Journal of Plant Protection and Pathology

Journal homepage: www.jppp.mans.edu.eg
Available online at: www. jppp.journals.ekb.eg

Direct and Indirect Impact of *Artemisia judaica* Extract on *Euseius scutalis*

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ABSTRACT

The potential of extract of *Artemisia Judaica* L. against the predator *Euseius scutalis* (Athias-Henriot) and two kinds of prey that fed on them, first-instar nymphs of whitefly and second instar larvae of onion thrips, The results showed that, the effect of extract on *B. tabaci* nymphs recorded great decline in the rate of mortality to 26.8% compared to 81.6% respectively; The same results on *T. tabaci* larvae were increased from 23.95% to 77% respectively, by increasing the applied concentration from 125 to 2000 ppm., while when newly emerged *E. scutalis* adult treated with the same concentration of extract increased total percent mortality such increase was concentration dependent. Indirect exposure technique of is more effective than the direct exposure technique. Therefore, when using the plant extract and the predator in one control program is recommended to spray the extract first and then release the predator about 48 hours later.

Keywords: plant extract - *Artemisia judaica* - *Euseius scutalis* - *Thrips tabaci* - *Bemisia tabaci* - IPM.

INTRODUCTION

In Egypt the *Euseius scutalis*, A-H is an important common phytoseiid mites. (Fouly *et al*. 2013) founded that, The mites Predator (family: Phytoseiidae) used as bio-agents of mite and insect controlling in greenhouses at worldwide. These results are in agremeent with those which (Fouly and Hassan, 1991, Gnanvossous, *et al*. 2005, Al-Shammery, 2011, Van Houten, *et al*. 2005, Messelink, *et al*. 2005 and Winner *et al*. 2008), reported that, the species of this common phytoseiid mites are generalists predators on the spider mites and some food sources i.g.,, thrips; whiteflies and pollen. Also, Fouly, *et al*., 2011, found that, phytoseiid mites *N. barkeri* and *N. cucumeris*, very important controlling against vegetables pests thrips; whiteflies and spider mites (Eriophyidae and Tetranychidae).

Khanjani, (2007) and Brisibe *et al*., (2009), mentioned that, the whitefly, *Bemisia tabaci* Genn, caused highly losses and destruction in ornamentals; fruit; vegetables and cotton crops especially in young plants. Omid Bakhsh *et al*., (2010) recorded that the damages of plants by Whiteflies pests and the direct action by plant sap sucking caused many losses in leave plant health, and indirect action, the pest transmits viruses to several plants at the worldwide. The transmitted viruses include of luteoviruses; nepoviruses; closteroviruses; carlaviruses; geminiviruses; potyviruses and rod shape-DNA, which in turn affects greatly on photosynthesis process, Byrne & Bellows, (1991); Lapidot & Polston (2006) and Thompson, (2011), also the *Thrips tabaci* L. on onion crops, cause highly economic loses in the open fields in tropical; subtropical region and temperate regions, it transmitting directly by feeding and in larval stage can transmit viruses indirectly (tomato spotted wilt "TSWV"), Sakimura, 1963. Pesticides and chemical control are very effective in such habit hidden and small pests led to toxicity to non-target organisms; development resistance; outbreak; new pests emergence and environmentally effects led to ecosystems sustainability, Theunissen and Legutowska 1991; Lewis 1997; Richter *et al* . 1999 and Jayasankar and Jesudasan., 2005. So, researchers welcome by use of chemical control which can affecting on pests with minimal impact on the environment and human. Aaccording to Samir Abdelgaleila *et al*., 2008, mentioned that, the Artemisia sp., grown in Egypt "Sinai Peninsula" and is an aromatic annual herbs and large member of botanical family "Asteracea" Compositae. The *A. annua* sp., Several isolates compounds are very important medicinal materials., belong to this type, including, sesquiterpenoids; triterpenoids; monoterpenoids; flavonoids; coumarin; phenolic; purines; steroids; fats and aliphatic compounds, Haghighian *et al*., 2008 and Brisibe *et al*., 2009. Similar results, are agreement with those which, Pavela., 2006 and Mahmoodi *et al*., 2014, mentioned that, like this extracts and oils have demonstrated antimicrobial and pesticides activity. Shekari *et al*., 2008 and Hasheminia *et al*., 2011, reported that, the insecticidal effects of *Artemisia* sp., included, (antifeedant; growth retardation and larvicidal effects).

