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Synthetic acylsugars and their effects on the control of arthropod pests

Acilaçúcares sintéticos e seu efeito no controle de artrópodes-praga

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ABSTRACT

One of the main problems facing agriculture is the loss of production as a result of the attack of agricultural pests. Alternative ways to work around this problem are being sought. There are substances called acylsugars that are naturally produced by the wild tomato species *S. pennellii* and affect arthropod pests. The objectives of this work were to synthesize two acylsugars and assess the biological effect of these on the arthropod pests *Bemissia tabaci* and *Tetranycus urticae*. The syntheses were performed via the reactions of glucose and sucrose (saccharose) with acetic anhydride using sodium acetate as the catalyst. The products of these reactions were sucrose octa-acetate and glucose penta-acetate, the structures of which were confirmed by spectroscopic techniques. In a resistance test against the mite, a linear correlation between the concentration of the synthesized substances, and the dislocation of the mite was obtained. A delay in the hatching of the arthropod eggs was observed, causing a mortality rate of approximately 95% in the 1st instar larvae of mites that was confirmed in adults. In the biological tests with *Bemisia tabaci*, there was a low rate of hatching and emergence, and the effect on the nymphs was the deformation of the emergent adults.

Index terms: *Solanum pennellii*; *Solanum habrochaites* var. *hirsutum;* sugar esters; *Bemisia tabaci*; *Tetranychus urticae*.

RESUMO

Um dos grandes problemas que a agricultura enfrenta é a perda de produção causada pelo ataque de pragas agrícolas. Assim, buscam-se maneiras alternativas de contornar esse problema. Dentre esses, encontram-se substâncias, denominadas de acilaçúcars, que são produzidas naturalmente por espécies selvagens do tomate *S. pennellii* e que apresentam efeito sobre artrópodes-praga. Os objetivos desse trabalho foram sintetizar dois compostos de acilaçúcares e avaliar o efeito biológico destas sobre os artrópodes-praga *Bemissia tabaci e Tetranycus urticae*. A síntese foi feita via as reações de glicose e sacarose com anidrido acético, utilizando acetato de sódio como catalisador. Os produtos dessas reações foram o octa-acetato de sacarose e o penta-acetato de glicose, cujas estruturas foram confirmadas por técnicas espectroscópicas. No teste de resistência do ácaro, foi possível obter um ajuste linear entre a concentração das substâncias sintetizadas e o deslocamento do ácaro. Ambas as substâncias obtidas apresentaram um atraso na eclosão dos ovos do artrópode, ocasionando uma mortalidade de aproximadamente 95% em ácaros de 1º ínstar que foram confirmadas em adultos. Nos testes biológicos com *Bemisia tabaci*, verificou-se uma baixa taxa de eclosão e emergência, sendo que o efeito sobre as ninfas foi a má formação para adultos emergidos.

Termos para indexação: *Solanum pennellii*; *Solanum habrochaites* var. *hirsutum*; ésteres de açúcares; *Bemisia tabaci*; *Tetranychus urticae*.

INTRODUCTION

According to data from the Food and Agriculture Organization (FAO, 2015), 42.1% of the agricultural production is lost because of several important factors. Approximately 15.6% of this loss is the result of damage of crops by insects. Among the agricultural pests that have caused serious damage to crops, mites of the *Tetranychus urticae* Koch species (Acari: Tetranychidae) and the white-fly [*Bemisia tabaci* Genn. (Homoptera: Aleyrodidae) biotype B] have had an important impact. The main problem is that, after infestation by these types of pests in the field, their eradication is practically impossible (Lucini et al., 2015).

The spider mite, *Tetranychus urticae*, is among the species that cause major damage to crops. The colonies develop on the abaxial surface of leaves, preferably in young plants, and they can spread to the axial surface when the attack is severe and intense. In very severe attacks, the formation of necrotic spots can occur, which causes dryness and premature leaf fall. In fruits, the attack leads to a decrease in size and number of the fruits and early ripening of the remaining

individuals. When the infestation rate in leaflets exceeds 15%, it can lead to substantial losses in production (Moraes; Flechtmann, 2008; Suekane et al., 2012).

