horticultura brasileira

Research

DIAS, DM; RESENDE, JTV; ZEIST, AR; GABRIEL, A; SANTOS, MH; VILELA, NC. 2019. Resistance of processing tomato genotypes to leafminer (*Tuta absoluta*). *Horticultura Brasileira* 37: 040-046. DOI - http://dx.doi.org/10.1590/S0102-053620190106

Resistance of processing tomato genotypes to leafminer (*Tuta absoluta*)

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ABSTRACT

Tomato crop presents several obstacles that hinder its cultivation, especially the tomato leafminer *Tuta absoluta* (Lepidoptera: Gelechiidae). To reduce damages caused by this pest, the development of resistant cultivars is one of the main alternatives. In this study we aimed to select tomato genotypes with high acylsugar contents and resistant to tomato leafminer. For this, contrasting F_2RC_1 genotypes for allelochemical contents, resulting from the interspecific cross between cultivar Redenção with processing characteristics, and the wild species *Solanum pennellii* accession 'LA-716', with high acylsugar contents, were submitted to a test of resistance to tomato leafminer with 14 treatments, being eight genotypes with high acylsugar content and four with low acylsugar content, in addition to the parental. Significant correlations and contrasts were observed between acylsugar contents and traits related to the resistance to tomato leafminer. The genotype RVTA-2010-31-pl#177 presented similar behavior to the wild parental, demonstrating potential to advance in the tomato breeding program for industrial processing with resistance to tomato leafminer.

Keywords: *Solanum lycopersicum*, *Solanum pennellii*, allelochemical, resistance to insects, acylsugars.

RESUMO

Resistência de genótipos de tomateiro para processamento à traça (*Tuta absoluta*)

A cultura do tomateiro apresenta vários entraves que dificultam o seu cultivo, com destaque para a traça-do-tomateiro, *Tuta absoluta* (Lep.: Gelechiidae). Para reduzir os danos causados por essa praga, o desenvolvimento de cultivares resistentes é uma das principais alternativas. Objetivou-se com este trabalho selecionar genótipos de tomateiro com elevados teores de acil-açúcar e resistentes à traça-do-tomateiro. Para isso, genótipos F_2RC_1, contrastantes para teores de aleloquímicos, resultantes do cruzamento interespecífico entre a cultivar Redenção, com características para processamento, e a espécie silvestre *Solanum pennellii,* acesso 'LA-716' de altos teores de acil-açúcares, foram submetidos a um ensaio de resistência à traça-do-tomateiro, contendo 14 tratamentos, sendo oito genótipos com alto teor de acil-açúcar, quatro com baixo teor, além dos parentais. Houve correlações e contrastes significativos entre os teores de acil-açúcar e características relacionadas à resistência à traça-do-tomateiro. O genótipo RVTA-2010-31-pl#177 comportou-se de maneira semelhante ao parental silvestre, demonstrando potencial para avançar no programa de melhoramento do tomateiro para processamento industrial com resistência à traça-do-tomateiro.

Palavras-chave: *Solanum lycopersicum*, *Solanum pennellii*, aleloquímico, resistência a insetos, acil-açúcares.

Received on November 6, 2017; accepted on August 16, 2018

Tomato (*Solanum lycopersicum*) is the most important fruit vegetable in world agriculture (El Balla *et al.*, 2013). In Brazil, tomato cultivation for *in natura* consumption is carried out especially in small and medium-sized properties, while processing tomato is cultivated in large areas (Gameiro *et al.*, 2007) with business characteristics, occupying, in the world, the position of main industrialized vegetable.

Processing tomato presents obstacles that hinder its cultivation, especially the susceptibility to different pests. Pest control increases production costs due to the great use of pesticides, causing ecological imbalance and adverse effects on the health of the rural worker and consumer (Silva *et al.*, 2009; Mamta *et al.*, 2016).

One of the most relevant pests of tomato cultivated in Brazil is the leafminer *Tuta absoluta* (Lepidoptera: Gelechiidae). In order to reduce the use of pesticides for its management, farmers should use alternative methods, such as planting pest-resistant genotypes (Silva *et al.*, 2013).

