 17 May and 3 June, and between 12 and 20 June was 32.2 ± 0.3 °C and 34.4 ± 0.3 °C (t = 3.2, df = 1, 25, P = 0.0025), respectively. The significant differences between mean minimum and maximum temperatures in the first (May) and second (June) sampling periods did not significantly affect the duration of intervals between oviposition and square abscission and development to the adult stage. The 3.3-d difference between the longer mean abscission interval in central and northern Texas (Hunter and Pierce 1912) and the Lower Rio Grande Valley is probably because of environmental differences, including temperature, that are likely greater than those we observed between the May and June sampling periods in the Lower Rio Grande Valley. The 1.3–2.7-d shorter abscission interval observed by Davich et al. (1965) than in Lower Rio Grande Valley field conditions might have been caused by insertion of boll weevil eggs by drilling holes in the squares using a glass pipette. Adult boll weevils, however, emerged from the fallen squares 1.2 d later in the Lower Rio Grande Valley than in central and northern Texas (Hunter and Pierce 1912). Boll weevil mortality in fallen squares in the Lower Rio Grande Valley has been reported to be as high as 90.8% because of lethal temperatures and associated desiccation (Summy et al. 1986). The observed delay in adult emergence might result from the detrimental aspects of high temperatures and desiccation. A delay in the abscission process, which is associated with the rate of development of boll weevils from egg until second or third instar (Coakley et al. 1969), did not occur because the square is attached to the plant so that desiccation, and possibly heat, are not major mortality factors. Knowing the intervals between visible events associated with the weevil's development might be important for establishing more rational insecticide intervention thresholds than at 10% oviposition on randomly selected squares (A.T. Showler, unpublished data).

Acknowledgments

Thanks to Jaime Cavazos and Tony Cansino for technical assistance, Andy Scott and Dale Murdens for cooperation, and to Tong-Xian Liu and Ivich Fraser for critical reviews.

References

Analytical Software. 1998. Statistix for Windows. Analytical Software, Tallahassee, FL

Coakley, J.M., F.G. Maxwell, and J.N. Jenkins. 1969. Influence of feeding, oviposition, and egg and larval development of the boll weevil on abscission of cotton squares. J. Econ. Entomol. 62:244-245.

Davich, T.B., D.A. Lindquist, and J. Hacskaylo. 1965. Implanting boll weevil egg in cotton squares for systemic insecticide and host-plant resistance studies. J. Econ. Entomol. 58:366-368.

Hunter, W.D. and W.D. Pierce. 1912. The Mexican cotton boll weevil; a summary of the investigation of this insect up to December 31, 1911. USDA Bur. Entomol. Bull. 114.

Showler, A.T. Influence of adult boll weevil (Coleoptera: Curculionidae) food resources on fecundity and oviposition. J. Econ. Entomol. 97: 1330-1334.