

EFFICIENCY OF LEAVES EXTRACTS OF CASTOR BEAN PLANT AGAINST *Aphis Gossypii* (Glover) AND *Tetranychus urticae* Koch ON CUCUMBER PLANT

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ABSTRACT

Laboratory and field experiments were conducted in Plant Protection Research Institute and at Fayoum district, Fayoum Governorate during 2001 – 2002 seasons. This study aimed to investigate the efficiency of a selective safe substances, leaves extracts of castor plant with three solvents varied in their polarity (petroleum ether) hexane and water) and plant oil (Castor seed oil) for controlling the cotton aphid *Aphis gossypii* (Glover) and the spider mite *Tetranychus urticae* (Koch). Four concentrations of plant extracts and plant oil were used. Mortality percentages were recorded after 1,2,3,5 and 7 days.

The obtained data indicated that the mortality of the cotton aphid and the spider mite are increased by increasing the concentration. After one day of treatment the castor bean oil showed the most potency followed by petroleum ether leaves extract and water than with hexane showing the LC50 value of 14.719, 33.366, 45.561 and 45.803 on the spider mite, 1.0335, 2.3189, 2.1166 and 3.0900 on the cotton aphid, respectively. Also, after seven days of treatment castor oil showed the most potency followed by the leave extracts of castor plant with petroleum ether and hexane than with water on the cotton aphid and the spider mite.

Field data indicated that castor oil treatment appeared to be the most effective against the populations of *A. gossypii* (Glover) and *T. urticae* (Koch), followed by petroleum ether, hexane, and water extracts during the two tested seasons, respectively. The early and total yield of cucumber were increased in the tested seasons from (0.48 and 0.5 to 0.7 and 0.75) and 0.9 and 1.2 to 2.7 and 2.75) Kg of fruit / plant for castor seed oil treatment, respectively.

INTRODUCTION

In Egypt, cucumber plants are attacked under field conditions with numerous insects such as, the cotton aphid *Aphis gossypii* (Glover) and spider mite *Tetranychus urticae* (Koch), Youssef (1976); Dibble (1980); Nour El-Din (1984); Attia and Hamaky (1987) and Nazato (1990).

The continuous use of some pesticides induced out break of pests due to the appear of resistant of these pest, destroyed natural enemies contamination of human foods, mammalian toxicity and caused environmental pollution, Shaheen et al. (1973) and El-Lakwah et al (1998). The bioactivity of several plant extracts and vegetable oils as pests control against cucumber pests were studied by several investigators (Fagoonee (1987); Kiss et al.(1988); Ji and Pirone (1989); Urinova et al.(1989); Adekenove et al.(1990) and Taha and Mahguoub (1995).

The present work aims to use a selective safe substances (plant extracts) and castor seed oil for controlling the two pests *A. gossypii* (Glover) and *T. urticae* (Koch.) and on quantity of cucumber crops.

MATERIALS AND METHODS

1- Extraction:

- Extraction of Castor bean leaves:
Castor bean leaves were extracted according to Su (1985) method using petroleum ether, hexane and water.
- Extraction of castor bean oil.

The extraction technique described in A.O.A.C. (1970) was adopted.

2- Experiments

Two experiments were conducted at plant Protection Research Institute laboratory and in cultivated cucumber field at Fayoum district, Fayoum Governorate during the two successive seasons 2000 and 2001.

The first experiment:

The experiment was conducted under prevailing laboratory conditions. The effectiveness of castor plant extract with different solvents (petroleum, Hexan and water) and castor oil were investigated against the cotton aphid and spider mite and folded in 10 petri-dishes (9 cm in diameter). Ten spider mite and the cotton aphid were placed on castor leaves treated by various plant extracts and castor seed oil with different concentrations (0.5, 1.0, 1.5 and 2%) . Mortality was recorded after 1, 3, 5 and 7 days post treatment. LC50, LC90, slop and 90 % confidence limit values of mortality were statistically according to Finney (1971). The toxicity index (Ti) was determined by using sun's equation (1950) as follows:

$$\text{Toxicity index (Ti)} = \frac{\text{LC50 (LC90) of the compound A}}{\text{LC50 (LC90) of the compound B}} \times 100$$

Where: A = is the most affective compound.

B = is the other tested compound.

The second experiment:

An area of one feddan was chosen and cultivated with cucumber plants, Madina cultivar, during Nily plantation on Jun 17 th of the successive years 2000 and 2001. The area was divided into 18 plots, the plot was divided into r replicates, the normal agricultural practice was adopted. The intensity of cucumber infestation by the cotton aphid and the spider mites were determined as counts of infestation in ten leaves per replicate. Samples of ten leaves were picked up from each treatment and placed in paper bags and directly taken to the laboratory for examination. Numbers of the spider mites and the cotton aphid before spraying and after 1, 3, 5 and 7 days of were calculated.

