

# COMPARISON BETWEEN SOME NATURAL CONTROL AGENTS AND BUPROFEZIN IN THE MANAGEMENT OF *APHIS GOSSYPII* (GLOVER), ON COTTON PLANTS

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## INTRODUCTION

The cotton aphid, *Aphis gossypii* (Glover), (Homoptera: Aphididae) being primarily a pest of cotton, is a polyphagous feeder (Hameed and Giamzo, 1975). This pest constitutes one of the major and important economic pests of cotton plants in Egypt and it causes heavy losses in many years (Hassanein *et al.*, 1971). This aphid feeds in colonies of large numbers on young leaves, mostly on the under-surface and also on tender parts and cause considerable damage. They suck the cell sap from leaves, lowering its vitality, turn yellow and crinkled. In addition, honeydew excretions and transmission of virus diseases are important problems.

In general, populations of aphids are frequently held under control by their natural enemies (predators) but aphids are plentiful during the summer months, before the appearance of their predators, which have longer life cycles.

The present work was designed to study the effect of different natural control agents (Biofly, Misrona oil and NeemAzal) compared to buprofezin to manage *Aphis gossypii* on cotton plants and their predators (*Chrysoperla carnea*, *Coccinella undecimpunctata* and *Coccinella septempunctata*) and its parasitoid (*Aphidius* spp.).

## MATERIAL AND METHODS

The following four compounds were tested:

- a. Biofly, an entomopathogenic fungi ( $3 \times 10^7$  c.f.u./1ml), containing the fungus *Beauveria bassiana*, used at a rate of 1.5 ml/liter of water.

- b. Buprofezin (Applaud 25% SC) (insect growth regulator IGR's): A soluble concentration, containing 25% a.i., applied at a rate of 1.5 ml/liter of water.
- c. NeemAzal, a botanical extract containing 1% Azadirachtin A (10 g/liter) from the neem tree, *Azadirachta indica* (Meliaceae), applied at a rate of 1.5 ml/liter of water.
- d. Super Misrona 95% EC, a local mineral oil, containing 95% paraffinic oil w/w, unsulfonated residue content reached 92%, applied at a rate of 20 ml/liter of water.

This study was conducted on cotton plants grown in Gharbia Governorate. Two experiments were conducted during June of the two successive years 2002 and 2003 when pest population density was high. An area of 1/4 feddan was divided into 20 plots, each of approximately 50m<sup>2</sup>. The plots were arranged in randomized block with four replicates for each treatment, and another four replicates as control. The plots were sprayed with different tested agents using a knapsack sprayer. Control plots were sprayed with water only.

One spray was conducted during each year on June. To evaluate the efficacy of tested insecticides the number of nymphs and adults were counted at pre-treatment and 1, 3, 6, 9, 12, 15 and 21 days after treatment. Each sample consisted of 30 cotton leaves taken randomly from each plot. The sampled leaves were collected in paper bags and transferred to the laboratory for careful examination. Aphid nymphs and adults were counted under a stereomicroscope, and both surfaces of each leaf was inspected.

The index for the effect of natural control agents:

From 0-45 % reduction in infestation = Low effect

From > 45-75% reduction in infestation = Medium effect

From > 75-100% reduction in infestation = High effect

The predators *Chrysoperla carnea*, *Coccinella undecimpunctata* and *Coccinella septempunctata*, were counted in the field by using a hand lens. Both surfaces of the leaf were inspected. To avoid escape of adults, predators were counted early in the morning.

Each inspected leaf was transferred to laboratory and leaf stored in well-ventilated emergence glass tube and monitored daily for parasitoid emergence (*Aphidius* spp.) and rate of parasitism was determined. The parasitized aphid became swollen, brownish and was smaller than the non-parasitized one.

The reduction percentage of infestation by aphids, number of predators and rate of parasitism were calculated according to the equation of Henderson and Tilton (1955). The data was subjected to analysis of variance (ANOVA) and the means were compared by L.S.D. test at 0.05 level, using SAS program (Anonymous, 1988).

## RESULTS AND DISCUSSION

In the first season (2002), the average pre-spraying counts of adults and nymphs of *A. gossypii* were 38.8-44.1 and 66.8-82.1/leaf, respectively and the average numbers of mature and immature stages of predators were 0.8-0.9 and 1.3-1.8/leaf, respectively and also the average number of parasitoids was 5.6-7.4 (Table I).

