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Bio-efficacy of insecticides against sapota insect pest complex under Junagadh conditions

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Abstract
Experiment was conducted under field condition At the RTTC Farm (Research Training and Testing Center) of Junagadh Agricultural University, Junagadh during the year 2017 to determine the bio-efficacy of different nine insecticides against sapota insect pest complex. The results showed that the treatment comprises of profenophos + cypermethrin 0.044 percent, flubendiamide 0.14 percent and indoxacarb 0.0079 percent were found most effective against infestation of chiku moth, bud borer and midrib folder, while the treatment of deltamethrin + triazophos 0.036 percent, dichlorovos 0.05 percent and flubendiamide 0.14 percent were found most effective against infestation of leaf miner.

Keywords: Sapota, chiku moth (*Nephopteryx eugraphellea* Ragonot), bud borer (*Anarsia achrasella* Bradley), leaf miner (*Achrocercops gemoniella* Stainton), midrib folder (*Banisia myrsusales earalis* Walker)

1. Introduction

The sapota *Manilkara achras* (Miller) Fosberg. belongs to family Sapotaceae, is commonly known as chiku, ciku, nasberry, sapodilla, chico. It is native of Maxico and Central America and now widely cultivated throughout the tropics. The pulp of fruit is useful for the preparation of sherbet and halwa [10]. The ripen fruits are used for making jams, jellies, osmodehydrated slices and squash [9]. It is largely grown for commercial purpose in Gujarat, Maharashtra, Karnataka, Tamil Nadu, Kerala, Uttar Pradesh, Haryana, Punjab and West Bengal [5]. In India, sapota ranks fifth in both production and consumption next to mango, banana, citrus and grape [12]. In India sapota is cultivated in 99 lakh ha area with a total production of 1236 lakh MT [1]. In Gujarat, it is grown under 30,010 ha area with a production of 3.31 lakh MT [2]. The sapota has flowering and fruiting throughout the year in warm and humid climatic condition that are also favorable for insect pests and diseases. More than 25 insect pests attacked to sapota tree [3]. Among the different insect pests attacking sapota, chiku moth (*Nephopteryx eugraphella*), bud borer (*Anarsia achrasella*) are major pests of sapota and active throughout the year on sapota tree. Therefore, present investigation of various insecticides against sapota insect pest complex was carried out in a South Saurashtra region of Gujarat under Junagadh condition.

2. Materials and Methods

To study the bio-efficacy of different insecticides against sapota insect pests, the experiment was laid out in CRD (Completely Randomized Design) with three replications and ten treatments. Kalipatti variety of sapota was planted earlier at 8 m × 8 m At the RTTC Farm (Research Training and Testing Center) of Junagadh Agricultural University, Junagadh.

2.1 Method of observations

In order to study the bio-efficacy of different insecticides, the treatment was evaluated based on percent infestation. In order to record the observation, eight twigs per plant were selected randomly and tagged and percent infestation were recorded, one day before and 1st day, 3rd day, 7th day and 10th day after treatment. The insecticidal spray was applied when the infestation of sapota insect pests were reached to threshold level. For insecticidal application, commercial formulation of various insecticides at given doses were prepared. The spray was carried out by foot sprayer / gator sprayer.

2.2 Observations recorded

1. Percent (%) damaged twigs of sapota by chiku moth (*N. eugraphella*).
2. Percent (%) damaged leaves of sapota by midrib folder (*B. myrsusalesearalis*) and leaf miner (*A. gemoniella*).
3. Percent (%) damaged buds of sapota by bud borer (*A. achrasella*) and chiku moth (*N. eugraphella*).

3. Results and Discussions

3.1 Results

3.1.1 Bio-efficacy of insecticides against infestation of chiku moth on twig

The result shown in Table 1 indicated that significantly the lowest percent of twig damage caused by chiku moth was recorded after 1st, 3rd, 7th and 10th DAS in the treatment of profenophos + cypermethrin 0.044 percent and it was at par with flubendiamide 0.14 percent and indoxacarb 0.0079 percent. The treatments of chlorantraniliprole 0.006 percent, dichlorovos 0.05 percent and deltamethrin + triazophos 0.036 percent which registered next effective treatments for the twig damage, respectively. Significantly highest percent of twig damage was recorded in the treatment of chlorpyriphos 0.05 percent and it was at par with quinalphos 0.05 percent and lamdacyhalothrin 0.0025 percent respectively.

