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EFFECTS OF POTASSIUM SILICATE APPLICATION ON PAPAYA PLANTS IN THE TWOSPOTTED SPIDER MITE POPULATION[1]

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ABSTRACT - The study objective was to determine whether potassium silicate application on papaya plants induces resistance to twospotted spider mite, *Tetranychus urticae*, and decreases its infestation. In greenhouse, the effects of potassium silicate in foliar and soil application on seedlings artificially infested, were evaluated. Two doses of potassium silicate 2 and 4L.ha^{-1} applied at different times were tested, resulting in treatments with different spray frequencies. Mites were submitted to three assessments, 20, 30 and 40 days after infestation, counting the number of eggs, mites and exuviae of *T. urticae* present along the main vein. In laboratory, fertility life tables of *T. urticae* fed with papaya leaves taken from plants of treatments receiving foliar application of potassium silicate were built. The residual effect was evaluated by spraying leaf discs in a Potter tower and transfer of females after 24 hours. Physiological analyses of leaves were performed to assess the physiological components indicative of activation of the defense mechanism of plants. The application of potassium silicate induced the production of plant defense substances reducing the net reproduction rate values (Ro). On the other hand, in the experiment about residual effect, it was observed hormoligosis induction with increased number of eggs per female. In the greenhouse, potassium silicate application did not result in reduced *T. urticae* infestation.
Index terms: *Carica papaya*, *Tetranychus urticae*, resistance inducer.

EFEITOS DA APLICAÇÃO DE SILICATO DE POTÁSSIO EM PLANTAS DE MAMOEIRO SOBRE A POPULAÇÃO DO ÁCARO-RAJADO

Resumo - O objetivo do trabalho foi determinar se a aplicação de silicato de potássio em plantas de mamoeiro induz resistência ao ácaro-rajado, *Tetranychus urticae*, e diminui sua infestação. Em casa de vegetação foi avaliado o efeito da aplicação de silicato de potássio, via foliar e via solo, em mudas infestadas artificialmente. Foram testadas duas doses de silicato de potássio, 2 e 4L.ha^{-1}, aplicadas em diferentes momentos, resultando em tratamentos com números diferentes de pulverizações. Para avaliação dos ácaros foram realizadas três avaliações, com 20, 30 e 40 dias após a infestação dos ácaros, contando-se o número de ovos, formas ativas e exúvias de *T. urticae* presentes ao longo da nervura principal. Em laboratório foram construídas tabelas de vida de fertilidade de *T. urticae* alimentado com folhas de mamoeiro retiradas das plantas dos tratamentos que receberam aplicação de silicato de potássio via foliar. O efeito residual foi avaliado com a pulverização de discos de folhas em torre de Potter e transferência das fêmeas 24 horas após. Foram realizadas análises fisiológicas das folhas para avaliação de componentes fisiológicos indicativos de ativação de mecanismos de defesa das plantas. A aplicação de silicato de potássio induziu a produção de substâncias de defesa da planta reduzindo os valores da taxa líquida de reprodução (Ro). Por outro lado, no experimento de efeito residual houve a indução de hormoligose, com aumento do número de ovos por fêmea. Em casa de vegetação, a aplicação de silicato de potássio não resultou em redução da infestação de *T. urticae.*
Termos para indexação: *Carica papaya*, *Tetranychus urticae*, indutor de resistência.

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INTRODUCTION

Twospotted spider mite, *Tetranychus urticae* Koch, is a major pest of papaya crop (SANCHES et al., 2011) and its control is performed with the use of acaricides. In this crop, due to the fact that the fruit is consumed fresh, the indiscriminate use of pesticides can lead its contamination and poisoning of consumers. In addition, twospotted spider mite can easily develop populations resistant to acaricides (FERREIRA et al., 2015; MONTEIRO et al., 2015; VAN LEEUWEN et al., 2015), which may induce the farmer to increase the dose and frequency of acaricide applications.

Thus, due to cultural characteristics and because *T. urticae* easily acquires resistance to acaricides, survey about alternative control methods is very important. Induction of resistance in the host plant can be an alternative for use in integrated pest management (GOMES et al., 2009). This strategy involves the activation of latent defense mechanisms of plants in response to treatment with biotic or abiotic agents (FAWE et al., 2001).