This study conducted to evaluate the direct effect of extracts of the leaves of *Artemisia Judaica* L. on *Bemisia tabaci and* its predator *Euseius scutalis*; as well as the indirect effect on the predator fed on treated whitefly.

MATERIALS AND METHODS

Mites and insects Collection:

The species Phytoseiid, *E. scutalis* (A-H), *B. tabaci* and *T. tabaci* were collected from twigs and leaves of castor plants *Ricinus communis*.

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DOI: 10.21608/jppp.2020.79161

Rearing of *Euseius scutalis:*

E. scutalis was reared on the discs leaf of castor plants *R. commuunis*; each one square inch was enough used for rearing predators during its whole the test. The single adult was transfer from culture to the mentioned leaf discs of castor plants, which were kept with a wet cotton pad putted in Petri-dishes (15 cm diameter). (Fouly *et al*., 2013).

Rearing of *Bemisia tabaci*:

The strain of whitefly was transferred to laboratory and reared on castor plant seedlings, planted in small pots 25cm diameter and kept under conditions of plastic greenhouse 27±2 ^{o}C and 70±5 RH and photoperiod 14-10 light-dark and small plant pots were transfer to cages "60×60×120 cm". The sides of these cages were covered by thin gauze 10×10 mesh, to give suitable ventilation. The cultures of whitefly 50-60 adults were established to each cage, and thin, the tested insects were screened on upper surface of plants using circular clips cages 2 cm diameter, 3.14 surface areas, for 72 hrs.

Rearing of *Thrips tabaci*:

To maintain feeding and ovipostion, the tested Thrips were kept in glass jars containing seedlings of castor plant, and to provide a hiding spot for non-feeding stages of *T. tabaci*, the bottom of these jars was covered with paper tissue. Jars were closed by fine mesh and a lid with a big hole to allow air circulations. Jars were kept and putt in climate chambers at 25±1°C with a photoperiod of 16-8 light-darkness and 45% air relative humidity.

Plant materials:

Samples of *Artemisia Judaica* were collected from three different regions (Elmejrh, Alhubaiqah and Ras Saada) in Nuweiba desert region, South Sinai, Egypt in September and November 2016.

Plant extracts preparation:

20gm weight powdered plant material was packaged in glass containers separately and 200 ml of ethyl alcohol 95% were used as a solvent for 7 days and electric shaker was used in shook for 15 minutes every day. At a temperature not exceed with about 30°C in a rotary evaporator under vacuum, the alcoholic extracts were collective and evaporated, and the biological tests were conducted by the residues left after evaporation, (Yazdani *et al*., 2014).

The concentrations used for treatment of whitefly and its predator were 125, 250, 500,1000, and 2000 ppm.

Toxicity Test:

Application on whitefly and onion thrips:

The leaf dipping technique was used (Yang *et al*., 2010) Plant leaves were dipped in several concentrations of *Artemisia Judaica* extract, control leaves were dipped in water. After drying at room temperature, 10 starved 2d- old first- instar nymphs of *B. tabaci*, 3d- old- second instar larvae of *T. tabaci* were placed on the treated leaf, the recorded of mortalities were taken after 12, 24, and 48 hrs. Each experiment was replicated 5 times.

Method of application on phytoseiid mite:

1- Direct effect:

The residual film technique was used. 3 ml of the desired concentration were evenly spread on a Petri dish surface (9 cm in diameter). The solvent was allowed to evaporate leaving a film of the different tested concentrations of extract of *A. Judaica*, Pair of newly emerged adults (male and female) of *E. scutalis* were exposed to the thin film for 24 hour. and feeding on appropriate quantity of untreated *B. tabaci*, (Farag, 1986). The control specimens were treated with water. Each concentration was replicated 5 times. Inspection was carried out daily and the recorded of mortalities were taken after 12, 24, and 48 hrs.

