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Bio-efficacy of newer insecticides against sapota seed borer, *Trymalitis margarias* Meyrick

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Abstract
In the present study, bio-efficacy of newer insecticides against seed borer, *Trymalitis margarias* Meyrick was tested during three consecutive season of 2012-13, 2013-14 and 2014-15 at sapota orchards of Fruit Research Station, Navsari Agricultural University, Gandevi. The result revealed that profenofos 50 EC 0.075% minimized fruit damage up to 4.03 per cent as well as novaluron 10 EC 0.005% recorded 4.83 per cent fruit infestation put forward superiority over standard check acephate 75 SP 0.1125% (9.86%) and other pesticides. The highest marketable fruit yield of 17.02 and 16.98 t/ha was obtained by the application of profenofos 0.075% and novaluron 0.005%, with less fruit loss of 0.69 and 0.82 t/ha, respectively over other chemicals. While on economics basis, the higher B:C ratio was recorded in novaluron 0.005% (3.28), profenofos 0.075% (3.14) and indoxacarb 0.0036% (2.46). The residue was not detected at harvest of fruits 10 days after spraying of profenofos 0.075% and novaluron 0.005%.

Keywords: Bio-efficacy, Seed Borer, *Trymalitis margarias* Meyrick, Sapota

1. Introduction
Sapota or sapodilla [*Manilkara achras* (Mill.) Forsberg] is an important sweet fruit of tropical region has attained the status of major fruit crop after mango and banana in Gujarat [5]. About 16 insect pests and mites were identified by scientist in last two decades from sapota orchards in Gujarat [13]. However, continuous flowering and fruiting pattern of sapota in South Gujarat agro-ecological circumstances augment proliferation of insect pests in wider area with monoculturing supported by changing ecological condition.

Under monoculture of Kalipatti variety, seed borer, *Trymalitis margarias* Meyrick (Lepidoptera: Tortricidae) has become emerging insect pest for sapota causing very serious damage at peak fruiting stage, which deteriorates the economic superiority of fruits [11]. As the higher fruit damage noticed during October-December, the market price gets affected during this span as compare to later months. The seed borer is an exotic pest and first reported from Dahanu area of Maharashtra in year 2000 [12]. Since its introduction, now this monophagous and micro-lepidopteran pest has spread and established in major sapota growing belts of Gujarat, Maharashtra, Tamil Nadu and Karnataka [8].

After its introduction, about 21 and 40 per cent incidence of *T. margarias* was reported in Thane [7] and Navsari [1] region during 2001 and 2003, respectively. The fruit spoilage activity of seed borer constantly remains 8-10 per cent in October-November during 2010-11 at main fruiting phase [2]. With importance of seed borer damage intensity and necessity of management technology, the bio-efficacy of newer molecules with microbial pesticide, botanicals were tested under field to minimize the fruit loss.

2. Materials and Methods
2.1 Experimental details: Treatments and design of layout
An experiment was laid out during three consecutive seasons of 2012-13, 2013-14 and 2014-15 at sapota orchards of Fruit Research Station, Navsari Agricultural University, Gandevi for the management seed borer. The trial comprised of nine treatments with insecticide, microbial pesticide, botanicals and acephate as a standard check along with control. The trial was designed in RBD replicated thrice on Kalipatti variety of sapota planted on 10 x 10 m spacing. Each treatment was given to all the trees in a single line and the observations were taken from selected three trees considering one tree as one replicate. Total three sprays were imposed at an interval of 20 days.

2.2 Observations
From each tree, about 100 fruits were randomly observed and among them, damaged fruits were counted at each spray after 10 and 20 days based on which per cent infestation was worked out. The annual yield particularly between November to May span of healthy fruits was recorded each year and economics was calculated on pooled yield during concluding year. All the necessary recommended production packages of practices were followed during the crop season of sapota. The dissipation study for residue of the effective insecticides in fruit at harvest of 5, 7, 10 and 15 days after last spray of effective insecticide were tested by QuECAERS method (Pesticide residue in food by acetonitrile extraction and partitioning with magnesium sulfates) at Food Quality Testing Laboratory, NAU, Navsari during concluding year of trial.

2.3 Statistical Analysis
The data on fruit infestation values were duly transformed into the corresponding arc sing values and subjected to analysis of variance.