Wild species of tomato are frequently adopted as a source of resistance to pests and diseases in the improvement of commercial cultivars of tomato (Lima *et al.*, 2016; Lucini *et al.*, 2015; Dias *et al.*, 2016), such as the species *Solanum pennellii*, accession 'LA-716', which shows resistance to pests (Moreira *et al.*, 2013; Dias *et al.*, 2016). The resistance obtained from this accession has been associated with the presence of allelochemicals, acting on mechanisms of antibiosis and antixenosis (Maluf *et al.*, 2010; Tian *et al.*, 2012; Dias *et al.*, 2016).

The most characteristic allelochemical in the accession 'LA-716' is the acylsugar (AS), which is exuded by type IV glandular trichomes (Andrade *et al.*, 2017), which has a deleterious effect on the development of certain phases of insects or even prevent their oviposition and feeding (Moreira *et al.*, 2013; Lucini *et al.*, 2015). Resende *et al.* (2002) and Gonçalves *et al.* (2006) revealed that high AS contents are due to the action of a larger gene, associated with others of smaller effect with additive action. Due to the type of inheritance involved, obtaining resistant or partially resistant hybrids will be possible by crossing and selecting lines with high contents of leaf AS.

According to Resende *et al.* (2009), genotypes selected for high AS contents are promising in breeding programs aimed at pest resistance. According to these authors, by means of backcrossing, resistant lines with favorable commercial characteristics can be obtained and used for the development of tomato hybrids.

Several studies have been carried out aiming at obtaining lines with characteristics for *in natura* consumption, with high allelochemical contents in the leaflets and resistant to pests (Silva *et al.*, 2009; Gonçalves Neto *et al.*, 2010; Maluf *et al.*, 2010). Studies on pest resistance in tomatoes for industrial processing are practically nonexistent. Thus, there is a need to explore the interspecific variability to obtain genotypes with an aptitude for industry and high AS contents. In this sense, the aim of this study is to select second-generation genotypes of first backcrossing (F_2BC_1) with high AS contents and resistant to tomato leafminer.

MATERIAL AND METHODS

The experiments were conducted in a greenhouse of the Center for Research in Vegetables of the Department of Agronomy of the Midwestern State University, Cedeteg campus, Guarapuava-PR, Brazil (25°23′00″S, 51°29′38.50″W, altitude 1100 m).

Obtaining segregating generations and laboratory analyses

To obtain F_1BC_1 plants, the backcrossing of F_2 genotypes developed and selected by Dias *et al.* (2013) for a high AS content was carried out with the commercial cultivar Redenção [*S. lycopersicum* line developed by Ferraz *et al.* (2003) of determined growth habit and characteristics for industrial processing, resistant to geminivirus and tospovirus, and low AS contents]. In turn, the F_2 genotypes developed by Dias *et al.* (2013) were obtained from interspecific cross-breeding of the cultivar Redenção with the wild species *S. pennellii* accession 'LA-716' (pollen donor parent with high AS contents and resistant to tomato leafminer). From the self-fertilization of F_1BC_1 plants, a segregating population F_2BC_1 was obtained.

For quantifying AS content and selecting F_2BC_1 tomato genotypes, 40 plants of 'Redenção', 40 plants of 'LA-716', and 420 plants of F_2BC_1 generation genotypes were cultivated in a greenhouse, being randomly distributed and duly identified. The parents 'Redenção' and 'LA-716' were used as a standard for quantifying AS contents, such as low and high AS contents, respectively.

At 35 days after transplanting, samples of young and expanded leaflets from the upper third of plants were collected to determine AS content following the methodology proposed by Resende *et al.* (2002). For this purpose, six leaf discs were collected in triplicate from each sample and conditioned in test tubes, totaling 6 cm^2 of leaf area. Subsequently, AS was extracted by adding dichloromethane and a colorimetric reaction by the Sommogy-Nelson test. Then, samples were submitted to absorbance reading at a wavelength of 540 nm in a Cary 60 spectrophotometer (Nelson, 1944). AS concentrations in leaflets are directly proportional to absorbance values, i.e. higher absorbance values lead to higher allelochemical contents.

