

STUDIES ON THE EFFECT OF SOME SAFE MATERIALS IN THE CHANGES OF THE POPULATION DENSITY OF SAP SUCKING PESTS AND BENEFICIAL INSECTS

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Abstract

An experiment was conducted at Fayoum Governorate on cotton plant in 2002 season to study the pesticide efficiency of mineral oils: CApl-1; CApl-2 and Sol-EC, sticking agents: CMC and glue, detergent : Sisi-6 and biological agents: B.t, Mvp and virus against sucking pests: egg and adults of mites, thrips whitefly and aphids also their side effect against predators, coccinella, spiders and orius. Results obtained indicated success of the following materials against pests with less injury against predators: CApl-2, Sisi-6 and B.T. against mite egg; CApl-1, CApl-2 Sol-EC, CMC virus and B.t against mite adults; CApl-1, Sol-EC, CMC, glue and virus against thrips and CMC, glue, MVP and B.T. against aphids.

Key words : Sucking pests;; cotton; safe materials ; minerals oils; sticking agents; detergent; Biological agents.

Introduction

In recent years, much attention has been paid to the use of the bacterial entomopathogen *Bacillus thuringiensis* against *S. littoralis* (Borie *et al.*, 1995, Abdel-Halim, 1997, Moawad *et al.*, 1992 and Zhhao Huaqi *et al.*, 1995). Also reported that *B. thuringiensis* could be used as abio-insecticides. On the other hands, many investigators studied the effects of nuclear polyhedrosis virus (N.P.V.) against *S. littoralis* on cotton (Topper *et al.*, 1984, Elleman *et al.*, 1985, Liang *et al.*, 1981).

Also petroleum oils were used because cheaper and more safe to human and environment, El-Sisi and El-Hariry 1989, 1998 used many types of petroleum oil to controlling aphids, also used it for controlling mites El-Sisi, 1981; Moustafa *et al.* 1985); indicated the efficiency of some mineral oils against thrips. Also (Ishaaya *et al.* (1986) indicated the effect of petroleum oil against adults of *Bemisia tabaci*. Badr *et al.* (1995) recommended the spray oils as one element of integrated pest management for their toxic and latent effect against *S. littoralis*.

Also large numbers of plants have been screened for their biologically active chemicals exhibiting diverse effects on insects such as toxic effect, antifeedant effects, inhibition of respiration, reproduction, retardation and ovicidal effect (El-Sisi and Badr 1995, El-Sisi *et al.*, 1995, El-Hariry *et al.*, 1998; Banbawale *et al.*, 1995, Salem, 1983, El-Sisi and Farag, 1989).

The aim of the present work is evaluating the pesticide efficiency of some locally formulated mineral oils, sticking agents and detergents also some commercial biological agents (B.t., MVP and virus) against some sucking pests that infested cotton crop also their side effect against predators.

Materials and Methods

1. Mineral Oils

- Sol. EC: It is a crude solvent prepared as emulsifiable concentrate, used at 3 L./feddan.
- CApl-1: Sulphonated solvent oil formulated as emulsifiable concentrate in central Agricultural Pesticides Laboratory (CAPL), used at 3L./feddan.
- CApl-2: Lubrication cut petroleum oil fraction formulated as emulsifiable concentrate used at 3L./feddan.

2. Sticking Agents

- CMC : It is a sodium carboxy methyl cellulose prepared as soluble liquid in water contained 5% wt./v. used at ratio 3.428 L./feddan.
- Glue: It is an animal product (albo-protein) prepared as soluble liquid formulation contained 33.3% (wt./v.) used at 1.5 L./feddan.

3. Surfactant (Detergent)

- Sisi-6 : product contained 10% (wt./v.) a.i. and used at ratio 750 cm³/fed.

4. Biological Agents

- B.t. : It is a *Bacillus thuringiensis* spores produced by Genetic lab. and used at 1 L./feddan.
- MVP11 : It is a B. t. toxin, produced by used at 1 L./feddan.
- Virus : It is a nuclear polyhydrosis virus produced by plant protection Res. used at 600 gm/fed.

Field experiment was conducted in cotton plants cultivated in Fayoum Governorat, at Biahmo in a highly infested field with different instars of all pest. Sucking pests, Aphid, *S. littoralis*, whitefly. Spraying was done at July 24, 1998 using a Knapsack motor sprayer under mentioned before ratio for each tested materials.

