Acrotomopus atropunctellus (Coleoptera: Curculionidae) Preference for Large Sugarcane Shoots Mitigates Damage to Sugarcane Crop

Authors: Pérez, María L. del P., Isas, Marcos G., Salvatore, Analía R., García, José M., and Trumper, Eduardo V.

Source: Florida Entomologist, 100(3) : 678-679

Published By: Florida Entomological Society

URL: https://doi.org/10.1653/024.100.0332

Acrotomopus atropunctellus (Coleoptera: Curculionidae) preference for large sugarcane shoots mitigates damage to sugarcane crop

María L. del P. Pérez[1,], Marcos G. Isas[1], Analía R. Salvatore[2], José M. García[3], and Eduardo V. Trumper[4]*

The sugarcane stem weevil, *Acrotomopus atropunctellus* (Boheman) (Coleoptera: Curculionidae), affects sugarcane in the principal Argentinian sugarcane-producing area (Pérez et al. 2016). Although its damage potential has been known since at least 1929 (Box 1929), significant crop injury was not observed until 2003 (Salvatore et al. 2006). The oviposition and feeding punctures made by the adults, and the tunnels made by the larvae, cause the death of sugarcane shoots (Perez et al. 2012a).

Although the production of shoots is constant across the whole sugarcane cycle, the proportion of small shoots is highest in the early phenological stages, mainly the sprouting and tillering phases (according to the classification of Romero 2002). Preliminary studies indicated that the *A. atropunctellus* emergence period overlaps with early and middle phenological stages (tillering and rapid growth) (Pérez et al. 2012b). The objective of this research was to assess the food preference of *A. atropunctellus* in relation to shoot size and to determine the effect of damage on shoot survival.

Adults used for experiments were collected from emergence cages placed in commercial sugarcane fields planted with variety LCP 85-384 located in Ranchillos (26.9847°S, 65.0100°W), Tucumán, Argentina. Only individuals emerging within the same week were used in each experiment.

Using forest soil as substrate, 300 vegetative seed pieces of sugarcane (each 10 cm long and bearing 1 lateral bud) of variety LCP 85-384, the dominant variety in this area (Ostengo et al. 2014), were planted in 250 cm^3 plastic cups, in batches of 100 cups, at 2 wk intervals to obtain shoots of different sizes. The cups were placed in a greenhouse under ideal conditions for seedling development (21–35 °C).

The shoots were classified according to diameter and height. The diameter was measured at the mid-point of its length, which in turn was measured from soil level to the leaf +1 ligule. Ranges were 5 to 7 mm wide and 5 to 11 cm long (small), 7 to 9 mm wide and 12 to 15 cm long (medium), and 10 to 12 mm wide and greater than 15 cm long (large). These size categories represent the most common sizes of shoots in the early phenological stages of sugarcane (Romero 2002).

The experimental unit consisted of an 8 L pot containing 3 shoots (1 shoot per size category) covered by a voile cage and forest soil as substrate. To determine feeding preference, 8 experimental unit were infested with 1 male and 8 were infested with 1 female (total n = 16). After 5 d, the damage was assessed through the number of punctures on shoots.

A second experiment was performed to study the impact of *A. atropunctellus* on survival of sugarcane shoots. The experimental unit consisted of a 20 L pot containing 2 shoots in the same size category covered by a voile cage. Only medium and large size categories were used because 100% of small size shoots died in a preliminary experiment. Pots were infested with 0, 1 (female), 2 (1 couple), 4 (2 couples), 6 (3 couples), and 9 weevils (4 couple plus 1 female), with 3 replicates per weevil density. After 2 wk, the numbers of dead shoots were counted.

Linear mixed effects models were used (Pinheiro & Bates 2000), and the analyses were carried out in Infostat R interface (Di Rienzo et al. 2009) with pot as a random effect and size category of shoots, sex of weevil, their interaction, and the density of weevil as fixed effects. Heteroscedasticity was modeled using a constant variance function (varIdent function, package nlme) (Pinheiro et al. 2015). Several models where fitted to the data. Means were compared with Fisher's least significant difference (LSD) test.

The model that included shoot size, sex, and their interaction as fixed effects and pot as random effect was selected. *Acrotomopus atropunctellus* preferred to feed on large and medium shoots instead of small ones (Fig. 1). Significant effects of sex (F = 7.39; df = 1; P = 0.016)

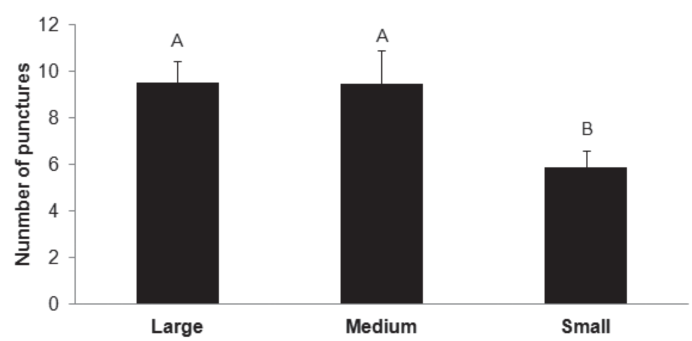

Fig. 1. Mean numbers (± SE) of feeding punctures made by *Acrotomopus atropunctellus* on sugarcane shoots of different sizes. Different letters represent significant differences between means (P < 0.05) (Fisher's LSD test).

