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Effect of Some medicinal plants on life cycle of Citrus Brown Mites (Eutetranychusorientalis)

Maged Sayed Ahmad[1]*, Ahmed Shawky[1], Madeha Othman Ghobashy[2], Rabab Hassan Ahmed Felifel[1]

[1]Dept. of Botany and Microbiology, Faculty of Science, Beni -Suef University, Egypt
[2] Dept. of Microbiology, Faculty of Science, Ain Shams University, Egypt.

ABSTRACT

Citrus brown mites, Eutetranychusorientalis seemed to be one of the most common phytophagous species found in citrus orchards. Four methanol plant extracts such as Myrrh, Ginger, Black cumin and Rosemary were used to screen their effects on the life cycle of citrus brown mites. Rosemary extract showed the highest activity on the rate of hatching ability and egg laying behavior. The four plant extracts showed the moderate effect on the egg viability, where methanol extracts of Myrrh showed the highest effect on the egg viability. Both Rosemary and Black cumin extracts showed the highest activity on the control of reproductive potentials of citrus brown mites.

Keywords: *Acaros, Ginger, Black cumin, Myrrh, Rosemary*

INTRODUCTION

Egypt has been famous for citrus production. Mites which are pests or beneficial predators have an important role in citrus production. There have been about 149 mite species, representing 39 families which were previously identified in Egypt [1]. The use of herbal medicine represents a long history of human body. Plants used as traditional medicine contain a wide range of substances that can be used to treat chronic and infectious diseases [2]. The most important bioactive compounds of plants are alkaloids, flavonoids, tannins and phenoliccompounds [3]. Many new natural product groups have revealed anti parasitic properties of surprising efficacy and selectivity [4]. Phytophagous citrus mites were reviewed recently by [5, 6].

[6] listed a total of 104 phytophagous species causing different levels of damage on leaves, buds and fruits, although only a dozen can be considered as major pests that usually require control measures to be taken.

The Oriental red mite (ORM), Eutetranychusorientalis [7] has been the the primary pest of citrus causing the yellowish discoloration of citrus leaves which can be found in many parts of the world. It was first reported by [8] It was detected in southern Spain in 2001. E. orientalis occurs in many countries in Africa and the Near, Middle and Far East below 40° N latitude. [9]. Pest management has been facing economic and ecological challenges worldwide due to the human and environmental hazards caused by the majority of the synthetic pesticide chemicals. The identification of the novel effective insecticidal compounds has been essential to combat increasing resistance rates. [10].

Acaricidal (pesticidal) activity of the oils extracted from the clove buds, neem or lemongrass has been reported. The most effective constituent of the contact toxicity has been methyleugenolata dose of 0.94 ug/cm^2 and 0.67 ug/cm2 against the European house dust mite, Dermatophagoides farina Huges (Pyroglyphidae) and the American house

dust mite, and Dermatophagoides pteronyssinus (Trouessart) (Pyroglyphidae) ; respectively. The application of eugenol, acetyleugenol, isoeugenol or methyleugenol was effective as fumigantagainst in both mite species and resulted in higher pestmortality than the chemical DEET at 17.85 ug/cm^2.Traditionally, eucalyptus oil is used to prevent pest infestation. More research is needed to verify bioefficacy of all elochemicals. [11]. The application of phytochemicals has been associated with Pipper. Longum in insect pests' control might be an alternative to currently used chemical pesticides for the development of target specific, biodegradable intonontoxic products, and it is also safer and potentially suitable to be used in the integrated pests' management programmes **[**12].

MATERIALS AND METHODS

Four dried plants were bought from ISIS Company, Cairo, Egypt (Production date : June, 2014), which were Nigellasativa, Zingiber officinale, Commiphoramyrrh and Rosemarinusofficinalis. The plant extraction was prepared according to [13] (10g /250 ml solvent). Mites were bought from a plant protection Institute, Dokki, Giza, Egypt.