Through the average absorbance values, contrasting plants from F_2BC_1 population were selected for AS contents. The genotypes RVTA-2010-31-pl#177, RVTA-2010-83-pl#357, RVTA-2010-31-pl#310, RVTA-2010-31-pl#319, RVTA-2010-83-pl#346, RVTA-2010-31-pl#347, RVTA-2010-94-pl#378, and RVTA-2010-94-pl#381 were selected for high AS content, while the genotypes RVTA-2010-94-pl#50, RVTA-2010-94-pl#95, RVTA-2010-94-pl#258, and RVTA-2010-94-pl#272 were selected for low AS content.

Thereafter, these F_2BC_1 genotypes were cloned using axillary sprouts in order to increase the number of plants. On the same date, seeds from the parents 'Redenção' and 'LA-716' were sown in 128-cell polystyrene trays. When the clones from the F_2BC_1 genotypes for high and low AS contents had the root system formed and the parents had between three and five true leaves, seedlings were transplanted to pots with a capacity of 8 dm^3, containing sieved soil and fertilizer as recommended for the crop.

Bioassay with tomato leafminer

The experimental design was a randomized block design with four replications. Treatments consisted of the selected genotypes for the contrasting AS contents, eight with high contents and four with low contents, as previously described. Cultivar Redenção and 'LA-716', parents of first generation of crossings, were also used as standard. Each sample unit corresponded to one pot containing one plant of each genotype.

At 45 days after transplanting, plants that were in early flowering were infested with two-day old adults of tomato leafminer. Three females were released for each male per plant in the greenhouse. The insects came from Laboratory of Entomology of the Department of Agronomy of Unicentro, from a programmed rearing, i.e. with individuals of the same age.

Severity of damages caused by the tomato leafminer was assessed by means of a grading scale (Labory *et al.*, 1999), as follows: a) Plant damage intensity (PDI) [0= no damage; 1= small lesions (0.1 to 5% damage); 2= small and non-coalescing lesions (5.1 to 20% damage); 3= medium to large lesions (20.1 to 50% damage); 4= large and coalescing lesions (50.1 to 80% damage); and 5=

completely destroyed plants (above 80% damage)]. b) Types of leaflet lesions (TLL) (0= without lesions; 1= few and small lesions; 2= small and medium lesions; 3= medium-sized lesions, without coalescence; 4= large and coalescing lesions, deformed leaflets; and 5= completely destroyed leaflet). c) Attacked leaflets (%) (PAL) (0= without attacked leaflets; 1= 0.1 to 5% attacked leaflets; 2= 5.1 to 20% attacked leaflets; 3= 20.1 to 50% attacked leaflets; 4= 50.1 to 80% attacked leaflets; and 5= more than 80% attacked leaflets).

Assessments were carried out by five previously trained evaluators, 14 and 21 days after infestation. Population growth of tomato leafminer was assessed 7, 14, and 21 days after infestation by counting the number of eggs on the adaxial and abaxial surface and number of caterpillars in the leaflets. For this, three expanded leaflets were collected from the upper, middle, and lower thirds of each plant and the number of eggs and caterpillars was counted in an area of 4 cm^2 of each leaflet, excluding the midrib.

Statistical analyses

The values of grades applied to the damage of plants, the percentage of attacked leaflets, number of attacked leaflets, number of eggs, and number of larvae were analyzed for the normality of residual variances by the Shapiro-Wilk test. Subsequently, an analysis of variance was carried out, followed by a grouping of means by the Scott-Knott test at 5% probability level using the statistical program SISVAR (Ferreira, 2008).

The association of AS contents and genotype resistance, mediated by damages in plants and number of eggs and larvae, were estimated using the Pearson correlation and the significance of correlations by means of the t-test using the program Assistat 7.7 Beta (Silva & Azevedo, 2016). Orthogonal contrasts between parents ('Redenção' and 'LA-716') and genotype groups with contrasting AS contents were estimated in the bioassay using the statistical program SISVAR (Ferreira, 2008).