The whitefly, *Bemisia tabaci,* causes direct and indirect damage. The first type of damage occurs when the whitefly inserts the mouthparts into the plant tissues to feed on sap. In young plants, a virus also simultaneously infects the plant, and it is able to halt the growth, resulting in losses that range between 40 and 70%. The virus can also cause a decrease in the commercial value of the fruits through the uneven maturation and decreased attractiveness to the consumer. The direct damages are those caused by the penetration of the mouthparts of the whitefly and the withdrawal of sap. This withdrawal of the sap causes physiological changes in the plant, which results in a reduction of up to 50% in the crop yield. The whitefly is considered to be a threat to most cultures (Gilbertson et al., 2015).

The main form of control in the short term for both pests is the use of pesticides, but this presents some problems such as high cost, toxicity to humans, the environment, wild life, and beneficial organisms in the soil, and in some cases, a low efficiency is observed (Ntalli; Caboni, 2012). Thus, new products have been studied for the control of arthropod pests. Plants can be an important source of these compounds because the secondary metabolism of plants can generate a wide variety of substances with a wide range of applications. The wild tomato, for example, produces the trichomes, substances effective as repellents of this type of pest. The acylsugars are examples of these compounds produced by *Solanum pennelli*, and they are important because they exhibit just such a repellent activity.

Acylsugars are esters of sugars, particularly sucrose and glucose, which have chains ranging from 2 to 16 carbon atoms, and they may be found in wild tomato species such as *Solanum pennellii*. The present study sought to synthesize acylsugars, characterize them spectroscopically, and conduct the biological testing of their efficiency against the spotted spider mite and the whitefly.

MATERIAL AND METHODS

Acylsugar Synthesis

The synthesis of acylsugars was accomplished at the Organic Chemistry Laboratory of the Chemistry Department of the Federal University of Lavras (UFLA). Two compounds were synthesized from the reaction of sucrose and glucose with acetic anhydride, using sodium acetate as a catalyst.

Acylsugar synthesis 01 (from sucrose)

To a 250-mL round bottom flask adapted with a reflux condenser, 15 g of sucrose (0.028 mol), 75 mL of acetic anhydride (0.793 mol), and 7.5 g of sodium acetate (0.049 mol) were added. The system was refluxed for a period of 2 h with constant stirring during 30 minutes. Subsequently, the mixture was poured into 500 mL of ice water and stirred with a magnetic stirrer for 1.5 h. The crystals obtained in this step were vacuum filtered and washed with cold water (Silva et al., 2008). The crystals were dissolved in a 1:1 mixture of methanol and water at 60 ºC for three minutes. The resulting solution was vacuum filtered and cooled in an ice bath to form the crystals, which were dried in a desiccator over P_2O_5.

Acylsugar synthesis 02 (from glucose)

To a 250-mL round bottom flask adapted with a reflux condenser, 5 g of glucose (0.028 mol), 25 mL of acetic anhydride (0.793 mol), and 4 g of ethyl sodium (0.049 mol) were added. The crystals of acylsugar 2 were obtained using the same experimental method adopted for acylsugar 1.

For both acylsugars obtained in this study, acetylation of the hydroxyl groups of the sucrose and glucose units occurs in the same way, by acyl substitution. This is a well-established mechanism in the field of organic chemistry and is justified by the fact that the carboxylate ion generated from acetic anhydride is a good leaving group. The general reaction for the synthesis of acylsugar 1 from sucrose and acetic anhydride, using sodium acetate as a catalyst, is shown in Figure 1.

The general reaction for the synthesis of acylsugar 2 from glucose and acetic anhydride is shown in Figure 2.

Spectroscopic characterization

Infrared analysis

For the IR spectra, a modelA-8201 Shimadzu FTIR Infrared Spectrometer was employed using KBr pellets.

Nuclear Magnetic Resonance Spectroscopy Hydrogen-1 and Carbon-13 (NMR ^{1}H and NMR ^{13}C)

NMR spectra were obtained on a Brüker Avance III spectrometer, at 14.1 Tesla (600.23 MHz frequency for hydrogen) with a shielded magnet (Ultrashield Plus®). The ^{1}H, gCOSY, gHSQC, and gHMBC NMR experiments were performed on both samples. All the spectra were acquired at a controlled temperature of 25 ºC. The stage

was adjusted manually. Samples were dissolved in $CDCl_3$, using TMS as the internal reference. The scalar coupling constants (*J*) are expressed in Hz and chemical shifts (δ) in ppm. The interpretation of the spectra was achieved with the help of the MestReNova® program.

