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Field Efficacy of Biopesticides Against *Plusia signata* (Fabricius) on *Gloriosa superba*

M. Suganthy* and P. Sakthivel
Department of Agricultural Entomology,
Tamil Nadu Agricultural University, Coimbatore - 641 003.

Field experiments were carried out in the Department of Medicinal and Aromatic Crops, Tamil Nadu Agricultural University, Coimbatore and in the farmer's holdings at Vellipalayam from August, 2011 to December, 2011 to study the field efficacy of bio-pesticides against *Plusia signata* (Fabricius) on *Gloriosa superba*. The results of the experiments revealed that flavanoids recorded superiority in the management of *P. signata* starting from 3rd day after treatment and it was statistically on par with quinalphos. Pungam oil 3 ml/litre was next in the order of efficacy, followed by azadirachtin 1% and NSKE 5%. Efficacy of *Bacillus thuringiensis* (*Bt*) (2 ml/lit) was realized only at seven days after treatment and persisted even after 14 days of second spray. At 14 days after treatment, *Bt* was second in the order of efficacy next to chemical pesticides and flavanoids. From the findings of both the field trials, flavanoids (Max Ranger-D2®) from Maxgrow Biotech (P) Ltd, Ludhiana was adjudged and recommended as the best alternative to chemical pesticides in gloriosa eco-system and are recommended as one of the components in organic pest management.

Key words: *Gloriosa superba*, semilooper, *Plusia signata*, bio-pesticides, *Bt*, flavanoids

Glory lily, *Gloriosa superba* (Linnaeus) (Family : Liliaceae) is an important medicinal crop that originated from tropical Asia and Africa. It is the state flower of Tamil Nadu.It is a medicinal plant of immense value in the traditional systems of medicine in India. The seeds are of economic value and possess many medicinal and curative properties.The seeds contain alkaloid called colchicine and thiocolchicocide (Chaudari and Thakur, 1998). In Ayurveda and Unani systems of medicine, the tuber of the plant was well known due to its pungent, bitter, acrid, heating, antihelminthic, laxative, alexiteric and abortifacient nature. It was widely used in the treatment of gout, ulcers, leprosy, piles, inflammations, abdominal pains, intestinal worms, thirst, bruises, infertility and skin problem (THDC, 2002). According to Lyla *et al.* (1992), severe incidence of *Polytela gloriosae* was noticed on *G. superba* in the garden at the College of Horticulture, Vellanikara, Kerala during October-November, 1989. Rathikannu (2005) recorded lily caterpillar, *Polytela gloriosae* (Fabricius), semilooper, *Plusia signata* (Fabricius) and tobacco cutworm, *Spodoptera litura* (Fabricius) in *G. superba* apart from the natural enemies *viz.,* spiders, *Oxyopus sp* and ladybird beetle, *Chilomenes sexmaculatus* (Fabricius).

Neem is a rich source of insecticide in the tropics and its potential for the management of several insect pests. The unique properties of the toxic principles from the seeds of Meliaceae are repellent, antifeedant and insect growth regulation combined with low cost, local availability, safety to the environment and compatibility with the agroecosystem which emphasize their potential in insect pest management. The efficacy of all neem products was observed by Karmarkar and Bhole (2000) and several field studies on the efficacy of neem based insecticides have been conducted by many workers (Sarode *et al*., 1995; Bhatnagar and Sharma, 1995; Rao *et al*., 1993; Gowri *et al*., 2002; Rathikannu, 2005). Shankar *et al.* (1993) reported that *Bt* formulation was found to be superior over the conventional insecticides and pyrethroids for the management of *H. armigera*. Hence, the present study was undertaken to test the field efficacy of bio-pesticides and flavanoids against *P. signata* infesting *G. superba*.