The effects of plant extract Myrrh; Black cumin; Rosemary and Ginger were studied on young adult females of the citrus brown mites by using leaf-dip technique according to [14]. Different concentrations of the plant extract (25%, 50%, 75%) were used to kill the young adult females. With the aid of a binocular microscope, fifteen adult females were placed on the lower surface of castor bean disc (1.5 cm in diameter). Each treatment was replicated 5 times realizing 75 individuals per each concentration. 24 hours after the administration, the survived adult females were transferred to the untreated discs of castor bean leaves. The fresh discs were kept, each in petri dish having a wet cotton wick, and were covered with muslin cloth. The number of laid eggs was daily counted during the oviposition period, concurrently; the hatchability of the daily deposition eggs was also recorded.

RESULTS AND DISCUSSION

Types of plant material and the parts used in testing the plants have been illustrated in Table1

Table 1. Types of plant material and the part used in testing of plants

Common name	Scientific name	Family name	Part used
Myrrh	Commiphoramyrrha	Burseraceae,	Branch and flowers
Ginger	Zingiberofficinale	Zingiberaceae	Stem
Rosemary	Rosmarinusofficinalis	Labiatea	Leaves and stem
Black cumin	Nigella Sativum	**Ranunculaceae**	Seeds

The effects of four plant extracts on citrus brown mites as an example of Acaros by using leaf-dip technique were investigated as follows : Data concerning the effect of Myrrh ; Black cumin ; Rosemary and Ginger as adult female treatments on the reproductive potential of female mites which have been tabulated in tables (2-4). In order to facilitate the presentation of data, each parameter could be discussed separately. The percent control of fecundity, viability and reproduction were estimated as follows :

A. **Egg laying behaviour :**

Data in table (2) clearly indicates that, the rate of daily deposited eggs varied considerably according to the used plant extracts (Bio acaricide) and the level of sub-lethal concentration, where they were more effective than the chemical acroicide. That, Rosemary extract (third day) revealed more effects as a bioacaricide followed by Black cumin (4nd day) ; Ginger (5nd day) and Myrrh (sixthday) methanol extract. In addition, methanol extract was more effective than the water extract. The highest number of laid eggs was observed at the first day in the untreated check, showing 6.7 eggs. While it was decreased in case of Rosemary, Black cumin, Ginger and Myrrhatthird and fourthday. On the other hand, Black cumin showed fluctuating pattern due to the tested contraction. It was clearly evident to notice the negative correlation between bioacaricide concentration, and the maximum number of deposited eggs, considering the total number of deposited eggs during the whole ovi position period. Data in table (1) clearly showed that methanol extract proved to be the most efficient bioacaricide in reducing the total number of laide ggs, compared to the chemical Acaricides.

B. Rate of hatchability :

The data in table (3) clearly indicated that, the rate of daily hatched eggs differed considerably according to the type of the four tested bio acaricides as well as the applied concentration. The highest number of hatched eggs was

occurred within 1-2 days (Myrrh), within 1-3 days (Black cumin, Ginger) and within 3-5 days (Rosemary). However, the highest number of hatched eggs was recorded on the second day. It is clearly evident that, no correlation was obtained between the highest number of hatched eggs and the highest percentage of hatchability.

The examination of the data in table (2) showed that, the tested bioacaricides significantly reduced the number of hatched eggs. The percentage of hatchability in the untreated check reached 72.96%. With Rosemary, it reached to 41.51%, 49.86% and with Black cumin, Ginger and Myrrh, it reached to 47.24% ; 35.42%, 30.68%, 35.12%, 25.42%, 20.68% in case of LC 25, LC, 50 treatment ; respectively.

Table 2 : Potential of sub-lethal concentrations of certain plant methanolic extract (Bio-acaricides) on the daily number of eggs laid/female of E. orientalis.