The cucumber yield were determined throught the experimental period according to El-Sayid (2000). The corrected mortality percent for each treatment was calculated according to Henderson and Tilton (1955).

RESULT AND DISCUSIONS

Table (1), showed that after one days of treatment the decrease in the used concentration caused a low mortality percentage amongst treated *Aphis gossypii* and *Tetranychus urticae*. The corrected mortality percentage after castor oil treatment ranged from 25.5 % and 16.8 % by using the lowest concentration (0.5) to 83.2 % and 60.7 % using the highest concentration (2.0 %). As for Castor plant Extract with petroleum ether and Hexan treatment. The corrected percentage of mortality ranged from 12.8, 11.5 % to 45.2, 42.2 and 3.5 % ; 0 % to 42.7, 26.2 % at (0.5 % and 2.0 %), respectively. In case of castor plant extract with water treatment these percentages ranged from 1.2, 0 % to 29.2 % and 0 % to 19.7 % at (0.5 % and 2.0 %), respectively. Such relationship has been mentioned by other outhurs El-Lakwah *et al.* (1998) on *Aphis gossypii* and Urinova *et al.* (1989) on *Aphis craccivora* and *Tetranychus urticae*.

Table (2), indicated that castor oil was the most toxic compound (LC50 values after one days of treatment were 1.0335, 14.719 g / l and toxicity index (Ti = 100) against *Aphis gossypii* and *Tetranychus urticae*. The castor plant extract with water the LC50 3.090 and 45.561 g / l (Ti) = 33.44 and 41.39 as for the LC90 values table (2), it could be noted that the castor oil proved to be the most potent (LC90 = 2.8049 and 62.637 g / l (Ti = 100 and 100) while the castor plant extract with water was the lowest one (LC90 = 6.935 and 223.499 g / l (Ti = 40 and 51.73) as for the castor plant extract with petroleum and Hexan LC50 = 10.782, 11.475 and 69.648, 244.019 Ti = 26.01, 24.4 and 57.99, 67.04 against *Aphis gossypii* and *Tetranychus urticae*, respectively.

The same results were obtained after seven days of treatment (Table 3), showed that the castor oil proved to be the most toxic compound based on the LC50, LC90 and Ti values, followed by hexane and petroleum ether extracts of castor plant extract than castor plant extract with water on the cotton aphid and spider mite. The obtained results are in harmony with findings of other investigators Raghavaiah and Jayarmaiah (1988) reported that neem extract reduced significantly the aphid population on the cabbage plants and datura extract was effective against cabbage aphids. Adekenov *et al.* tested a chloroform extract of boucls, leaves were effective against the spider mite (*T. urticae*)

The data given in Table (4), indicate that the tested castor oil and plant extracts have an effective role in decreasing the population of *A. gossypii* and *T. urticae* on cucumber plants planted at Fayoum Governorate. The mean of mortality percentages for the number of *A. gossypii* (nymphs + adults) and *T. urticae* (adults) were 89.5, 90.45 and 70.12, 70.55 % for plots sprayed with castor oil during the two successive seasons, respectively. The petroleum ether and hexane extracts of castor plant leaves gave reduction ranged from 46.0 to 76.0 % , 49.4 to 80.6 % and 42.2 to 73.3 % , 42.9 to 75.2 % on *A. gossypii* and *T. urticae* 43.5 to 61.5 % ; 43.6 to 61.9 % and 29.2 to 60.1 % ; 29.5, 60.9 % during the two successive seasons, respectively. While the castor plant extract with water treatment gave lowest reduction ranged

Table (1): Corrected mortality % of *Aphis gossypii* Glover and *Tetranychus urticae* treated with four concentrations of castor leaves plant extracts and castor seeds oil.

