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Evaluation of insecticides against sapota fruit Borer, *Phycita erythrolophia* Hampson

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Abstract
The field experiment was conducted to study the evaluation of selected insecticides for managing sapota fruit borer, *P. erythrolophia* during November 2013-14 on Kalipatti variety at New Orchard, College of Agriculture, Dharwad during January 2013-14 on thirty six sapota trees chosen for the study. Randomized Block Design (RBD) was used for the experiment with three replications and twelve treatments. The mean Percent fruit damage in different treatments ranged from 13.70 to 34.65 Percent. Spinosad45 SC proved very effective in recording lowest fruit damage of 13.70 Percent followed by Profenophos 50 EC (14.23%), DDVP 76 EC (16.78%), rynaxypyr 20 SC (18.77) and indoxacarb 14.5 SC (18.78) whereas, the remaining treatments were less effective. However, highest fruit damage was noticed in untreated check (34.65%). Highest reduction in fruit damage over untreated check was recorded by spinosad 45 SC (60.46%), followed by profenophos 50 EC (58.93), DDVP 76 EC (51.57). Emamectin benzoate 5 SG prove to be less effective as it registered lowest reduction in fruit damage (29.40%). However by navoluron 10 EC (33.53%) and NSKE 5% (34.57%). respectively on kalipatti variety. The overall mean larval population/twig was lowest in spinosad 45 SC (4.50) followed by profenophos 50 EC (5.75), DDVP 76 EC (5.90), indoxacarb 14.5 SC (6.31), rynaxypyr 20 SC (6.48) and flubendiamide 480 SC (6.49). The Percent reduction in larval population was maximum in spinosad 45 SC (60.00) over in untreated check; this was followed by profenophos 50 EC (48.88) and DDVP 76 EC (47.55). Emamectin benzoate 5 SG however proved to be less effective as it recorded lowest reduction in larval population (42.90). Spinosad 45 SC proved to be highly effective in recording highest fruit yield of 5327 kg/ha followed by Profenophos 50 EC (5298kg/ha) and Flubendiamide 480 SC (4991kg/ha). Thus spinosad 45 SC proved best candidate in recording lowest fruit damage, minimum larval population, highest sapota fruit yield, against sapota fruit borer, *Phycita erythrolophia* on Kalipatti.

Keywords: Evaluation, Insecticides, Sapota fruit borer, *Phycita erythrolophia*

1. Introduction

Sapota (*Manilkara achras* (Mill.) Farsberg, syn. *Achras zapota* Linn.) belongs to family Sapotaceae is a native of Mexico. India is considered to be the largest producer of sapota in the world and it is being cultivated in an area of about 163.9 thousand ha with a production of 1495.0 metric tonnes by Anon [2]. It is widely grown in Maharashtra, Gujarat, Karnataka, Tamil Nadu, Kerala, Punjab and Haryana. Out of the total fruit production in India, Karnataka ranks first contributing 25 Percent of total production of sapota. More than 25 insect pests attack sapota [3]. Among the different pests, bud borer, mid rib folder, chiku moth and fruit flies are considered as major pests of sapota. Sapota fruit borer is a major and regular pest causing damage to the sapota crop under North Karnataka districts. At sapota orchard, Agriculture College, UAS Dharwad, sapota fruit borer *Phycita erythrolophia* Hampson was reported as a predominant species causing considerable damage to flower buds and fruits of sapota Vishwanath *et al*. [6] (1978) and the early instars larvae of sapota fruit borer, *P. erythrolophia* feeds on flower buds whereas the later instars cause damage to fruits by boring into pulp and due to its continuous feeding the excretary pellets get entrapped in silken web, thus resulting in premature fruit fall and pest was found active throughout the year. There is no literature pertaining to management of sapota fruit borer. However, considering the importance of *P. erythrolophia* the present investigation was undertaken in order to know the effectiveness of certain chemicals to control the sapota fruit borer, *Phycita erythrolophia* under north Karnataka conditions.

2. Materials and Methods

The field experiment was conducted to study the evaluation of selected insecticides for managing sapota fruit borer, *Phycita erythrolophia* during November 2013-14 on kalipatti variety thirty six sapota trees were seleceted at New Orchard, Agriculture College, Dharwad, University of Agricultural Sciences, Dharwad, Karnataka, India. Randomized Block Design (RBD) was used for the experiment with three replications and twelve treatments (Table 1). Only one spray was given and each tree was sprayed with the help of foot sprayer. The observations on damaged fruits were made from five randomly selected twigs on each marked/tagged sapota tree. The incidence of sapota fruit borer was recorded a day before and three, seven and twenty days after spray. The Percent damaged fruits were worked out. The data obtained from each of the objectives were subjected to statistical analysis after suitable transformation. The yield of fruit was recorded after each treatment. All the necessary recommended production packages of practices were followed during the crop season of sapota.