Biological tests

Two arthropod pests were used for the execution of the biological tests: the spider mite (*T. urticae*) and the whitefly (*Bemisiatabaci*), resulting from a programmed culture and natural infestation, respectively. Three cultures were tested: tomato (*Solanum lycopersicum* var redemption.), tobacco (*Nicotiana tabacum* L.) and the jack bean (*Canavalia ensiformis*). These cultures were used because of their availability for the execution of the experiment and the size of the infestations of pests in the crops available.

Assay of resistance against *Tetranychus urticae*

The resistance to the *Tetranychus urticae* mite was quantified by the bioassay proposed by Snyder and Weston (1990), with some modifications. The mites used for the bioassay were collected from the rearing stock. The bioassay was initiated 45 days after sowing the tomato seedlings (*Solanum lycopersicun* var. redemption), which exhibited no natural resistance. After this time, the leaflets were cut with a diameter of 15 mm, and they were sprayed with solutions of acylsugars at concentrations of 2.5; 5; 10; 25 and 50 g L^{-1} in DMSO. Three types of controls were used, the positive control (an extract of the wild species *Solanum pennellii* (acylsugar-rich species), the negative control using only H_2O, and the relative control employing the solvent DMSO. These three substances were sprayed on *S. lycopersicum* var. redemption leaflets.

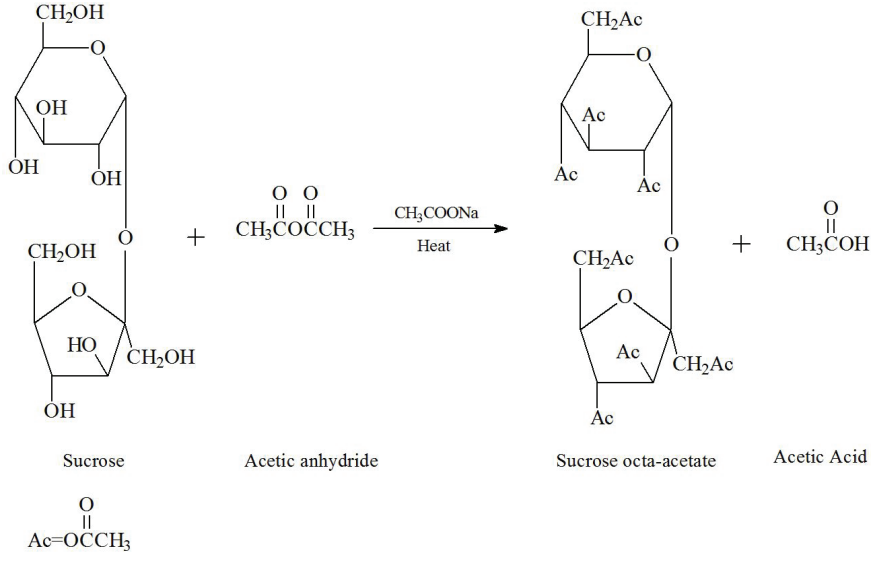


Figure 1: Scheme for the synthesis of acylsugar 1 (sucrose octa-acetate).

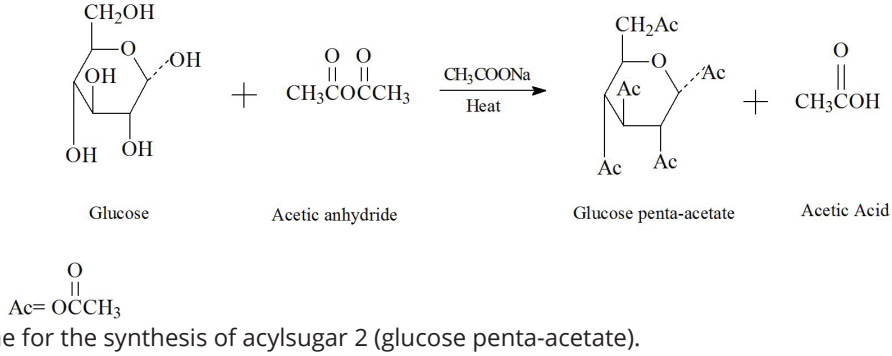


Figure 2: Scheme for the synthesis of acylsugar 2 (glucose penta-acetate).