Results in Table (1) indicate that in first year (2002), the three natural control agents gave moderate effect against adults and nymphs of *A. gossypii*, Biofly, NeemAzal and Super Misrona oil gave 59.6%, 63.3% and 54.9% reduction, respectively against adults after 21 days. Also, the three natural control agents gave moderate effect against nymphs of *A. gossypii*, Biofly, NeemAzal and Super Misrona oil gave 64.2%, 69.4% and 60.5% reduction, respectively after 21 days. They also showed moderate toxic effect against mature stages of predators while gave 69.2%, 74.1% and 69.2% reduction on mature stages, respectively. While against immature stages, Biofly had a moderate effect (70.7% reduction. NeemAzal and Super Misrona oil were highly toxic and killed 76.4% and 78.1%, respectively. The three natural control agents (Biofly, NeemAzal and Super Misrona oil) were highly toxic to parasitoids killed (85.8%, 83.3% and 86.6%, respectively).

On the other hand, Buprofezin gave high efficacy against all targets. Adult females and nymphs of *A. gossypii* were reduced by 86.2% and 90.6%, respectively. Reduction in mature stages of predators was 82.7%, and in immature stages 84.3% and 93.9% of parasitoids.

Statistical analysis in (Table 1) for year 2002 show significant differences between the four tested agents on adults of aphids ( $F = 1783.1$ , L.S.D. 0.05 = 1.073), on nymphs ( $F = 2681.9$ , L.S.D.0.05 = 0.847), on mature stages of predators ( $F = 838.8$ , L.S.D.0.05 = 0.717) on immature stages of predators ( $F = 501.3$ , L.S.D.0.05 = 0.815), and on parasitoids ( $F = 131.1$ , L.S.D.0.05 = 1.298).

Mineral oil was the most effective, and nymphs were not able to moult and grow normally. Mineral oil interfered with both respiration and membrane function

and disrupts feeding activities. For oil to be effective, it must coat the pest and its eggs, thus complete coverage is essential for optimum results (Sieburth et al., 1998).

The present results are not in harmony with those of Shalaby et al. (1991) who found that, KZ oil provided the lowest percentage of aphid population reduction (11%). Also they found that Star oil and KZ oil caused the lowest residual effect. Mourad (1992) found the mineral oils to be less effective against this aphid while Marshal, Nuvacron, Kerate and dimethoate were more effective and had a long residual activity.

These results are in harmony with those obtained by Emam and Daoud (1992) who found that KZ oil reduced aphid population by 55.7% on pepper plants.

In the second season (2003), the average pre-spraying counts of adults and nymphs of *A. gossypii* were 54.9-66.5 and 87.5-98.5/leaf, respectively and the average number of the mature and immature stages of predators were 0.9-1.2 and 1.7-1.9/leaf, respectively and also the average number of parasitoids were 7.9-9.2 (Table 2).

Results in Table (2) indicate that in the second year (2003) the three natural control agents had moderate effect against adults and nymphs of *A. gossypii*, Biofly, NeemAzal and Super Misrona oil gave 64.0%, 65.4% and 59.6% reduction, respectively against adults after 21 days. Also, the three natural control agents had moderate effect against nymphs of *A. gossypii*, and gave 66.5%, 74.3% and 63.2% reduction, respectively after 21 days. They also showed moderate toxic effect against mature and immature stages of predators except NeemAzal which was highly toxic. They gave 68.4%, 76.3% and 68.4% reduction against mature stages, respectively while all of them were highly toxic against immature stages where they gave 78.3%, 78.6% and 77.9% reduction, respectively. The three natural control agents (Biofly, NeemAzal and Super Misrona oil) were also highly toxic against parasitoids (83.6%, 86.4% and 87.7% reduction, respectively).

On the other hand, Buprofezin showed high efficacy against adult females of *A. gossypii* (87.5% reduction), against nymphs (93.9% reduction), mature predators (82.5% reduction), immature stages of predators (86.9% reduction) and parasitoids (94.6% reduction).

Statistical analysis for the year 2003 (Table 2) show significant differences between the four tested agents on adults of aphids ( $F = 1635.8$ , L.S.D.  $0.05 = 1.014$ ), on nymphs ( $F = 2011.3$ , L.S.D.  $0.05 = 1.001$ ), on mature stages of predators ( $F = 928.6$ , L.S.D.  $0.05 = 0.729$ ), on immature stages of predators ( $F = 108.5$ , L.S.D.  $0.05 = 1.354$ ), and on parasitoids ( $F = 191.4$ , L.S.D.  $0.05 = 1.102$ ).

**TABLE (I)**

Effect of different natural control agents compared to Buprofezin on *Aphis gossypii* and its parasitoids and predators/leaf on cotton plants during 2002 season.