Bio-acaricides	Lethal Conc.	Average No. Of deposited Eggs on successive day												Total No. Of Eggs laid		Average No. Of deposited Eggs/day	
		1st		2nd		3rd		4th		5th		6th					
		W	M	W	M	W	M	W	M	W	M	W	M	W	M	W	M
Myrrh	LC25	3.5	1.8	3.0	1.3	2.7	1.0	2.2	0.5	1.5	0.0	0.5	0.0	13.3	4.6	2.22	0.77
	LC50	2.8	1.7	2.2	1.5	1.9	0.7	1.2	0.2	0.8	0.0	0.0	0.0	8.9	4.1	1.48	0.68
	LC75	1.8	0.4	1.6	0.3	1.5	0.0	0.7	0.0	0.2	0.0	0.0	0.0	5.62	0.7	0.94	0.12
Ginger	LC25	3.2	0.7	2.7	0.3	2.1	0.0	1.9	0.0	0.9	0.0	0.0	0.0	10.8	1.0	1.8	0.5
	LC50	2.2	0.5	1.9	0.5	1.3	0.0	0.7	0.0	0.0	0.0	0.0	0.0	6.1	1.0	1.02	0.5
	LC75	1.7	0.2	1.3	0.3	0.9	0.0	0.5	0.0	0.0	0.0	0.0	0.0	4.4	0.5	0.73	0.08
Rosemary	LC25	1.5	0.8	1.2	0.3	1.1	0.0	0.8	0.0	0.0	0.0	0.0	0.0	4.6	1.1	0.77	0.18
	LC50	0.7	0.6	0.7	0.5	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.7	1.1	0.28	0.18
	LC75	0.5	0.4	0.5	0.3	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	0.7	0.25	0.12
Black cumin	LC25	2.7	0.9	2.1	0.3	7.8	0.0	1.2	0.0	0.7	0.0	0.0	0.0	8.5	1.2	1.42	0.18
	LC50	2.5	0.7	1.7	0.5	1.3	0.3	0.9	0.0	0.4	0.0	0.0	0.0	6.8	1.5	1.13	0.25
	LC75	1.7	0.4	1.6	0.3	0.5	0.0	0.3	0.0	0.0	0.0	0.0	0.0	3.8	0.7	0.63	0.12
Untreated	……..	6.7		6.4		5.3		4.5		3.6		2.4		28.9		4.81	

W= water extract, M= methanolic extract

C. Control of reproductive potential :

With regard to the remarkable importance of depression, I egg production (fecundity) as a criterion for blocking the reproductive potential, it could be noticed that, Rosemary was the most effective material, followed by Black cumin and Ginger. However, Myrrh was the least one in this respect (table 3). On the other hand, the levels of concentrations had a slight effect on reducing the fecundity of E. orientalis. The percent control of fecundity revealed 90.18, 89.93 and 94.05% by Rosemary, reaching to 71.58, 87.15 and 94.26% in case of Black cumin, and reaching to 2.68, 11.97 and 26.51% in Ginger, and 3.65, 9.50, 23.15 % and 4.28, 8.65 and 21. 45 % in Myrrh at the LC 25, LC 50 and LC 75 treatments ; respectively.

The examination of the data in table (3) proved that, the tested acaricides moderately controlled the eggviability. The level of sub-lethal concentration had no effect in this respect. Myrrh proved to be the most effective material followed by Ginger, Black cumin and Rosemary ; respectively. The percent control of the egg viability showed 53.79, 39.02 and 31.47% with the above mentioned acaricides ; respectively.

