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Effect of different Insecticides on Parasitisation of Solenopsis Mealybug by *Aenasius bambawalei*

Meenu[1] and Pala Ram[2]

[1,2]CCSHAU, Hisar
E-mail: [1]mmeenu17@gmail.com, [2]palaram@yahoo.com

Abstract—*Among all treatments highest number of parasitized mealybugs was found in control (42.81) followed by novaluron (38.20), nimbecidine (22.44) and imidacloprid (21.80). Profenophos, quinalphos, thiodicarb and spinosad proved to be most toxic as the number of mummies formed was very low (1.71-4.20) indicating that these may prove harmful if parasitoids are released within 24h of insecticide application. In respect of emergence of adult parasitoids from the successfully parasitized mealybugs, all the insecticides (imidacloprid, novaluron, spinosad, nimbecidine, profenophos, quinalphos and thiodicarb) resulted in significantly low emergence as compared to control (93.08%). Among the insecticides highest adult emergence was recorded in novaluron (85.42%) which was followed by imidacloprid (80.08%), nimbecidine (73.22%) and thiodicarb (67.30%). Spinosad seemed much toxic as resulted in only 8.36 per cent adult emergence. Profenophos and quinalphos proved to be most toxic as there was no adult emergence therefore application of spinosad, profenophos and quinalphos should be avoided in the field when adult parasitoids are active in order to conserve the parasitoid. There was no significant difference in the percentage of females and males in the progeny of the parasitoid in different treatments. Among the insecticides, highest adult longevity was observed in nimbecidine (14.63 days) followed by novaluron (12.03 days), imidacloprid (9.62 days), thiodicarb (7.86 days) and spinosad (1.28 days).*

1. INTRODUCTION

Cotton, *Gossypium hirsutum* L. is one of the important cash crops providing livelihood to millions of people associated with its cultivation, textile and apparel industries[5]. Cotton crop suffers from various insect-pests right from sowing to harvesting. Among these solenopsis mealybug, *Phenacoccus solenopsis* Tinsley, a polyphagous pest, is of major importance which causes considerable damage to this crop in India. The mealybugs suck the cell sap from leaves, twigs, stems, roots and fruiting bodies. Plants infested during vegetative phase exhibit symptoms of distorted and bushy shoots, crinkled and/or twisted and bunchy leaves, and stunted plants that dry completely in severe conditions. Females are capable of producing hundreds of eggs *i.e* they have high reproducing capacity. They form dense, white, waxy colonies on stems, shoots and leaves. Female adults are wingless with a 3-4 mm long oval-shaped body covered by a waxy coating giving them a 'mealy' or 'cottony' appearance. Adult males are about 1 mm long, with a grey body and a single pair of transparent wings. Parasitoids have been a favorite subject for biological control programme because they tend to be highly specific to one or a few species of host, and therefore can be used to target specific pests. *Aenasius bambawalei* Hayat is the most important endoparasitoid of solenopsis mealybug, *P. solenopsis*. Inspite of the success of the biological control, chemical control is still being largely used as an important component of integrated pest management (IPM) and is used in conjunction with the biological control. Therefore, necessary studies about the associated use of pesticides with parasitoids[3] and predators are important and may help in the decision making in IPM. Hence, keeping this in view the present study has been proposed to investigate the effect of different insecticides, recommended for insect-pests control in cotton crop, on parasitisation of solenopsis mealybug by its parasitoid, *A. bambawalei* and to identify safer insecticides that can be used when parasitoids are available in the field.

2. MATERIALS AND METHODS

The culture of *P. solenopsis* was maintained on the potato sprouts placed in the plastic tubs. Third instar mealybugs were transferred to the single hole wooden cage where these were exposed to *A. bambawalei* adults for parasitisation for regular supply of different stages of the parasitoid. Initially the parasitoid culture in single hole wooden cage was raised by placing the field collected mummies into single hole wooden cage. The present studies were conducted under laboratory conditions (26±2^{o}c temperature). Potato sprouts infested with 50 big sized mealybugs (3rd instar) were taken from the culture. Solutions of different insecticides were prepared using tap water as in previous experiments. The insecticide solution was sprayed on potato sprouts with the help of the atomizer till surface run-off. Potato sprouts were dried and placed in a glass jar. Five 1-2 days old honey fed parasitoid adult pairs were collected from the single hole wooden cage in glass vial and released in a glass jar for 24h. Glass jar was covered with muslin cloth and tightened by rubber band. After 24h the parasitoids were removed and observations were recorded on number of mealybugs parasitised, adult emergence, sex-ratio and adult longevity. Per cent adult emergence, reduction in

parasitism, sex-ratio and adult longevity was calculated as described in previous experiment. Insecticides were classified into different categories.

