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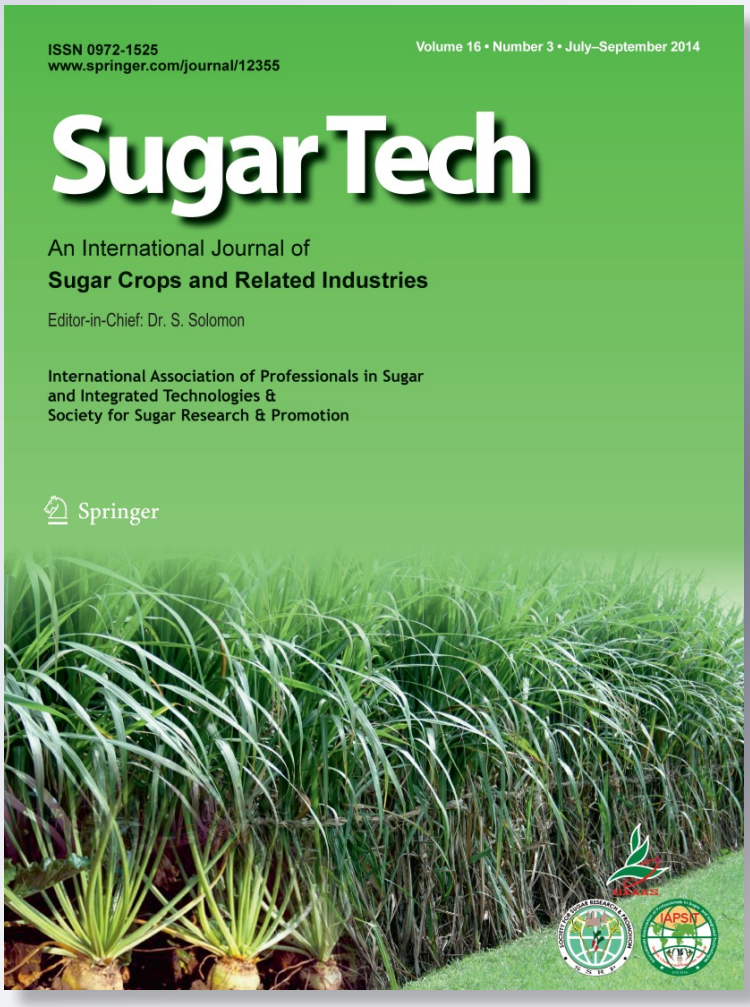

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LETTER TO THE EDITOR

Green Cane Harvest Effect on *Pseudaletia unipuncta* (Haworth) (Lepidoptera: Noctuidae) Larvae Abundance and Losses Caused by This Pest in Tucumán, Argentina

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Abstract From 2010 to 2012 harvest seasons, studies of the armyworm *Pseudaletia unipuncta* were conducted in sugarcane in Tucumán. The larvae are nocturnal and during the day remain hidden under the crop residues or in the soil. Damage begins in spring when temperature rises. They produce damage by feeding and killing the shoots, delaying the growth of the new shoots in the cane field. This study aimed to evaluate the effect of agricultural residues of sugarcane green harvest on larval abundance and the losses caused by this armyworm. Trials were conducted at three locations. Twelve points of 2 m row length were evaluated every 15 days from September to November. The number of larvae and percentage of affected shoots were evaluated. When the attack of *P. unipuncta* began in September, a plot of 1 ha was sprayed with pesticides, and another plot was left with harvest residues and the pest. Five samples of 10 stalks were extracted per plot. Factory parameters (pol, brix) were evaluated in the lab. Localities averaged shoot losses between 13 and 30 %. The average relative abundance of larvae in the plots with harvest residues was 0.5 larvae per 2 m row; no larvae were found in plots without residues. Factory sugar yield was 10.7 % in the plot without insecticidal control and 12 % in the treated plot, with a total sugar loss of 23.2 % per ha. To prevent losses caused by this species, it is important to sample early green cane harvested fields in spring.