Ovicidal effect of acylsugars on *Tetranychus urticae*

The bioassay of mite eggs was performed in Petri dishes (100 mm diameter) containing a foam sponge dampened with distilled water. Four disks (20 mm diameter) cut from jack bean leaves were placed on the foam sponge with the abaxial side facing up. An adult female mite from the culture, aged 10 to 12 days, was placed on each disk. After 24 hours, the females were removed, leaving only the eggs. The treatments were applied: AA1-1 (sucrose octa-acetate at a concentration of 25 g L^{-1}), AA1-2 (sucrose octa-acetate at 50 g L^{-1}), AA2-1 (glucose penta-acetate at 25 g L^{-1}), AA2-2 (glucose penta-acetate at 50 g L^{-1}). As a positive control, the extract of *S. pennellii* was used, DMSO was used as the relative control, and H_2O as the negative control.

Daily observations were performed to analyze the effect the acylsugars had on the mite eggs. The experiment was terminated when the all the eggs in the negative control (H_2O) had hatched. The bioassay was conducted in a completely randomized design (CRD) with seven treatments and ten repetitions, evaluating 40 subjects per treatment. The set of plates was maintained in a BOD chamber at 25±1 ºC, with 70±10:01% humidity and a photoperiod of 12 hours.

Acylsugar effect on 1st instar of *Tetranychus urticae*

The mite bioassay of the 1st instar was performed in Petri dishes (100 mm diameter), containing a foam sponge dampened with distilled water. Four leaf disks (20 mm diameter) from the jack bean (*Canavalia ensiformis)* were placed on the sponge, keeping the abaxial side facing up, and one mite of the 1st instar was placed on each leaf. The leaf disks were treated as described in the previous section.

After 24 hours following the installation of the bioassay, the evaluation was performed, which was to assess the mortality of the arthropods. The bioassay was performed in an entirely randomized design with seven treatments and ten repetitions, evaluating at least 40 subjects per treatment. The set of plates was maintained in a BOD chamber at 25±1 ºC, with 70±10:01% humidity and a photoperiod of 12 hours.

Activity of acylsugars against *Tetranychus urticae* adults

The bioassay with adult mites was performed in Petri dishes (100 mm diameter) containing a foam sponge dampened with distilled water. Four disks (20 mm diameter) cut from jack bean leaves were placed on the sponge with the abaxial side facing up. One adult mite of approximately 15 to 17 days of age was place on each disk. The leaf disks were treated with the acylsugars and the controls as described above.

After 24 hours, the mortality of the arthropods was verified. The bioassay was conducted in a completely randomized design with seventreatments and 10 repetitions, with at least 40 subjects per treatment. The set of plates was maintained in a BOD chamber at 25±1 ºC, with 70% ± 10:01 humidity and a photoperiod of 12 hours.

Biological tests with the whitefly (*Bemisia tabaci*)

A natural infestation of *Bemisia tabaci* occurred in a tobacco culture (*Nicotiana tabacum L.*) kept in a greenhouse of the Research Center for Vegetables (RCV), State University of the Midwest/ UNICENTRO.

Biological tests with whitefly eggs (*Bemisia tabaci*)

Young tobacco leaves were used because of the large infestation. Leaflets (30 mm diameter) were cut from the leaves, taking the precaution to include approximately the same number of eggs on each leaflet. The leaflet were treated with the acylsugars and the controls in the same manner as described above.

After applying the treatment, the number of eggs was determined by counting the number of eggs on a 1.5-cm^2 area of the abaxial surface of the leaflets with the aid of a stereoscopic microscope. These counts were performed daily, and the experiment was terminated when all the eggs in the negative control had hatched.

Biological tests with whitefly nymphs (*Bemisia tabaci*)

Old tobacco leaves were used for *in vitro* tests because of the large number of whitefly nymphs. Leaflets (30 mm diameter) were cut from the tobacco leaves, taking the precaution to include approximately the same number of nymphs on each leaflet. The leaves selected were good quality, normal, commercial leaves with no visible damage. The treatments with the acylsugars and the controls were performed as described above.

