FORAGING RESOURCES OF OVERWINTERING BOLLWEEVILS IN CROCKETT AND MUNDAY, TEXAS

G. D. Jones and J. R. Coppedge
USDA-ARS, APMTRU
College Station, TX
D. Gryder
Department of Anthropology
Texas A&M University
College Station, TX

Abstract

Pollen analyses were used to determine alternative foraging resources of boll weevils, *Anthonomus grandis* Boheman (Coleoptera: Curculionidae), in Crockett and Munday, Texas from May to July, 1995. Pollen from boll weevils captured in Crockett were more diverse than those captured in Munday. Crockett boll weevils contained 161 different pollen types, while Munday boll weevils contained 82. Pollen representing 29 families, 39 genera, and 10 species were identified in Crockett samples, and 35 families, 37 genera, and 12 species in Munday samples. The greatest number of pollen grains and pollen types occurred in May in Crockett samples and in June in Munday. Boll weevils foraged on the fewest alternative foraging resources in July in both sites. Our research suggests that boll weevils in Crockett and Munday, Texas have a wide range of alternative foraging resources prior to cotton production.

Introduction

The boll weevil *Anthonomus grandis* Boheman (Coleoptera: Curculionidae) invaded the United States about 100 years ago. Today, boll weevils have spread to all cotton growing areas in the United States and are a major cotton pest.

Boll weevil eradication is partially based on the premise that most boll weevils enter cotton before first square or they die from starvation. Unfortunately, many scientists believe that boll weevils forage only on cotton and a few other taxa. Recent studies suggest that the adult stage has a wide range of foraging resources. Stoner (1968) found adult boll weevils foraging on Sphaeralcea spp. (Malvaceae), globe mallow, in Arizona. In Texas, Rummel et al. (1978) found adults feeding on Hymenopappus sp. (Asteraceae), woolly white. Cate and Skinner (1978) reported that pollen could be found in the boll weevil gut and that the identification of this pollen could indicate alternative foraging resources. From pollen analyses, Benedict et al. (1991) and Jones et al. (1993) found that boll weevils are not as restricted, or specific, in the species they forage as was previously believed.

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Pollen analyses of overwintering boll weevils captured near Uvalde, Texas indicated that Texas boll weevils foraged on pollen from a variety of plant species (Jones and Coppedge 1996). As a continuation of that research, we examined alternative foraging resources used by overwintering boll weevils captured at two other Texas locations in other habitats.

Methods and Procedures

Boll weevils were captured in pheromone traps south-west of Crockett and west of Munday, Texas. Five traps were placed about 1 mile apart along four lines radiating out from three central cotton fields. Three boll weevils captured from sites 2 and 5 of each line (about 2 and 5 miles away from the cotton fields, respectively) and Field number 3 were examined for pollen.

Each boll weevil was chemically processed to destroy the boll weevil's tissue, but not the pollen, and the pollen residue was examined using light microscopy. Light micrographs were taken of all pollen types. Pollen types were identified to the lowest rank possible; family, genus, or species. Identification of unknown pollen types was made comparing the unknown type to the Areawide Pest Management Research Unit's pollen reference collection.

Results

A total of 5531 pollen grains were encountered in Crockett samples, and 1162 in Munday's (Table 1). Pollen diversity was greater in Crockett boll weevils than Munday's. A total of 161 pollen types was found in Crockett samples, and 82 in Munday samples. This greater pollen taxa diversity is due to the greater diversity of plants around the Crockett trap lines. CrockettÔs trap lines traverse three of the ten Texas vegetational zones, Pineywoods, Blackland Prairies, and Post Oak Savannah; whereas Munday's are located in one, Rolling Plains (Gould 1975). Only 35% of the pollen types found in Crockett samples were identified to family, genus, or species ranks, whereas 67% were identified in Munday's samples (Table 1).

Nearly twice as many pollen grains were found each month in Crockett samples than Munday's (Table 2). May's Crockett boll weevils had the greatest number of pollen grains, genera, and species (Table 2). Munday's June boll weevils had the greatest number of plant families. Boll weevils captured in July had the fewest pollen grains, families, and species (Table 2). Reduction of pollen types in July not only suggests cotton foraging, but also indicates a reduction of alternative foraging resources. In general, more plants bloom in spring (March- May) and fall (September- November) in Texas than in summer (June-August). Unlike the Uvalde area that has a major flowering period in summer (Jones and Coppedge 1996), summer, in most of Texas, is a dirth period for flowering plants, and therefore, fewer alternative foraging resources are available.

Frequency of occurrence (Jones and Coppedge 1996) indicates how often a pollen type is expected to be encountered within the samples. In other words, in May's Crockett boll weevils, Asteraceae pollen is expected to occur 34% of the time (Table 3). Because of the nature of blooming periods, a plant family may not occur in every month. From the overall total, Asteraceae pollen were the most frequent entomophilous (insect pollinated) type in Crockett (Table 3).

During June, frequency of occurrence of pollen in Munday boll weevils is relatively uniform with little variation (Table 4). This uniformity indicates an even distribution of alternative foraging resources. However, in July, frequency of occurrence varies greatly indicating that alternative resources are patchy and grouped together in various locations. July is dominated by Cheno-Am (Chenopodiaceae/Amaranthaceae), Fabaceae, and Poaceae pollen types. Overall, Fabaceae pollen were the most common entomophilous types (Table 4).