Although not considered an essential nutrient, silicon has emerged as an important element in physiological and biochemical processes of different crops, with possibility for resistance induction (VIEIRA et al., 2016; GOMES et al., 2009). The benefits of its application include increased productivity and resistance to abiotic and biotic stresses, as incidence of pests and diseases (FAWE et al., 2001; EPSTEIN, 2009; NIKPAY & NEJADIAN, 2014). Silicon can be used as fertilization, in sowing moment or later coverage, but also as spraying and potassium silicate (K_2SiO_3) is an option of a silicon source. Considering that for the action as the resistance inducer may be necessary silicon in soluble form, not polymerized (SAMUELS, 1991) the spraying must be repeated a few times.

Plants sprayed with potassium silicate can show significant reduction in population growth of insect pests, as verified by Pinto et al. (2014) on cacao and by Dalastra et al. (2011) in peanuts. In the case of twospotted spider mite, foliar application of potassium silicate can provide reduction in fertility. On strawberry, its application resulted in reduction from 32,7% to 21.6% in the number of eggs laid (VICENTINI, 2010) and on papaya from 29.5% to 14.1% (SILVEIRA, 2013).

The study objective was to determine whether the application of potassium silicate on papaya plants induces resistance to twospotted spider mite, *Tetranychus urticae*, and decreases its infestation.

MATERIAL AND METHODS

The experiments were carried out in a greenhouse and in the Acarology Laboratory, both from São Paulo State University (UNESP), Faculty of Engineering, Ilha Solteira. In greenhouse, the effect of potassium silicate application on twospotted spider mite, *T. urticae*, was evaluated using artificial infestation of papaya plants with mites from a rearing on jack bean (*Canavalia ensiformes* L.).

Two experiments were conducted, the first from September/2013 to March/2014 and the second from May to November/2014. In both cases, seedlings were grown in plastic bags using 'Sunrise Solo' papaya seeds from Embrapa Mandioca e Fruticultura, Cruz das Almas (BA) and Caliman Agricola S/A, Linhares (ES) in the first and second periods, respectively. Seedlings were transplanted to the greenhouse soil at 43 days after sowing for the first experiment and after 51 days for the second.

The statistical design was randomized blocks with different number of treatments in each period and eight replicates, with each plot consisting of one papaya plant.

First period (September/2013 to March/2014)

In the first period, two doses of potassium silicate (Sifol® - 12% Si and 15% K_2O) were tested, sprayed at different times: T1 - control (without spraying), T2 - 2 $L.ha^{-1}$ with three spraying at 21, 14 and 7 days before infestation (DBI), T3 - 2 $L.ha^{-1}$ with two spraying at 21 and 7 DBI, T4 - 4 $L.ha^{-1}$ with three spraying at 21, 14 and 7 DBI, T5 - 4 $L.ha^{-1}$ with two spraying at 21 and 7 DBI and T6 - 4 $L.ha^{-1}$ with spraying at 7 DBI.

For infestation, each plant received six discs of jack bean leaves with five females each, which were placed on six different mature leaves, fixed with a pin. Infestations were performed 148 days after sowing.

Three evaluations were performed at 20, 30 and 40 days after artificial infestation, and in each of them, an infested leaf from each plant was removed and taken to the laboratory. Under stereoscopic microscope, the count of the number of eggs, mites and exuviae of *T. urticae* present along the main vein was counted.

Second period (May to November/2014)

In second period three experiment were conducted. Firstly in greenhouse, the highest dose of potassium silicate (Sifol® - 12% Si and 15% K_2O) tested in previous period and a double dose were used and four treatments were tested: T1 - control (without spraying); T2 - 4 $L.ha^{-1}$ with four foliar applications at 28, 21, 14 and 7 DBI; T3 - 4 $L.ha^{-1}$ with nine spraying at 28, 21, 14 and 7 DBI and 7, 14, 21, 28 and 35 days after infestation and T4 - 8 $L.ha^{-1}$ with seven soil applications at 28, 21, 14 and 21 DBI and 7, 28 and 35 days after infestation. Based on the results of the previous period we decided to increase the number of applications.