3. Results and Discussion
Seed borer (*T. margarias*) is an internal feeder and damaging symptoms appears at maturity of fruits through exit hole, which showed unique feeding habit that makes obscurity in damage identification. The just hatched caterpillars of seed borer bore hole on the surface of the fruit and make galleries through the fruit pulp. The caterpillars were of dark red colour. It reaches to the seed through boring the seed coat and finally damages the kernel of the fruit seed. The mature larvae emerge out of the infested fruit and further rotting of entry hole due to fungus and ants started spoilage, which deteriorates the quality of the fruits. The infested fruit becomes unfit for consumption just 3-4 days after way out of larvae from fruit during ripening and completed life cycle within 34-45 days [15].

Regarding the seasonal occurrence of seed borer infestation, peak activity was reported from October to December under South Gujarat agro-ecological situation [3, 4, 6]. Therefore, management practice initiated at start of October and insecticide evaluation results against seed borer during 2012-13 showed lowest fruit infestation up to 5.17 per cent due to profenofos 0.075%, followed by novaluron 0.005% with 6.83 per cent damage (Table 1). During succeeding second year 2013-14, the lowest fruit infestation was also reported in profenofos 0.075% (2.54%), followed by novaluron 0.005% (3.09%) at 10 DAS. However subsequently, the lowest fruit damage (3.54 and 3.31%) was obtained with novaluron 0.005%, which was found similar with profenofos 0.075% (4.14 and 3.34% at 20 DAS and average values, respectively).

In concluding third year trial (2014-15), the performance of insecticides against seed borer revealed reduced fruit infestation up to 3.58 per cent on trees treated by profenofos 0.075%, which was found comparable with novaluron 0.005% exhibited 4.33 per cent fruit damage. Throughout study, standard check acephate 0.1125% found less effective than profenofos and nuvaluron, while the higher mean fruit infestation was observed under pongamia oil 1.0% and untreated plot.

The pooled data on evaluation of pesticides against seed borer indicated that lowest fruit damage due to profenofos 0.075% (3.29, 4.77 and 4.03%), followed by novaluron 0.005% (4.36, 5.29 and 4.83% at 10, 20 DAS and average values, respectively). Both the insecticides performed better over standard check acephate 0.1125% with 9.60, 10.12 and 9.86 per cent at 10, 20 DAS and average value, respectively which was also showed indifferent performance compare to indoxacarb 0.0036% and deltamethrin 0.003% against seed borer. All the treatment recorded significantly lower fruit infestation than untreated control (14.27%).

The harvesting of fruits was done in the span of November to May months with 6-7 pickings. The highest marketable yield of healthy fruits of 17.02 and 16.98 t/ha was obtained from trees sprayed by profenofos 0.075% and novaluron 0.005%, respectively. Both the insecticides performed better over standard check acephate 0.1125% had 13.04 t/ha fruit yield, which was also showed sub-standard as compare to deltamethrin 0.003% (13.93 y/ha) against seed borer. The minimum loss due to damage fruit yield was obtained in profenofos (0.69 t/ha) and novaluron (0.82 t/ha), whereas the higher loss was recorded in pongamia oil (1.43 t/ha) and *Bt* (1.42 t/ha) in terms of unhealthy fruit yield. With Regards to economics, the higher BC ratio was computed in novaluron 0.005% (3.28), profenofos 0.075% (3.14) and indoxacarb 0.0036% (2.46).

In the residue analysis report of the two insecticides through QuECAERS method, below detectable level (BDL) was reported at fruit harvest 10 days after last spraying in profenofos 0.075% and novaluron 0.005% with lesser value than quantification limit of 0.05 and 0.06 µg/g, respectively in both insecticides.

In earlier findings of Shinde *et al.* [14] in Maharashtra, profenofos 50 EC, deltamethirn 2.8 EC and lambda-cyhalothrin 5 EC showed significant results in reducing sapota seed borer damage, which similar with present results. While in contrast, Munj *et al.* [10] found emamectin benzoate 5 SG superior over lambda-cyhalothrin 5 EC, profenofos 40 EC and deltamethirn 2.8 EC. However, in comparison of ready-mix and individual insecticides study of Khambhu and Bisane [9], profenophos 0.075% found effective over other individual application of insecticides *viz.*, deltamethrin 2.8 EC, triazophos 40 EC and chlorpyriphos 20 EC against seed borer.