Statistical analysis

The data obtained in all the experiments was subjected to the analysis of variance using single factor Completely Randomized Design. Angular and square root transformations of the data were done as and when required and then analysed using the statistical software, OPSTAT developed by CCSHAU, Hisar.

3. RESULTS AND DISCUSSION

Effect of different insecticides on parasitisation of solenopsis mealybug by *A. bambawalei*

Among all treatments highest number of parasitized mealybugs was found in control (42.81) (Table 1) followed by novaluron (38.20), nimbecidine (22.44) and imidacloprid (21.80). Profenophos, quinalphos, thiodicarb and spinosad proved to be most toxic as the number of mummies formed was very low (1.71-4.20) indicating that these may prove harmful if parasitoids are released within 24h of insecticide application.

The results also showed that all the insecticides tested significantly reduced parasitization by the parasitoid as compared to control (85.61%). Among insecticides only novaluron was found to be safer as it had resulted in 76.40 per cent parasitization followed by nimbecidine (44.81%) and imidacloprid (43.62%) while the other insecticides caused less parasitism which may be due to quick knock down effect caused by these to adult females of the parasitoid. Profenophos and quinalphos were found to be most toxic as these resulted in 3.4 and 3 per cent parasitism, respectively. Per cent parasitism in thiodicarb and spinosad was 84 per cent in each. Based on the reduction in parasitization over control the insecticides were classified into different toxicity categories. Among the insecticides tested novaluron was classified as harmless (<30%), imidacloprid and nimbecidine as slightly harmful (30-79%), spinosad, profenophos, quinalphos and thiodicarb as moderately harmful (80-99%).

The present findings are consistent with that of Jalali and Singh (2003) [1] who reported that nimbecidine caused a slight reduction in parasitism by *T. chilonis.* Ramesh and Manickvasagam (2006) [4] also reported nimbecidine to cause significantly lower parasitism by *T. chilonis* than control which is in tune with current results.

Effect of different insecticides on adult emergence of *A. bambawalei* from the successfully parasitized mealybugs (sprayed before parasitization)

Among the insecticides highest adult emergence was recorded in novaluron (85.42%) which was followed by imidacloprid (80.08%), nimbecidine (73.22%) and thiodicarb (67.30%). Spinosad seemed much toxic as resulted in only 8.36 per cent adult emergence. Profenophos and quinalphos proved to be most toxic as there was no adult emergence. Therefore application of spinosad, profenophos and quinalphos should be avoided in the field when adult parasitoids are active in order to conserve the parasitoid. Based on the reduction in adult emergence over control the insecticides were classified into different toxicity categories. Imidacloprid, thiodicarb, novaluron and nimbecidine were classified as harmless (<30%), spinosad as moderately harmful (30-79%) and profenophos and quinalphos as harmful (>99%).

The present findings are in accordance with those of Khattak and Rashid (2006) [2] and Ramesh and

Table 1: Effect of different insecticides on parasitisation (number of mealybugs parasitized) of solenopsis mealybug by *A. bambawalei*

Treatments	Dose/lt of water	Number of mealybugs parasitized (mummies)	Percent parasitiz-ation	Reduction in parasitiz-ation over control (%)	Toxicity category
Imidacloprid	0.3ml	21.80 (4.77)*	43.62 (41.29)#	52.50	II
Novaluron	1ml	38.20 (6.26)	76.40 (60.92)	11.50	I
Spinosad	0.4ml	4.20 (2.26)	8.40 (21.45)	90.18	III
Nimbecidine	5ml	22.44 (4.82)	44.81 (41.94)	51.00	II
Profenophos	3ml	1.71 (1.62)	3.40 (6.07)	96.02	III
Quinalphos	4ml	1.50 (1.55)	3.00 (6.07)	96.49	III
Thiodicarb	1.5g	4.20 (2.25)	8.40 (21.44)	90.19	III
Control	-	42.81 (6.61)	85.61 (67.93)	-	-

C.D.(p=0.05)		(0.36)	(3.86)		

* Figures in parentheses in the column are means of square root transformed values

* Figures in parentheses in the column are means of angular transformed values

Manickavasagam (2006)[4] who have also reported that nimbecidine and neem oil though significantly affected the parasitization did not show negative effect on the adult emergence of *T. chilonis*.

