INCIDENCE OF THE GRANULATE CUTWORM, *FELTIA SUBTERRANEA* (F.) (LEPIDOPTERA:NOCTUIDAE) IN EARLY SEASON MISSISSIPPI COTTON: AN EXAMPLE OF THE UTILITY OF A HELIOTHINE EGG IDENTIFICATION SYSTEM (*HEL*-ID) IN IPM

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Abstract

Hel-ID, a unique diagnostic test kit, that identifies both the cotton bollworm, *Helicoverpa zea* (Boddie) and the tobacco budworm, *Heliothis virescens* (F.) in the egg stage was developed by Agdia, Inc., Elkhart, Indiana and Mississippi State University (MSU) in 1997. This kit is produced by using species specific monoclonal antibodies developed by Zeng and Ramaswamy, MSU and a proven ELISA method developed by Agdia. *Hel*-ID was introduced commercially in May 1998. During the early 1999 growing season an unusual pest of cotton was detected with the use of *Hel*-ID. Numerous incidences from the Mississippi Delta were reported where eggs collected from cotton gave negative test results (80-100%). *Hel*-ID was identifying tobacco budworm populations, but no identifications were being made for cotton bollworm. The eggs causing the negative results were identified as the granulate cutworm, *Feltia subterranea* (F.). The incidence showed the importance of egg identification tests. Without the test kit, the granulate cutworm eggs were being identified as cotton bollworm. The misinformation could have resulted in unneeded insecticidal treatments. The negative results from *Hel*-ID indicated to consultants and producers a species other than cotton bollworm or tobacco budworm was present in cotton, in numbers usually associated with these two species. Everyone using *Hel*-ID reported saving money by trusting *Hel*-ID results and not treating in the face of the unknown or "mystery eggs".

Reprinted from the *Proceedings of the Beltwide Cotton Conference*
Volume 2:1004-1006 (2000)
National Cotton Council, Memphis TN

Introduction

Hel-ID, a unique diagnostic test kit, that identifies both the cotton bollworm, *Helicoverpa zea* (Boddie) and the tobacco budworm, *Heliothis virescens* (F.) in the egg stage was developed by Agdia, Inc., Elkhart, Indiana and Mississippi State University (MSU) in 1997. The kit is produced by using species specific monoclonal antibodies (MAbs) developed by Zeng and Ramaswamy, MSU and a proven ELISA method developed by Agdia. *Hel*-ID was introduced commercially in May 1998. During June, 1999, calls began to come into Agdia with questions about *Hel*-ID's performance. The customers described the tests as giving results identifying 10-20% of the eggs as tobacco budworm with the remaining wells as negative. This type of problem usually indicates either: 1) missing a step in the testing process, 2) a defective test or 3) an insect species that is neither cotton bollworm or tobacco budworm.

Because of concern from customers and Agdia's interest that *Hel*-ID perform accurately, technical help was dispatched to Mississippi and Alabama during the week of June 20-26, 1999. Remedial action was immediately taken. First, a representative number of kits were recalled. Testing determined they were working correctly. Secondly, additional instructions were sent to individuals reporting problems with the tests. Communication from the consultants indicated their testing techniques were accurate. Thirdly, consultants and producers were advised that they were working with an insect that was not cotton bollworm or tobacco budworm. This explanation was not readily accepted, because in most cases the percentage of negative wells was as high as 80-100% of all eggs being tested. Consultants and researchers thought it unlikely a different noctuid was present in cotton in those high numbers.

Results and Discussion

Method of Testing Eggs

The investigation of the reported inaccurate test results was initiated by consultants and growers who regularly use *Hel*-ID in Mississippi. A specific protocol was developed for testing eggs from field collections. The same protocol was used for collections from all areas reporting problems with the kit. First, eggs were collected from fields that had previously produced high populations of the eggs testing negative for cotton bollworm and tobacco budworm. Next, eggs were taken to USDA, ARS, Southern Insect Management Research Unit (SIMRU), Stoneville, Mississippi. *Hel*-ID tests were conducted on half of the field collected eggs. Established

laboratory colonies of cotton bollworm and tobacco budworm eggs were used as controls. Finally, the remaining half of field-collected eggs were placed on artificial diet for rearing to larger larvae and adults for identification. The eggs placed on diet were held at SIMRU and the MSU Delta Branch Experiment Station, Stoneville, MS. Because there had been no identification of this insect species it became known among consultants and researchers as the "mystery eggs" (Taylor 1999).