After the treatment, the number of nymphs were determined by counting the nymphs on a selected area of 1.5 cm^2 of the abaxial surface of the leaflets with the aid of a stereoscopic microscope. Daily counts were performed to verify the transformation of instar nymphs to adult whiteflies. The experiment was terminated when the all nymphs emerged as adults in the negative control.

Statistical analysis

The data for the mite resistance test was submitted to the Tukey test at 5% probability. The data from the tests for activity against the spotted spider mites (eggs, 1st instar and adults) and whiteflies (eggs and nymphs) were analyzed by the Scott-Knot test at 5% probability. All data were transformed to $\sqrt{(x+1)}$. Analyses were performed using the (Ferreira; Sisvar, 2008) software.

RESULTS AND DISCUSSION

Synthesis reactions

The sucrose octa-acetate, designated AA1, was obtained with a yield of 13.92%. The glucose penta-acetate, designated AA2, was obtained in a 7.37% yield.

Infrared spectroscopy

The infrared spectra of sucrose and glucose are very similar because they possess the same functional groups. A broad band characteristic of the O-H stretching vibration was observed in the region between 3400 and 3300 cm^{-1}. In the region near 3000 cm^{-1}, a signal that can be assigned to the stretching of sp^3-hybidized C-H bonds could be seen. The vibration occurring between 1100 and 1000 cm^{-1} corresponded to the C-O stretching vibration.

The difference in the spectra of the products and their respective starting materials demonstrates that a reaction occurred. There is a great similarity between the spectra of the products, all of which exhibited a very strong band near 1700 cm^{-1}, characteristic of the carbonyl stretch of an ester (COOR). This absorbance proves that the acetylation of the hydroxyl groups present in the starting substrate had occurred.

Nuclear magnetic resonance spectroscopy of hydrogen and carbon (^{1}H NMR and ^{13}C NMR)

The presence of a doublet in the ^{1}H NMR spectrum of substance AA1, which integrates for one hydrogen atom at δ_H 5.62 with a coupling constant of 3.6 Hz, provides strong evidence that H1 and H2 have an equatorial-axial correlation. The signal for H2 at δ_H 4.81 is a double doublet (dd, 10.4, 3.6 Hz), which also corroborates this proposal. The δ_H 5.01 signal, which appears as a triplet (t, 9.9 Hz), suggests the presence of typical diaxial coupling. All chemical shift values for the hydrogen atoms of the single spin system H1 to H6 could be identified by means of the inspection of the COSY contour map. Furthermore, the chemical shifts of ^{13}C atoms of the same spin system were indicated by the HSQC contour map: δ_C 89.6; 70.0; 69.2; 67.8; 68.2 and 63.2.

The fructose unit is identified by ^{13}C resonance signals at δ_C 104.0; 75.5; 74.6; 78.6; 61.6 and 62.3. The eight acetyl units present in the structure were correlated with resonance signals between δ_C 169.4 and 170.6. All spectroscopic data collected by NMR are shown in Table 1 for a better view of the data.

For substance AA2, a doublet at δ_H5.72 with a 8.3 Hz coupling constant is present in the ^{1}H NMR spectrum. This signal is compatible with a β-D-glucose unit. The triplet at δ_H 5.25 (t, 9.4 Hz), corresponding to H3, confirms the diaxial relationship between H2 and H4. All the hydrogens in the spin system H1 to H6 were identified from the COSY contour map. The same carbons to which these hydrogens are attached were determined by means of the HSQC contour map and are listed in Table 2. The resonances of each of the acetyl carbonyl groups present in the structures could be properly determined from the HMBC contour map. For example, H1 was correlated with the carbon C1' (δ_C168.9) in the HMBC contour map.

Assay of resistance to *Tetranychus urticae*

With regard to the spider mite resistance test, there was no statistically different difference between the two acylsugars synthesized from glucose and sucrose. There was a linear relationship between the displacement of the mite and the concentration of the acylsugars (R^2= 93.33). As the concentration increased, the distance to which the mites moved decreased. This fact is probably related to an effect that the synthesized substances present on the mite. Thus, the greatest effect on the distance that the mites traveled was observed with the highest concentrations tested. Lucini et al. (2015) found that the higher the concentration of this acylsugar on tomato leaflets, the shorter the distance traveled by the mite, corroborating the data found in this study.