Keywords Sugarcane · Armyworm · Losses

The armyworm *Pseudaletia unipuncta* Haworth (Lepidoptera: Noctuidae) receives its common name on account of the fact that it usually moves in massive waves, covering several acres and devouring leaves, buds and tender stems on its way (Margheritis and Rizzo 1965). *P. unipuncta* is considered a polyphagous pest of agricultural crops in North America (Breeland 1958; López et al. 2000; Guppy 1961) and in Europe (Bues et al. 1986). It is one of the most serious pests of pastures in the Azores, with high infestations reported in summer and early autumn (Tavares et al. 1992). It is distributed worldwide.

In Argentina, Margheritis and Rizzo (1965) reported it as a pest of agricultural importance and Hayword (1958) cited it as an important insect pest in Tucumán. Pastrana and Hernández (1978) included it in their work on lepidopteran caterpillars in corn. It attacks specific grasses and cereals, including corn, flax, alfalfa, etc. In northern Argentina, major attacks by this pest have not yet been reported on those crops, or on sugarcane. However, in 1998, this pest was observed affecting sugarcane in Tucumán (Salas et al. 1998).

Mature *P. unipuncta* larvae show a gregarious and mobile behaviour, forming large aggregations. The species completes two or three generations each year, with overlapping activity during September-December. Its thermal threshold is 6 °C and so it resists low temperatures, apparently overwintering as a fourth-stage larva and as a pupa (Navarro et al. 2009).

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Table 1 Infested shoots in different sugarcane plantation sites in Tucumán, Argentina. September–November 2009

Regions	Localities	Average		
		N° Attacked shoots	N° Unattacked shoots	% Attacked shoots
	Alabama	45	267	14.4 ± 1.8a
	Colonia 1 y 2	64	178	26.4 ± 1.8bc
North	Fca Mayo	61	279	17.9 ± 1.8ab
	La Cruz	90	252	26.3 ± 1.8bc
	La Marta	55	323	14.5 ± 1.8a
	Los Pérez	66	296	18.2 ± 1.8ab
	Average			19.6 %
	San Pablo	58	321	15.3 ± 1.8a
	Fronterita	81	418	16.2 ± 1.8a
Central	Los Ralos	67	262	21.9 ± 1.8abc
	Luisiana	47	231	17.2 ± 1.8a
	Mercedes	71	363	16.2 ± 1.8a
	Average			17.4 %
	Providencia	81	321	20.1 ± 1.8abc
	León Rouges	80	253	24.0 ± 1.8abc
South	Arcadia	101	252	28.6 ± 1.8c
	Ciudacita	96	336	22.2 ± 1.8abc
	La Trinidad	70	299	18.7 ± 1.8ab
	J.B. Alberdi	79	337	18.9 ± 1.8ab
	Average			22.1 %

Mean ± standard error. Values not followed by the same letter are not significantly different (LSD $P < 0.05$). $n = 30$

Adult longevity under field conditions is estimated to be about 10 days. The female oviposits approximately 500 eggs. In spring, when temperature rises, the larvae begin feeding on shoots, damaging the plants, and causing their death. Even though new shoots appear, a delay in crop growth can be observed (Salas et al. 1998).

From the 2006 to 2010 sugarcane harvest seasons in Tucumán, armyworm attacks were observed in early harvested plots, especially those kept under green cane harvest management, during dry springtime seasons. *P. unipuncta* infestation delays sugarcane development and causes yield losses. Nonetheless, these have not yet been quantified in Tucumán (Salas et al. 1998).

Our study aimed to evaluate the effect of sugarcane green harvest residue on *P. unipuncta* larvae abundance and the losses caused by this true armyworm in Tucumán province, Argentina.

In order to determine percentages of sugarcane shoots attacked by *P. unipucta* during sprouting, plots under an early green cane harvest management system (with residue mulching being retained on the soil) were monitored every 15 days from September to November 2009. These plots belonged to seventeen different locations within the sugarcane area of the province: La Cruz, Los Pérez, La Marta, Fca Mayo, Colonia 1y2, Luisiana, Alabama, Los Ralos, San Pablo, Mercedes, Fronterita, Providencia, León Rouges, Arcadia, Ciudacita, Trinidad and J. B. Alberdi. Sampling consisted of counting damaged and undamaged shoots along five metres of row. Three repetitions per plot were considered. The samples were taken at 50 m, 20 and 100 leaving 20 rows between them, following a zigzag pattern with these data, percentage of affected shoots out of the total number of shoots was estimated.