2- Direct effect:

newly emerged adults (male and female) of *E. scutalis* were fed on whitefly previously treated with sublethal concentrations of extract of *A. Judaica* (Baoying *et al*., 2001), The control specimens were treated with water, A percent of mortality of the predator were recorded.

Statistical analyses

The obtained data in tests were estimated to evaluate of isolates relative efficiency. The Mortality was corrected according to Abbot's formula 1925. The regression lines "concentration/mortality" were drawn with probit logarithmic graph according to method developed by (Finney., 1971). Values "LC_{50} and LC_{90}" were calculated according to program of probane.

RESULTS AND DISCUSSION

Toxicity Test:

On tested insects:

The lethal effect of *A. Judaica* extracts on 2d-old first nymphal instar of *Bemisia tabaci* was recorded. As shown in (Table 1), the effect of extract on the nymphs showed great decline in the rate of mortality to 26.77% compared to 81.62% by increasing the applied concentration from 125 to 2000 ppm., respectively; while natural mortality was 10.35% in the control, on the other hand, The lethal effect of *A. Judaica* extract on 3d- old- second instar larvae of *T. tabaci* was recorded., the least percentage of larvae mortality was 23.95%, which was recorded with the lowest tested concentration (125 ppm.), while The highest percentage of mortality (77%) was achieved at 2000 ppm. compared with 9.41% in control trials, (Table 1). The effect of *Artemisia* extract could be detected on the basis of the calculated LC_{50} and LC_{90} values, which recorded 437.6167, 1596.04 ppm. for nymphs of whitefly, and 522.69 , 2420.59 ppm. for onion thrips larvae (Table 3).

Indirect or direct exposure of newly emerged *E. scutalis* adult treated with different concentration of *Artemisia judaica* extract, increased total percent mortality. Such increase was concentration dependent. Whereas the total death recorded 4.19% in control trials, adult death in case of direct exposure technique (Table, 2) slightly increased from 7.7, to 13.86% at 125 to 2000 ppm, respectively. Comparable trend was recorded with the mites, indirectly exposed to the *E. scutalis* extract concentrations (Table, 2). increasing the mortality was recorded at 125 to 2000 ppm by 15.82 and 45.25%, respectively, The direct effect of *E. scutalis* extract on newly emerged adults could be detected on basis of the calculated LC_{50} and LC_{90} values which recorded 32089.58 and $2.677889*10^{6}$ ppm, respectively, while the values for indirect exposure technique recorded 549.0956 and 1596.04ppm (Table, 3). It is clear that indirect exposure technique was more toxic than direct exposure technique.

Table 1. Mortality percentages of 2d-old first nymphal instar of *B.tabaci* and 3d- old- second instar larvae of *T. tabaci* treated with different concentration of *Artemisia judaica* extract:

Cocn. (ppm)	Mortality %			
	Obs.		Corr.	
	10.35	0	Obs.	Corr.
0	26.77	18.65	9.41	0
125	42.86	36.96	23.95	16.34
250	64.68	61.77	41.92	36.44
500	75.72	74.34	57.32	53.81
1000	81.62	81.02	65.87	63.39
2000				

Table 2. Mortality percentages of *E. scutalis* adult treated with different concentration of *Artemisia judaica* extract (direct and indirect effect):

Conc. ppm	Adult mortality %			
	direct		indirect	
	Obs.	Corr.	Obs.	Corr.
0	4.19	0	4.19	0
125	7.7	3.67	15.82	12.23
250	8.72	4.70	23.61	20.36
500	11.37	7.52	31.05	28.23
1000	12.57	8.81	35.67	33.02
2000	13.86	10.09	45.25	43.12

Table 3. Values "LC50 and LC90" conc.ppm at confidence limits 95% of extract of *Artemisia Judaica* leaves against *Bemisia tabaci* nymphs, *Thrips tabaci* larvae and there predator *E. scutalis* adult:

