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THE EFFECT OF HARVESTING AND REPLANTING ON ARTHROPOD GROUND PREDATORS IN FLORIDA SUGARCANE

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ABSTRACT

Arthropod ground predators were sampled with pitfall traps in Florida sugarcane fields. More red imported fire ants, *Solenopsis invicta* Buren, were caught in pitfall traps than all other predators combined. Sugarcane harvesting did not affect pitfall trap catches of arthropod ground predators. However, replanting reduced arthropod catches for five to six months. These data show that for most of its three to five year crop cycle, Florida sugarcane is a stable ecosystem at ground level for arthropod ground predators.

Key Words: Sugarcane, predators, Florida, pitfall traps, ants

RESUMEN

Se muestrearon los depredadores artrópodos del suelo con trampas de suelo ("pitfall", trampas donde la presa cae en un hoyo en el suelo) en campos de caña de azucar en Florida. Se capturaron más hormigas de fuego importadas, *Solenopsis invicta* Buren, en las trampas que todos los otros depredadores juntos. La cantidad de depredadores artrópodos capturados en las trampas no fué afectada al cosechar la caña de azucar. No obstante, resembrando redujó la cantidad de artrópodos capturados durante cinco a seis meses. Estos datos muestran que por la mayor parte de su ciclo de cultivo, de tres a cinco años, la caña de azucar en Florida es un ecosistema estable al nivel de suelo para los depredadores artrópodos del suelo.

Sugarcane (*Saccharum* spp.) is a major field crop in Florida and is primarily grown in the Everglades area of southern Florida. Numerous studies have been published about various biological control agents in Florida sugarcane. A list of many of these studies is provided by Hall (1988). In a later report, Hall & Bennett (1994) discuss in greater detail the overall biological control and IPM of sugarcane pests in Florida sugarcane. However, there are no published reports on the population dynamics of arthropod ground predators in Florida sugarcane. Florida sugarcane is a long-term crop and few tillage practices are required over the entire course of a 3 to 5 year planting (Hall & Bennett 1994). Hence, what the effect of yearly harvesting and eventual replanting of sugarcane is on arthropod ground predators is an interesting question. The objective of this study was to determine the effects of harvesting and replanting on arthropod ground predators in Florida sugarcane.

MATERIALS AND METHODS

Four sugarcane fields in southern Florida were sampled starting in June, 2000. Two of the fields were eighteen months old at the start of sampling. These fields were left in production after harvest (ratooned) and were used to measure the effect of harvest on activity of arthropod ground predators. In this paper, I consider arthropods to be predaceous if they belong to a taxonomic group in which most members are predaceous. Two of the fields were three and one half years old at the start of sampling. These older fields were replanted to sugarcane (successive planting) after harvest and were used to measure the effect of replanting on activity of arthropod ground predators. The two ratooned fields were harvested during February, 2001. Harvesting consisted of burning the sugarcane to remove litter and removal of sugarcane stalks by mechanical harvesting. The two successively planted fields were harvested and replanted during November, 2000. Harvesting was as described for ratooned fields. Replanting consisted of fields being disced, sugarcane seedpieces placed in furrows, Thimet 20G (AI = phorate) placed in furrows on cane at 4.55 kg AI/hectare, and then seedpieces covered with soil.

Pitfall trap sampling in all four fields started June, 2000 and continued until June, 2001. Each pitfall trap consisted of a nine cm diameter plastic cup containing 100 ml of ethylene glycol. A five cm deep plastic collar was also cut from the 9 cm plastic cups. The top of this collar was taped in the middle of a 26 cm diameter paper plate with it's center removed. This collar was then inserted into the pitfall trap and the plate loosely covered with soil. This arrangement prevented soil subsidence around the trap rim thus allowing arthropods easy access to the trap. A small metal roof was also placed above each trap to prevent rainfall from filling traps. Five traps were used in each field. The first trap was located mid-field in a sug-

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arcane row 50 m into the field to avoid possible edge effects. The next four traps were placed 5 m apart in the row into the field. Traps were used for two weeks each month. After each two week period, traps were taken to a laboratory and samples drained into paper towels and frozen. Thereafter, ants (Formicidae), earwigs (Dermaptera), ground beetles (Carabidae), rove beetles (Staphylinidae), spiders (Araneida), and centipedes (Chilopoda) were counted under a microscope. Taxonomic determinations of ants and spiders were made since these were the most abundant predators found in traps. The relative abundance of predators in all traps was determined. For statistical analysis, data from the two ratooned fields were pooled as were data from the two replanted fields. The mean monthly catch of ants, spiders, and total predators in pitfall traps in ratooned fields and replanted fields was compared using Least Significant Difference (LSD) tests (SAS 1996).

Results and Discussion

A total of 4,255 arthropod ground predators were caught in pitfall traps during the one year study (Table 1). Of these, the vast majority were ants being 67.6% of the total catch. Among ants, the imported fire ant, *Solenopsis invicta* Buren was clearly the dominant ant species being 79.2% of all ants found in traps. These data are consistent with the report of Cherry & Nuessly (1992) that showed that *S. invicta* had become the dominant ant species in Florida sugarcane since first being found there in 1970. In fact, more S. *invicta* (2,279) were caught in pitfall traps in this study than all other predators combined. There is a wealth of literature on *S. invicta* as a predator in sugarcane and other ecosystems and this is reviewed by Reagan (1986).