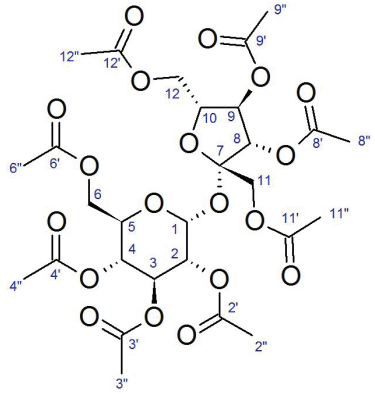
Effect of synthetic substances on *T. Urticae* eggs, 1st instar and adults

The substances tested exhibited an ovicidal effect that affected the hatching (Table 3). The incubation of the *T. urticae* eggs until the beginning of emergence ranged from 3 to 4 days, depending on the treatment. In the presence of negative (H_2O) and relative (DMSO) controls, the emergence began on the third day and ended on the fifth day of assessment, at which time all the eggs had hatched and the mites were living on the leaflets. The same result was not observed for the treatments with acylsugars or with the positive control (*S. pennellii* extract). In

these cases, the emergence began on the fourth day of evaluation. There was a delay in the period of the egg stage. On the fifth day of evaluation, the percentage of hatching was low, and the highest percentage observed was 30%. In addition, the low percentage of hatching mites was due to the degree of emergence of dead individuals, thus demonstrating again the efficiency of the product. The products exert an antibiosis effect; that is, they affect the biology of the mite.

The effects of substances against 1st instar and adult mites after approximately 17 days are presented in Table 3. A high efficiency against adult mites and the 1st instar was observed, achieving a 100% mortality at the highest concentrations applied. At lower concentrations

Table 1: Spectroscopic data for compound AA1, (^{13}C, 150 MHz ^{1}H, 600 MHz, 2.000 mg in 6.000 mL $CDCl_3$).

Structure	Carbon No.	δC	δH, *mult.* (*J* em Hz)
	1	89.6	5.62, d (3.6)
	2	70.0	4.81, dd (10.4; 3.6)
	3	69.2	5.36-5.40, m
	4	67.8	5.01, t (9.9)
	5	68.2	4.06-4.30, m
	6a	63.2	4.06-4.30, m
	6b	63.2	4.06-4.30, m
	7	104.0	
	8	75.5	5.36-5.40, m
	9	74.6	5.30, t (5.9)
	10	78.6	4.06-4.30, m
	11	61.6	4.12, s
	12a	62.3	4.06-4.30, m
	12b	62.3	4.06-4.30, m
	2′	169.4-170.6	
	2″	20.4-20.7	1.95, s*
	3′	169.4-170.6	
	3″	20.4-20.7	1.98, s*
	4′	169.4-170.6	
	4″	20.4-20.7	2.03, s*
	6′	169.4-170.6	
	6″	20.4-20.7	2.03, s*
	8′	169.4-170.6	
	8″	20.4-20.7	2.04, s*
	9′	169.4-170.6	
	9″	20.4-20.7	2.05, s*
	11′	169.4-170.6	
	11″	20.4-20.7	2.05, s*
	12′	169.4-170.6	
	12″	20.4-20.7	2.11, s*

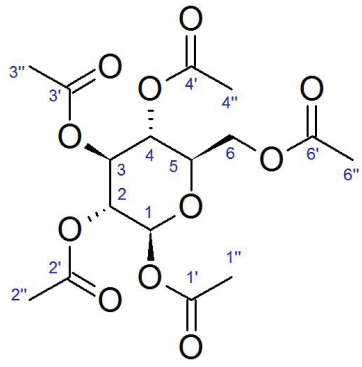
* Numeric values can be altered.

of both treatments, the efficiency increased at higher concentrations, which was expected. Comparing the results for 1st instar and adults, the efficiency of the product was observed to be greater for the 1st instar arthropods, probably because the adults are more resistant and their defense mechanisms are already formed.

Effect of the acylsugars on the whitefly eggs and nymphs

The percentages of hatching and emergence of whitefly nymphs are shown in Table 4. The *S. pennellii* extract was as effective as smaller concentrations of the synthetic acylsugars in inhibiting the hatching of whitefly eggs. At

Table 2: Spectroscopic data for compound AA2 (^{13}C, 150 MHz ^{1}H, 600 MHz, 2000µg in 6000 µL $CDCl_3$).