Egg Testing Results

The results from all eggs tested during the week showed that field eggs were 100% negative while the known cotton bollworm and tobacco budworm eggs were 100% positive. The "mystery eggs" were being reported from most areas of the Delta. Descriptions being attributed to this different species were that they appeared slightly larger and whiter than cotton bollworm eggs, and were laid in groups of 4 to 5 per leaf. Accounts were reported from consultants, the research community, producers, and chemical companies. Eggs previously placed on diet in the SIMRU laboratory started to hatch in two days. This was significant because one of the possible explanations for negative results from *Hel*-ID had been the probability that these were infertile cotton bollworm eggs. Researchers with USDA-ARS and MSU Extension reared the larvae and sent late instars and adults to the MSU Entomological Museum for identification. The insect was later identified as the granulate cutworm, *Feltia subterranea* (F.)

Granulate Cutworm

The granulate cutworm, *F. subterranea* has long been recognized as the most important true cutworm in Florida and other southern states (Cline and Habeck 1977). *F. subterranea* feeds on most field and vegetable crops found in its geographical range, including cotton (Crumb 1929). Sprenkel and Johnson (1999) report that it is capable of causing stand loss to cotton in Florida. The granulate cutworm has been considered one of the primary defoliating insects on peanut, *Arachis hypogaea* L. in the southeastern United States (Deitz et al. 1992). The insect has been considered an economic pest of peanuts in Alabama, Georgia, and Florida for many years (Bass and Johnson 1978, Morgan and French 1971, Hamm and Lynch 1982, Cline and Habeck 1977).

The eggs of the granulate cutworm are almost hemispherical, white and flattish on the lower surface. The egg is 0.63 mm across and about 0.55 mm high. The eggs are deposited singly or a few together on the foliage of plants (Crumb 1929). Larvae are dark brown to gray with pale longitudinal stripes and the head is pale brown. This species may be positively identified by the presence of small, somewhat retrorse, conical skin granules. The larvae also have pronounced setae that is curved and strongly capitate. The six larval stages range from 2 to 38 mm in length. The thorax and forewings of the granulate cutworm adults are yellowish-brown. The thoracic collar is dark with a distinct black line, and the abdomen is gray. The hind wings are pure white with the veins and a slight border sometimes smoky gray-brown with a blackish cast. The orbicular spot is small, rounded, and connected with the reniform spot by a black dash. The wings span from 38.0 to 44.5 mm (Crumb 1929).

The granulate cutworm eggs were initially mistaken by consultants and researchers as cotton bollworm eggs. However, after the *Hel*-ID test kits showed the presence of a different species in cotton fields the eggs received closer scrutiny. Under closer examination the cutworm eggs could be separated by the observant collector. Most of the consultants were able to use the fact that the eggs were deposited in small groups to indicate differences.

Summary

There did not seem to be much damage resulting from the heavy granulate cutworm outbreak experienced during the 1999 growing season. The basic tenants of IPM were certainly being applied in this situation. The pest was first identified and then control decisions were made based on the damage caused by the insect in question. The danger in this situation would have been if consultants and producers made control decisions, thinking the unknown was cotton bollworm. This factor emphasizes the utility of egg diagnostic kits like *Hel*-ID. The granulate cutworm outbreak reiterated the validity and accuracy of *Hel*-ID and highlights its role as an important tool in cotton bollworm and tobacco budworm management strategies in the cotton ecosystem.

All the consultants that used *Hel*-ID to test egg collections applied good judgement when faced with control decisions based on the 80-100% 'other species' phenomenon of the 1999 season. The consultants all reported their trust in *Hel*-ID and therefore decided not to assume the kit wrong and did not use any insecticide treatments when "mystery egg" collections were high.

Disclaimer

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