3.1.2 Bio-efficacy of insecticides against infestation of chiku moth on bud

The result shown in Table 2 indicated that significantly the lowest percent of bud damage caused by chiku moth was recorded after 1st, 3rd, 7th and 10th DAS in the treatment of profenophos + cypermethrin 0.044 percent and it was at par with flubendiamide 0.14 percent and indoxacarb 0.0079 percent. The treatments of chlorantraniliprole 0.006 percent, dichlorovos 0.05 percent and deltamethrin + triazophos 0.036 percent which registered effective treatments for the bud damage, respectively. Significantly highest percent of bud damage was recorded in the treatment of chlorpyriphos 0.05 percent and it was at par with quinalphos 0.05 percent and lamdacyhalothrin 0.0025 percent respectively.

3.1.3 Bio-efficacy of insecticides against infestation of bud borer

The result shown in Table 3 indicated that significantly the lowest percent of bud damage caused by bud borer was recorded after 1st, 3rd, 7th and 10th DAS in the treatment of profenophos + cypermethrin 0.044 percent and it was at par with flubendiamide 0.14 percent and indoxacarb 0.0079 percent. The treatments of chlorantraniliprole 0.006 percent, lamdacyhalothrin 0.0025 percent and dichlorovos 0.05 percent which registered next effective treatments for the bud damage, respectively. Significantly highest percent of bud damage was recorded in the treatment of chlorpyriphos 0.05 percent and it was at par with quinalphos 0.05 percent and deltamethrin + triazophos 0.036 percent respectively.

3.1.4 Bio-efficacy of insecticides against infestation of leaf miner

The result shown in Table 4 indicated that significantly the lowest percent of leaf damage caused by leaf miner was recorded after 1st, 3rd, 7th and 10th DAS in the treatment of deltamethrin + triazophos 0.036 percent and it was at par with dichlorovos 0.05 percent and flubendiamide 0.14 percent. The treatments of profenophos + cypermethrin 0.044 percent, indoxacarb 0.0079 percent and chlorantraniliprole 0.006 percent which registered next effective treatments for the leaf damage, respectively. Significantly highest percent of leaf damage was recorded in the treatment of chlorpyriphos 0.05 percent and it was at par with quinalphos 0.05 percent and lamdacyhalothrin 0.0025 percent which registered respectively.

3.1.5 Bio-efficacy of insecticides against infestation of midrib folder

The result shown in Table 5 indicated that significantly the lowest percent of twig damage caused by midrib folder was recorded after 1st, 3rd, 7th and 10th DAS in the treatment of profenophos + cypermethrin 0.044 percent and it was at par with flubendiamide 0.14 percent and indoxacarb 0.0079 percent. The treatments of chlorantraniliprole 0.006 percent, dichlorovos 0.05 percent and deltamethrin + triazophos 0.036 percent which registered next effective treatments for the twig damage, respectively. Significantly highest percent of twig damage was recorded in the treatment of chlorpyriphos 0.05 percent and it was at par with quinalphos 0.05 percent and lamdacyhalothrin 0.0025 percent respectively.

Table 1: Bio-efficacy of insecticides against infestation of chiku moth (*N. eugraphella*) on sapota twig during year 2017

Sr No.	Treatment	Concentration (%)	Twig damage (%) caused by chiku moth (*N. eugraphella*)				
			Before Spray	1 DAS	3 DAS	7 DAS	10 DAS
1.	Indoxacarb 15.8 EC	0.0079%	26.62 (20.07)	23.49 (15.89)	22.47 (14.61)	20.92 (12.75)	22.11 (14.17)
2.	Chlorantraniliprole 18.5 SC	0.006%	28.66 (23.01)	27.33 (21.08)	26.63 (20.09)	24.65 (17.40)	25.68 (18.78)
3.	Flubendiamide 480 SC	0.14%	26.86 (20.41)	22.62 (14.80)	21.75 (13.73)	20.13 (11.84)	21.11 (12.97)
4.	Dichlorovos 76 EC	0.05%	29.34 (24.01)	27.99 (22.02)	27.34 (21.10)	25.63 (18.71)	26.69 (20.18)
5.	Lamdacyhalothrin 5 EC	0.0025%	32.61 (29.05)	31.72 (27.65)	30.64 (25.97)	29.67 (24.51)	30.41 (25.62)
6.	Profenophos + Cypermethrin 44 EC	0.044%	26.79 (20.32)	21.77 (13.76)	20.82 (12.64)	18.75 (10.33)	19.68 (11.34)
7.	Deltamethrin + Triazophos 36 EC	0.036%	30.85 (26.29)	28.78 (23.17)	27.91 (21.91)	26.38 (19.75)	27.28 (21.00)
8.	Quinalphos 25 EC	0.05%	33.19 (29.97)	32.31 (28.56)	31.25 (26.91)	30.39 (25.59)	31.12 (26.71)
9.	Chlorpyriphos 20 EC	0.05%	33.31 (30.16)	32.64 (29.09)	31.69 (27.59)	30.67 (26.02)	31.34 (27.05)
10.	Control	-	32.41 (28.73)	33.05 (29.75)	33.55 (30.54)	34.20 (31.60)	34.65 (32.33)
S.Em ±			1.82	1.29	1.26	1.16	1.23
C.D. at 5%			NS	3.78	3.69	3.42	3.61
C.V.%			10.49	7.90	7.94	7.71	7.87

DAS = Days After Spray.