[1]Instituto de Tecnología Agroindustrial del Noroeste Argentino (ITANOA), Estación Experimental Agroindustrial Obispo Colombres (EEAOC)-Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET), Av. William Cross 3150, C.P. T4101XAC, Las Talitas, Tucumán, Argentina; E-mail: mlperez@eeaoc.org (M. L. P. P.); mgisas@hotmail.com (M. G. I.)
[2]Facultad de Agronomía y Zootecnia, Universidad Nacional de Tucumán, Avenida Néstor Kirchner 1900, Argentina; E-mail: asalvatore@hotmail.com (A. R. S.)
[3]Estación Experimental Agroindustrial Obispo Colombres (EEAOC), Las Talitas, Tucumán, Argentina; E-mail: joegarcía_220@hotmail.com (J. M. G.)
[4]Instituto Nacional de Tecnología Agropecuaria (INTA), Ruta Nac. Nro. 9 km 636 (C.P. 5988), Manfredi, Córdoba, Argentina; E-mail: eduardo.trumper@gmail.com (E. V. T.)
*Corresponding author; E-mail: mlperez@eeaoc.org.ar (M. L. P. P.)

and shoot size (F = 9.23; df = 2; P = 0.001) on the number of punctures were identified. Size by sex interaction was not significant (F = 0.98; df = 2; P = 0.387) indicating that shoot preference does not vary according to sex. However, the number of punctures made by females (10.4 ± 1.2) was 1.6 times greater than that produced by males (6.3 ± 0.9). This behavior may be due to the different nutritional demands associated with reproduction and oviposition (Behmer & Joern 1994).

In shoots of medium size, shoot mortality with 1 weevil per pot was 15% whereas densities of 2 weevils per pot and higher caused shoot mortalities of 100% (P = 0.001). In large shoots, only densities of 9 weevils per pot caused mortality (25%) (P = 0.001).

Although large- and medium-sized shoots were preferred by *A. atropunctellus* adults, the low numbers of punctures found on small shoots were enough to cause their death. Considering the susceptibility of small shoots, this pest would cause greater impact in early than in late phenological stages.

Sugarcane planting and harvesting dates affect the emergence dynamics of shoots. In Tucumán, these operations are simultaneously conducted from May to Nov (Digonzelli et al. 2005; Romero et al. 2005). Despite its negative impact on yield (Digonzelli et al. 2006), producers sometime use late planting dates (Oct–Nov) due to machinery availability. The manipulation of sowing or planting dates to avoid the main pulse of pest emergence or immigration is a widely used tactic in integrated pest management (Ghosh 1989). Beuzelin et al. (2011) recommended this management option to protect sugarcane yields against *Diatraea saccharalis* F. sensu Guenée (Lepidoptera: Crambidae). Avoidance of late planting or harvest dates could be a useful tactic for mitigating *A. atropunctellus* incidence in sugarcane crops because it would avoid the overlap of crop sprouting or ratooning and emergence of *A. atropunctellus* adults.

This study was supported by Estacion Experimental Agro-industrial Obispo Colombres (EEAOC) and Instituto de Tecnología Agroindustrial del Noroeste Argentino (ITANOA) of Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET).

Summary

The sugarcane weevil, *Acrotomopus atropunctellus* (Boheman) (Coleoptera: Curculionidae) is an increasingly important sugarcane pest in Argentina. Its emergence period overlaps with early stages of sugarcane phenology. This research assessed the preference of *A. atropunctellus* for shoot size and the effect of damage on shoot survival. *Acrotomopus atropunctellus* preferred to feed on large- and medium-sized shoots, regardless of sex. However, older plants were resistant to injury. Also, the number of punctures produced by females was 1.6 times greater than that produced by males. Avoiding late planting or harvest dates could be a useful tactic for mitigating *A. atropunctellus* incidence in sugarcane crops.

Key Words: weevil; late harvest date; integrated pest management; puncture

Sumario

El picudo de la caña de azúcar, *Acrotomopus atropunctellus* (Boheman) (Coleoptera: Curculionidae) es una plaga de la caña de azúcar cada vez más importante en Argentina. El periodo de emergencia de los adultos de *A. atropunctellus* coincide con estados fenológicos tempranos de la caña de azúcar (macollaje y gran crecimiento). El objetivo de este trabajo fue conocer la preferencia de alimentación de *A. atropunctellus* según distintos tamaños de brotes de caña de azúcar y el efecto del daño sobre la sobrevivencia de los brotes. *Acrotomopus atropunctellus* prefirió alimentarse de brotes medianos y grandes y la preferencia no varió según el sexo. Sin embargo, las plantas más viejas fueron resistentes al daño. Además, el número de perforaciones producidas por las hembras fue 1.6 veces mayor que las producidas por los machos. Evitar fechas de siembra y cosechas tardías puede contribuir a la reducción de incidenciade *A. atropunctellus* en los cultivos de caña de azúcar.

Palabras Clave: picudo; fecha tardía de cosecha; manejo integrado de plagas; perforaciones

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