3. Results and Discussion

The larva of sapota fruit borer, *P. erythrolophia* damages by boring into fruits and feeding on pulp. A bored hole is seen on sapota fruits and due to continuous feeding the excretory pellets are seen on bored holes. Usually one larva was found in each affected fruit. Larva in its entire period feeds on fruits only but sometimes early larval instars rarely feed on flower buds by scarping the petals. The literature on the evaluation of insecticides for the management of sapota fruit borer, *P. erytholophia*is very scanty. Hence the literature in the bio efficacy of insecticides and evaluation of different molecules in the management of bud borer *A. achrasella* presented here under.

3.1 Field Efficacy of Insecticides

The Percent damage to fruits a day before imposition of treatments was uniform in all the treatments as indicated by non-significant differences (Table 2). Three days after spraying spinosad 45 SC recorded lowest fruit damage of 17.08 Percent being on par with profenophos 50 EC (18.00), DDVP 76 EC (19.12), rynaxypyr 20 SC (21.08) indoxacarb 14.5 SC (22.20) and flubendiamide 480 SC (22.33) and Malathion 50 EC (22.67). However untreated check recorded significantly highest fruit damage of 31.67 Percent being statically on par with emamectin benzoate 5 SG (26.19) and navoluron 10 EC (25.15%).

Seven days after spraying, significantly minimum Percent fruit damage was recorded in spinosad 45 SC (14.30) being on par with profenophos 50 EC (14.50), DDVP 76 EC (18.15), indoxacarb 14.5 SC (19.00), rynaxypyr 20 SC (19.11) and flubendiamide 480 SC (20.48). Whereas the untreated check recorded highest fruit damage of 33.36 Percent.

Twenty days after spraying spinosad 45 SC recorded lowest fruit damage of 9.73 Percent which is statistically on par with profenophos 50 EC (10.20), DDVP 76 EC (13.08). The highest fruit damage was recorded in untreated check (38.91) Percent.

The mean Percent fruit damage in different treatments ranged from 13.70 to 34.65 Percent. spinosad 45 SC proved to be very effective in recording lowest fruit damage of 13.70 Percent. This was followed by profenophos 50 EC (14.23), DDVP 76 EC (16.78), rynaxypyr 20 SC (18.77) and indoxacarb 14.5 SC (18.78) whereas, the remaining treatments were less effective. However, highest fruit damage was noticed in untreated check (34.65%). Highest reduction in fruit damage over untreated check was recorded by spinosad 45 SC (60.46%), followed by profenophos 50 EC (58.93), DDVP 76 EC (51.57). Emamectin benzoate 5 SG proved to be less effective as it registered the lowest reduction in fruit damage (29.40%). However by [5] navoluron 10 EC (33.53%) and NSKE 5% (34.57%). However application of profenophos (40%) + cypermethrin (4%) at the rate of 0.044 Percent proved effective against *A. achrasella* on sapota trees by Anon. [1] reported that Polytrin-C (profenophos and cypermethrin) at 0.044 Percent (0.69%) and Nurelle-D (chlorpyriphos and cypermethrin) at 0.055 Percent (1.40%) were significantly effective in controlling bud borer, *A. achrasella*.

These findings contradicts the present results Though theses insecticides were not systematic in nature, they were found effective in either on eggs, which were found on leaves, flowers and fruits. Sometimes part of the larval body is seen outside the holes of sapota fruit.

The literature on the efficacy of insecticides in the present study have not been evaluated by the previous workers. Thus it forms the first study on the evaluation of these new molecules against sapota fruit borer. However [4] reported the efficacy of conventional insecticides viz., monocrotophos and quinalphos against sapota fruit borer, *Phycita erythrolophia.*

