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Field Trial of Three Plant Extracts against *Tetranychus urticae* Population as a Comparative with Acaricidal (Abamectin) on Two Vegetable Crops

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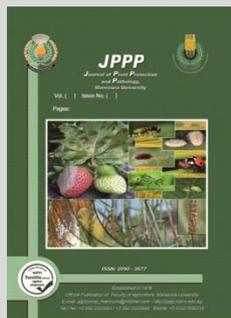


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ABSTRACT

The present experiments were conducted to study the thorn apple or jimsonweed *Datura stramonium* (Solanaceae) leaves, Egyptian henbane *Hyoscoyamus muticus* (Solanaceae) flowers and physic nut *Jatropha curcas* (Euphorbiaceae) seeds. Extracts were studied for their efficacy against Two-spotted spider mite *Tetranychus urticae* as a comparative with the acaricidal Vertemic. The plants were extracted by Acetone and spraying on eggplant crop *Solanum molongena* (Solanaceae) and kidney bean crop *Phasolus vulgaris* (Fabaceae) at concentration 4% in infected fields. The reduction percentages of the population were determined after 1, 3, 7, 14 and 21 days from treatments and data were analysed by Anova table and mortality percentages were calculated by Abbot's formula. From these study it was concluded that, the plant extracts are more effective as acaricides because they recorded highly reduction percentages for *T. urticae*. *D. stramonium* reach 92.30 and 94.12 mortality on eggplant and kidney bean respectively, *J. curcas* recorded 90.58 and 90.56% reduction percentages on *S. molongena* and *P. vulgaris* respectively while the extract of *H. muticus* recorded 95.40 and 87.46% mortality rates on the same crops respectably. On the other hand Vertemic was more effective on *T. urticae*.

Keywords: Plant extracts, acaricides, phytophagous mites, *Tetranychus urticae*, vegetables



INTRODUCTION

Two-spotted spider mite *Tetranychus urticae* considered as one of the major pest in vegetable crops, it is one of the most important pests of greenhouse plants in the world and is associated with 900 plant species (Jeppson *et al.*, 1975). This mite usually feed on leaves and fruits consequently, causing reduction in both quantity and quality of the crops (Russell *et al.*, 1993). *T. urticae* mite has a high reproduction rate and short growth period, and its population in low humidity and high temperature sharply increase (Dang *et al.*, 2010). The synthetic insecticides and acaricides which use to control the plant pests extend their activities to non-target animals, They are potentially dangerous consumers and are implicated in the pollution of the environmental (Ngami *et al.*, 2001). Furthermore, use of non-selective synthetic pesticides that have negatively effective on the natural enemies (Cranhamj & Helle, 1985 and Mahmoud *et al.* 2008). So among bioactive natural compounds, several plant essential oils, plant extracts and microbial secondary metabolites were evaluated as acaricidal (Calmasur *et al.* 2006; pontes *et al.* 2007; shi *et al.* 2006; Abou-shosha *et al.* 2013 and Villanueva & Walgenbach. 2006). Recently many studies in several countries demonstrated that certain plant extracts and essential oils have repel, contact and fumigant insecticidal-acaricidal against specific pests (Isman 2000, Ngoh *et al.* 1998, Mozaffari *et al.* 1998 and Dehghani & Ahmadi 2012). Also the plant extracts yield high mortality at low concentration in *T. urticae* population (Pervin *et al.* 2012). *Hyoscoyamus muticus* (Solanaceae) plant known as Egyptian henbane, *Datura stramonium* (Solanaceae) known as thorn apple or Jimsonweed and *Jatropha curcas* (Euphorbiaceae) highly spreading in Egypt, they has been known for its medicinal effects, which also appeared acaricidal effect against *T.*

urticae. A field experiment was conducted on the three plant extracts (*H. muticus*, *D. stramonium* and *J. curcas*) to evaluate against *T. urticae* on *Solanum molongena* and *Phasolus vulgaris* plants as a comparative with the acaricidal vertemic.