The infestation occurred 138 days after sowing with the same methodology cited for previous experiment. The evaluations were the same.

Also in the second trial period, a fertility life table of *T. urticae* fed with papaya leaves taken from plants receiving foliar application of potassium silicate in greenhouse was built, being T1 - control (no spraying); T2 - 4 $L.ha^{-1}$ with four spraying and T3 - 4 $L.ha^{-1}$ with nine spraying. From the moment that the papaya leaves were removed from the plants until the moment they were used for disc production, the leaves were kept in a bowl with water. This study was conducted in conjunction with that carried out in greenhouse, beginning two days after artificial infestation of seedlings with *T. urticae* females.

For this purpose, eggs were initially obtained from *T. urticae* females grown in papaya plant discs of each treatment and placed to lay eggs for a period of 24 hours in new discs of the corresponding treatment. Then, females were removed and the eggs were counted and observed up to the emergence of adults. Immediately after the larvae hatching, the discs were cut and the pieces were placed on new papaya leaf discs of the corresponding treatment to ensure adequate food for mites until they reach adult phase. When post-embryonic stage was finished, the length and viability of the period from egg to adult phase was determined.

Adult *T. urticae* females were individualized on new papaya leaf discs of the corresponding treatment and daily observed for the counting of the number of eggs. Assessments occurred until the death of each female. Every three days, females were transferred to a new leaf disc.

Plates were kept in laboratory with photoperiod of 10 hours, temperature of 25°C ± 1°C and relative humidity of 66 ± 8%.

Data obtained were used to prepare fertility life tables for the three treatments, according to Birch (1948). The parameters determined were: rm (intrinsic rate of increase),, λ (finite rate of increase), T (mean generation time) and Ro (net reproductive rate).

Lastly, in second period an experiment to evaluate the residual acaricide effect of potassium silicate was also conducted in the second period. In this case, the experimental plot consisted of a Petri dish of 9 cm in diameter containing a layer of cotton wool moistened with deionized water and on it, a jack bean leaf disc containing one *T. urticae* female. The statistical design was completely randomized with two treatments: T1 - control sprayed with water and T2 - spraying with potassium silicate (Sifol® 4 $L.ha^{-1}$) and fourty replicate. Each dish was considered a replicate. Leaf discs were sprayed in Potter tower with pressure of 17 $pounds/inch^2$ and volume of 4 ml per application. After 24 hours, each disc received one *T. urticae* female of the same age obtained as described for the preparation of fertility life table. Evaluations were performed 24, 48, 72 and 96 hours after transference of females, recording the number of live and dead mites and the number of eggs. After 96 hours, females were removed, the number of eggs was counted and discs were observed until the emergence of larvae.

Physiological analysis

The plants used in both periods were submitted to laboratory analysis to assess physiological components indicative of activation of defense mechanisms. Analyses were performed at the Laboratory of Plant Metabolism Physiology, UNESP – São Paulo State University, campus of Ilha Solteira, with appropriate methodologies for each analysis. For this, two leaves per plant were removed, placed in plastic bags and stored in freezer until the end of analyses.

In the first period, the contents of total soluble amino acids (YEMM et al., 1955), total soluble proteins (BRADFORD, 1976), phenolic compounds (SINGLETON & ROSSI, 1965), hydrogen peroxide (ALEXIEVA et al., 2001), total and specific catalase activity (KRAUS et al., 1995, with modifications of AZEVEDO et al., 1998) were evaluated. In the following period, analyses of total soluble amino acid, total soluble proteins and hydrogen peroxide were performed.

The silicon content of plants was determined at the Laboratory of Plant Nutrition, UNESP – São Paulo State University, campus of Ilha Solteira.

Statistical analyzes

For the greenhouse experiments, data on the number of eggs, mites and exuviae per leaf, amount of silicon, amounts of amino acids, proteins, phenolic compounds, hydrogen peroxide and catalase activity were analyzed. In the case of laboratory experiments, data considered were length of the oviposition period, daily and total number of eggs per female and female longevity. All data were submitted to analysis of variance and means compared by Duncan test at 5% probability. The number and viability of eggs laid by females fed on discs sprayed with water and potassium silicate were compared using the Student t test.