Relative frequency (Jones and Coppedge 1996) indicates a pollen type's importance within the sample. Juglandaceae, Poaceae, and Salicaceae were the most important plant families in May (Table 5) in Crockett boll weevils. Asteraceae and Poaceae pollen were most important in June. The most important overall entomophilous types were Asteraceae (Table 5).

Relative frequency of pollen found in Munday's boll weevils was more variable than Munday's frequency of occurrence (Tables 4 and 6). Cupressaceae was the most important anemophilous (wind pollinated) plant family in June and in the overall total (Table 6). The most important overall entomophilous plant family was Fabaceae (Table 6) followed by Asteraceae.

Eight Fabaceae taxa were found in Crockett samples including: *Acacia, Glycine, Mimosa, Trifolium, Vicia,* and *Neptunia*. The Fabaceae represented more pollen types than any other family. *Acacia*, *Mimosa,* and *Neptunia* were also found in Uvalde samples (Jones and Coppedge 1996). Following the Fabaceae in the number of pollen types was the Asteraceae with seven types, including *Ambrosia*, *Helianthus*, *Taraxacum,* and *Iva*.

Similarly, more Fabaceae and Asteraceae pollen types were found in Munday samples. Nine Fabaceae taxa were found including: *Acacia, Glycine, Melilotus, Mimosa, Neptunia, Trifolium*, and *Vicia*. Five Asteraceae taxa were found including *Artemisia* and *Helianthus*. Although Rhamnaceae pollen was not as prevalent as in Uvalde, it was a major component in Munday samples.

As in Uvalde samples (Jones and Coppedge 1996), Malvaceae pollen was never a major pollen constituent. Usually, when an insect ingests pollen, the nutritive material inside the pollen grain is "sucked" out and the durable pollen grain shell (exine) remains whole and identifiable. However, cotton pollen grains are fragile and easily destroyed when eaten. Malvaceae pollen occurred in Crockett samples, but not Munday's.

Our research shows that boll weevils in both Crockett and Munday have as wide range of alternative foraging resources as those analyzed from Uvalde (Jones and Coppedge 1996). When plants bloom in the spring, boll weevils forage on the greatest diversity of plants. July is usually dry in Texas and therefore alternative foraging resources are reduced. The most important alternative entomophilous foraging resources in Crockett are members of the Asteraceae and Salicaceae, and in Munday are members of the Fabaceae and Asteraceae. Because of the diversity of plant species in Texas, alternative foraging resources vary greatly. Since pollen feeding provides significant energy and nutrition for dispersing boll weevils, it is important to define the full range of alternative foraging resources.

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Table 1. Total number of pollen grains, pollen types, identified and unidentified types, families, genera, and species found in Crockett and Munday boll weevils.

	Crockett	Munday
# Pollen grains	5531	1162
# Pollen Types	161	82
# Identified	61	55
# Unknown	101	27
# Families	29	35
# Genera	39	37
# Species	10	12

Table 2. Number of pollen grains, families and genera by month from the pollen analyses of boll weevils captured in Crockett and Munday study sites.

Site	Month	#Grains	#Families	#Genera	#Species
Crockett	May	3453	25	34	10
	June	1228	19	18	3
	July	850	12	7	1
Munday	June	822	30	11	5
	July	340	17	14	3

Table 3. Monthly frequency of occurrence (to nearest whole number) and overall total by family of pollen found in boll weevils captured at the Crockett study site.

Taxon	May	June	July	Total
Alismataceae	0	26	29	15
Apiaceae	9	31	3	14
Asteraceae	34	69	58	50
Fabaceae	21	6	10	13
Fagaceae	40	23	10	27
Juglandaceae	60	9	0	29
Pinaceae	19	17	3	14
Poaceae	92	71	23	68
Salicaceae	74	14	6	39

Table 4. Monthly frequency of occurrence (to nearest whole number) and overall total by family of pollen found in boll weevils captured at the Munday study site.

Taxon	June	July	Total
Asteraceae	49	13	40
Cheno-Am*	37	73	46
Cupressaceae	69	7	63
Fabaceae	49	67	54
Poaceae	27	53	34
Rhamnaceae	39	1	30
Scrophulariaceae	22	0	16
Tamaricaceae	34	20	36

* Chenopodiaceae and Amaranthaceae pollen types, are lumped together into the category “Cheno-Am”.

Table 5. Relative frequency of the most commonly encountered families in the pollen analyses of boll weevils captured at the Crockett study site.

Taxon	May	June	July	Total
Alismataceae	0	31	31	31
Apiaceae	17	38	3	29
Asteraceae	72	100	100	100
Fabaceae	44	11	25	28
Fagaceae	84	42	25	55
Juglandaceae	100	16	0	60
Pinaceae	40	32	8	29
Poaceae	100	100	58	100
Salicaceae	100	26	17	79

Table 6. Relative frequency of the most commonly encountered families in the pollen analyses of bollweevils captured at the Munday study site.

Taxon	June	July	Total
Asteraceae	69	11	63
Cheno-Am*	52	61	74
Cupressaceae	97	39	100
Fabaceae	69	56	85
Fagaceae	31	0	26
Poaceae	38	44	54
Rhamnaceae	55	6	49
Scrophulariaceae	31	0	26
Tamaricaceae	49	17	57

* Chenopodiaceae and Amaranthaceae pollen types, are lumped together into the category “Cheno-Am”.