EARLY SEASON FORAGING RESOURCES OF MISSISSIPPI BOLL WEEVILS

G. D. Jones, J.R. Coppedge
USDA-ARS, APMRU
College Station, TX
D. D. Hardee
USDA-ARS, SIMRU
Stoneville, MS

Abstract

Spring-time alternative foraging resources of Mississippi boll weevils *Anthonomus grandis* Boheman (Coleoptera: Curculionidae) were determined from pollen analyses of adults captured from March through May 1996. There were 2057 pollen grains and 104 pollen types found in the samples. Pollen from 47 families, 64 genera, and 12 species was identified in the samples. March samples contained the fewest pollen grains, types, genera, families, and species while May samples contained the most. Nine pollen types were classified as Fabaceae and eight were Asteraceae. Overall, pollen from plant families Asteraceae, Cornaceae, Fagaceae, and Poaceae were the most common pollen types. Asteraceae, Fagaceae, and Poaceae pollen were found in more samples than any other plant family. Our results indicate that overwintering boll weevils in Mississippi foraged on a large diversity of plant species.

Introduction

The boll weevil, *Anthonomus grandis* Boheman (Coleoptera: Curculionidae), is a major cotton pest. Although the larval stage forages mainly on flower buds and fruits of the cotton tribe (Malvaceae: Gossypieae), the adult stage has a wider range of foraging resources (Rummel et al. 1978, Cross et al. 1975, Benedict et al. 1991, Jones et al. 1993, Jones and Coppedge 1996, Jones et al. 1997). Adults forage on a variety of malvaceous taxa including: *Abutilon, Cienfuegosia, Gossypium, Hampea, Hibiscus, Sida, Sphaeralcea,* and *Thespesia* (Walker 1959, Stoner 1968, Cross et al. 1975, Chandler and Wright 1991, Jones et al. 1993).

Benedict et al. (1991) found not only Malvaceae pollen in the midgut of south Texas boll weevils, but also pollen from 14 other families. In boll weevils from northeastern Mexico, they found Malvaceae pollen and pollen from five other families. Likewise, Jones et al. (1993) found boll weevils captured in northeastern Mexico contained Malvaceae pollen and pollen from 14 other families.

Pollen from 44 families (Including Malvaceae) was found in overwintering boll weevils captured in Uvalde, Texas (Jones and Coppedge 1996). In overwintering boll weevils captured in Crockett, and Munday, Texas, Jones et al. (1997) found pollen from 29 and 35 plant families, respectively.

Alternative food sources play a significant role in adult boll weevil survival especially during host-free periods. It has been suggested that foraging on non-malvaceous taxa during host-free periods is an evolutionary adaptation to living in the tropics where boll weevils remain active year round (Jones et al. 1993). Because Mississippi boll weevils are not active year-round, we wanted to determine if overwintering boll weevils foraged on non-malvaceous taxa prior to cotton production.

Methods and Procedures

Adult boll weevils were captured in pheromone traps (Hardee et al. 1975) from March through May 1996 near Elizabeth (Washington Co.), Mississippi. Hardee traps (Hardee et al. 1996) were placed on the east and west sides of a historically boll weevil active 10-ha cotton field (core field). In addition, traps were placed at approximately 1.7 km intervals for 13 km along four lines radiating from the core field. Trapped boll weevils were collected from all traps twice weekly. When possible, 10 captured boll weevils were immediately frozen for pollen examination. Since determination of foraging resources was more important than individual foraging variability, as many as 10 boll weevils per trap were processed together in a single centrifuge tube. Prior to processing, boll weevils were individually rinsed several times with 95% ethyl alcohol (**ETOH**). Samples were chemically treated to dissolve the insect tissue but not the pollen (Jones and Coppedge 1996). Once reduced to a residue, samples were strained through a 450µm screen. Straining removes any large undissolved body parts that might interfere with pollen identification. The residue was stained with Safranine O. One drop of pollen residue was placed onto a glass slide. Each sample=s pollen residue was examined with light microscopy. Pollen was identified to the lowest rank possible: family, genus, or species. No differentiation was made between Chenopodiaceae and Amaranthaceae pollen nor between Taxodiaceae and Cupressaceae pollen.