Hall & Bennett (1994) have noted that insect pests of sugarcane are good candidates for classical biological control because some pest damage may be generally tolerated, sugarcane is a long term crop, and few tillage practices are required over the entire course of the three to five year planting. They also note that pre-harvest burning is the most disruptive practice that may interfere with biological control. However, the effects of burning on arthropod populations are complex and not always predictable. For example, ants were the most frequently caught predators in this study and MacKay et al. (1991) noted that fire may reduce species richness of ants, increase ant activity, or have no effect on ant populations. Data in Table 2 show that there were significant differences in catches of ants, spiders, and total predator numbers among different months in ratooned fields. However, there were no significant differences in catches of these groups in the month immediately preceding harvest and following harvest in ratooned fields. Also, catches of these groups during the three month post-harvest period were not significantly different than the

Table 1. Relative abundance of arthropod ground predators caught in pitfall traps in Florida sugarcane fields.

Predator	Number	% of total catch
Ants	2877	67.6
Brachymyrmex obscurior Forel	50	1.2
Monomorium pharaonis (Linn.)	52	1.2
Odontomachus ruginodis Wheeler	96	2.3
Pheidole moerens Wheeler	126	3.0
Solenopsis invicta Buren	2279	53.4
Strumigenys louisianae Roger	46	1.1
Tetramorium simillimum Smith	65	1.5
Wasmannia auropunctata (Roger)	60	1.4
Unknown	109	2.6
Earwigs	252	5.9
Ground Beetles	76	1.8
Rove Beetles	89	2.1
Spiders	913	21.5
Corinnidae	116	2.7
Gnaphosidae	49	1.2
Linyphiidae	69	1.6
Lycosidae	633	14.9
Unknown	46	1.1
Centipedes	48	1.1
Total	4255	100.0

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TABLE 2. PREDATORS CAUGHT IN PITFALL TRAPS IN RATOONED FIELDS OF FLORIDA SUGARCANE.

	Predators[1]		
Month	Ants	Spiders	Total[2]
June - 2000	30.5 ± 34.8 A	3.1 ± 1.5 BC	34.5 ± 35.9 A
July	19.1 ± 19.4 AB	13.2 ± 17.8 A	35.0 ± 29.5 A
August	7.3 ± 8.5 BC	5.4 ± 4.8 BC	13.0 ± 10.1 B
September	7.3 ± 11.2 BC	8.1 ± 4.7 AB	16.8 ± 14.7 B
October	2.3 ± 2.8 C	3.6 ± 2.9 BC	5.9 ± 4.8 B
November	1.1 ± 1.4 C	3.3 ± 6.3 BC	4.4 ± 7.2 B
December	2.7 ± 1.9 C	1.8 ± 1.8 C	5.0 ± 2.9 B
January - 2001	1.7 ± 2.7 C	1.8 ± 1.9 C	3.5 ± 4.3 B
February	Harvest	Harvest	Harvest
March	9.2 ± 10.9 BC	1.9 ± 1.6 C	13.7 ± 11.6 B
April	1.8 ± 1.5 C	4.1 ± 2.9 BC	6.4 ± 4.1 B
May	4.0 ± 4.7 C	2.2 ± 1.9 C	10.7 ± 6.8 B

[1]Mean ± SD. Means in a column followed by the same letter are not significantly different (alpha = 0.05) using the LSD test (SAS 1996).
[2] Total predators = all predators noted in Table 1.

three month pre-harvest period. These data show that the sugarcane harvesting, including the burning of the fields, did not reduce overall activity of ants, spiders, or total predator number in ratooned fields.

Predator catches in pitfall traps in successively planted fields of Florida sugarcane are shown in Table 3. Pitfall trap catches of ants, spiders, and total predators all decreased in the month following replanting versus the month immediately before replanting. Also, total predator catches remained low for the first four months after replanting compared to pre-planting catches and then increased dramatically at five to six months after planting. These data make sense since replanting is more disruptive to the soil habitat than harvesting because replanting involves not only burning of the field and mechanical harvesting, but also discing, and the use of a soil insecticide.

To summarize, my data show that sugarcane harvesting had no significant effect on total numbers of arthropod ground predators caught in pitfall traps. In contrast, replanting significantly reduced total numbers of ground predators in pitfall traps, but these numbers resurged after 5 to 6 months to preharvest levels. These data show that through most of its 3 to 5 year crop cycle, Florida sugarcane is a stable ecosystem at ground level for most arthropod ground predators.

TABLE 3. PREDATORS CAUGHT IN PITFALL TRAPS IN REPLANTED FIELDS OF FLORIDA SUGARCANE

	Predators[1]		
Month	Ants	Spiders	Total[2]
June - 2000	61.6 ± 120.9 A	5.7 ± 3.2 CDE	69.0 ± 120.3 A
July	16.5 ± 19.8 B	11.7 ± 6.9 BC	34.7 ± 28.0 ABC
August	9.5 ± 11.9 B	8.2 ± 6.6 BCD	9.4 ± 17.0 BC
September	10.6 ± 14.2 B	13.2 ± 12.1 B	27.1 ± 18.3 BC
October	21.3 ± 42.0 B	21.6 ± 18.6 A	44.3 ± 48.2 AB
November	Replant	Replant	Replant
December	2.4 ± 2.3 B	2.2 ± 1.7 DE	5.4 ± 3.5 C
January - 2001	1.6 ± 1.8 B	1.2 ± 1.2 E	3.0 ± 2.5 C
February	1.3 ± 1.6 B	0.7 ± 0.8 E	2.7 ± 2.1 C
March	2.1 ± 2.6 B	0.4 ± 0.7 E	4.5 ± 2.6 C
April	14.9 ± 32.3 B	2.0 ± 2.0 DE	18.3 ± 32.5 BC
May	32.3 ± 43.9 AB	0.9 ± 1.0 E	48.2 ± 39.7 AB

[1]Mean ± SD. Means in a column followed by the same letter are not significantly different (alpha = 0.05) using the LSD test (SAS 1996).
[2] Total predators = all predators noted in Table 1.

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