Pre-treatment count was recorded before spraying at 50 plants for each treatment and post-treatment count was recorded after 1,2,3 and 5 days of treatment. Also pre and post treatment count was conducted on predators: Orius, spider coccinella then percentage of reduction was calculated according Henderson and Tilton (1955):

$$\% \text{ Reduction} = 1 - \frac{\text{Pre treatment count} - \text{Post treatment count}}{\text{Pre-treatment count}} \times 100$$

$$\text{percentage of reduction} = 100 \left(1 - \frac{T_a \times c_b}{T_b \times c_a} \right)$$

where : T_b number before treatment in treated plot.

T_a number after treatment in treated plot.

c_b number before treatment in check plot

c_a number after treatment in check plot.

Results and Discussion

According to Ministry of Agriculture recommendation for using the natural products and safe materials on controlling pests, succeed material should give initial effect more than 70% reduction and residual effect don't less than 40% reduction. Therefore results obtained could be divided into groups: (1) succeeded according to this limitation (2) gave high initial effect but did not succeed in residual effect (3) showed low initial effect but gave high residual effect (4) did not succeed in controlling pests.

Group 1

Succeeded in controlling pests such as CApl-2, Sisi-6, and *B.t.* were successful against egg of mites (Table 1), all tested materials except glue and MVP were successful against adults of mite (Table 2), while all tested materials except CApl-2, MVP and *B. t.* were successful against thrips (Table 3), no one of any tested materials were successful against adults of whitefly (Table 4), sticking agent: CMC and glue, MVP and *B. t.* were successful against aphid (Table 5).

Group 2

Which gave high initial effect and low residual effect; this group could be used in case of high infestation but the treatment, should be replicate every short periods, this group as show in (Table 1) are : MVP against egg of mite, Sisi, 6 against whitefly adults (Table 4) and Sisi-6 against aphids (Table 5).

Group 3

Gave low initial effect and high residual effect, this grapes could be used in case of low infestation as protection control such as CApl-1 and virus for controlling mite egg (Table 1), MVP against mite adults (Table 2), CApl-2 and *B.t.* against thrips adults (Table 3), CMC, MVP and *B.t.* against whitefly adults (Table 4) and capl-2 and virus against aphid (Table 5).

Group 4

Did not succeed, this group should not be use for controlling the mean pest as Solar EC, glue against mite egg (Table 1); glue against mite adults (Table 2), MVP against thrips adults (Table 3), virus against whitefly adults and CApl-1 and Solar EC against aphids (Table 5).

On the other hand, the side effect of the tested materials against predators are shown in (Tables 6,7 and 8), which indicated an increase in coccinella percentage in all tested specially in case solar EC and *B.t.* than untreated one exception CApl-2, CMC and glue showed slightly reduction percentage at their residual effect, glue and *B.t.* gave high initial reduction percentage against spider followed by mineral oils but there are not any side residual effect for the all tested materials, CApl-1, CApl-2,

CMC, glue, sisi-6 and *B.t.* showed initial reduction percentage on Orios, all tested materials showed residual side effect on ories except glue and Sisi-6. Generally, it could be explain the mode of action of the tested materials as the following: the ovicidal effect of mineral oils against mite egg, involved the blocking of respiration as a result of presence of oil film (Smith and Pearce, 1948). While their effect against immature and mature stages of due to suffocation effect (Deong *et al.*, 1927). Sticking agents : CMC and glue may act as tangle foot and then prevent pest to move over the target causing its death as a result of the starving because pests become unable to eat. Detergent Sisi-6 may solve the epicuticle of pests body as result of its emulsify then cause mortality. Biological agents: virus MVP and *B.t.* may cause their effect against pests by three ways, first by solution of epi-cuticle as a result of surfactants contained such as wetting and spreading agent, etc. The effect in this case by the same method mentioned before use Sisi-6. Secondly: as a result of toxic effect such as MVP, third by their illness effect of pests such as virus and *B.t.*

Finally, those local, safe and cheap material gave good effects against some sucking pests there infested cotton plant the economic crop in Egypt. Moreover exhibits less side effect than commercial pesticides could be recommended for controlling those pests instead of toxic, dangerous and economic commercial pesticides.

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Table 1. Effect of tested materials against eggs of *T. letoralis* on cotton plant (season 1998).

Treatment	Pre-treatment No./leaf	Initial effect		Residual effect				
		after 1 day		after 3 days	5 days		Total	Mean
No./Leaf	% R.	No./Lean	No. leaf					
CAPL-1	22.5	15.0	36.66	10.1	0.00	10.10	5.05	84.49
CAPL-2	22.5	3.0	87.34	4.0	0.00	4.0	2.00	93.85
SOL-EC	14.0	18.0	-22.14	25.0	30.3	22.3	27.65	-36.45
CMC	22.5	10.0	57.78	17.0	8.8	25.8	12.9	60.38
Glue	5.0	6.0	-14.00	25.5	13.3	38.8	19.4	-168.07
Sisi-6	14.0	2.2	85.08	5.0	0.0	5.0	2.5	87.66
Virus	19.0	13.3	33.5	0.0	9.0	9.0	4.5	83.63
MVP	19.0	3.0	85.0	32.0	31.0	63.0	31.5	-14.54
B.t.	22.2	6.0	74.33	3.0	9.2	12.2	6.1	81.01
Control	19.0	20.0	-	34.0	21.0	55.0	27.5	-

% R = reduction percentage

Table 2. Effect of tested materials against spider mites (*Tetranychus letoralis*) on cotton plant (season 1998).