RESULTS AND DISCUSSION

For the results related to the severity of damages caused by the tomato leafminer (Table 1), the genotype RVTA-2010-31-pl#177 (high AS content) stood out with the lowest plant damage intensity (PDI) at 14 DAI, type of leaflet lesions (TLL) at 21 DAI, and percentage of attacked leaflets (PAL) at 14 and 21 DAI. Only the wild parent 'LA-716' presented inferior results. This evidences the potential of this genotype for the improvement of tomato with characteristics for industrial processing aiming at obtaining plants with resistance to tomato leafminer. Another F_2BC_1 genotype that presented a low damage severity was RVTA-2010-94-pl#381, with values of PDI and TLL not differing from RVTA-2010-31-pl#177 at 14 DAI (Table 1).

Regarding the oviposition of tomato leafminer on the adaxial surface of leaflets (Table 2), the assessments at 7 and 14 DAI showed that the genotypes RVTA-2010-31-pl#177, RVTA-2010-83-pl#357, RVTA-2010-31-pl#310, RVTA-2010-31-pl#347, and RVTA-2010-94-pl#378, selected for high AS contents, had a low number of eggs in the leaflets, not differing from the parent 'LA-716'.

Generally, a lower number of eggs was observed at 21 DAI for all genotypes of a low AS content and 'Redenção'. This occurred due to the severe damage caused by caterpillars, which reduced the attractiveness of plants and the possibility of oviposition by tomato leafminer.

Regarding the assessment of the abaxial surface, the genotypes RVTA-2010-31-pl#177, RVTA-2010-83-pl#357, RVTA-2010-31-pl#310, and RVTA-2010-31-pl#319, along with 'LA-716', presented lower number of eggs deposited on leaflets at 7 and 14 DAI. The genotype RVTA-2010-31-pl#347 differed only at 14 DAI for the characteristic under analysis. However, no difference was observed between the assessed genotypes for the number of eggs of the abaxial surface at 21 DAI due to the destruction of low-content genotypes by caterpillars.

The genotypes selected for high acylsugar contents and 'LA 716' showed a lower number of caterpillars in the leaflets at 7 DAI, not differing from each other. However, the low-content genotypes and cultivar Redenção presented the highest number of caterpillars attacking leaflets, thus evidencing the pest preference for these genotypes.

At 14 DAI, the lowest number of caterpillars was observed in the genotypes *S. pennellii* 'LA-716', RVTA-2010-31-pl#177 (high), RVTA-2010-83-pl#357 (high), RVTA-2010-31-pl#310 (high), and RVTA-2010-31-pl#347 (high). However, the genotypes RVTA-2010-31-pl#319 (high), RVTA-2010-83-pl#346 (high), RVTA-2010-94-pl#378 (high), and RVTA-2010-94-pl#381 (high), although selected for high contents of allelochemicals, showed a higher number of caterpillars in the leaflets when compared to the genotypes mentioned above. However, these genotypes were superior to those selected for low contents of allelochemical, which had a high infestation by caterpillars.

At 21 DAI, the genotypes RVTA-2010-31-pl#177 (high), RVTA-2010-83-pl#357 (high), RVTA-2010-31-pl#310 (high), RVTA-2010-31-pl#319 (high), RVTA-2010-83-pl#346 (high), and RVTA-2010-31-pl#347 (high), together with 'LA716,' presented the lowest number of caterpillars in the leaflets, showing a satisfactory level of resistance to this pest. The low-acylsugar genotypes and the cultivar Redenção, together with the high-content genotypes RVTA-2010-94-pl#378 and RVTA-2010-94-pl#381, were the most infested by caterpillars. This result is due to the high pest suppression in the greenhouse, which migrated to the other plants after destroying those susceptible.

In general, for the number of caterpillars (NC) and eggs of the adaxial and abaxial surfaces, the genotypes selected for high AS contents presented the lowest incidence of caterpillars (Table 2).