RESULTS

In experiments carried out in greenhouse, no significant difference in the number of mites and exuviae in all evaluations was observed. For the number of eggs, potassium silicate spraying reduced their amount in all treatments conducted during the first period in assessment performed 30 days after infestation (Table 1). In these experiments the coefficients of variation were high, since the mites are not distributed uniformly on the leaf surface.

In laboratory, treatments with potassium silicate reduced the total number of eggs per female from 167.5 in the control treatment to 106.2 eggs on treatment with four spraying and 100 eggs with nine spraying (Table 2). The length of the oviposition period and the longevity of females did not differ among treatments and females laid eggs during 20.3, 12.8 and 15.2 days and lived 25.0, 17.5 and 18.4 days, considering treatments from the lowest to the highest number of spraying, respectively.

In the control treatment, the highest average for daily oviposition was 15.8 eggs/female on the sixth day of oviposition, similar to oviposition of 15.6 eggs per female recorded in treatment with four spraying (Figure 1). Using nine spraying, one female laid at most an average of 10.9 eggs. In addition, the population of females fed on leaf discs from plants that did not receive potassium silicate was reduced by 50% after 23 days of adult phase, while this level of reduction was found with 15 days for the populations on discs from plants submitted to other treatments.

The effect of potassium silicate sprays on fertility and survival could be observed with fertility life table results (Table 2). In the control treatment, the intrinsic rate of increase was 0.24, with finite rate of increase (λ) of 1.27 females per female per day. With four sprays, these values were 0.24 and 1.27 females per female per day and with nine sprays, 0.23 and 1.25 females per female per day respectively (Table 2). The mean generation time (T) of 20.5 days in the control treatment was reduced to 18.7 days with 4 sprays and 19.0 days with nine sprays. The combined effect of reduced fertility and survival is expressed in the net reproduction rate values (Ro). The population of *T. urticae* increased 136.9 times in one generation in the control treatment, 80.4 times in plants that received four potassium silicate sprays and 74.7 times those with nine sprays.

In the laboratory, potassium silicate spraying on leaf discs with transfer of females after 24 hours resulted in an increase in the number of eggs laid per female from 24.4 eggs in the control treatment to 30.3 eggs per female under the effect of pulverization ($t = 6.4833$; $p < 0.0001$). The egg viability was 88.6% in the treatment with potassium silicate and 80.7% in the control treatment ($t = 2.6097$, $p = 0.0118$).

The use of potassium silicate did not affect the silicon content in both experiments, the content of phenolic compounds and total catalase activity in the first experiment, and the protein and hydrogen peroxide contents in the second experiment (Table 3). However, for both periods, the application of potassium silicate provided increase in the amount of free amino acids present in the leaves of papaya plants (Table 3). In the first experiment, the highest amount, even higher than in the control treatment, was recorded with $4L.ha^{-1}$ and three sprays while in the second experiment, the highest values were obtained with $4L.ha^{-1}$ and nine sprays and with applying on the soil. Furthermore, in the first period, sprays increased the hydrogen peroxide content in the three treatments with the highest dose of potassium silicate and with greater number of sprays of this dose the lowest specific catalase activity was observed (Table 3).

DISCUSSION

In biological experiments carried out in laboratory, it was observed that potassium silicate caused reduction in the fecundity of *T. urticae* females of 36.6% and 40.3% in treatments with four and nine sprays, respectively. Reduction in the number of eggs laid per female in leaves from plants sprayed with potassium silicate has been reported in literature for *T. urticae* in strawberry (VICENTINI, 2010) and papaya (SILVEIRA, 2013) in percentages ranging from 14.1 to 32.7%.