Two different management systems were evaluated in 1 ha plots at three localities, Simoca, Fronterita and Luisiana, in the province of Tucumán). In one treatment, stubble was burnt after harvest, whereas in the other it was kept on the field throughout the season. Damage was evaluated by recording total number of shoots and number of shoots attacked by *P. unipuncta* along a 2 m linear row at 25 spots chosen at random. To determine larvae abundance, twelve spots of 2 linear metres were selected at random, in the area bounded by 80 cm on both sides of the planting line. At these spots, the larvae were counted in an area comprising 80 cm on both sides of the planting line, where they remain hidden under the residues during the day.

The yields from adjacent blocks planted with LCP85-384 on the same date were compared. When the *P. unipuncta* attack began in September 2010, a 1 ha plot was sprayed with pesticides (Cipermetrina 150 cm^3/ha, diluted in 200–250 L of water per ha). The spray was carried out at sunset with a self-propelled sprayer, while keeping another plot covered with harvest residues and untreated.

Table 2 Average percentage of attacked shoots and larvae number recorded in plots under different management practices in three localities in Tucumán province

Locality	With cover		Without cover	
	% Attacked shoots	N° larvae	% Attacked shoots	N° larvae
Simoca	30.0 ± 6.1	0.7	0.0	0.0
Fronterita	13.7 ± 1.6	0.6	0.0	0.0
Luisiana	16.1 ± 4.6	0.3	0.0	0.0
Average	19.3	0.5	0.0	0.0

Mean ± standard error

Table 3 Damage and yield levels in plots without chemical applications and in plots under chemical control

Parameter	*N*	Without chemical control	With chemical control	% Reduction
Height (m)	50	1.40 ± 0.1a	1.45 ± 0.1a	3.0
Internode number	50	14.40 ± 02.2a	15.20 ± 0.2a	5.2
Stalk weight (kg)	50	6.52 ± 0.4a	7.28 ± 0.4a	10.2
Factory yield (%)	50	10.70 ± 0.3a	12.00 ± 0.3b	10.8
% Sugarcane pol	50	17.50 ± 0.4a	19.07 ± 0.4b	10.1

N total observations; Mean ± standard error. Values followed by different letters within a parameter are significantly different (LSD. $P < 0.05$)

In May 2011, five samples were taken at random from each block, each consisting of ten contiguous stalks. Stalk weight, height and internode number were determined for the ten stalks. Sugarcane brix and pol% were assessed in those ten stalk samples at the chemistry laboratories of Obispo Colombres Agroindustrial Experiment Station.

In the field, it was observed that *P. unipuncta* hibernated as larvae in the early stages, and its damage was first appreciated in spring, when temperature increased. *P. unipuncta* larvae are nocturnal and hide during the day under crop residues or in the soil. They produce damage by eating and killing the shoots, which leads to a decrease in shoot number per rootstock.

In fields under early green cane harvesting management, the armyworm was present in all 17 localities checked, distributed in all the sugarcane area. ANOVA results showed that the locality factor had a significant influence on attack distribution in the province ($F_{(16:50)} = 5.6$; $P \leq 0.0001$). The locality which showed the highest infestation levels was Arcadia, with 28.6 % of attacked shoots, whereas the least affected were Alabama 14.5 % and La Marta 14.5 %. The three regions in which the province was divided, showed little difference in the percentage of attacked shoots (Table 1).

Infestation levels under different management practices in Luisiana, Simoca and Fronterita differed: plots without residue cover suffered almost no attacks (0 % affected shoots) and those managed under residue mulching (green-cane harvesting) showed 13–30 % of pest incidence (Table 2).

Stalk height, weight, and internode number had no significant differences between the two treatments. However, significant differences were recorded regarding yield parameters between the control plots and the ones that received chemical control against *P. unipuncta* (Table 3). The total loss caused by P. *unipuncta* was 23.2 % sugar loss per ha.

Early green cane harvesting management had a significant influence increasing *P. unipunta* attack in the province. Plots without residue cover suffered no *P. unipunta* attacks. To prevent sugarcane losses produced by this species, sampling fields becomes important in spring, especially in the case of those which are kept under green cane management systems.

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