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Bioefficacy of Different Insecticides Against Sapota Bud Worm, *Anarsia Sp.* (Lepidoptera: Gelechidae)

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ABSTRACT: *Field studies were carried out to evaluate efficacy of insecticides viz Cartap hydrochloride 50 SP (0.05%), Spinosad 45 SC (0.0169 %), Indoxacarb 14.5 SC (0.0145%), Polytrin-C 44 EC (0.044 %), Karanj oil (*Pongamia pinnata*) (0.03%),* Bacillus thuringiensis *5 WP (0.0075%) against the bud borer,* Anarsia sp. *(Lepidoptera : Gelechidae). Results showed that among different treatments Spinosad 45 SC (0.0169 %),* Bacillus thuringiensis *5 WP (0.0075%) and Polytrin-C 44 EC (0.044 %) with lowest percent fruit infestation of 2.99, 4.51 and 5.35 highest fruit yield of 2757, 1945 and 1467kg/ ha were recorded, respectively followed by hydrochloride 50 SP (0.05%) recorded 7.36 percent fruit infestation and 1121 kg/ha fruit yield. While among the insecticides of Karanj oil (*Pongamia pinnata*) (8.54%), followed by Indoxacarb 14.5 SC (7.92 percent fruit infestation) with mean fruit yield of 959 and 1298 kg/ha were obtained, respectively. The economics of different insecticidal treatments revealed that Polytrin-C 44 EC @ 0.044 per cent had highest C: B ratio* i.e., *1:9.03 followed by* Bacillus thuringiensis*5 WP @ 0.0075 per cent (1:8.36).*

Key words: Anarsia sp., *Bioefficacy, Bud Worm, Sapota.*

INTRODUCTION

India is considered to be the largest producer of sapota in the world with an area of about 1.60 lakh hectares and production of 1424 metric tones as reported by Anonymous [1]. According to Anonymous [2] Chhattisgarh, covers 220 hectare area and yielding 748.5 metric tones of sapota fruits. Various factors are there which affects the yield of Sapota, among which damage caused by insect pests is one of the important factors. More than 25 insect pests attacks sapota [3, 7]. Among these, bud worm is a major and regular pest causing damage to the sapota crop. The larva of bud worm bore into the fruits, fungus attacked on infested fruit later drop down resulting direct impact on fruit yield. Jhala [5] recorded that bud borer damage ranged from 2.0 to 15.0 per cent and according to Sathish [6] bud borer damage ranged from 2.14 to 11.29 per cent. Excessive use of chemicals to control this pest not only causes economical restrain on farmers but also produces the harmful side effects on the environment as well as human beings. The best way to overcome this situation is application of appropriate insecticides with proper dose to destroy the pest at its initial stage of the life cycle. Hence, an investigation on bioefficacy of different insecticides against sapota bud worm, *Anarsia sp.* was carried out.

MATERIALS AND METHODS

The current experiment was conducted during August, 2013 – June, 2014 at the Horticulture Instructional Farm, TCB College of Agriculture and Research Station Bilaspur, a constituent College of Indira Gandhi Krishi Vishwavidyalaya, Raipur (Chhattisgarh) India, with seven treatments, replicated thrice in Randomized Block Design. Twenty one trees of sapota variety Kalipatti were randomly selected and the insecticidal treatments (Table 1) were applied with the help of foot sprayer on the onset of maximum pest incidence. Pre treatment observation were recorded a day before treatment. After treatment, observations were recorded on trees randomly selected of which four twigs in four directions (North,

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South, East, West) and the number of damaged fruit were recorded from randomly selected twenty fruit after 3,10 and 20 days of the first insecticidal application. The treatments were repeated after 28 days as the second round of spray schedule. Twenty fruit were observed from each direction per tree to record the damage caused by bud worm. The number of healthy and damaged fruit per twig was counted and percentage of infestation was worked out. The data thus generated was analyzed using arc sine transformations. The cost benefit ratio for each treatment was also worked out.