MATERIALS AND METHODS

1. Plants and preparation of extracts:

Three plant species were covered in this study of these jimsonweed *Datura stramonium* (Solanaceae) leaves, Egyptian henbane *Hyoscoyamus muticus* (Solanaceae) flowers and physic nut *Jatropha curcas* (Euphorbiaceae) seeds. The leaves and seeds of *D. stramonium* and *J. curcas* plants were collected from the farm, Faculty of Agriculture Al-Azhar University, Assiut branch. While the flowers of *H. muticus* were collected from Al-Wady Al-Gadeed desert. The seeds, flowers and green leaf plants were dried in shade at room temperature for two weeks, then removed the seeds shell and grinded using an electric blender homogenized to fine powder for leaves and flowers and coarse powder for seeds and then stored in opaque screw tight jar until use. 200 g. powdered sample from each plant was charged into soxhlet apparatus and acetone successively. Each time before employing the solvent of higher polarity sample was dried.

2 Field efficacy:

To evaluate the effect of the plant extracts on *T. urticae* in the field trials were conducted at research farm, Faculty of Agriculture, Al-Azhar University, Assiut branch. For the present experiment, natural *T. urticae* infestation was used to evaluate the efficacy of three plants namely *Datura stramonium*, *Hyoscoyamus muticus* and *Jatropha curcas* comparative with acaricide Vertemic (abamectin) against population of *T. urticae* mite at concentration 4% for each extract on eggplant crop *Solanum molongena* (Solanaceae) and bean crop *Phasolus vulgaris* (Fabaceae). The experimental

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units comprised three plots each measuring 12m. x 19m. three treatments at concentration 4%, Vertemic was applied with 40ml/100L. water and another one as a control. A randomised block design with three replicates was used for experimentation. During application of extracts the whole plants were thoroughly covered by spray fluid and care was taken to maintain the distance around 25 cm. between the nozzle and plant parts, treatments were applied by knapsack sprayer furnished with one nozzle boom. The number of *T. urticae* population (mobile stage) were counted before spraying and after using binocular from upper and lower surface of 10 leaves from each plot in three replicates in addition to the control. The samples were collected after spraying with intervals 1, 3, 7, 14 and 21 days, the reduction percentages were calculated according to Abbot's formula.

3 – Statistical Analysis:

Obtained data was subjected to one-way analysis of variance (ANOVA) followed by f-test according to procedures by IBM SPSS Statistics for Windows, version 20 (2011) and M.S. Mean Square. The mean values were compared at 5% level tests and reduction percentages were calculated according to Abbot's formula (Abbot's, 1925).

RESULTS AND DISCUSSION

Results

1 Effect of plant extracts on population of *T. urticae* comparative with acaricidal vertemic on eggplant *S. molongena* plants under field condition:

The results obtained in Table (1) explained that, whole plant extracts when applied at concentration 4% on eggplant (*S. molongena*) crop against *T. urticae* were reached to highest reduction percentages after one week except *D. stramonium* reached to the highest mortality after three days and still effective until the 3rd week, with reduction percentages 86.61, 92.30, 86.94, 82.89 and 80.50 % after one day, three days, one week, two weeks and three weeks respectively with mean of

reduction 85.85 %. The extract of *H. muticus* was the best one from the another two extracts. *H. muticus* and *J. curcas* gave good results comparative with vertemic acaricide , they recorded 80.76, 81.48, 95.40, 90.81 and 71.12% reduction percentages with average 83.91% for *H. muticus* and 83.27 %, 83.30 %, 90.58, 90.39 and 60.17% reduction percentages with average 81.54% for *J. curcas* after One day, Three days one week, two weeks and three weeks respectively. On the other hand; the acaricidal vertemic was the highest on extinguish the population of *T. urticae* with reduction percentages 97.01, 97.37, 98.93, 98.99 and 97.21% after the same periods of investigate respectively, with average 97.90%. The results has revealed that, there was significant difference among the treatments.

2 Effect of plant extracts on the population of *T. urticae* comparative with acaricidal vertemic on *Phasolus vulgaris* under field condition:

Data in Table (2) evidenced that, when plant extracts applied on bean plants (*Phasolus vulgaris*) at concentration 4%, the extract of *J. curcas* was the 1st effective extract with reduction percentages 84.34, 89.58, 90.56, 87.46 and 75.88 % after 1, 3, 7, 14 and 21 days respectively with mean of reduction 85.54%, followed by *D. stramonium* was the second one it recorded mortality percentages 69.36, 85.86, 86.16, 94.12 and 85.26% after 1, 3, 7, 14 and 21 days with mean of reduction 84.15%. *H. muticus* was the last effective one with reduction percentages 47.88, 55.95, 77.31, 87.46 and 79.68 % after 1, 3, 7, 14 and 21 days respectively with average reduction 69.65%. But the acaricide vertemic was effective from first day to the 3rd week, the reduction percentages of vertemic were 87.85, 90.42, 90.94, 96.91 and 97.03% after same periods of investigate respectively with average reduction 92.63%. Statistically there was significant difference among the extracts and between the extracts and vertemic.