Treatment	Pre-treatment No./leaf	Initial effect after 1 day		Residual effect				
		No./Leaf	% R.	after 3 days No./Leaf	5 days No. leaf	Total	Mean	% R.
CAPL-1	18.0	10.0	77.6	5.0	4.3	9.3	4.65	95.30
CAPL-2	15.0	4.0	89.36	6.0	4.3	10.3	5.15	93.75
SOL-EC	18.0	2.0	95.56	9.0	9.5	18.5	9.25	90.65
CMC	15.0	2.5	93.34	47.0	5.0	52.0	26.0	68.48
Glue	5.0	9.0	28.0	39.0	48.0	87.0	43.5	-58.18
Sisi-6	18.0	0.0	100.0	3.0	0.0	3.0	1.5	98.48
Virus	6.0	3.3	78.0	0.0	4.2	4.2	2.1	93.63
MVP	6.0	8.0	46.7	0.0	7.0	7.0	3.5	89.39
B.t.	4.0	1.0	90.0	1.0	4.0	5.0	2.5	88.63
Control	6.0	15.0	-	27.0	39.0	66.0	33.0	-

% R = reduction percentage

Table 3. Effect of tested materials against Thrips spp. on cotton plant (season 1998).

Treatment	Pre-treatment No./leaf	Initial effect after 1 day		Residual effect				
		No./Leaf	% R.	after 3 days No./Leaf	5 days No. leaf	Total	Mean	% R.
CAPL-1	2.0	1.0	75.0	2.0	3.0	5.0	2.5	67.10
CAPL-2	3.0	2.0	33.33	1.0	4.0	5.0	2.5	78.07
SOL-EC	2.0	3.0	75.0	3.0	3.5	6.5	3.25	57.23
CMC	2.0	1.0	75.0	2.0	3.0	5.0	2.5	67.10
Glue	6.0	2.0	83.4	3.0	4.0	7.0	3.5	84.64
Sisi-6	5.0	2.0	80.0	1.0	5.0	6.0	3.0	84.21
Virus	1.0	0.0	100.0	0.0	3.0	3.0	1.5	60.52
MVP	1.0	3.0	-50.0	2.0	4.0	6.0	3.0	21.05
B.t.	2.2	3.0	32.0	1.0	3.3	4.3	2.15	74.28
Control	1.0	2.0	-	3.0	4.6	7.6	3.8	-

% R = reduction percentage

Table 4. Effect of tested materials against nymph of whitefly *Bamisia. tebaic* on cotton plant (season 1998).

Treatment	Pre-treatment No./leaf	Initial effect after 1 day		Residual effect				
		No./Leaf	% R.	after 3 days No./Leaf	5 days No. leaf	Total	Mean	% R.
CAPL-1	6.0	3.0	52.0	3.3	4.1	7.4	3.7	53.88
CAPL-2	5.0	3.0	42.0	3.8	4.1	7.5	3.75	43.39
SOL-EC	6.0	4.0	36.0	4.3	5.1	9.4	4.70	41.42
CMC	5.0	0.0	100.0	0.0	1.3	1.3	0.65	96.27
Glue	4.0	1.0	76.0	2.0	3.0	5.0	2.0	53.26
Sisi-6	3.0	0.0	100.0	2.0	5.0	7.0	3.5	12.75
Virus	6.0	5.0	20.0	5.4	6.0	11.4	5.7	28.95
MVP	5.6	5.1	13.0	2.0	4.0	6.0	3.0	59.93
B.t.	3.3	3.5	-2.0	3.1	2.1	5.2	2.6	41.08
Control	4.3	4.5	-	5.2	6.3	11.5	5.75	-

% R = reduction percentage

Table 5. Effect of tested materials against nymph and weingless adult of aphid *Aphis gossypii* on cotton plant (season 1998).