In plants submitted to potassium silicate application, the concentration of free amino acids in tissues was higher as a result of peptide bonds synthesis reduced or proteolytic enzymes activity increased. Under stress, metabolism is affected and the plant releases amino acids related to defense response or osmotic adjustment, such as proline and GABA, that has been reported for other stressful situations such as drought stress (OLIVEIRA, 2005; LECHINOSKI et al., 2007; SOUZA et al., 2014). Furthermore, in the first period, the applications increased the hydrogen peroxide content in the three treatments with the highest dose of potassium silicate. The hydrogen peroxide generation is increased in response to various stress conditions, suggesting that this compound plays an important role in the acclimation process and cross-tolerance, in which a prior exposure to a certain stress can induce tolerance to subsequent exposure to the same stress or other different (NEIL et al., 2002).

The net reproduction rate (Ro) values obtained from the fertility life table represent the combined effect of fertility and survival of females. These values were lower in both treatments with potassium silicate spraying, indicating a detrimental effect of this product on the mite population. The value of 136.9 obtained for Ro in the control treatment is higher than that reported in literature for *T. urticae* on different hosts. Thus, Silva et al. (1985) obtained in cotton 34.4 for IAC 19 variety and 53.9 for IAC 17 variety. In papaya, there are records of 91.54 for Ro in 'Tainnung' variety and 120.3 in 'Golden' variety (SALOMÃO et al., 2009) and also 76.5 in 'Calimosa' variety and 106.7 in 'Sunrise' variety (MORO et al., 2012). Thus, the values obtained enable concluding that 'Sunrise Solo' papaya variety was highly favorable to *T. urticae* population development.

Although potassium silicate applications have induced defense substances production in papaya plants and reduced the fertility of *T. urticae* females in laboratory experiment, this effect was not as evident as in assessments carried out in greenhouse. In greenhouse, the only significant difference was in the number of eggs per leaf recorded at 30 days in the first experiment. For mites and exuviae, and also for eggs in the other evaluations, treatments were equal. A likely explanation for these data can be obtained in the test of residual effect of potassium silicate spraying in Potter tower. In this test, the number and viability of eggs laid per female was greater under the effect of potassium silicate spray. These results are highly suggestive of hormoligosis effect on *T. urticae* females. Hormoligosis is a physiological phenomenon that can occur in many organisms in response to low concentrations of stress factors, including the application of pesticides. The presence of non-lethal stressors can increase fertility, as a survival response (ABIVARDI, 2008). In the case of twospotted spider mite, spraying cotton plants with pyrethroid insecticides can cause large population increases (OLIVEIRA & VERCESI, 1983; BARROS et al., 2007), as a result of a larger number of eggs deposited, probably related to the activity of detoxification enzymes (HOY, 2011). Potassium silicate deposit on the leaf surface, which was visible due to the large amount of white spots, may have caused hormoligose in greenhouse experiment. In the case of fertility life table experiment, papaya leaves were kept in water prior to removal of discs to feed mites, and thereby potassium silicate residues may have been removed preventing the hormoligosis effect. Production of plant defense substances was responsible for fertility reduced in this experiment. Thus it is possible that hormoligose occurrence has neutralized the resistance inductor effect of potassium silicate in the greenhouse experiments.

Despite potassium silicate application on papaya plants was not sufficient to provide significant reduction in *T. urticae* infestation, further experiments could be performed with higher doses for avoid the hormoligosis effect.

TABLE 1 - Average number of eggs, mites and exuviae of *Tetranychus urticae* at 20, 30 and 40 days after artificial infestation on papaya plants submitted to potassium silicate sprays. Ilha Solteira–SP, 2014.