*Corresponding author email: suganthyento@rediffmail.com

Materials and Methods

Field trials were carried out in the Department of Medicinal and Aromatic Crops, Tamil Nadu Agricultural University (TNAU), Coimbatore and in the farmer's holdings at Vellipalayam, Coimbatore during August, 2011 to December, 2011 to assess the efficacy of selected bio-pesticides and flavanoids against *P. signata* on *G. superba*. The experiments were conducted in randomized block design (RBD) with seven treatments and three replications (Table 1). *G. superba* was sown at a spacing of 60×45 cm. Recommended packages of practices were followed to raise good crop. Two rounds of sprays were given at 15 days interval. Pre-treatment count on pest population was taken before spraying. Post-treatment counts were taken at 1, 3, 5, 7 and 14

days after spraying. Fourteenth day count was taken as pre-treatment count for the second spray. Ten plants were selected at random from each plot and the larval count was recorded and expressed as number per plant. (* Flavanoids - Distilled purified flavanoids (6 %), Adjuvant spreader (42 %), Surfactant (22 %), Aqua (30 %)) The data from field trials were analyzed following the procedure described by Panse and Sukatme (1969).

Results and Discussion

Results of the field experiment conducted in the farmer's holdings at Vellipalayam revealed that the pre-treatment count on larval population ranged from 2.4 to 2.6 larvae per plant. At one day after spraying there was no significant difference among the treatments in the larval population except flavanoids and standard check quinalphos, which registered 2.10 and 2.07 larvae per plant, respectively. Similar trend was observed on 3rd day after treatment (DAT) also. At 5 DAT, significant population reduction was observed in all the treatments except *Bt*. Significant reduction in larval population was observed in flavanoids and quinalphos treated plots which recorded 0.27 and 0.20 larvae per plant, respectively at 5 DAT. At 7 DAT, cent per cent reduction in larval population was observed in flavanoids and quinalphos treatments followed by pungam oil, azadirachtin and neem seed kernel extract with a larval population of about 0.67, 0.87 and 0.97 larvae per plant respectively. Results of earlier studies suggest that spraying with NSKE 5% reduced the damage by *P. signata* to an extent of 35.92 to 45.83 per cent (Rathikannu, 2005). At 14 DAT, significant reduction in larval population was observed in *Bt* treated plots with a larval population of about 0.87 larvae per plant (Table 1).

Pre-treatment population count during second spraying ranged from 0.0 to 1.3 larvae per plant. There was no larval population in flavanoids and quinalphos treated plots during pre-treatment count of the second spray. There was no significant difference in the larval population of other treatments at one day after spraying. Similar trend was observed at third day after second spray also. At 5 DAT, significant reduction in larval population was observed in all the plots. Significant population reduction was observed in pungam oil (0.80 larvae per plant), azadirachtin (0.83 larvae per plant) and neem seed kernel extract (0.90 larvae per plant). At 7 DAT, significant reduction in larval population was observed in *Bt* treated plot (0.43 larvae per plant) followed by pungam oil (0.60 larvae per plant), azadirachtin (0.63 larvae per plant) and neem seed kernel extract (0.67 larvae per plant). At 14 days after second spraying, significant reduction in larval population was observed in *Bt* treated plots with a larval population of about 0.27 larvae per plant. Reduction in the larval population of *P. signata* in flavanoids treated plot was found to be on par with the standard chemical check quinalphos (Table 1).

Table 1. Efficacy of bio-pesticides against *Plusia signata* on *Gloriosa superba* at Vellipalayam