3.2 Larval Population

The larval population one day before spraying was uniform in all the treatments which ranged from 7.53 to 10.17 as indicated by non-significant differences between the treatments (Table 3). Three days after spraying spinosad 45 SC recorded lowest larval population of 5.08/twing being statistically on par with profenophos 50 EC (7.02), flubendiamide 480 SC (7.08), DDVP 76 EC (7.10), indoxacarb 14.5 SC (7.18), rynaxypyr 20 SC, (7.41), *Bacillus thuringiensis* (7.73), Malathion 50 EC (7.89) and navoluron 10 EC (8.04). Maximum larval population of 10.29 / twig was recorded in untreated check. Seven days after spraying, all the chemical treatments were found to be effective in recoding the larval population revealed by non-significant differences which ranged from 4.77 to 8.70. Untreated check recorded highest larval population of 10.73/twig. Twenty days after spraying**,** spinosad 45 SC recorded lowest number of larvae (3.65/twig) being statistically on par with profenophos 50 EC (3.75), DDVP 76 EC(4.13), indoxacarb 14.5 SC (4.90), rynaxypyr 20 SC (5.07), and flubendiamide 480 SC (5.56). The highest larval population was registered in untreated check (11.77/twig).

The overall mean larval population/twig was lowest in spinosad 45 SC (4.50) followed by profenophos 50 EC (5.75), DDVP 76 EC (5.90), indoxacarb 14.5 SC (6.31), rynaxypyr 20 SC (6.48) and flubendiamide 480 SC (6.49). The Percent reduction in larval population was maximum in spinosad 45 SC (60.00) over in untreated check; this was followed by profenophos 50 EC (48.88) and DDVP 76 EC (47.55). Emamectin benzoate 5 SG however proved to be less effective as it recorded lowest reduction in larval population (42.90). Thus the mean larval population/twig was lowest in spinosad45 SC (4.50) followed by profenophos 50 EC (5.75), DDVP 76 EC (5.90) compare to other treatments.

3.3 Yield (kg/ha) in Kalipatti variety

Spinosad 45 SC (5327 kg/ha) proved to be highly effective in recording significantly highest sapota fruit yield being on par with profenophos 50 EC (5298kg/ha), Flubendiamide 480 SC

(4991kg/ha) (Table 2). Emamectin benzoate 5 SG (4530kg/ha), navoluron 10 EC (4593kg/ha), *Bacillus thuringiensis* (4692kg/ha) and NSKE 5% (4627kg/ha) were less effective compared to above mentioned insecticides. Malathion 50 EC (Standard check) was found to be less effective in recording higher yield. The lowest fruit yield was recorded in untreated check (4331 kg/ha)

Table 1: Details of treatments employed for the management of sapota fruit borer

SL. No.	Treatment Common name	Trade name	Dosage
1	Spinosad 45 SC	Tracer	0.3 ml/l
2	Flubendiamide 480 SC	Fame	0.1 ml/l
3	Emamectin benzoate 5 SG	Proclaim	0.2 g/l
4	DDVP 76 EC	Nuvon	0.5 ml/l
5	Profenophos 50 EC	Curacron	2.0 ml/l
6	Navoluron 10 EC	Rimon	1.0 ml/l
7	*Bacillus thuringiensis*	Dipel	2.0 kg/ha
8	Rynaxypyr 20 SC	Coragen	0.2ml/l
9	Indoxacarb 14.5 SC	Avunt	0.5ml/l
10	NSKE	Nimbicidine	5%
11	Malathion 50 EC (standard check)	Malathion	2.0 ml/l
12	Untreated check	-	-

Table 2: Efficacy of different insecticides on fruit damage due to Sapota fruit borer, *Phycita erythrolophia* on kalipatti variety during 2013-14