Results

We examined 240 boll weevils in 71 samples for pollen (Table 1). March had the fewest samples and May the most. Because more boll weevils were captured in May, more May boll weevils were processed. All March and April samples contained pollen, and 94% of the May samples contained pollen (Table 1). Overall, 96% of the spring samples contained pollen (Table 1).

A total of 2057 pollen grains was found in the samples (Table 1). Altogether, there were 104 pollen types of which 84 were identified (Table 2) to family, genus, or species ranks. Pollen representing 47 families, 64 genera, and 12

Reprinted from the *Proceedings of the Beltwide Cotton Conference*
Volume 2:1009-1011 (1998)
National Cotton Council, Memphis TN

species were identified in the samples. May=s samples contained more pollen (1682), types (70), families (39), genera (44), and species (9) than samples in other months (Tables 1 and 2). May samples also had the greatest range in number of pollen grains (1-226). March samples contained the fewest pollen grains (16), types (5), genera (5), families (5), and species (1) (Tables 1 and 2). More unknown pollen types occurred in April=s samples (13, Table 2).

More Fabaceae types were found than any other family followed by Asteraceae. Nine pollen types were classified as Fabaceae. Fabaceae genera included: *Gleditsia, Medicago, Trifolium*, and *Vicia*. Eight Asteraceae genera were encountered including: *Ambrosia, Artemisia, Circium*, and *Taraxacum*.

Asteraceae pollen had the highest percent of total pollen in March (63%, Table 3). However, Fagaceae pollen had the highest percent in April and May, 29 and 26% respectively (Table 3). Asteraceae, Fagaceae, Cupressaceae/Taxodiaceae, and Ulmaceae pollen grains were found in all three months. Percent Asteraceae, Cupressaceae/Taxodiaceae, and Ulmaceae pollen progressively lessened from March to May (Table 3). Percent Poaceae grains increased from April to May. Overall, Asteraceae, Cornaceae, Fagaceae, and Poaceae pollen grains were the most common pollen types.

Asteraceae pollen grains were found in all samples In March (Table 4). Fagaceae pollen was found in more April samples (89%) followed by Salicaceae (63%) and Asteraceae (58%) pollen (Table 4). Although Salicaceae=s percent of total pollen was relatively low in April (4.6%) and May (2.4%) (Table 3), Salicaceae pollen occurred in more than 60% of April=s samples and more than 40% of May=s (Table 4).

Poaceae pollen was found in the greatest number of samples (78%) in May followed by Fagaceae (74%), Asteraceae (59%), and Oleaceae (50%). In May, Fagaceae and Poaceae pollen were found in more than twice as many samples as pollen from other plant families. Alismataceae pollen was found in 5% of the samples in April and 17% of the samples in May, but its percent of total pollen was too small, 0.24 and 0.65% respectively, to include in Table 3. Overall in the spring season, pollen from Fagaceae, Asteraceae, and Poaceae were found in more samples than any other plant family (Table 4). Regardless of the month, Asteraceae pollen was found in more than 50% of all samples (Table 4).

Discussion

Our results are similar to pollen analyses of overwintering boll weevils trapped in Texas (Jones and Coppedge 1996, Jones et al. 1997). Pollen types found in Mississippi boll weevils were similar to those found in Crockett, TX (Jones et al. 1997). This is not surprising since the habitat along Mississippi traplines is similar to that along Crockett traplines. However, unlike Texas boll weevils, Mississippi boll weevils foraged less on Fabaceae and Rhamnaceae pollen. Asteraceae, Fagaceae, Salicaceae, and Poaceae pollen were the main pollen types found in Mississippi boll weevils.