Table 3 : Potential of sub-lethal concentrations of certain Bioacaricides on the daily number of hatched eggs/female of E. orientalis

Bio-acaricides	Lethal Conc.	Average No. Of deposited Eggs on successive day												Total No. Of Eggs laid		Average No. Of deposited Eggs/day	
		1st		2nd		3rd		4th		5th		6th					
		W	M	W	M	W	M	W	M	W	M	W	M	W	M	W	M
Myrrh	LC25	1.2 56.75	0.6 45.79	0.9 74.24	0.3 56.43	0.7 64.52	0.3 61.75	0.6 72.56	0.2 75.35	0.5 57.48	0.0 0.0	0.3 59.76	0.0 0.0	4.4 61.65	1.4 73.15	0.73	0.35
	LC50	0.8 45.56	0.4 41.35	0.7 65.71	03 45.65	0.6 54.86	0.2 51.45	0.5 59.53	0.0 0.0	0.3 43.52	0.0 0.0	0.0 0.0	0.0 0.0	2.9 48.75	0.9 75.37	0.58	0.30
	LC75	0.7 44.85	0.4 40.45	0.6 54.60	0.3 43.71	0.5 34.95	0.0 0.0	0.3 54.86	0.0 0.0	0.2 35.65	0.0 0.0	0.0 0.0	0.0 0.0	2.3 44.54	0.7 42.14	0.46	0.35
Ginger	LC25	1.2 75.54	0.9 81.24	1.1 75.45	0.3 82.45	0.8 76.45	0.0 0.0	0.6 86.34	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	3.7 75.85	1.2 83.25	0.93	0.60
	LC50	1.1 60.27	0.7 55.65	1.0 54.65	0.2 57.82	0.3 73.19	0.0 0.0	0.2 56.76	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	2.6 69.52	0.9 65.34	0.65	0.45
	LC75	0.8 52.63	0.5 45.34	0.8 67.12	0.1 43.42	0.2 78.96	0.0 0.0	0.1 58.34	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	1.9 65.43	0.6 54.42	0.47	0.30

Rosemary	LC25	1.5 63.73	0.9 72.52	1.2 56.25	0.3 65.45	0.8 75.35	0.0 0.0	0.5 67.23	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	4.0 72.32	1.2 68.30	1.00	0.60
	LC50	0.7 59.61	0.4 65.48	0.6 67.43	0.2 74.12	0.3 65.34	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	1.6 65.21	0.6 71.23	0.52	0.03
	LC75	0.5 45.95	0.4 65.15	0.5 58.65	0.2 53.46	0.2 59.36	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	1.2 54.56	0.6 61.56	0.40	0.30
Black cumin	LC25	1.2 85.75	1.0 43.56	1.1 72.23	0.3 63.56	0.8 52.61	0.0 0.0	0.6 65.38	0.0 0.0	0.7 65.98	0.0 0.0	0.0 0.0	0.0 0.0	4.9 75.67	1.4 82.43	0.94	0.80
	LC50	1.0 65.54	0.9 61.18	0.9 57.73	0.2 54.16	0.5 64.57	0.3 56.89	0.5 64.73	0.0 0.0	0.4 54.89	0.0 0.0	0.0 0.0	0.0 0.0	3.3 68.19	1.4 75.45	0.80	0.46
	LC75	0.8 52.64	0.7 48.28	0.6 65.17	0.1 51.19	0.3 67.71	0.0 0.0	0.3 53.69	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	3.0 56.54	1.0 65.42	0.75	0.50
Untreated	……..	4.75 73.67		5.70 75.34		3.50 65.78		2.95 75.56		2.75 74.23		1.45 72.12		21.1		3.52	

W= water extract, M= methanolic extract

Value bold represents the highest number of hatched eggs.

Value between brackets represents the percentage of hatchability.

This part is the remaining part of table 3

Considering the percent control of reproduction as adopted by [14], it could be seen that, the applied acaricides was the most influential factor in this respect (Table 4). No precise relationship could be observed between the tested concentrations of acaricides and the percent control of reproduction. Rosemary and Black cumin had a great influence in reducing the reproduction of the female mites. The percent control of the reproduction resulted in 93.87 and 90.44% ; respectively. However, Ginger and Myrrh had a moderate effect in this respect as 60.14% and 40.25%.