As observed for the number of eggs, the genotype RVTA-2010-94-pl#272 (low AS content) was completely damaged by the attack of tomato

Table 1. Plant damage intensity (PDI), type of leaflet lesions (TLL), and percentage of attacked leaflets (PAL) assessed at 14 and 21 days after infestation (DAI) with tomato leafminer (*Tuta absoluta*) in F_2BC_1 genotypes with contrasting acylsugar contents, *Solanum lycopersicum* cultivar Redenção and *Solanum pennellii* accession 'LA-716'. Guarapuava, UNICENTRO, 2015/2016.

Genotype	Acylsugar[1]	PDI	
		14 DAI	21 DAI
S. pennellii 'LA-716'	0.620	1.30 a	1.40 a
RVTA-2010-31-pl#177 (high)	0.434	2.25 b	3.25 b
RVTA-2010-83-pl#357 (high)	0.482	3.75 c	4.80 c
RVTA-2010-31-pl#310 (high)	0.416	3.40 c	4.80 c
RVTA-2010-31-pl#319 (high)	0.654	3.65 c	4.80 c
RVTA-2010-83-pl#346 (high)	0.484	4.00 d	4.80 c
RVTA-2010-31-pl#347 (high)	0.463	4.10 d	4.80 c
RVTA-2010-94-pl#378 (high)	0.444	4.14 d	4.75 c
RVTA-2010-94-pl#381 (high)	0.489	3.15 b	4.75 c
RVTA-2010-94-pl#50 (low)	0.120	4.02 d	4.90 c
RVTA-2010-83-pl#95 (low)	0.145	4.00 d	4.55 c
RVTA-2010-94-pl#258 (low)	0.160	4.10 d	4.75 c
RVTA-2010-94-pl#272 (low)	0.155	4.80 d	4.80 c
'Redenção'	0.143	4.75 d	5.00 c
CV (%)		12.06	4.88
Correlation		-0.61**	0.40
	Acylsugar[1]	TLL	
		14 DAI	21 DAI
S. pennellii 'LA-716'	0.620	1.25 a	1.20 a
RVTA-2010-31-pl#177 (high)	0.434	2.00 a	3.30 b
RVTA-2010-83-pl#357 (high)	0.482	3.80 b	4.80 c
RVTA-2010-31-pl#310 (high)	0.416	3.35 b	4.90 c
RVTA-2010-31-pl#319 (high)	0.654	3.60 b	4.80 c
RVTA-2010-83-pl#346 (high)	0.484	4.05 c	4.85 c
RVTA-2010-31-pl#347 (high)	0.463	4.02 c	4.90 c
RVTA-2010-94-pl#378 (high)	0.444	4.05 c	4.80 c
RVTA-2010-94-pl#381 (high)	0.489	3.10 b	4.90 c
RVTA-2010-94-pl#50 (low)	0.120	4.18 c	4.90 c
RVTA-2010-83-pl#95 (low)	0.145	4.15 c	4.90 c
RVTA-2010-94-pl#258 (low)	0.160	4.10 c	4.95 c
RVTA-2010-94-pl#272 (low)	0.155	4.80 c	5.00 c
'Redenção'	0.143	4.7 c	5.00 c
CV (%)		14.36	4.08
Correlation		-0.63**	-0.44
	Acylsugar[1]	PAL	
		14 DAI	21 DAI
S. pennellii 'LA-716'	0.620	1.00 a	1.05 a
RVTA-2010-31-pl#177 (high)	0.434	3.20 b	3.35 b
RVTA-2010-83-pl#357 (high)	0.482	4.50 c	5.00 c
RVTA-2010-31-pl#310 (high)	0.416	4.30 c	5.00 c
RVTA-2010-31-pl#319 (high)	0.654	4.40 c	5.00 c
RVTA-2010-83-pl#346 (high)	0.484	4.35 c	5.00 c
RVTA-2010-31-pl#347 (high)	0.463	4.35 c	5.00 c
RVTA-2010-94-pl#378 (high)	0.444	4.50 c	5.00 c
RVTA-2010-94-pl#381 (high)	0.489	4.00 c	5.00 c
RVTA-2010-94-pl#50 (low)	0.120	4.60 c	5.00 c
RVTA-2010-83-pl#95 (low)	0.145	4.55 c	5.00 c
RVTA-2010-94-pl#258 (low)	0.160	4.73 c	5.00 c
RVTA-2010-94-pl#272 (low)	0.155	4.90 c	5.00 c
'Redenção'	0.143	4.75 c	5.00 c
CV (%)		8.68	4.88
Correlation		-0.54**	-0.40