Treatments	20 days			30 days			40 days		
	eggs	mites	exuviae	eggs	mites	exuviae	eggs	mites	exuviae
	First experiment (September/2013 to March/2014)								
Control	1.4	1.4	3.2	5.2 a	3.6	9.5	8.5	5.4	12.0
$2L.ha^{-1}$ – 3 sprays[1]	4.0	10.4	38.7	0.9 b	0.6	1.5	1.2	2.0	6.1
$2L.ha^{-1}$ – 2 sprays[2]	1.7	3.5	8.9	0.9 b	0.5	8.1	4.6	2.4	14.9
$4L.ha^{-1}$ – 3 sprays	4.5	4.0	7.5	1.4 b	0.2	3.2	5.5	1.9	19.1
$4L.ha^{-1}$ – 2 sprays	0.9	1.9	6.7	1.9 b	1.2	6.0	4.2	1.2	10.4
$4L.ha^{-1}$ – 1 sprays[3]	1.5	1.6	7.6	0.4 b	0.7	1.0	0.3	1.6	9.4
F (treatment)	1.06^{ns}	1.38^{ns}	1.70^{ns}	3.05*	1.27^{ns}	1.79^{ns}	2.41^{ns}	0.96^{ns}	1.09^{ns}
CV (%)	57.0	66.1	60.4	51.7	48.3	68.5	56.0	53.9	54.6
	Second experiment (May to November 2014)								
Control	55.0	37.6	128.1	34.6	35.6	73.4	6.2	13.5	153.5
$4L.ha^{-1}$ – 4 sprays[4]	9.5	20.5	52.1	17.7	15.2	84.2	2.5	19.2	249.5
$4L.ha^{-1}$ – 9 sprays[5]	22.9	22.4	77.6	26.9	29.7	96.1	12.6	15.1	162.1
$8L.ha^{-1}$ 7 soil applications[6]	17.1	21.5	78.1	31.2	27.6	115.5	10.2	17.2	177.6
F (treatment)	1.45^{ns}	0.54^{ns}	1.96^{ns}	0.35^{ns}	0.85^{ns}	0.45^{ns}	0.30^{ns}	0.28^{ns}	0.17^{ns}
CV (%)	51.3	36.9	25.2	59.1	43.4	32.0	75.2	43.0	16.6

Original means. Statistical analysis with data transformed into log (x + 2). For the first experiment, means followed by different letters differ by Duncan test at 5% probability.[1]With 21, 14 and 7 days before infestation (DBI); [2]21 and 7 DBI; [3]7 DBI; [4]28, 21, 14 and 7 DBI; [5]28, 21, 14, 7 DBI and 7, 14, 21, 28, 35 days after infestation (DAI); [6]28, 21, 14 DBI and 7, 14, 21, 28, 35 DAI.

TABLE 2 - Parameters of adulthood and fertility life table of *Tetranychus urticae* on papaya leaf discs from plants submitted to potassium silicate sprays. Ilha Solteira -SP, 2014.

Parameters	Treatments			F	CV
	Control	$4L.ha^{-1}$ 4 sprays[1]	$4L.ha^{-1}$ 9 sprays[2]		
Oviposition period (days)	20.3 a	12.8 a	15.2 a	2.790	23.4
Eggs/female	167.5 a	106.2 b	100.0 b	4.155*	25.8
Eggs/female/day	7.1 a	6.7 a	5.6 a	1.149	15.2
Female longevity (days)	25.0 a	17.5 a	18.4 a	1.784	25.7
r_m	0.24	0.24	0.23		
λ	1.27	1.27	1.25		
T	20.5	18.7	19.0		
Ro	136.9	80.4	74.7		

Original data. Statistical analysis with data transformed into $(x + 1)^{1/2}$. In rows, means followed by different letters differ by Duncan test at 5% probability. rm = intrinsic increase rate; λ = finite increase rate; T = mean generation time; Ro = net reproduction rate. [1]28, 21, 14 and 7 days before infestation (DBI) [2]28, 21, 14, 7 DBI and 7, 14, 21, 28, 35 days after infestation.

TABLE 3 - Quantification of amino acids, proteins, phenolic compounds, hydrogen peroxide and catalase in papaya plants submitted to potassium silicate sprays. Ilha Solteira-SP, 2014.