Table 1. Effect of plant extracts sparing on population of *Tetranychus urticae* at concentration 4 % on *solanum molongena*

Days extracts		One day	Three days	One week	Two weeks	Three weeks	Mean
<i>D. stramonium</i>	red	86.61%	92.30 %	86.94 %	82.89 %	80.50 %	85.85 %
	effc	10.90 ±13.54 C	7.70 ±5.87 AB	16.80 ±7.84 C	8.30 ±7.01 B	18.10 ±6.49 B	12.36 ±8.15
<i>H. muticus</i>	red	80.76 %	81.48 %	95.40 %	90.81 %	71.12 %	83.91%
	effc	9.00 ±8.18 AB	11.30 ±10.67 C	2.90 ±2.28 AB	5.80 ±5.01 B	16.00 ±5.42 B	9.00 ±6.28
<i>J. curcas</i>	red	83.27 %	83.30 %	90.58 %	90.39 %	60.17 %	81.54 %
	effc	6.30 ±3.62 AB	7.60 ±7.82 AB	6.60 ±2.95 B	4.70 ±3.95 B	17.10 ±8.91 B	8.46 ±5.45
Vertemic	red	97.01 %	97.37 %	98.93 %	98.99 %	97.21 %	97.90 %
	effc	1.60 ±1.71 A	1.70 ±1.77 AB	0.90 ±1.10 A	0.00 ±0.00 A	1.80 ±1.75 A	1.20 ±1.26
F value		2.44	2.97	26.30	5.38	15.33	32.98
M. S.		162.83	158.02	504.03	120.86	590.03	219.89

Table 2. Effect of plant extracts sparing on population of *Tetranychus urticae* at concentration 4 % on *Phasolus vulgari*

Days extracts		One day	Three days	One week	Two weeks	Three weeks	Mean
<i>D. stramonium</i>	red	69.36 %	85.86 %	86.16 %	94.12 %	85.26 %	84.15 %
	effc	5.10 ±9.09 A	2.70 ±2.41 A	3.80 ±2.78 A	2.20 ±1.69 A	5.70 ±3.30 B	3.90 ±3.85
<i>H. muticus</i>	red	47.88 %	55.95 %	77.31 %	87.46 %	79.68 %	69.65 %
	effc	13.60 ±11.43 B	13.40 ±10.76 B	8.50 ±4.38 B	7.50 ±5.04 B	12.80 ±4.47 C	11.16 ±7.21
<i>J. curcas</i>	red	84.34 %	89.58 %	90.56 %	87.46 %	75.88 %	85.54 %
	effc	3.80 ±3.74 A	2.90 ±2.92 A	3.30 ±3.16 A	6.90 ±7.84 B	13.60 ±5.97 C	6.10 ±4.72
Vertemic	red	87.85 %	90.42%	90.94 %	96.91 %	97.03 %	92.63 %
	effc	1.10 ±1.66 A	1.60 ±2.50 A	1.50 ±1.28 A	0.80 ±0.03 A	0.80 ±1.23 A	1.16 ±1.33
F value		5.21	8.96	9.04	4.94	21.84	29.68
M. S.		291.27	305.77	89.09	112.17	371.09	179.22