Table 4 : Potential of sub-lethal concentrations of four Bioacaricides on reproductive potential of E. orientalis.

Bio-acaricides	Lethal Conc.	Average No. Of deposited eggs		Control of fecundity		Average No. Of hatched eggs		%Hatchability		%Control of viability		%Control of reproductive	
		W	M	W	M	W	M	W	M	W	M	W	M
Myrrh	LC25	2.22	0.77	53.85	83.99	4.4	1.4	61.65	73.15	53.84	83.99	79.26	84.94
	LC25	1.48	0.68	69.23	85.86	2.9	0.9	48.75	75.37	69.23	85.86	82.52	91.47
	LC25	0.94	0.12	80.45	97.50	2.3	0.7	44.54	42.14	80.04	97.50	86.93	90.05
	Mean	1.54	0.53	67.98	88.98	3.2	1.0	51.65	63.55	67.70	89.11	82.90	88.82
Ginger	LC25	1.8	1.6	62.57	83.20	2.3	0.7	44.54	42.14	62.57	98.60	73.54	82.95
	LC25	1.02	1.0	78.79	79.20	3.7	1.2	75.85	83.25	78.79	98.60	84.09	87.21
	LC25	0.73	0.08	68.19	98.33	2.6	0.9	69.52	65.34	84.82	98.33	86.64	91.47
	Mean	1.18	1.09	75.19	77.33	2.9	0.9	63.3	63.57	75.39	98.51	81.42	87.21
Rosemary	LC25	0.77	0.18	83.99	96.25	4.0	1.2	72.32	68.30	83.99	96.25	71.59	82.95
	LC25	0.28	0.18	94.17	96.25	1.6	0.6	65.21	71.23	94.17	96.25	85.22	91.47
	LC25	0.25	0.12	94.80	97.50	1.2	0.6	54.56	61.56	94.80	97.50	88.63	91.47
	Mean	0.43	0.16	91.06	96.67	2.3	0.8	64.03	67.03	90.98	96.66	81.81	88.63
Black cumin	LC25	1.42	0.18	70.47	96.25	4.9	1.4	75.67	82.43	70.47	95.25	73.29	77.27
	LC25	1.13	0.25	76.50	94.80	3.3	1.4	68.19	75.45	76.50	94.8	77.27	86.93
	LC25	0.63	0.12	86.90	97.50	3.0	1.0	56.54	65.42	85.90	97.50	78.69	85.97
	Mean	1.06	0.18	77.96	96.25	3.7	1.3	66.80	74.43	77.95	96.18	76.41	83.39
Untreated	……..	4.81		…….		20.72		72.96		……		……..	

W= water extract, M= methanolic extract

Percent control of fecundity = [(C-T) /C] x 100

Where : C=No. Of the deposited eggs/female in the check.

T=No. Of the deposited eggs/female in the treatment.

Percent control of viability = [(C-T) /C] x 100

Reproductive potential of citrus brown mites.

Where : C= % hatched eggs/female in the check.

T= % hatched eggs/female in the treatment.

Percent control of reproduction= [(V1– V2) / V1]x 100

Where : V1 = No. Of the viable eggs/female in the check.

V2 = No. Of viable eggs/female in the treatment

From the results, it was found that the rate of daily deposited and hatched eggs varied considerably according to the used plant extracts.

Methanol extract of Rosemary showed the highest activity on the rate of hatchability and egg laying behavior. It reduced the number of laid and hatched eggs compared to the chemical acaricide. While the effect of the four plant extracts showed moderate effects on the egg viability where methanol extract of Myrrh showed the highest effect on the egg viability.

Both of methanol extracts of Rosemary and Black cumin showed a great influence and the highest activity on the control of reproductive potential on citrus brown mites. This research agreed with [11, 12]. Further studies are needed for more confirmation and application studios.

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