*Means followed by same letters in the column belong to the same group by the Scott-Knott test, 5% probability; **Significant by Student test, 5% probability; [1]Acylsugar contents at 540 nm. PDI= notes from 0 (no damage) to 5 (completely destroyed plants). TLL= notes from 0 (without lesions) to 5 (completely destroyed leaflet). PAL= notes from 0 (without attacked leaflets, 0%) to 5 (more than 80% attacked leaflets).

leafminer at 21 DAI, which resulted in a low number of caterpillars in the leaflets.

Oviposition and number of caterpillars in the leaflets were lower in several F_2BC_1 genotypes selected for high AS contents. However, some high-content genotypes did not differ from those selected for low contents, presenting a higher number of eggs and caterpillars. Dias *et al.* (2013) obtained similar results, in which some genotypes with high AS content showed oviposition and number of caterpillars without differing from the genotypes selected for low allelochemical content. In addition, Gonçalves Neto *et al.* (2010) verified high oviposition by tomato leafminer in clones with high contents of this allelochemical, with no difference for low-content controls. These results may be due to the presence of other allelochemicals with an antagonistic effect to resistance coming from high acylsugar contents. Maluf *et al.* (2010) reported that the divergence of results is commonly observed in breeding programs aiming at pest resistance in genotypes obtained from interspecific crossings between a line of *S. lycopersicum* and a wild parent with subsequent backcrossing with *S. lycopersicum*.

The linear correlations were negative and significant at 7 and 14 DAI between AS contents of the assessed genotypes and values for the number of eggs of the adaxial and abaxial surfaces and NC, with values of −0.56 and −0.76, −0.74 and −0.81, and −0.86 and −0.83, respectively (Table 2). These correlations indicate a direct association between the non-preference for oviposition of tomato leafminer and high AS contents in the leaflets of the genotypes, thus demonstrating the action of this allelochemical on resistance mechanisms known as antixenosis.

Lucini *et al.* (2015) studied the resistance mechanisms presented by F_2 genotypes with contrasting AS contents from a crossing between *S. lycopersicum* and *S. pennellii* accession 'LA-716'. By means of choice and no-choice tests, the presence of resistance mechanisms by antixenosis and antibiosis in F_2 genotypes selected for high AS contents was identified when submitted to the

Table 2. Number of eggs and caterpillars of tomato leafminer (*Tuta absoluta*) in leaflets of F_2BC_1 genotypes with contrasting acylsugar contents, *Solanum lycopersicum* cultivar Redenção and *Solanum pennellii* accession 'LA-716' at 7, 14, and 21 days after infestation (DAI). Guarapuava, UNICENTRO, 2015/2016.