Like the Texas studies (Jones and Coppedge 1996, Jones et al. 1997), as the season progressed (March to May), more boll weevils emerged and therefore more were trapped for pollen analyses. Likewise, the number of pollen grains and pollen types found later in spring (May, 70), was much higher than that found earlier (March, 5). More plant species are in bloom in May than March, and therefore more pollen taxa are likely to be consumed.

In overall number of pollen grains during the spring season, more Fagaceae pollen (26%) was found than any other type, followed by Poaceae (18%), Asteraceae (6%) and Cornaceae (6%). Not only were more Fagaceae grains found than any other type, but also Fagaceae pollen was found in more samples (77%) than any other type.

Most Asteraceae encountered and the Cornaceae are entomophilous (insect pollinated). Fagaceae and Poaceae are anemophilous (wind pollinated). Anemophilous types are often considered accidental contaminants in the samples. However, in caged studies, boll weevils consumed *Celtis laevigata* C. von Willdenow (Ulmaceae) pollen, an anemophilous taxa (Benedict et al. 1991). In addition, honeybees are known to actively forage on both Fagaceae and Poaceae pollen (Pellet 1977, Jones 1993). Whether this is also true for boll weevils is not known.

Summary

Overwintering boll weevils emerging prior to cotton production must forage on other food sources to survive. Pollen is high in protein and other nutrients needed for survival. Our results, indicate that overwintering boll weevils in this Mississippi study site foraged on pollen from a large diversity of plant species. Boll weevils emerging in March foraged on fewer alternative foraging resources than boll weevils emerging in May. As spring progressed, boll weevils foraged on pollen from an increasing diversity of plant species. Since pollen feeding plays a role in boll weevil survival, it is essential to know which alternative foraging resources are utilized during host-free periods.

Acknowledgments

We appreciate Stanley D. Jones (**BRCH**) and Vaughn M. Bryant, Jr. (**TAMU**) for their help and review of this manuscript. We are also indebted to Ester F. Wilson (**USDA**, **APMRU**), John A. Martin (**USDA**, **APMRU**), and Kim D. Ostiguin (**USDA**, **APMRU**) for their work on this project. We also thank Dillon F. Gorham (**TAMU**) and Dennis Gryder (**TAMU**) for their work on this research.

References

Benedict, J. H., D. A. Wolfenbarger, V. M. Bryant, Jr., and D. M. George. 1991. Pollens ingested by boll weevils (Coleoptera: Curculionidae) in southern Texas and northeastern Mexico. J. Econ. Entomol. 84(1): 126-131.

Chandler, L. D. & J. E. Wright. 1991. Longevity of the boll weevil (Coleoptera: Curculionidae) on cotton and alternate feeding sources under various temperature regimes in the laboratory. J. Econ. Entomol. 84: 1699-1704.

Cross, W. H., M. J. Lukefahr, P. A. Fryxell, and H. R. Burke. 1975. Host plants of the boll weevil. Environ. Entomol. 4(1): 19-26.

Hardee, D. D., G. H. McKibben, and P. M. Huddleston. 1975. Grandlure for boll weevils: controlled release with a laminated plastic dispenser. J. Econ. Entomol. 68: 477-479.

Hardee, D. D., A. A. Weathersbee, III, J. M. Gillespie, G. L. Snodgrass, and A. R. Quisumbing. 1996. Performance of trap designs, lures, and kill strips for the boll weevil (Coleoptera: Curculionidae). J. Econ. Entomol. 89: 170-174.

Jones, G. D. 1993. Melissopalynology of East Texas. Ph. D. dissertation. Texas A&M University. College Station, TX. 200 pp.

Jones, G. D. and J. R. Coppedge. 1996. Pollen feeding by overwintering boll weevils. Proceedings Beltwide Cotton Conferences. 976-977.

Jones, G. D., J. R. Coppedge, and D. Gryder.   1997. Foraging resources of overwintering boll weevils in Crockett and Munday, Texas. Proceedings Beltwide Cotton Conferences. 980-981.