RESULTS AND DISCUSSION

The results presented in Table 1 indicates that the pretreatment observation, the fruit infestation was ranged from 7.08 to 9.58 per cent, which were recorded non significant differences among different treatments (Table 1). Three days after first spray, the fruit infestation was almost similar in all the treated trees in the range of 5.00 to 8.33 per cent and there were no significant differences among all the treatments. At ten days after first spray, the trees treated with Spinosad 45 SC recorded least fruit infestation (2.92%), it was at par with *Bacillus thuringiensis* 5 WP (5.42%) and Polytrin-C 44 EC (6.25%) but differed significantly from Indoxacarb 14.5 SC (8.33%),Cartap hydrochloride 50 SP (8.75%), Karanj oil (*Pongamia pinnata*) (9.58%) and untreated control (10.00%). At twenty days after spray, the trees treated with Spinosad 45 SC recorded least fruit infestation (1.25%), but differed significantly from *Bacillus thuringiensis* 5 WP (4.58%). The highest fruit infestation was recorded in Karanj oil (*Pongamia pinnata*) (10.83%) which was at par with Polytrin-C 44 EC (8.33%), Cartap hydrochloride 50 SP (9.17%) and Indoxacarb 14.5 SC (10.42%). The second spray was done 28 days after first spray. Pre treatment observations were recorded a day before treatment, in which the fruit infestation ranged from 7.50 to 9.58 per cent with non significant differences. After three days of treatment the fruit infestation ranged from 4.17 to 8.33 per cent, which differed non significantly among treatments. After ten days of spray, all treatments were superior over untreated control. The trees treated with Polytrin-C 44 EC and *Bacillus thuringiensis* 5 WP recorded least fruit infestation of 2.50 and 2.50 per cent, respectively, which was at par with Spinosad 45 SC (2.92%). Karanj oil (*Pongamia pinnata*) @ 0.03 per cent treatment observed least effective against bud worm, *Anarsia sp.* with highest fruit infestation of 7.08 per cent. Twenty days after spraying of insecticides, all treatments were significantly superior over untreated control. The trees treated with Spinosad 45 SC recorded least fruit infestation (1.25%). It was at par with *Bacillus thuringiensis* 5 WP with (1.67%) but differed significantly from Cartap hydrochloride 50 SP (7.92%) and Indoxacarb 14.5 SC (8.33%). The highest fruit infestation (9.58 %) was recorded in Karanj oil (*Pongamia pinnata*) @ 0.03 per cent, which was at par with Polytrin-C 44 EC (5.42%) and untreated control (10.83%). Thus, the overall per cent fruit damage data revealed that Spinosad 45 SC @ 0.0169 per cent was found most effective against bud worm, *Anarsia sp.*, as it recorded lowest fruit infestation of 2.99 per cent. The second best treatment was *Bacillus thuringiensis* 5 WP (4.51%) followed by Polytrin-C 44 EC (5.35%). Karanj oil (*Pongamia pinnata*) @ 0.03 per cent recorded highest fruit infestation (8.54 %) and declared least effective.

In this study, Spinosad 45 SC @0.0169 per cent was recorded most effective against bud worm, *Anarsia sp.* followed by *Bacillus thuringiensis* 5 WP and Polytrin-C 44 EC. Similarly, Suryavanshi and Patel [8] reported that Polytrin-C 44 EC @0.044 and *Bacillus thuringiensis* 5 WP @ 0.05 per cent effectively controlled the bud boring insect, *Anarsia achrasella* with 0.69 per cent and 1.75 per cent bud infestation, respectively. Deshmukh [4] also reported that Polytrin-C @ 0.044 per cent was effectively controlled the bud borer (*A. achrasella* and *N. eugraphella*). The highest fruit yield of sapota (2757 kg/ha) was recorded in Spinosad 45 SC treatment followed by *Bacillus thuringiensis* 5 WP (1945 kg/ha), Polytrin-C 44 EC (1467 kg/ha), Indoxacarb 14.5 SC (1298 kg/ha), Cartap hydrochloride 50 SP (1121 kg/ha), Karanj oil (*Pongamia pinnata*) (959 kg/ha) and untreated control (859kg/ha).

The economics of different insecticidal treatments presented in (Table 2.) indicated that Polytrin-C 44 EC @ 0.044 per cent had highest C: B ratio *i.e.*, 1:9.03 followed by *Bacillus thuringiensis*5 WP @ 0.0075 per cent (1:8.36), Spinosad 45 SC @ 0.0169 per cent (1:6.60), Karanj oil (*Pongamia pinnata*) @0.03 per cent (1:4.56), Cartap hydrochloride50 SP @ 0.05 per cent (1:2.83) and Indoxacarb 14.5 SC @ 0.0145 per cent (1:2.97). The present findings are in agreement with Suryavanshi and Patel [8] who also reported that Polytrin-C 44 EC @ 0.044 per cent had highest C: B ratio *i.e.,* 1:16.34.