Treatments	Silicon	Amino acids	Proteins	Phenolic compounds	Hydrogen peroxide	Catalase	
						Total activity	Specific activity
			First experiment (September/2013 to March/2014)				
Control	1.21	11.52 bc	1.42 b	9.00	0.18 cd	0.67	0.0075 a
2L.ha^{-1} – 3 sprays	1.15	14.13 ab	1.99 b	9.65	0.09 d	0.59	0.0050 ab
2L.ha^{-1} – 2 sprays	1.31	16.30 ab	1.17 b	8.32	0.22 bc	0.58	0.0087 a
4L.ha^{-1} – 3 sprays	1.03	19.59 a	1.40 b	10.59	0.59 a	0.42	0.0012 b
4L.ha^{-1} – 2 sprays	1.23	15.67 ab	3.20 a	8.81	0.46 ab	0.62	0.0087 a
4L.ha^{-1} – 1 sprays	1.61	10.06 c	2.08 b	8.63	0.36 ab	0.69	0.0087 a
$F_{(Treatment)}$	0.91^{ns}	2.89*	4.32**	1.06^{ns}	4.11**	0.74^{ns}	3.50**
CV (%)	12.76	20.47	17.43	11.45	9.35	9.75	0.23
			Second experiment (May to November 2014)				
Control	8.86	6.46 b	1.11		3.24		
4L.ha^{-1} - 4 sprays	8.56	8.67 ab	1.18		3.05		
4L.ha^{-1} - 9 sprays	9.27	12.37 a	0.72		2.95		
8L.ha^{-1} soil application	9.12	11.54 a	1.14		4.17		
F (treatment)	0.95^{ns}	4.20*	2.00^{ns}		0.56^{ns}		
CV (%)	4.58	17.96	10.68		25.20		

Original data. Statistical analysis performed with data transformed into $(x + 1)^{1/2}$. In columns, for each period, means followed by different letters differ by the Duncan test at 5% probability.

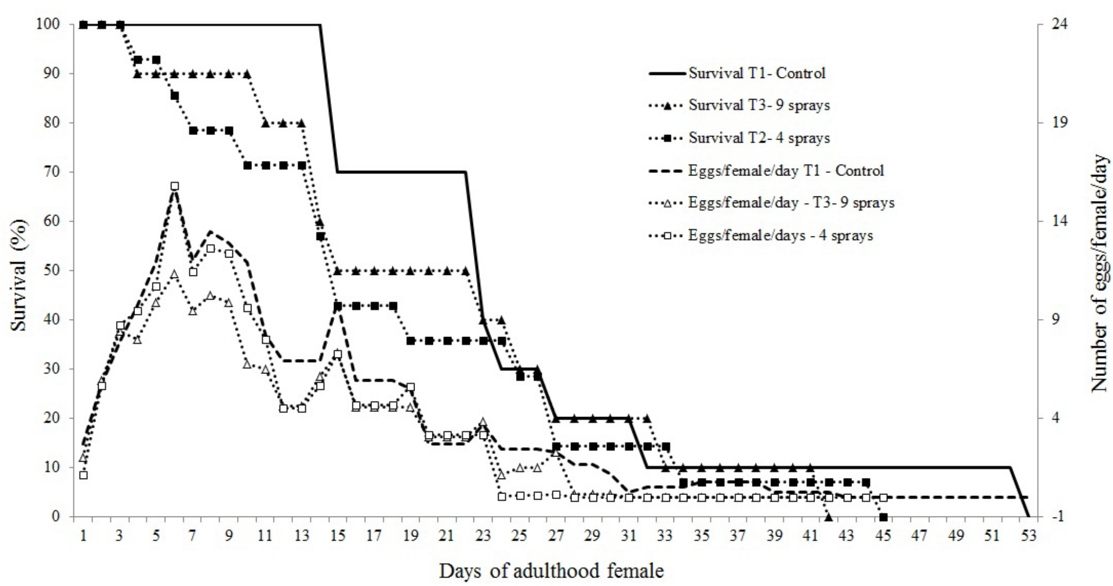

FIGURE 1 - Daily number of eggs per female and survival of *Tetranychus urticae* females on papaya leaf discs from plants submitted to potassium silicate sprays. Ilha Solteira-SP, 2014.

CONCLUSIONS

Potassium silicate increases free amino acids and hydrogen peroxide concentrations related to the plant defense system and reduces the net reproduction rate (Ro) of *T. urticae*. Potassium silicate induces hormoligosis effect on *T. urticae* female. Potassium silicate show no significant reduction in infestation of *T. urticae* on papaya plants.

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