Jones, R. W, J. R. Cate, E. M. Hernandez, and E. S. Sosa. 1993. Pollen Feeding and Survival of the boll weevil (Coleoptera: Curculionidae) on selected plant species in Northeastern Mexico. Environ. Entomol. 22(1): 99-108.

Pellett, F. C.   1977.   American honey plants.   5th ed. Orange Judd Publishing co., Inc. Carthage, IL. 467 pp.

Rummel, D. R., J. R. White, and G. R. Pruit. 1978. A wild feeding host of the boll weevil in west Texas. Southwest. Entomol. 3: 171-175.

Stoner, A.   1968.   *Sphaeralcea* spp. as hosts of the boll weevil in Arizona. J. Econ. Entomol. 61:1100-1102.

Walker, J. K. 1959. Some observations of the development of the boll weevil on the wine cup, Callirhoe involucrata (Nutt.) A. Gray. J. Econ. Entomol. 56: 755-756

Table 1. Total number of samples (samples), boll weevils processed (BW), samples containing pollen, percent with pollen, and pollen data by month and season found in Mississippi boll weevils.

	March	April	May	Spring Season
samples	3	19	49	71
BW	3	39	198	240
samples with pollen	3	19	46	68
% with pollen*	100	100	94	96
# pollen grains	16	413	1,682	2,057
Min # pollen grains	3	2	1	1
Max # pollen grains	9	117	226	226

* rounded to nearest whole number

Table 2. Monthly and overall spring session pollen type data encountered in Mississippi boll weevils.

	March	April	May	Spring Season
# pollen types	5	53	70	104
# types identified	5	40	60	84
# types unknown	0	13	10	20
# families	5	33	39	47
# genera	5	39	44	64
# species	1	5	9	12
Min # pollen types	2	2	1	1
Max # pollen types	4	16	16	16
Mean # pollen types*	3	8	8	7

* rounded to nearest whole number

Table 3. Monthly and overall spring season percent of total number of pollen grains per family for the most common plant families encountered in Mississippi boll weevils.

	March	April	May	Spring Season
Anacardiaceae			7.24	5.74
Apiaceae		3.15	1.78	2.04
Asteraceae	62.50	8.22	4.91	6.04
Cheno-Am**		3.63	0.43	1.07
Cornaceae			7.86	6.23
Cupressaceae/ Taxodiaceae**	6.25	2.42	0.18	0.68
Fabaceae		4.59	2.33	2.79
Fagaceae	6.25	29.06	25.74	26.25
Juglandaceae			4.67	3.69
Moraceae		5.32	0.49	0.47
Oleaceae		6.30	2.58	3.31
Poaceae		1.45	22.73	18.28
Rosaceae		6.29	1.77	3.46
Salicaceae		4.60	2.40	2.82
Ulmaceae	6.25	2.18	0.36	0.78
Violaceae		2.42		0.49

** No differentiation was made between Chenopodiaceae and Amaranthaceae pollen grains nor between Cupressaceae and Taxodiaceae pollengrains.

Table 4. Monthly and overall spring season percent of total number of samples in which pollen from the most common plant families occurred in Mississippi boll weevils.

	March	April	May	Spring Season
Alismataceae		5.26	17.39	13.24
Anacardiaceae			47.83	32.35
Apiaceae		26.32	6.52	11.76
Asteraceae	100.00	57.89	58.70	60.29
Cheno-Am**		21.05	15.22	16.18
Cupressaceae/ Taxodiaceae**	33.33	15.79	6.52	10.29
Cyperaceae		10.53	2.17	4.41
Fabaceae		42.11	26.09	29.41
Fagaceae	33.33	89.47	73.91	76.47
Juglandaceae			47.83	32.35
Moraceae		36.84	15.22	20.59
Oleaceae		42.11	50.00	45.59
Poaceae		21.05	78.26	58.82
Salicaceae		63.16	43.48	47.06
Ulmaceae	33.33	21.05	10.87	14.71

** No differentiation was made between Chenopodiaceae and Amaranthaceae pollen grains nor between Cupressaceae and Taxodiaceae pollen grains.