Treatment	Pre-treatment No./leaf	Initial effect after 1 day		Residual effect				
		No./Leaf	% R.	after 3 days No./Lean	5 days No. leaf	Total	Mean	% R.
CAPL-1	4.0	3.0	43.75	4.0	5.4	9.4	4.7	27.31
CAPL-2	2.0	4.0	-50.00	4.0	5.5	9.5	4.75	46.90
SOL-EC	3.0	3.0	25.00	3.3	4.5	7.8	3.9	19.58
CMC	4.0	1.0	81.25	1.4	2.5	3.9	1.95	68.06
Glue	3.0	0.0	100.00	1.0	3.0	4.0	2.0	58.76
Sisi-6	2.0	0.0	100.00	1.2	3.0	4.2	2.1	35.05
Virus	4.0	1.0	81.25	2.0	2.8	4.8	2.4	62.88
MVP	3.0	1.0	75.00	2.0	3.0	5.0	2.5	48.45
B.t.	4.0	1.0	81.25	2.0	3.0	5.0	2.5	61.34
Control	3.0	4.0	-	4.2	5.5	9.7	4.85	-

% R = reduction percentage

Table 6. Effect of tested materials against Coccinellidae on cotton plant (season 1998).

Treatment	Pre-treatment No./leaf	Initial effect after 1 day		Residual effect				
		No./Leaf	% R.	after 3 days No./Lean	5 days No. leaf	Total	Mean	% R.
CAPL-1	1.0	4.0	-166.4	5.0	4.5	9.5	4.75	-171.0
CAPL-2	2.0	1.0	66.7	3.0	3.5	6.5	3.25	7.0
SOL-EC	0.2	1.0	-233.3	2.0	3.0	5.0	2.5	-614.0
CMC	3.0	5.0	-11.11	5.5	4.5	10.0	5.0	4.0
Glue	3.0	5.0	-11.11	5.0	4.5	9.5	4.75	9.0
Sisi-6	1.0	1.0	33.4	3.0	3.5	6.5	3.25	-85.71
Virus	3.0	4.0	-11.12	4.5	4.0	8.5	4.25	19.04
MVP	3.0	4.0	-11.12	4.0	4.0	8.0	4.0	23.37
B.t.	0.8	2.0	-66.12	3.5	3.5	7.0	3.5	-149.99
Control	3.0	4.5	-	5.0	5.5	10.5	2.25	-

% R = reduction percentage

Table 7. Effect of tested materials against Trow spider on cotton plant (season 1998).

Treatment	Pre-treatment No./leaf	Initial effect after 1 day		Residual effect				
		No./Leaf	% R.	after 3 days No./Lean	5 days No. leaf	Total	Mean	% R.
CAPL-1	1.0	1.0	33.4	0.5	5.14	5.54	2.77	-23.11
CAPL-2	1.0	1.0	33.4	3.0	2.0	5.0	2.5	-11.11
SOL-EC	1.0	1.0	33.4	1.0	4.0	5.0	2.5	-11.11
CMC	2.0	1.0	66.67	3.0	10.0	13.0	6.5	-44.44
Glue	1.0	0.0	100.0	2.0	3.0	5.0	2.5	-11.11
Sisi-6	1.0	1.0	66.6	2.0	4.0	6.0	3.0	-33.33
Virus	2.0	2.0	66.6	3.0	2.0	5.0	2.5	44.44
MVP	2.0	2.0	66.6	2.1	4.0	6.1	3.05	32.22
B.t.	3.0	0.0	100.0	4.0	5.0	9.0	4.5	33.33
Control	2.0	3.0	-	2.0	7.0	9.0	4.5	-

% R = reduction percentage

Table 8. Effect of tested materials against Orius sp on cotton plant (season 1998).

Treatment	Pre-treatment No./leaf	Initial effect after 1 day		after 3 days	Residual effect			
		No./Leaf	% R.	No./Leaf	5 days No. leaf	Total	Mean	% R.
CAPL-1	2.0	0.0	100.0	0.0	2.0	2.0	1.0	62.96
CAPL-2	1.5	0.1	94.13	1.0	0.5	1.5	0.75	62.96
SOL-EC	2.8	1.0	64.29	0.0	1.0	1.0	0.50	91.18
CMC	1.5	0.3	82.4	0.5	2.0	2.5	1.25	38.27
Glue	0.5	0.2	64.8	0.1	3.3	3.4	1.70	-151.85
Sisi-6	0.8	0.2	78.0	0.1	2.1	2.2	1.1	-1.85
Virus	0.5	0.1	82.4	0.1	1.1	1.2	0.6	11.11
MVP	0.9	1.0	-2.22	0.1	2.1	2.2	1.1	9.46
B.t.	1.0	0.0	100.0	1.3	3.1	4.4	2.2	-62.96
Control	3.0	3.4	-	3.1	5.0	8.1	4.05	-

% R = reduction percentage