Tested stages		LC_{50} Confidence limits 95%	LC_{90} Confidence limits 95%
Bemisia tabaci nymphs		437.62 (376.19 - 499.7)	1596.04 (1331.93 - 2016.45)
Thrips tabaci larvae		522.6931 (444.4611- 604.3473)	2420.598 (1902.756 - 3369.862)
Esieus scutalis adult	direct	32089.58 (5732.137 - $3.542*10^{11}$)	$2.677889*10^{6}$ (68102.39 - 7.169556^{21})
	indirect	549.0956 (428.2056 - 681.3644)	3423.762 (2302.557 - 6592.569)

Undoubtedly that, the extracts of natural "herbal therapy products" are environmental friendly and inexpensive, and we needed for alternatives, include non-chemical, strategy of control in systems of crop protection, to keep pace with the rapid development of insect and resistant of mites strains. Wei *et al*., 2004, reported that, the anti-malarial activity A. judaica is an important traditional drug manufacturer, its contains, oxidations; artemisia ketones; carawayline; methyl wormwood; volatile oil; artemisinin; camphor; artemisinic acid; artemisinic alcohol; oxidized crylophylene and eucalyptol, and the volatile oil contains, anti-parasitic; antiviral; antibacterial; antipyretic; anti-tumor; regulating immune function and other roles. Kim *et al*., 2011, found that, such as "thyme and garlic" as an essential oils led to *B. tabaci* suppression, significantly. Aslan *et al*., 2004, mentioned that, the essential oils "fumes" of *Satureja hortensis* L.; *Ocimum basilicum* L., and *Thymus vulgaris* L. give highly toxicity against adults and nymphs of *Tetranychus urticae* K. and *B. tabaci*, adults. Hassanein *et al*. 2004 and Abd-Elshafy *et al*. 2007, found that, the extracts of *Artemisia manifested*, chloroform; ethyl acetate; hexane; diethyl ether and ethanol, give more effective against *Hylomma dromedarii*, larvae and 4th instar larvae of *S. littoralis*. On the other hand, Soliman *et al*. 2005 and Shekari *et al*. 2008, stated that, extracts of Artemisia with chloroform; ethanol; ethyl acetate and petroleum ether give highly toxic for two spotted of spider mite *T. urticae*, and the leaf extract methanolic of *A. annua* L., was more effective against 3rd larval instar and adults of elm leaf beetle Xanthogaleruca luteola Mull., estimated LC_{50} 48% and 43.7% for adults at 24 and 48 hrs., respectively. According to (Atif A. El-Banna *et al*. 2002), the Indirect exposure technique of both NeemAzal formulation and organophosphorus insecticide [Actellic compound] on *Aphis craccivora* Kock and its predator *Coccinella undecmipunctata* is more effective than the direct exposure technique.

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التأثير المباشر والغير مباشر لنبات البعيثران (الشيح الخليلي) علي المفترس الاكاروسي *Euseius scutalis*

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تهدف هذه الدراسة الى تقيّم تأثير سمية مستخلص نبات البعيثران (الشيح الخليلي) علي الطور البالغ للمفترس الاكاروسي *E. scutalis* وعلي نوعين من الفرائس الذي يتغذي عليها حوريات النبابة البيضاء في العمر الاول وبرقات حشرة التربس في العمر الثاني وقد وجد ان نسبة الامائه لحوريات النبابه البيضاء قد زادت بزياده التركيز من 125 الي 2000 جزء في المليون من 26.77% الي 81.62% بالتتابع، ونفس النتيجه ليرقات التربس حيث سجلت نسبه الامائه 23.95% للتركيز 125 جزء في المليون و77% للتركيز 2000جزء في المليون، وايضا زادت نسبة موت الافراد البالغه من المفترس بزيادة تركيز المستخلص النباتي من 7.7% الي 13.86% في حاله معاملة المفترس بالطريقه المباشره، ومن 15.82% الي 45.25% في حاله معاملة المفترس بالطريقه الغير مباشره من التركيز 125 الي 2000 جزء من المليون بالتتابع . وهذا يعني أن تأثير المبيد علي المفترس في الطريقة الغير مباشرة يكون أكثر سمية عن المعاملة بالطريقة المباشرة. لذلك عند استخدام المستخلص النباتي والمفترس في برنامج مكافحه واحد ينصح برش المستلخلص اولا ثم اطلاق المفترس بعدها بحوالي 48 ساعه.