Effect of insecticides on sex and longevity of *A. bambawalei* adults emerged from parasitized mealybugs (sprayed before parasitization)

There was no significant difference in the percentage of females and males in the progeny of the parasitoid in different treatments. The per cent females and males in the progeny of the parasitoid

Table 2: Effect of different insecticides on adult emergence of *A. bambawalei* from the successfully parasitized mealybugs (sprayed before parasitization)

Treatments	Dose/lt of water	Adult emergence (%)	Reduction in adult emergence over control (%)	Toxicity category
Imidacloprid	0.3ml	80.08 (63.51)	14.00	I
Novaluron	1ml	85.42 (67.70)	8.22	I
Spinosad	0.4ml	8.36 (16.74)	91.01	III
Nimbecidine	5ml	73.22 (58.96)	21.33	I
Profenophos	3ml	0.00 (0.99)	100	IV
Quinalphos	4ml	0.00(0.99)	100	IV
Thiodicarb	1.5g	67.30 (55.19)	27.69	I
Control	-	93.08 (74.88)	-	-
C.D.(p=0.05)		(3.77)		

Figures in parentheses are means of angular transformed values

Table 3: Sex and longevity of *A. bambawalei* adults emerged from parasitized mealybugs (sprayed before parasitization)

Treatments	Dose/lt of water	Females in progeny (%)	Males progeny (%)	Longevity (days)
Imidacloprid	0.3ml	78.76 (62.58)	21.24 (28.77)	9.62
Novaluron	1ml	73.22 (58.83)	26.78 (29.82)	12.03
Spinosad	0.4ml	77.88 (64.71)	22.12 (26.53)	1.28
Nimbecidine	5ml	74.64 (59.76)	25.36 (29.94)	14.63
Profenophos	3ml	-	-	-
Quinalphos	4ml	-	-	-
Thiodicarb	1.5g	76.46 (60.98)	23.54 (30.61)	7.86
Control	-	76.92 (64.11)	23.08 (25.85)	19.43
C.D.(p=0.05)		(NS)	(NS)	1.95

Figures in parentheses are means of angular transformed values

in different treatments ranged from 73.22 to 78.76 and 22.12 to 26.78, respectively.

Among all the treatments highest adult longevity was observed in control (19.43 days). Among the insecticides, highest adult longevity was observed in nimbecidine (14.63 days) followed by novaluron (12.03 days), imidacloprid (9.62 days), thiodicarb (7.86 days) and spinosad (1.28 days). It was concluded that there was no effect of insecticides on the sex ratio of the parasitoid when the pupae of the parasitoid were sprayed with different insecticides. On the basis of the results on adult emergence and adult longevity it can be concluded that although adult emergence was not significantly reduced in case of imidacloprid, novaluron and nimbecidine as compared to control but the adult longevity was significantly affected. The present findings are in line with those of Ramesh and Manickavasagam (2006)[4] who reported that the per cent females of *T. chilonis* emerging from parasitized eggs treated with different insecticides were on par with control.

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REFERENCES

[1] Jalali, S. K. and Singh, S. P. 2003. Effect of neem product and biopesticides on egg parasitoid, *Trichogramma chilonis* Ishii. *Journal of Applied Zoological Research*, **14**(2): 125-128.

[2] Khatak, M. K. and Rashid, M. 2006. Evaluation of neem (*Azadirachta indica*) oil, neem seed water extracts and Baythroid TM against bollworms and egg parasitoid, *Trichogramma chilonis*, *Pakistan Entomologist*, **28**(1):5-9.

[3] Pratissoli, D., Vianna, U. R., Oliveira, H. N. and Pereira, F. F. 2003. Efeito do armazenamento de ovos de *Anagasta kuehniella* (Lepidoptera: Pyralidae) nas caracteristicas biologicas de tres species de *Trichogramma* (Hymenoptera: Trichogrammitidae). *Revista Ceres*, **50**:95-105.

[4] Ramesh, B. and Manickvasagam, S. 2006. Non-killing effects of certain insecticides on the development and parasitic features of *Trichogramma* spp. *Indian Journal of Plant Protection*, **34**(1): 40-45.

[5] Sahito, H. A., Abro, G. H., Syed, T. S., Memon, S. A., Mal, B. and Kaleri, S. 2011. Screening of pesticides against cotton mealybug, *Phenacoccus solenopsis* Tinsley and its natural enemies on cotton crop. *International Research Journal of Biochemistry and Bioinformatics*, **1**(9):232-236.