Treatment	Rate of Applic. /L.W.	Pre spraying count					Average number					Average reduction %				
		<i>Aphis gossypii</i>		Predators		Parasitoids	<i>Aphis gossypii</i>		Predators		Parasitoids	<i>Aphis gossypii</i>		Predators		Parasitoids
		A	N	M	I		A	N	M	I		A	N	M	I	
Biofly	1.5 ml	44.1	75.1	0.9	1.5	5.6	37.2	50.1	0.8	1	4.1	59.6	64.2	69.2	70.7	85.8
NeemAzal	1.5 ml	39.8	79.6	0.8	1.3	5.9	30.5	45.3	0.6	0.7	5.1	63.3	69.4	74.1	76.4	83.3
Super Misona Oil	20 ml	41.3	66.8	0.9	1.6	7.1	38.9	49.2	0.8	0.8	4.9	54.9	60.5	69.2	78.1	86.6
Buprofezin	1.5 ml	38.8	81.5	0.8	1.4	6.7	11.2	14.2	0.4	0.5	2.1	86.2	90.6	82.7	84.3	93.9
Control	-	42.2	82.1	0.9	1.8	7.4	88.1	152.9	2.6	4.1	38.2	-	-	-	-	-
F												1783.0	2681.9	838.7	501.2	131.1
LSD												1.073	0.847	0.716	0.815	1.298

A = Adult females N = Nymphs M = Mature predator I = Immature predator

TABLE (II)

Effect of different natural control agents compared to Buprofezin on *Aphis gossypii* and its parasitoids and predators/leaf on cotton plants during 2003 season.

Treatment	Rate of Applic. L.W.	Pre spraying count					Average number					Average reduction %				
		<i>Aphis gossypii</i>		Predators		Parasitoids	<i>Aphis gossypii</i>		Predators		Parasitoids	<i>Aphis gossypii</i>		Predators		Parasitoids
		A	N	M	I		A	N	M	I		A	N	M	I	
Biofly	1.5 ml	65.2	95.2	1.1	1.8	7.9	31.1	70.1	1.1	1.4	5.9	64.0	66.5	68.4	78.3	83.6
NeemAzal	1.5 ml	54.9	88.7	1.2	1.7	8.2	25.2	50.2	0.9	1.3	5.1	65.4	74.3	76.3	78.6	86.4
Super Misrona Oil	20 ml	56.2	87.5	1.1	1.9	9.2	30.1	70.9	1.1	1.5	5.2	59.6	63.2	68.4	77.9	87.7
Buprofezin	1.5 ml	61.2	92.9	0.9	1.7	8.6	10.1	12.3	0.5	0.8	2.1	87.5	93.9	82.5	86.9	94.6
Control	-	66.5	98.5	1.2	1.9	9.1	115.8	216.8	3.8	6.8	41.5	-	-	-	-	-
F												1635.8	2011.3	928.6	108.5	191.4
LSD												1.1014	1.001	0.729	1.354	1.102

A = Adult females N = Nymphs M = Mature predator I = Immature predator

These results are in harmony with those obtained by Lowery et al., (1993) who found that Neem seed oil treatment reduced the strawberry aphid, *Chaetosiphon fragaefolii* by 55.2% on strawberry.

It could be concluded that the natural control agents (Biofly, NeemAzal and Super Misrona oil) gave medium reduction against *A. gossypii* and also, they were less toxic against the predators. These natural control agents would be used against this aphid. Also, we can use these compounds in IPM programs by spraying these compounds to reduce the pest population and then release the mass reared predators to give complete reduction of insect population.

Buprofezin is very effective against aphid adults and nymphs. On the other hand, it was also toxic on predators and parasitoids.

## SUMMARY

The four control agents Biofly, Buprofezin, NeemAzal and Super Misrona oil were tested against the cotton aphid, *Aphis gossypii* on cotton plants during 2002 and 2003 seasons. In the first year (2002), the three agents (Biofly, NeemAzal and Super Misrona oil) gave moderate effect against adults and nymphs of *A. gossypii*. They also gave moderate toxic effect against mature and immature stages of predators, while they gave had higher toxic against immature stages of predators, while NeemAzal and Super Misrona oil against immature stages they were highly toxic. The three natural control agents gave highly toxic effect against parasitoids. Buprofezin had high efficacy against adult females of *A. gossypii*, while it was highly toxic against mature and immature stages of predators and parasitoids. In the second year (2003) the three natural control agents gave moderate effect against adults and nymphs of *A. gossypii* after 21 days. They also had moderate toxic effect against mature stages of predators except NeemAzal which was highly toxic against immature stages of predators and against parasitoids. Buprofezin had high efficacy against adult females of *A. gossypii*, immature stages of predators and parasitoids.

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