Table 1: Efficacy of different treatments against sapota seed borer (2012-15)

Tr. No.	Treatments	Per cent fruit infestation*							
		10 DAS				20 DAS			
		2012-13	2013-14	2014-15	Pooled	2012-13	2013-14	2014-15	Pooled
T_1	Profenofos 50 EC (0.075%) @ 1.5 ml/l	4.00 (11.44)	2.54 (9.11)	3.33 (10.44)	3.29 (10.33)	6.33 (14.50)	4.14 (11.71)	3.83 (11.25)	4.77 (12.49)
T_2	Novaluron 10 EC (0.005%) @ 0.5 ml/l	6.00 (14.14)	3.09 (10.04)	4.00 (11.50)	4.36 (11.89)	7.67 (16.05)	3.54 (10.81)	4.67 (12.42)	5.29 (13.09)
T_3	Fenobucarb 50 EC (0.1%) @ 2 ml/l	13.00 (21.11)	12.31 (20.53)	9.83 (18.24)	11.72 (19.96)	13.67 (21.69)	12.47 (20.66)	10.83 (19.18)	12.32 (20.51)
T_4	Indoxacarb 14.5 SC (0.0036%) @ 0.25 g/l	8.67 (17.09)	6.36 (14.52)	5.33 (13.23)	6.79 (14.95)	10.00 (18.41)	6.82 (15.10)	5.83 (13.94)	7.55 (15.82)
T_5	Deltamethrin 18.5 EC (0.003%) @ 0.16 ml/l	10.00 (18.41)	7.28 (15.47)	6.33 (14.48)	7.84 (16.12)	10.33 (18.74)	7.68 (16.04)	7.00 (15.29)	8.34 (16.69)

T_6	Acephate 75 SP (0.1125%) @ 1.5 g/l	12.67 (20.85)	8.29 (16.63)	7.83 (16.16)	9.60 (17.88)	13.00 (21.13)	8.87 (17.30)	8.50 (16.88)	10.12 (18.43)
T_7	*Bt* @ 2 g/l (1x10^{11}spores/ml)	12.33 (20.53)	11.67 (19.92)	10.83 (19.18)	11.61 (19.88)	12.67 (20.81)	11.53 (19.80)	11.33 (19.65)	11.84 (20.09)
T_8	Pongamia oil (1.0%)@ 2 ml/l + sticker	14.00 (21.95)	13.09 (21.13)	12.50 (20.66)	13.20 (21.25)	15.00 (22.77)	13.67 (21.68)	12.83 (20.96)	13.84 (21.80)
T_9	Control	14.67 (22.51)	13.86 (21.82)	13.17 (21.24)	13.90 (21.86)	15.34 (23.05)	14.73 (22.50)	13.83 (21.81)	14.63 (22.45)
SEm ± (T)		0.78	0.94	1.09	0.55	0.72	0.86	0.92	0.49
CD at 5%(T)		2.33	2.81	3.28	1.55	2.16	2.59	2.76	1.39
SEm ± (TxY)		--	--	--	0.94	--	--	--	0.84
CD at 5% (TxY)		--	--	--	NS	--	--	--	NS
CV%		7.21	9.80	11.74	9.56	6.34	8.66	9.48	8.11
* Figures in parenthesis are arc sin transformed values. DAS = Days after spraying.									

Table 2: Efficacy of different treatments against sapota seed borer and yield (2012-15)

Tr. No.	Treatments	Per cent fruit infestation (Average of post spray)*				Yield (t/ha)				Yield of damage fruits (t/ha)	BC Ratio	Residue limit
		2012-13	2013-14	2014-15	Pooled	2012-13	2013-14	2014-15	Pooled			
T_1	Profenofos 50 EC (0.075%) @ 1.5 ml/l	5.17 (12.97)	3.34 (10.41)	3.58 (10.85)	4.03 (11.41)	17.00	17.17	16.90	17.02	0.69	3.14	BDL
T_2	Novaluron 10 EC (0.005%) @ 0.5 ml/l	6.83 (15.09)	3.31 (10.43)	4.33 (11.96)	4.83 (12.49)	16.00	18.27	16.67	16.98	0.82	3.28	BDL
T_3	Fenobucarb 50 EC (0.1%) @ 2 ml/l	13.33 (21.40)	12.39 (20.60)	10.33 (18.71)	12.02 (20.23)	8.70	12.40	12.60	11.23	1.35	0.47	--
T_4	Indoxacarb 14.5 SC (0.0036%) @ 0.25 g/l	9.33 (17.75)	6.59 (14.81)	5.58 (13.59)	7.17 (15.38)	13.93	16.17	16.27	15.46	1.11	2.46	--
T_5	Deltamethrin 18.5 EC (0.003%) @ 0.16 ml/l	10.17 (18.58)	7.43 (15.76)	6.67 (14.88)	8.09 (16.41)	10.90	15.23	15.67	13.93	1.13	2.05	--
T_6	Acephate 75 SP (0.1125%) @ 1.5 g/l	12.83 (20.99)	8.58 (16.97)	8.17 (16.52)	9.86 (18.16)	10.53	14.13	14.47	13.04	1.29	1.46	--
T_7	*Bt* @ 2 g/l (1x10^{11}spores/ml)	12.50 (20.67)	11.60 (19.86)	11.08 (19.41)	11.73 (19.98)	10.23	12.87	13.27	12.12	1.42	0.90	--
T_8	Pongamia oil (1.0%)@ 2 ml/l + sticker	14.50 (22.36)	13.38 (21.40)	12.67 (20.81)	13.52 (21.53)	8.47	11.43	11.93	10.61	1.43	0.36	--
T_9	Control	15.00 (22.78)	14.30 (22.16)	13.50 (21.52)	14.27 (22.15)	6.47	10.53	11.17	9.39	1.34	--	ND
SEm ± (T)		0.52	0.60	0.64	0.36	0.71	0.69	0.83	0.44	--	--	--
CD at 5%(T)		1.48	1.70	1.83	1.02	2.13	2.07	2.50	1.29	--	--	--
SEm ± (TxY)		--	--	--	89.00	--	--	--	0.75	--	--	--
CD at 5% (TxY)		--	--	--	NS	--	--	--	NS	--	--	--
CV%		6.77	9.23	10.62	8.83	10.84	8.41	10.09	9.74	--	--	--
* Figures in parenthesis are arc sin transformed values.												
BDL- Below Detectable Level; ND- Not Detected.												