The Pest	Conc.	1 day				3 days				5 days				7 days			
		A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D
<i>A. gossypii</i>	0.5 %	25.5	11.5	12.8	1.2	27.0	21.2	23.5	2.3	27.2	22.0	24.3	4.2	30.0	24.5	25.2	16.0
	1.0 %	28.2	17.2	18.2	3.0	29.5	22.5	25.2	8.2	30.2	26.0	34.2	12.1	34.2	28.2	29.9	26.0
	1.5 %	77.5	39.5	40.5	8.5	81.2	41.2	47.5	16.5	83.5	48.0	56.5	20.2	86.5	61.2	63.9	28.0
	2.0 %	83.2	42.2	45.2	29.2	90.3	50.5	67.2	43.2	94.5	64.0	68.1	50.5	96.2	73.4	75.2	55.0
<i>T. urticae</i>	0.5 %	16.8	-	3.5	-	18.3	9.3	13.2	2.2	25.0	11.2	16.9	10.0	29.2	15.2	21.5	12.5
	2.0 %	36.5	12.1	15.9	5.52	38.6	14.2	17.6	14.2	39.2	21.6	22.6	15.6	42.5	29.5	30.2	19.3
	1.5 %	50.6	19.6	30.14	12.6	52.2	23.6	32.6	19.6	54.2	31.2	37.2	24.2	59.5	44.5	45.2	37.3
	2.0 %	60.7	26.2	42.7	19.7	62.6	29.8	49.6	27.0	67.3	42.6	51.2	39.2	72.1	59.2	60.5	48.0

A = Castor oil
 B= Castor plant extract with Hexan
 C= Castor plant extract with petroleum
 D= Castor plant extract with water

Table (2): Efficiency of Castor leaves plant extracts with different solvents and castor seeds oil against adults of spider mite *Tetranychus urticae* Koch and the cotton aphid *Aphis gossypii* (Glover) on cucumber plants (one day after treatment).

Concentration g / l	Corrected mortality						LC50 (95 % Fiducial limits)		LC90 (95 % Fiducial limits)		Slop (±S.E)		Toxicity index (Ti)	
	T		A		T	A	T	A	T	A	T	A	T	A
1- Castor oil	0.5 %	16.8 %	25.5 %											
	1.0 %	36.5 %	28.2 %											
	1.5 %	50.6 %	77.5 %		14.719	1.0335	62.637	2.8049	2.047	2.9559	100	100	100	100
	2.0 %	60.7 %	83.2 %		(12.034-19.31)	(0.96-1.23)	(39.62-139.47)	(1.84-4.57)	± 0.312	± 0.1106				
2-Castor plant extract petroleum ether	0.5 %	3.5 %	12.8 %											
	1.0 %	15.9 %	18.2 %		33.366	2.3189	69.648	10.7829	2.702	1.9203	62.99	50.56	67.04	26.01
	1.5 %	30.14 %	40.5 %		(18.71- 36.85)	(1.87-3.94)	(41.9-232.217)	(6.11-33.721)	± 0.577	± 0.3344				
	2.0 %	42.7 %	45.2 %											
3-Castor plant extract with hexane	0.5 %	-	11.5 %											
	1.0 %	12.18 %	17.2 %		45.803	2.1166	244.019	11.4751	1.764	1.7459	46.28	48.82	57.95	24.4
	1.5 %	19.62 %	39.5 %		(28.868-91.28)	(1.74- 4.49)	(73.93-319.83)	(5.37-33.07)	± 0.99	± 0.573				
	2.0 %	26.2 %	42.5 %											
4-Castor plant extract with water	0.5 %	-	1.2 %											
	1.0 %	5.52 %	3.0 %		45.561	3.0900	223.499	6.9351	2.382	3.6507	41.39	33.44	51.74	40.4
	1.5 %	12.6 %	8.5 %		(29.72-82.865)	(2.41-5.09)	(85.32-367.98)	(5.26-8.54)	± 1.155	± 1.3452				
	2.0 %	19.72 %	29.2 %											

T = *Tetranychus urticae* Koch.
A = *Aphis gossypii* (Glover)

Table (3): Efficiency of castor leaves plant extract with different solvents and castor seeds oil against adults of spider mite *Tetranychus urticae* Koch and the cotton aphid *Aphis gossypii* (Glover) on cucumber plants (seven days after treatment).