Treatment	(Larvae per plant)*									
	Days after I st Spray					Days after II nd Spray				
	1st day	3rd day	5th day	7th day	14th day	1st day	3rd day	5th day	7th day	14th day
NSKE 5%	2.33	2.20	1.83	0.97	1.13	1.10	1.07	0.90	0.67	1.23
	(1.00)^{bc}	(0.99)^{c}	(0.95)^{b}	(0.86)^{c}	(0.88)^{c}	(0.87)^{b}	(0.87)^{b}	(0.85)^{b}	(0.82)^{c}	(0.89)^{d}
Azadirachtin 1%	2.40	2.23	1.73	0.87	1.20	1.17	1.07	0.83	0.63	1.10
	(1.01)^{cd}	(0.99)^{c}	(0.94)^{b}	(0.85)^{c}	(0.89)^{c}	(0.88)^{b}	(0.87)^{b}	(0.84)^{b}	(0.81)^{c}	(0.87)^{c}
Pungam oil (3 ml / litre)	2.53	2.30	1.73	0.67	1.07	1.03	0.93	0.80	0.60	1.03
	(1.02)^{cd}	(1.00)^{c}	(0.94)^{b}	(0.82)^{b}	(0.87)^{c}	(0.87)^{b}	(0.85)^{b}	(0.84)^{b}	(0.81)^{c}	(0.87)^{c}
Bt (2 ml / litre)	2.63	2.60	2.43	1.37	0.87	0.97	0.93	0.93	0.43	0.27
	(1.03)^{d}	(1.02)^{d}	(1.01)^{c}	(0.90)^{d}	(0.85)^{b}	(0.86)^{b}	(0.85)^{b}	(0.85)^{b}	(0.78)^{b}	(0.76)^{b}
Flavanoid (1 ml / litre)	2.10	1.07	0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(Max ranger -D2)	(0.98)^{ab}	(0.87)^{b}	(0.76)^{a}	(0.71)^{a}	(0.71)^{a}	(0.71)^{a}	(0.71)^{a}	(0.71)^{a}	(0.71)^{a}	(0.71)^{a}
Quinalphos (2 ml / litre)	2.07	0.73	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	(0.98)^{a}	(0.83)^{a}	(0.75)^{a}	(0.71)^{a}	(0.71)^{a}	(0.71)^{a}	(0.71)^{a}	(0.71)^{a}	(0.71)^{a}	(0.71)^{a}
Control	2.50	2.63	2.80	3.10	4.70	4.77	4.80	5.07	5.20	7.07
	(1.01)^{cd}	(1.02)^{d}	(1.04)^{d}	(1.06)^{e}	(1.18)^{d}	(1.18)^{c}	(1.19)^{c}	(1.20)^{c}	(1.21)^{d}	(1.32)^{e}

In a column, means followed by a common letters are not significantly different at 5 % level , Figures in parenthesis are square root-transformed values, * Mean of three replications

Experimental results of the field trial conducted in the Department of Medicinal and Aromatic Crops, TNAU, Coimbatore revealed that the pre-treatment larval count ranged from 4.20 to 4.73 larvae per plant (Table 2). There was no significant reduction in larval population at one day after spraying. At 3 DAT, significant larval reduction was observed in flavanoids and quinalphos treated plots, with the larval population of 0.67 and 0.57 larvae per plant, respectively. At 7 DAT, flavanoids and quinalphos treated plots recorded cent per cent larval population reduction, followed by pungam oil (1.67 larvae per plant), azadirachtin (1.80 larvae per plant) and neem seed kernel extract (2.23 larvae per plant). At 14 DAT, *Bt* treated plots recorded significantly less number of *P. signata* (1.27 larvae per plant), as against 6.03 larvae per plant in untreated control plots. Flavanoids and quinalphos treated plots were completely free from the population of *P. signata* (Table 2).

Pre-treatment count on larval population before second spraying ranged from 0.0 to 6.03 larvae per plant. At 1, 3 and 5 DAT, flavanoids and the chemical check, quinalphos recorded their superiority by

Table 2. Efficacy of bio-pesticides against *Plusia signata* on *Gloriosa superba* at TNAU, Coimbatore

