SUPPRESSION OF THE BOLL WEEVIL IN ORGANIC COTTON BY RELEASE OF *CATOLACCUS GRANDIS* AS PART OF THE SOUTHERN ROLLING PLAIN BOLL WEEVIL ERADICATION PROGRAM

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Abstract

The use of synthetic chemicals is prohibited in the production of cotton grown for organic certification. Obviously, management of the boll weevil in such cotton located within a boll weevil eradication zone presents unique challenges. As a research effort to evaluate augmentative releases of *Catolaccus grandis* (Burks) for suppressing boll weevil in organic cotton, a farm within the Southern Rolling Plains Eradication Zone was identified. The test was conducted on 134 acres (six fields) of the Ralph Hoelscher farm.

The main objective of this experiment was to create a sufficiently high parasite to host ratio during the first and second larval generation of boll weevil and greatly suppress or eliminate within-field reproduction of the pest on the organic farm. Six control fields (where boll weevil control was directed by eradication program protocols, and other pest control was by grower discretion) were selected for comparison on the basis of similarities (proximity, planting date, and irrigation potential) to the release fields. Release and control fields were sampled at weekly intervals to measure and compare boll weevil and other pest and natural enemy populations.

The Texas Boll Weevil Eradication Foundation provided funds to employ personnel to conduct field sampling, as well as facilities and equipment to perform laboratory examination of collected specimens to measure impact of the treatments. The USDA/ARS IPM research unit at Mississippi State produced boll weevil hosts and shipped them to the USDA/APHIS/PPQ Mission Biological Control Center. The parasite was reared on these larvae and shipped as pupae to the Texas A&M University Research and Extension Center in San Angelo. A laboratory was provided by the Center for holding the emerging parasite adults before they were released in the organic cotton fields.

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Releases began on July 19 at the rate of 350 females per acre per week and continued for a total of nine weeks. Boll weevil population densities (measured by inspection of whole plant and ground samples) on the organic farm were observed at very low levels during the release period and did not differ significantly from density levels in the insecticide-treated control fields. Desiccation of weevil immatures in abscised squares accounted for a large portion of mortality, especially from mid-July to mid-August in release and control fields. The first indication of weevil reproduction (presence of recently emerged adults in field collected samples) was not until the week of Sept. 11 in release fields, whereas weevil reproduction was first observed the week of August 28 in the control fields.

Percent mortality of boll weevil cohorts (third instar infested squares) was assessed during three periods. Generational percent mortality of these cohorts was 100 and 40 during Aug. 11-28, 76 and 40.2 during Aug. 28-Sept. 13, and 32.5 and 18.2 during Sept. 6-24 for release and control fields, respectively. Generational mortality was significantly higher in release fields compared to control fields during the first two periods, only. In the release fields, percent mortality due to parasitism was 100, 47, and 7 for the three periods, respectively.

Percent feeding and oviposition punctures of squares were 7.1±0.8 and 5.4±4.0 in release and control fields, respectively on Sept. 9. On Sept. 20, percent punctures were 15.5±4.6 and 27.3±8.9 in release and control fields, respectively. No significant differences between treatments were observed for either date.

Boll weevil pheromone traps along the periphery of control and release fields were monitored for 11 weeks from July 10 to September 18. Except for the weeks of July 17, Aug. 21, and Sept. 9, mean captures per trap per week were numerically higher in control fields. Seasonal mean captures per trap for control fields (1.73 ±0.31) were significantly higher than for release fields (0.97±0.18).

The last release of *C. grandis* was made Sept. 15. Because materials with efficacy against boll weevil are not available and/or approved for organically-grown certification, immature fruiting forms on the organic farm remained vulnerable (until a killing freeze about mid-December) to infestation by migrating weevils and any progeny produced after *C. grandis* release was terminated. Consequently, infestations of mature and green bolls by boll weevils was as high as 20 percent in some release fields by late October. On the other hand, weekly treatments with malathion in control fields prior to and during this period maintained weevil infestations in mature and green bolls at near undetectable levels. No significant difference between treatments was observed for open plus mature boll numbers on 10/27/95. Bolls per ft^2 were 1.60±0.50 and 1.48±0.92 for release and control fields, respectively, indicating yields of near 200 lbs lint per acre.

The beet armyworm as well as other armyworms, bollworms, and loopers combined to cause extensive damage in release as well as control fields. Moderate populations were observed in mid-July, however, most damage occurred during mid-August when larval numbers peaked at 3.8 and 8.3 larvae per linear foot in release and control fields, respectively. Microbial insecticides and the natural enemy complex in parasite-release fields greatly limited damage by subsequent worm generations.

Results of this study, as well as other boll weevil suppression experiments conducted using augmentative releases of *C. grandis* demonstrate that weekly releases of this parasite can essentially eliminate early season boll weevil reproduction in cotton. Importantly, in 1995, natural enemies on the organic farm were spared during the early season and were able to suppress a potentially damaging aphid population and contributed to the suppression of caterpillar pests, particularly the beet armyworm. Moreover, use of microbial insecticides instead of synthetic insecticides further spared natural enemy populations. Emphasizing bio-based elimination of boll weevil reproduction during early season spares predators and parasites to suppress other pests, thereby potentially facilitating areawide suppression or eradication. Research and commercialization of *in vitro* diets for *C. grandis* could make mass production economically feasible. Such technology may prove useful in current boll weevil eradication areas or other areas infested with boll weevil as a means to reduce insecticide usage in environmentally-sensitive sites, for organically-grown cotton, or in regions that may inherently be at higher risk to secondary pest outbreaks.