Genotype	Acylsugar[1]	Number of eggs of the adaxial surface		
		7 DAI	14 DAI	21 DAI
S. pennellii 'LA-716'	0.620	0.16 a	0.50 a	0.33 a
RVTA-2010-31-pl#177 (high)	0.434	3.75 a	2.16 a	1.25 b
RVTA-2010-83-pl#357 (high)	0.482	1.83 a	1.00 a	0.08 a
RVTA-2010-31-pl#310 (high)	0.416	2.33 a	1.50 a	0.33 a
RVTA-2010-31-pl#319 (high)	0.654	6.58 b	3.09 a	0.92 b
RVTA-2010-83-pl#346 (high)	0.484	6.00 b	5.08 b	1.42 b
RVTA-2010-31-pl#347 (high)	0.463	3.58 a	2.17 a	0.58 a
RVTA-2010-94-pl#378 (high)	0.444	3.99 a	3.08 a	0.25 a
RVTA-2010-94-pl#381 (high)	0.489	5.33 b	3.25 a	0.58 a
RVTA-2010-94-pl#50 (low)	0.120	5.67 b	6.25 b	1.25 b
RVTA-2010-83-pl#95 (low)	0.145	5.80 b	5.50 b	1.25 b
RVTA-2010-94-pl#258 (low)	0.160	5.50 b	4.42 b	1.33 b
RVTA-2010-94-pl#272 (low)	0.155	9.42 b	4.58 b	0.00 a
'Redenção'	0.143	6.92 b	6.42 b	0.83 b
CV (%)		52.13	43.61	103.61
Correlation		-0.56**	-0.76**	-0.27
	Acylsugar[1]	Number of eggs of the abaxial surface		
		7 DAI	14 DAI	21 DAI
S. pennellii 'LA-716'	0.620	1.08 a	0.75 a	0.17 a
RVTA-2010-31-pl#177 (high)	0.434	3.50 a	2.08 a	0.92 a
RVTA-2010-83-pl#357 (high)	0.482	3.99 a	3.33 a	0.42 a
RVTA-2010-31-pl#310 (high)	0.416	3.42 a	3.17 a	0.42 a
RVTA-2010-31-pl#319 (high)	0.654	5.42 a	4.58 a	0.67 a
RVTA-2010-83-pl#346 (high)	0.484	5.25 a	6.84 b	0.83 a
RVTA-2010-31-pl#347 (high)	0.463	4.67 a	3.08 a	0.50 a
RVTA-2010-94-pl#378 (high)	0.444	7.09 b	4.33 a	1.42 a
RVTA-2010-94-pl#381 (high)	0.489	6.42 b	4.58 a	0.75 a
RVTA-2010-94-pl#50 (low)	0.120	7.92 b	10.83 b	1.83 a
RVTA-2010-83-pl#95 (low)	0.145	6.75 b	7.92 b	1.08 a
RVTA-2010-94-pl#258 (low)	0.160	6.75 b	8.67 b	1.83 a
RVTA-2010-94-pl#272 (low)	0.155	10.50 b	6.33 b	0.00 a
'Redenção'	0.143	9.89 b	8.5 b	1.08 a
CV (%)		55.08	48.11	103.43
Correlation		-0.74**	-0.81**	-0.48
	Acylsugar[1]	Number of caterpillars		
		7 DAI	14 DAI	21 DAI
S. pennellii 'LA-716'	0.620	0.00 a	0.00 a	0.08 a
RVTA-2010-31-pl#177 (high)	0.434	0.92 a	4.58 a	10.67 a
RVTA-2010-83-pl#357 (high)	0.482	1.25 a	5.50 a	5.83 a
RVTA-2010-31-pl#310 (high)	0.416	0.58 a	1.58 a	4.33 a
RVTA-2010-31-pl#319 (high)	0.654	0.83 a	9.33 b	7.58 a
RVTA-2010-83-pl#346 (high)	0.484	1.08 a	8.84 b	9.42 a
RVTA-2010-31-pl#347 (high)	0.463	1.50 a	4.59 a	8.08 a
RVTA-2010-94-pl#378 (high)	0.444	0.83 a	8.08 b	12.92 b
RVTA-2010-94-pl#381 (high)	0.489	1.17 a	7.92 b	17.33 b
RVTA-2010-94-pl#50 (low)	0.120	2.83 b	23.42 c	16.92 b
RVTA-2010-83-pl#95 (low)	0.145	3.34 b	17.80 c	15.67 b
RVTA-2010-94-pl#258 (low)	0.160	2.33 b	12.34 b	21.25 b
RVTA-2010-94-pl#272 (low)	0.155	3.83 b	24.58 c	0.33 a
'Redenção'	0.143	5.25 b	21.14 c	18.33 b
CV (%)		93.22	36.79	89.44
Correlation		-0.86**	-0.83**	-0.50

*Means followed by same letters in the column belong to the same group by Scott-Knott test, 5% probability; **Significant by Student test, 5% probability; [1]Acylsugar contents at 540 nm.

presence of the tomato leafminer.

At 21 DAI, no significant correlations were observed between AS contents in the genotypes and the assessed variables, given the destruction of low-content plants (Tables 1 and 2).