Treatment	(Larvae per plant)*									
	Days after Ist Spray					Days after IInd Spray				
	1st day	3rd day	5th day	7th day	14th day	1st day	3rd day	5th day	7th day	14th day
NSKE (5%)	4.23	4.07	3.87	2.23	2.67	2.63	2.43	2.30	1.43	1.83
	(1.15)^{c}	(1.14)^{b}	(1.12)^{b}	(0.99)^{b}	(1.03)^{c}	(1.03)^{c}	(1.01)^{d}	(1.00)^{d}	(0.91)^{d}	(0.95)^{d}
Azadirachtin (1%)	4.57	4.30	4.00	1.80	2.33	2.30	1.93	1.77	1.07	1.37
	(1.17)^{c}	(1.15)^{b}	(1.13)^{bc}	(0.95)^{b}	(1.00)^{c}	(1.00)^{c}	(0.96)^{cd}	(0.95)^{cd}	(0.87)^{cd}	(0.90)^{c}
Pungam oil (3 ml / litre)	4.53	4.30	3.97	1.67	2.13	2.13	1.70	1.50	1.00	1.20
	(1.17)^{b}	(1.15)^{b}	(1.13)^{bc}	(0.93)^{b}	(0.98)^{c}	(0.98)^{c}	(0.94)^{c}	(0.92)^{c}	(0.86)^{bc}	(0.89)^{c}
Bt (2 ml / litre)	4.57	4.53	4.43	3.23	1.27	1.13	0.90	0.83	0.73	0.30
	(1.17)^{c}	(1.17)^{b}	(1.16)^{cd}	(1.07)^{c}	(0.89)^{b}	(0.88)^{b}	(0.85)^{b}	(0.84)^{b}	(0.83)^{b}	(0.76)^{b}
Flavanoids (1 ml / litre)	4.23	2.33	0.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(Max ranger -D2)	(1.15)^{a}	(1.00)^{a}	(0.82)^{a}	(0.71)^{a}	(0.71)^{a}	(0.71)^{a}	(0.71)^{a}	(0.71)^{a}	(0.71)^{a}	(0.71)^{a}
Quinalphos (2 ml / litre)	3.77	2.03	0.57	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	(1.11)^{a}	(0.97)^{a}	(0.80)^{a}	(0.71)^{a}	(0.71)^{a}	(0.71)^{a}	(0.71)^{a}	(0.71)^{a}	(0.71)^{a}	(0.71)^{a}
Control	4.47	4.57	4.63	4.87	6.03	6.07	6.30	6.57	6.70	7.53
	(1.16)^{c}	(1.17)^{b}	(1.17)^{d}	(1.19)^{d}	(1.26)^{d}	(1.26)^{d}	(1.28)^{e}	(1.29)^{e}	(1.30)^{e}	(1.35)^{e}

In a column, means followed by a common letters are not significantly different at 5 % level, Figures in parenthesis are square root-transformed values, * Mean of three replications

registering cent percent mortality. At 7 DAT, significant reduction in larval population was observed in *Bt* treated plots (0.73 larvae per plant) followed by pungam oil (1.0 larvae per plant) and azadirachtin (1.07 larvae per plant). Significant larval reduction was observed in *Bt* treated plots (0.30 larvae per plant) at 14 DAT. Reduction in larval population in flavanoid treated plots were statistically on par with the chemical check quinalphos even after 14 days of second spraying (Table 2). The results were in accordance with the findings of Ramprasad *et al*. (1998), who reported that NSKE 5% was found to be effective as fenvalerate (0.01%) against *S. litura*. Rathikannu (2005) reported that spraying of NSKE 5% was better in reducing the damage by semilooper, *P. signata* to an extent of 35.92 to 45.83 per cent followed by NEEMAZAL T/S 1% 900 ml ha^{-1} (35.12 to 40.74%). Estoy *et al*. (1992) also reported that azadirachtin 1 % and NSKE 5 % bring about suppression of *S. litura* on green gram and on soybean (Soejinto, 1992).

Hence, it is concluded that flavanoids are highly comparable with chemical pesticides in the management of semilooper infesting *G. superba*. Thus, flavanoids are adjudged as the best alternative to the chemical pesticides in gloriosa eco-system and are recommended as one of the components in organic pest management for *P.signata*.

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