Concentration g / l	Corrected mortality		LC50 (95 % Fiducial limits)		LC90 (95 % Fiducial limits)		Slop (±S.E)		Toxicity index (TI)		
	T	A	T	A	T	A	T	A	T	A	
2- Castor oil											
0.5 %	29.2 %	30.0 %									
1.0 %	42.5 %	34.2 %	1.0938	0.886	5.3488	1.996	1.8595	3.538	100	100	100
1.5 %	59.5 %	86.0 %	(0.925-1.267)	(0.65-1.19)	(3.607-11.041)	(1.24-3.93)	± 0.2936	± 0.1.452	100	100	100
2.0 %	72.1 %	96.2 %									
2-Castor plant extract petroleum ether											
0.5 %	21.5 %	25.2 %									
1.0 %	30.2 %	29.9 %	1.653	1.296	8.9723	4.1330	1.7448	2.3509			
1.5 %	45.2 %	63.9 %	(1.383- 2.163)	(1.06-1.66)	(5.238-26.27)	(3.314-15.03)	± 0.3036	± 0.752	66.17	68.36	59.71
2.0 %	60.5 %	75.2 %									
3-Castor plant extract with hexane											
0.5 %	15.2 %	24.5 %									
1.0 %	29.5 %	28.2 %	1.6855	1.55	6.9041	4.1515	2.0931	1.971			
1.5 %	44.5 %	61.2 %	(1.445-2.099)	(1.23-2.29)	(4.534-14.768)	(2.245.448)	± 0.3179	± 0.428	64.33	57.71	77.47
2.0 %	59.2 %	73.4 %									
4-Castor plant extract with water											
0.5 %	12.6	16.0 %									
1.0 %	19.3 %	26.0 %	2.262	3.213	10.1336	6.727	1.9685	1.279			
1.5 %	37.3 %	28.0 %	(1.8415-3.235)	(1.98-29.29)	(5.862-28.594)	(8.259-38613.2)	± 0.3354	± 0.444	48.33	38.8	52.78
2.0 %	48.0 %	55.0 %									

T = *Tetranychus urticae* Koch.
A = *Aphis gossypii* (Glover)

from 26.2 to 50.7 % 28.2 to 51.9 % and 21.8 to 41.9 % ; 21.9 , 41.9 % on *A. gossypii* and *T. urticae* during two successive seasons, respectively. Javier and Morallo-Rejesus(1986) found that both crude and semi-purified extracts of piper nigrum were more toxic than malathion to larvae of *plutella xylostella*.

The cucumber observation and total yield increased by castor plant extract with different solvents (Table 5) was similar to the increase in tomato yield reported by El-Sebaey and Abd El-Wahab(2003) and King et al. (1985). Thus, as a conclusion, it can be said that using castor oil treatment and plant extract of castor leaves with petroleum ether may used safely for reducing the population of *A. gossypii* (nymphs and adults) and *T. urticae* (nymphs and adults).

Table (4): Efficiency of castor leaves plant extracts with different solvents and castor oil seeds on the population density of *Aphis gossypii* (Glover) and *Tetranychus urticae* (Koch) on Cucumber plants at Fayoum Governorate during two successive seasons.

Treatment	Seasons	Name of the pest	Conc. %	No. of Indiv. Prespray	Reduction (%) post-spray				
					1 day	3 days	5 days	7 days	Reduction %
Castor leaves Plant extracts	2001	A		17.3	46.0%	48.6%	68.4%	76.0%	59.72%
1-With petroleum ether	2001	T	2%	35.2	43.5%	50.1%	53.3%	61.5%	52.1%
	2002	A		16.9	49.4%	52.6%	71.2%	80.6%	63.45%
	2002	T		39.6	43.6%	50.2%	53.6%	61.9%	52.3%
	2001	A		18.1	42.0%	48.2%	67.4%	73.3%	57.7%
2-With Hexae	2001	T	2%	40.2	29.2%	30.1%	43.1%	60.1%	40.62%
	2002	A		15.8	42.9%	49.6%	68.0%	75.2%	56.9%
	2002	T		36.9	29.5%	30.9%	43.5%	60.9%	41.2%
	2001	A		11.9	26.2%	36.0%	42.2%	50.7%	36.8%
3- with water	2001	T	2%	32.5	21.8%	29.1%	40.5%	41.9%	33.35%
	2002	A		12.2	28.2%	39.2%	44.5%	51.9%	40.95%
	2002	T		38.8	21.9%	29.5%	40.9%	41.9%	33.55%
	2001	A		12.6	81%	88.7%	92.1%	96.3%	89.5%
4- Castor seed oil	2001	T		31.6	65.3%	69.2%	70.9%	75.1%	70.12%
	2002	A	2%	12.9	82.1%	89.2%	93.6%	96.9%	90.45%
	2002	T		35.7	66.2%	69.5%	71.2%	75.3%	70.55%
	2001	A	1.5 l / fed	17	100%	100%	75%	55%	82.5%
5- Actellic 50% EC	2002	A		19	100%	100%	76%	57%	83.25%
	2001	T	1.5 l / fea.	72.1	54.2%	50.6%	40.7%	22.8%	42.07%
6-Actellic 50% EC	2002	T		61.0	53.9%	52.1%	39.1%	21.9%	41.8%
	2001	A		11.2	16.3%	16.7%	16.9%	18.1%	--
Control	2002	A	-	14.5	19.1%	19.6%	20.2%	22.6%	--
	2001	T		45	46%	51%	55%	56%	--
	2002	T		59	62%	67%	63%	69%	--

A = *Aphis gossypii* (Glover) T = *Tetranychus urticae* Koch.