Structure	Carbon No.	δC	δH, *mult*. (*J* em Hz)
	1	91.6	5.72, d (8.3)
	2	67.5	5.11-5.16, m
	3	72.6	5.25, t (9.4)
	4	70.1	5.11-5.16, m
	5	72.6	3.82-3.86, m
	6a	61.1	4.12, dd (12.4; 2.4)
	6b	61.1	4.29, dd (12.4; 4.7)
	1′	168.9	
	1″	20.5*	2.01, s*
	2′	160.1	
	2″	20.5*	2.03, s*
	3′	169.3	
	3″	20.5*	2.09, s*
	4′	170.0	
	4″	20.6*	2.03, s*
	6′	170.5	
	6″	20.7*	2.12, s*

* Numeric values can be altered.

Table 3: Percentage of emergence of *T. urticae* eggs.

Treatment	Concentration (g L^{-1})	Emergence of *T. urticae* eggs (%)			Mortality of *T. urticae* (%)	
		3st day	4st day	5st day	1st instar	Adult
AA1	25	0.00b	21.27b	29.47b	97.5a	95.0b
AA1	50	0.00b	4.29b	16.43b	100.0a	100.0a
AA2	25	0.00b	11.60b	22.27b	100.0a	92.5b
AA2	50	0.00b	6.27b	10.76b	100.0a	100.0a
H_2O	-	36.46a	65.66a	100.0a	0.00b	0.00c
EXTRACT	-	0.00b	11.54b	6.47b	100.0a	100.0a
DMSO	-	44.34a	65.84a	100.0a	0.00b	0.00c
CV(%)		108.95	58.78	49.97	3.94	2.66

Means followed by the same letter in the column do not differ statistically by the Scott-Knott test (α <0.05). Legend: AA1- sucrose octa-acetate; AA2- glucose penta-acetate. Original data in the table. For analysis, the data were transformed to $\sqrt{(x+1)}$.

higher concentrations, the emergence was very low, about 3% for sucrose octa-acetate and about 8% for glucose penta-acetate. Even though these substances were statistically equal, it appears that the sucrose derivative was more effective.

Table 4: Effect of the acylsugars against eggs and nymphs of *Bemisia tabaci*.

Treatment	Concentration g L^{-1}	Whitefly	
		Eggs	Nymphs
AA1	25	13.77b	13.21b
AA1	50	2.71c	5.34c
AA2	25	21.85b	4.79c
AA2	50	8.39c	2.38c
H_2O	-	99.48a	98.47a
EXTRACT	-	21.02b	6.15c
DMSO	-	97.02a	98.60a
CV(%)		24.01	14.58

Means followed by the same letter in the column do not differ statistically by the Scott-Knott test (α <0.05). Legend: AA1- sucrose octa-acetate; AA2- glucose penta-acetate. Original data in the table. For analysis, the data were transformed to $\sqrt{(x+1)}$.

Based on the data obtained for the emergence of nymphs, the mode of behavior of the different substances was observed to differ with respect to the emergence of eggs. Among the substances tested, the lowest concentration of the acylsugar from sucrose (AA1) was shown to be the most inefficient when compared to the other substances; approximately 13% emergence occurred, a figure that attracts attention because of the high effectiveness of the product. The percentage of emergence of about 2% was observed with the highest concentration of the acylsugar from glucose (AA2), and it can be considered to be a product of great efficiency.

In addition to the low germination rate, it was found that those nymphs that emerged exhibited birth defects. The opposite effect was observed in the relative and negative controls, which emerged in perfect condition. This fact means that the product obtained was more powerful because it reduces the number of the flies that emerge and the few who do emerge exhibit malformations.

CONCLUSIONS

The displacement of the mite was affected by the acylsugars, proving that there is a linear relationship between concentration and displacement of arthropod. The application of both synthesized substances resulted in a delay in the emergence of arthropod eggs, causing a mortality of approximately 100% in 1st instar and adult mites. In the biological tests, an ovicidal activity against *Bemisia tabaci* eggs was observed with the two synthesized compounds, and the small number of nymphs that emerged exhibited malformations. Synthetic acylsugars are products that have a potential for use in the management of arthropod pests.

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