4. Conclusion

In line of wanting specific technology for sapota seed borer management in South Gujarat, alternate three applications of profenofos 50 EC (0.075%) @ 1.5 ml/l and novaluron 10 EC (0.005%) @ 0.5 ml/l at 20 days interval from October onwards significantly reduced the fruit loss and proportionately maximize of economic value of fruits in sapota. Beside, insecticide residual problem can be avoided by fruit harvesting 10 after days spray.

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6. References

1. Anon. Annual Report All India Coordinated Research Project on Tropical Fruits. Fruit Research Station, NAU, Gandevi. 2003-04, 32-34.
2. Anon. Annual Report All India Coordinated Research Project on Tropical Fruits. Fruit Research Station, NAU, Gandevi, 2010-11, 51-54.
3. Anon. Annual Report All India Coordinated Research Project on Tropical Fruits. Fruit Research Station, NAU, Gandevi. 2012-13, 57-58.
4. Anon. National Horticulture Data base Ministry of Agriculture, Government of India, 2012-13.
5. Anon. Annual Report All India Coordinated Research Project on Fruits. Fruit Research Station, NAU, Gandevi. 2013-14, 65-70.
6. Anon. Annual Report All India Coordinated Research Project on Fruits. Fruit Research Station, NAU, Gandevi. 2014-15, 55-56.
7. Dumbre MR, Desai BD, Mule RS, Mehendele SK, Jalgaonkar VN. Studies on seasonal incidence and biology of sapota seed borer, *Trymalitis margarias* Meyrick in Thane district. Pestology. 2004; 28(6):50-3.
8. Jayanthi PDK, Verghese A. Establishment of sapota seed borer, *Trymalitis margarias* Meyrick, an invansive species in India: Exigencies involved in limiting the spread. Karnataka Journal of Agricultural Sciences. 2010; 23(1):165.
9. Khambhu CV, Bisane KD. Population dynamics and management of sapota seed borer, *Trymalitis margarias* (Meyrick). Pest Management in Horticultural Ecosystems. 2015; 21(2):125-130.
10. Munj YA, Mule SR, Narangalkar LA. Integrated

management of sapota seed borer *Trymalitis margarias* Meyrick. Pestology. 2014; 38(8):36-39.
11. Patel AN, Saxena SP, Naik BM, Patel AR, Patel NL. Sapota Cultivation. *Pub*: Fruit Research Station, NAU, Gandevi, 2013, 29-38.
12. Patel ZP. Record of seed borer in sapota, *Manilkara achras* (Mill.) Forsberg. Insect Environment. 2001; 6(4):149.
13. Patel ZP. Insect pests of sapota and their management, In: Management of insect pests, diseases and physiological disorders of fruit crops. 2002, 110-113.
14. Shinde BD, Dahiphale AV, Mumj AY, Palshetkar MG. Evaluation of insecticides and biopesticides against sapota seed borer, *Trymalitis Margarias*, Meyrick. In: 99th Indian Science Congress held at KIIT, Bhubaneswar (Odisha), 2012, 75.
15. Shukla A. Seasonal incidence and biology of sapota seed borer, *Trymalitis margarias* Meyrick. Pak Entomology. 2009; 31(2):107-110.