Table (5): Effect of different treatment on cucumber yield infested with *A.gossypii* and *T.urticae* at Fayoum Governorate during two successive seasons.

Treatment	Early yield				Total yield			
	No. of fruit / plant		Kg. of fruit / plant		No. of fruit / plant		Kg. of fruit / plant	
	F	S	F	S	F	S	F	S
Castor leaves plant extracts								
1- with petroleum ether	5.55 ± 0.3	5.57 ± 0.1	0.68 ± 0.1	0.7 ± 0.6	23.1 ± 0.6	23.2 ± 0.31	2.6 ± 0.11	2.68 ± 0.34
2- with hexane	5.32 ± 0.9	5.4 ± 0.2	0.63 ± 0.2	0.6 ± 0.4	22.9 ± 0.2	22.93 ± 0.71	2.1 ± 0.96	2.3 ± 0.75
3- with water	5.0 ± 0.3	5.0 ± 0.6	0.59 ± 0.23	0.59 ± 0.12	20.1 ± 0.36	20.2 ± 0.9	1.5 ± 0.37	1.6 ± 0.46
4- Castor oil	5.7 ± 0.9	5.8 ± 0.4	0.7 ± 0.4	0.75 ± 0.5	23.3 ± 0.41	23.4 ± 0.63	2.7 ± 0.26	2.75 ± 0.44
5- Actellic 50% EC.	5.8 ± 0.5	5.85 ± 0.1	0.76 ± 0.26	0.8 ± 0.4	24.9 ± 0.61	24.96 ± 0.45	2.8	2.86 ± 0.22
Control	4.9 ± 0.5	4.92 ± 0.3	0.48 ± 0.9	0.5 ± 0.16	10.5 ± 0.25	11.1 ± 0.5	0.9	1.2 ± 0.51

F = the first season 2001
S = the second season 2002

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فعالية مستخلص نبات الخروع مع بعض المذيبات ضد من القطن *Aphis gossypii* (Glover) والعنكبوت الأحمر *Koch Tetranychus urticae* على نبات الخيار .
حورية عبد الوهاب
معهد بحوث وقاية النباتات - مركز البحوث الزراعية - الدقى - الجيزة - مصر .

أجريت تجربتان أحدهما معملية في معمل معهد بحوث وقاية النباتات بالدقى والأخرى حقلية أجريت في محافظة الفيوم - مركز الفيوم خلال موسمين متتاليين ٢٠٠١-٢٠٠٢ م لدراسة فعالية مستخلص نبات الخروع مع بعض المذيبات (بتروليم أثير - الهكسان - الماء) وزيت الخروع بيمض التركيزات (٠.٥% ، ١.٥% ، ٢%) على من القطن *A. gossypii* والعنكبوت الأحمر *Tetranychus urticae* وأخذت النتائج بعد ٢٤ ساعة ، ٢ يوم ، ٣ أيام ، ٥ أيام ، ٧ أيام .

أوضحت النتائج تزايد في نسبة الموت أو الخفض في تعداد حشرة المن والعنكبوت الأحمر زاد مع زيادة التركيز في المستخلص والزيت. وبالنظر الى التركيز النصفى القاتل LC50 للأفتين المن والعنكبوت الأحمر كان زيت الخروع هو أكثرهم كفاءة يليه مستخلص نبات الخروع مع مذيب البتروليم أثير ثم مع مذيب الهكسان حيث بلغت قيم التركيز النصفى القاتل LC50 ١٤،٧١٩ ، ٢٣،٣٦٦ ، ٤٥،٨٠٣ ، ٤٥،٥٦١ على العنكبوت الأحمر و١،٠٣٣ ، ٢،٣١٨٩ ، ٢،١١٦ ، ٣،٠٩٠٠ على من القطن بعد يوم من التجربة تقريبا. وكان مستخلص الخروع مع مذيب الماء أقل كفاءة . أيضا بعد ٧ أيام من التجربة كان زيت الخروع على الأفتين أعلى كفاءة ومستخلص نبات الخروع مع مذيب الماء أقل كفاءة.

كما أوضحت النتائج في تجربة الحقل أيضا أن زيت الخروع كان أعلى كفاءة على الأفتين يليه مستخلص نبات الخروع مع مذيب بتروليم أثير . وأيضا بالنسبة للعلاقة بين تأثير المعاملات وانتاجية محصول الخيار ، ودلت النتائج على زيادة المحصول المبكر والكلى في المعاملات بالمقارنة بالكنترول .