At 21 DAI, the difference of resistance of F_2BC_1 genotypes selected for high AS contents was not more evident due to the joint action of two ecological conditions imposed by the restricted environment of the greenhouse: population and hosts. Thus, the most susceptible genotypes (low AS content) allowed the population growth of tomato leafminer in a number higher than that the environment supported, which led to the destruction of these hosts and migration of the pest to lower susceptible genotypes (high AS content). However, the tendency is that plants selected for high AS content and exposed to natural infestation conditions have superior resistance to leafminer over the tomato growing cycle. A complementary study conducted with no chance to choosing by the host could better evidence this issue.

By means of the estimate of contrasts of interest for the characteristics related to population growth of tomato leafminer, a difference was observed between both groups of F_2BC_1 genotypes with contrasting AS contents at 14 DAI (−2.52, −4.44, and −13.05 for the number of eggs of adaxial and abaxial surface and NC, respectively) (Table 3). In addition, no difference was observed between the parent 'LA-716' vs. F_2BC_1 genotypes with high AS contents, F_2BC_1 genotypes with low AS contents differed from 'LA-716' for these same characteristics, those of high content differed from 'Redenção' for NC, and no difference was observed for genotypes with a low AS content with 'Redenção'. Thus, the promotion of resistance to tomato leafminer attack was related to the presence of the AS allelochemical at high concentrations in the leaf epidermis.

Maluf *et al.* (2010), Maciel *et al.* (2011), Dias *et al.* (2013), and Baier *et al.* (2005) reported that high AS contents in leaflets of genotypes obtained from the interspecific crossing of *S.*

Table 3. Estimates of the means of contrasts of interest used for comparisons of resistance to tomato leafminer (*Tuta absoluta*) in plants of F_2BC_1 genotypes with contrasting acylsugar contents, *Solanum lycopersicum* cultivar Redenção and *Solanum pennellii* accession 'LA-716' at 7, 14, and 21 days after infestation (DAI). Guarapuava, UNICENTRO, 2015/2016.

Contrasts of interest	Number of eggs of the adaxial surface		
	7 DAI	14 DAI	21 DAI
Genotypes (high) *vs*. Genotypes (low)	-2.42	-2.52*	-0.28
'LA-716' *vs*. Genotypes (high)	-4.01	-2.17	-0.34
'LA-716' *vs*. Genotypes (low)	-6.43	-4.69*	-0.62
'Redenção' *vs*. Genotypes (high)	2.74	3.75	0.16
'Redenção' *vs*. Genotypes (low)	0.32	1.23	-0.12
	Number of eggs of the abaxial surface		
	7 DAI	**14 DAI**	**21 DAI**
Genotypes (high) *vs*. Genotypes (low)	-3.01	-4.44*	-0.45
'LA-716' *vs*. Genotypes (high)	-3.88	-3.25	-0.57
'LA-716' *vs*. Genotypes (low)	-6.89	-7.69*	-1.02
'Redenção' *vs*. Genotypes (high)	4.29	4.50	0.34
'Redenção' *vs*. Genotypes (low)	1.91	0.06	-0.10
	Number of caterpillars		
	7 DAI	**14 DAI**	**21 DAI**
Genotypes (high) *vs*. Genotypes (low)	-2.06	-13.05*	-4.02
'LA-716' *vs*. Genotypes (high)	-1.02	-6.30	-9.44
'LA-716' *vs*. Genotypes (low)	-3.08	-19.35*	-13.46
'Redenção' *vs*. Genotypes (high)	4.22	14.84*	8.81
'Redenção' *vs*. Genotypes (low)	2.17	1.78	4.79

*Significant by Student test at 5% probability.

lycopersicum with the wild accession 'LA-716' and subsequent backcrossing with *S. lycopersicum* act as an important provider of pest resistance. Among the tested segregating F_2BC_1 genotypes, RVTA-2010-31-pl#177 stood out with high AS contents, proving to be resistant to tomato leafminer since the oviposition, the number of caterpillars, and the severity of damage to plants decreased.

Selection of genotypes with high acylsugar contents, resistant to tomato leafminer, is of great relevance in a genetic breeding program since it allows prospecting generations to obtain isogenic lines with backgrounds more compatible with established requirements within the productive chain of processing tomato.

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