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

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Acrotomopus atropunctellus (Coleoptera: Curculionidae)
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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 cm³ 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)

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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 (Digononzelli et al. 2005; Romero et al. 2005). Despite its negative impact on yield (Digononzelli 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 harvesting dates could be a useful tactic for mitigating *A. atropunctellus* incidence in sugarcane crops because it would avoid the overlap of crop spraying or ratoooning and emergence of *A. atropunctellus* adults.

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**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

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