Treatments	Dosage/l	Percent fruit damage				Mean Percent fruit damage	Percent reduction in fruit damage over UTC	Yield Kg/ha
		1 DBS*	3 DAS**	7 DAS	20 DAS			
Spinosad 45 SC	0.3 ml	22.67	17.08 (24.34)[ab]	14.30 (22.19)[a]	9.73 (18.13)[a]	13.70	60.46	5327
Flubendiamide 480 SC	0.1 ml	23.71	22.33 (28.12)[a-d]	20.48 (26.89)[ab]	17.28 (24.42)[b-e]	20.03	39.39	4991
Emamectin benzoate 5 SG	0.2 g	25.41	26.19 (30.77)[de]	24.41 (29.59)[b]	22.74 (28.46)[e]	24.45	29.40	4530
DDVP 76 EC	0.5 ml	24.51	19.12 (25.65)[a-d]	18.15 (25.16)[ab]	13.08 (21.16)[ab]	16.78	51.57	5093
Profenophos 50 EC	2.0 ml	23.00	18.00 (25.09)[ab]	14.50 (22.37)[a]	10.20 (18.53)[a]	14.23	58.93	5298
Navoluron 10 EC	1.0 ml	27.67	25.15 (30.03)[c-e]	22.67 (28.41)[d]	21.28 (27.46)[be]	23.03	33.53	4593
Bacillus thuringiensis	0.002g/l	21.60	23.67 (29.00)[b-d]	22.58 (28.36)[b]	18.67 (25.38)[b-e]	21.64	37.54	4692
Rynaxypyr 20 SC	0.2ml	22.85	21.08 (27.31)[a-d]	19.11 (25.91)[ab]	15.15 (22.86)[bc]	18.77	45.82	4837
Indoxacarb 14.5 SC	0.5ml	23.19	22.20 (28.06)[a-d]	19.00 (25.60)[ab]	16.12 (23.62)[b-d]	18.78	45.80	4709
NSKE	5%	24.71	24.17 (29.38)[b-d]	23.49 (28.94)[b]	20.18c (26.65)[c-e]	22.61	34.57	4627
Malathion 50 EC (Standard check)	2.0 ml	24.15	22.67 (28.32)[a-d]	21.72 (27.75)[b]	19.10 (25.89)[c-e]	21.16	38.93	4738
Untreated check (UTC)	-	34.67	31.67 (34.02)[e]	33.36 (34.98)[c]	38.91 (38.52)[f]	34.65	-	4331
S.Em.±	-	5.22	1.54	1.76	1.47	1.18	-	-
CD 5%	-	NS	4.52	5.17	4.31	3.48	-	-
CV%	-		9.40	11.24	10.15	9.58	-	-

*DBS: Day before spray, **DAS: Days after spray.
*Figures in parentheses are arc sin transformed values

Table 3: Efficacy of different insecticides against larval population of Sapota fruit borer, *Phycita erythrolophia* on kalipatti variety during 2013-14

Treatments	Dosage/l	Mean larval population/ twig				Overall mean larval population /twig	Percent reduction in larval population over UTC
		1 DBS*	3DAS**	7DAS	20DAS		
Spinosad 45 SC	0.3 ml	7.79	5.08 (13.01)[a]	4.77 (12.58)[a]	3.65 (10.87)[a]	4.50	60.00
Flubendiamide 480 SC	0.1 ml	7.53	7.08 (15.45)[ab]	6.83 (15.13)[ab]	5.56 (13.52)[abc]	6.49	42.31
Emamectin benzoate 5 SG	0.2 g	9.18	9.52 (17.17)[b]	8.70 (14.87)[ab]	8.76 (17.16)[de]	8.99	20.08
DDVP 76 EC	0.5 ml	8.67	7.10 (15.50)[ab]	6.48 (15.86)[ab]	4.13 (11.45)[a]	5.90	47.55
Profenophos 50 EC	2.0 ml	8.41	7.02 (15.32)[ab]	6.45 (13.65)[ab]	3.77 (11.17)[a]	5.75	48.88
Navoluron 10 EC	1.0 ml	8.12	8.04 (16.44)[ab]	7.08 (15.33)[ab]	6.99 (15.24)[cd]	7.35	34.66
Bacillus thuringiensis	0.002g/l	7.74	7.73 (16.15)[ab]	6.98 (15.21)[ab]	6.41 (14.65)[bcd]	7.04	37.42
Rynaxypyr 20 SC	0.2ml	9.08	7.41 (15.82)[ab]	6.97 (15.29)[ab]	5.07 (12.29)[ab]	6.48	42.40
Indoxacarb 14.5 SC	0.5ml	9.74	7.18 (15.45)[ab]	6.84 (15.18)[ab]	4.90 (12.77)[abc]	6.31	43.91
NSKE	5%	9.67	9.19 (17.54)[b]	8.32 (16.77)[ab]	7.56 (15.89)[d]	8.36	25.68
Malathion 50 EC (Standard check)	2.0 ml	9.67	7.98 (16.22)[ab]	7.01 (15.37)[b]	6.81 (15.11)[cd]	7.29	35.20
Untreated check (UTC)	-	10.17	10.29 (22.01)[c]	10.73 (18.75)[b]	11.77 (19.61)[d]	11.25	-
S.Em.±		1.80	1.26	1.51	0.91	0.53	-
CD 5%	-	NS	3.70	6.00	2.66	1.57	-
CV%	-		13.22	17.41	11.06	13.29	-

*DAS: Day after spray, **DAS: Days after spray.*Values in the parentheses are √x+0.5 transformed value

4. Conclusion

Spinosad 45 SC proved to be best candidate in recording lowest fruit damage minimum larval population and highest sapota fruit yield followed by Profenophos 50 EC and DDVP 76 EC against sapota fruit borer, *Phycita erythrolophia* on Kalipatti

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