Discussion

From the present study was found that, the plant extracts showed an obvious effect on *T. urticae* population when *D. stramonium*, *H. muticus* and *J. curcas* applied at concentration 4% on *S. molongena* (eggplant) and *P. vulgaris* (Kidney bean) under field conditions. *H. muticus* extract caused high mortality percentage 95.4 % after one week from spraying with mean 83.91%. Whereas the extracts obtained from *D. stramonium* and *J. curcas* plants gave 85.85% and 81.51% as a mean of reduction respectively, when applied on eggplant crop under field condition. Whereas when the above mentioned extracts applied on *T. urticae* infested *P. vulgaris* the plant extract of *D. stramonium* was the highest one it recorded 94.12% reduction percentage after two weeks from spraying, followed by *J. curcas* with 90.56 % reduction percentage after one week, but the *H. muticus* extract was the last one it gave 87.46% Reduction percentage after two weeks from spraying. Statistically significant difference was found between vertemic and extracts. The present results are agreement with those obtained by Radhakrishnan and Prabhakaran (2014) they evaluated ten plant extracts obtained from weeds at concentration 2.5 and 5.0% against adult females of *Oligonychus coffeae* and they found that, among the plants, the aqueous extracts of *Allamanda cathartica* and *Conyza bonariensis* gave 100.0% and 80.0% mortality respectively at 5% concentration after 96hr. of observation and other plants show moderate effect on *O. coffeae*. Also Pervin *et al.* (2018) evaluated *Hyoscyamus niger* and *Hypericum calycinum* extracts against *T. urticae* under laboratory conditions. They found the extract of *H. niger* was more effective on adult females it recorded 91.00% mortality, while *H. calycinum* extract gave 87.00% mortality percentage at concentration 12% by used direct leaf spraying. In a similar way, Munir, *et al.* (2020) evaluated the hydrophobic organic compound [methyl benzoate (MB)] isolated from the freshwater fern *Salvinia molesta* (Salviniales: Salviniaceae) as a green acaricides under laboratory and greenhouse conditions. They found a leaf-dipping assay using 1% MB killed 100% of *T. urticae* females and spraying MB with concentration 1% against *T. urticae* on tomato plants under greenhouse conditions gave 97.5% mortality within 96h. after 48h. of treatment. Also the present results are agree with (Savithamma *et al.* 2013; Usha & Paratyusha 2014; Kanika and Rachna 2014; Keradmand *et al.* 2015 and Waked 2016). Finally, the results of this study indicated that the acetone extracts of *H. muticus*, *D. stramonium* and *J. curcas* could be useful against *T. urticae* infested vegetable plants.

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معاملات حقلية لثلاث مستخلصات نباتية ضد أعداد العنكبوت الأحمر *Tetranychus urticae* مقارنة بالمبيد الأكاروسى (أبامكتين) على اثنان من محاصيل الحضر
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اجريت التجارب الحالية لدراسة تأثير مستخلص نبات السكب او السكران *Hyoscyamus muticus* (Egyptian henbane) ازهار, ومستخلص نبات الداتورا *Datura stramonium* (Thorn apple) أوراق, ومستخلص نبات الجتروفا *Jatropha curcas* (nut) بذور وقد تم رش محصولي الباذنجان *Solanum molongena* والفاصوليا *Phasolus vulgaris* بتركيز 4 % باستعمال متور الرش الظهري سعة عشرين لتر، واخذت النتائج بعد 1، 3، 7، 14 و 21 يوم من المعاملة وكانت النتائج كالآتي. بعد رش الباذنجان بالمستخلصات بتركيز 4 % سجل مستخلص الداتورا أعلى نسبة خفض (30، 92 %) لأعداد العنكبوت الأحمر بعد ثلاث أيام من المعاملة بمتوسط عام 85,85 %، تلاه مستخلص السكب بنسبة خفض 40، 95 % بعد اسبوع من المعاملة بمتوسط 83, 91 %، ثم جاء مستخلص نبات الجتروفا في المرتبة الثالثة حيث حقق نسب خفض 85، 90% و 39، 90 بعد 7 و 14 يوم على الترتيب بمتوسط 81,54 %. بينما سجل مبيد الفيرتمك أعلى متوسط لنسب الخفض حيث سجل 97,90% كمتوسط عام. بينما عند معاملة محصول الفاصوليا المصاب بالعنكبوت الأحمر بنفس المستخلصات سألقة الذكر ونفس التركيز كانت النتائج قريبة من سابقتها، حيث حقق مستخلص نبات الداتورا أعلى نسبة خفض لأعداد الحلم بعد اسبوعين من المعاملة بواقع 12, 94% و بمتوسط 15، 84 % تلاه مستخلص الجتروفا حيث سجل 56, 90 % بعد اسبوع من المعاملة و متوسط 85,54 % بينما كان مستخلص السكب هو الأقل تأثيراً حيث حقق 46، 87 % كنسبة خفض لأعداد الحلم بعد اسبوعين من المعاملة بمتوسط 69,65 %، في حين حقق مبيد الفيرتمك 27، 3 % موت لأعداد الأفة بمتوسط بعد الاسبوع الثالث من المعاملة و متوسط عام 53,21 %. في النهاية يمكن القول ان المستخلصات النباتية يمكن استخدامها في مكافحة الآفات النباتية بدلاً من المبيدات المخلقة الى حد ما.