Table 1
Bioefficacy of different insecticides against bud worm, *Anarsia sp.*

			Per cent fruit damage								Over all damage (%)
		Concentr-ation (%)	Before 1st Spray	First Spray			Before 2nd Spray	Second Spray			
S. No.	Treatments			3 DAS	10 DAS	20 DAS		3 DAS	10 DAS	20 DAS	
1	Cartap hydrochloride50 SP	0.05	7.50 (15.82)	6.25 (14.41)	8.75 (15.83)[b]	9.17 (17.59)[c]	8.75 (17.11)	7.50 (15.40)	4.58 (12.31)[b]	7.92 (16.25)[bc]	7.36 (15.69)[b]
2	Spinosad 45 SC	0.0169	8.33 (16.74)	5.42 (13.42)	2.92 (9.76)[a]	1.25 (6.29)[a]	8.33 (16.62)	4.17 (11.70)	2.92 (9.76)[a]	1.25 (6.29)[a]	2.99 (9.92)[a]
3	Indoxacarb 14.5 SC	0.0145	9.58 (17.83)	7.08 (15.40)	8.33 (16.74)[b]	10.42 (18.19)[c]	9.17 (17.49)	7.92 (16.13)	5.42 (13.30)[c]	8.33 (16.54)[bc]	7.92 (16.25)[b]
4	Polytrin-C 44 EC	0.044	7.92 (16.13)	5.00 (12.81)	6.25 (13.91)[a]	8.33 (16.67)[c]	7.92 (16.25)	4.58 (12.31)	2.50 (8.83)[a]	5.42 (12.88)[c]	5.35 (13.16)[ab]
5	Karanj oil (*Pongamia pinnata*)	0.03	6.67 (14.91)	5.83 (13.80)	9.58 (17.45)[b]	10.83 (19.05)[c]	9.58 (18.01)	8.33 (16.67)	7.08 (15.26)[d]	9.58 (18.01)[c]	8.54 (16.89)[b]
6	*Bacillus thuringiensis* 5 WP	0.0075	9.17 (17.49)	7.92 (16.12)	5.42 (13.31)[a]	4.58 (12.03)[b]	9.17 (17.59)	5.00 (12.65)	2.50 (6.90)[a]	1.67 (7.23)[a]	4.51 (12.05)[a]
7	Untreated control	–	7.08 (15.40)	8.33 (16.74)	10.00 (18.38)[b]	11.25 (19.51)[c]	7.50 (15.82)	7.92 (15.89)	8.33 (16.74)[e]	10.83 (19.14)[c]	9.44 (17.83)[b]
	SEm ±	–	1.35	1.06	1.48	1.42	0.12	1.90	0.21	1.27	0.70
	CD at 5%	–	NS	NS	4.56	4.39	NS	NS	0.64	3.91	2.17

* DAS-Days after spray
* Figures in parentheses are arc sin transformed values and those outside are original values.
* In a column treatment means marked with same letter do not show significant difference at 5 per cent level of significance.

Table 2
Economics of different insecticides against *Anarsia sp.* in sapota, *Achras sapota* L.

Treatments	Concentration per cent	Quantity of insectides used per ha (kg or Lit./ha)	Total cost of plant protection + labour cost	Fruit yield (kg/ha)	Net realization over control (Rs/ha)	C:B Ratio
Cartap hydrochloride 50 SP	0.05	2.50	3692	1121	10474	1:2.84
Spinosad 45 SC	0.0169	0.94	11479	2757	75935	1:6.62
Indoxacarb 14.5 SC	0.0145	2.10	5905	1298	17559	1:2.97
Polytrin-C 44 EC	0.044	2.50	2692	1467	24336	1:9.04
Karanj oil (*Pongamia pinnata*)	0.03	0.75	875.3	959	4005	1:4.58
Bacillus thuringiensis 5 WP	0.0075	3.75	5192	1945	43436	1:8.37
Untreated control	–	–	–	859	–	–
S.Em.±	–	–	–	1.51	–	–
C.D. at 5 %	–	–	–	4.66	–	–
C.V. (%)	–	–	–	25.35	–	–

*Total cost of plant protection used including labour charges.
*Market price of fruit @ Rs 40.00/kg

Cartap hydrochloride 50 SP	= Rs. 1200 Per kg
Spinosad 45 SC	= Rs. 11500 Per litre
Indoxacarb 14.5 SC	= Rs. 2480 Per litre
Polytrin-c 44 EC	= Rs. 800 Per litre
Karanj oil (*Pongamia pinnata*)	= Rs. 244.44 Per litre
Bacillus thuringiensis 5 WP	= Rs. 4500 Per kg

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