The figures in parentheses are retransformed values, those outside are arcsine transformed values.

Table 2: Bio-efficacy of insecticides against infestation ofchiku moth (*N. eugraphella*) on sapota bud during year 2017

Sr No.	Treatment	Concentration (%)	Bud damage (%) caused by chiku moth (*N. eugraphella*)				
			Before Spray	1 DAS	3 DAS	7 DAS	10 DAS
1.	Indoxacarb 15.8 EC	0.0079%	16.00 (7.60)	14.09 (5.93)	12.93 (5.01)	11.65 (4.08)	12.63 (4.78)
2.	Chlorantraniliprole 18.5 SC	0.006%	17.09 (8.63)	15.59 (7.22)	14.23 (6.05)	13.66 (5.58)	14.14 (5.97)
3.	Flubendiamide 480 SC	0.14%	16.63 (8.19)	13.47 (5.43)	12.25 (4.50)	10.66 (3.42)	11.66 (4.08)
4.	Dichlorovos 76 EC	0.05%	17.44 (8.98)	16.32 (7.90)	14.83 (6.55)	14.26 (6.07)	14.85 (6.57)
5.	Lamdacyhalothrin 5 EC	0.0025%	19.33 (10.95)	18.15 (9.70)	17.18 (8.72)	15.80 (7.41)	16.73 (8.28)
6.	Profenophos + Cypermethrin 44 EC	0.044%	15.25 (6.92)	12.26 (4.51)	11.52 (3.99)	10.11 (3.08)	11.01 (3.64)
7.	Deltamethrin + Triazophos 36 EC	0.036%	19.04 (10.64)	16.85 (8.40)	15.40 (7.05)	14.84 (6.56)	15.34 (7.00)
8.	Quinalphos 25 EC	0.05%	19.89 (11.57)	18.90 (10.50)	17.62 (9.16)	16.02 (7.62)	16.99 (8.54)
9.	Chlorpyriphos 20 EC	0.05%	20.20 (11.92)	19.31 (10.93)	18.17 (9.72)	16.69 (8.25)	17.44 (8.98)
10.	Control	-	18.43 (10.00)	19.67 (11.33)	20.03 (11.73)	20.41 (12.17)	20.83 (12.64)
S.Em ±			1.14	0.71	0.66	0.59	0.66
C.D. at 5%			NS	2.10	1.93	1.72	1.93
C.V.%			10.97	7.50	7.39	7.05	7.50

DAS = Days After Spray.
The figures in parentheses are retransformed values, those outside are arcsine transformed values.

Table 3: Bio-efficacy of insecticides against infestation of bud borer (*A. achrasella*) on sapota bud during year 2017

Sr No.	Treatment	Concentration (%)	Bud damage (%) caused by bud borer (*A. achrasella*)				
			Before Spray	1 DAS	3 DAS	7 DAS	10 DAS
1.	Indoxacarb 15.8 EC	0.0079%	14.16 (5.99)	12.90 (4.98)	12.27 (4.51)	11.12 (3.72)	11.81 (4.19)
2.	Chlorantraniliprole 18.5 SC	0.006%	14.55 (6.31)	13.85 (5.73)	13.07 (5.12)	11.94 (4.28)	12.73 (4.85)
3.	Flubendiamide 480 SC	0.14%	14.00 (5.85)	12.22 (4.48)	11.80 (4.18)	10.60 (3.38)	11.38 (3.89)
4.	Dichlorovos 76 EC	0.05%	15.51 (7.15)	14.59 (6.34)	14.03 (5.87)	12.90 (4.98)	13.48 (5.44)
5.	Lamdacyhalothrin 5 EC	0.0025%	14.73 (6.46)	14.15 (5.98)	13.69 (5.60)	12.44 (4.64)	13.10 (5.14)
6.	Profenophos + Cypermethrin 44 EC	0.044%	14.18 (6.00)	11.57 (4.02)	11.16 (3.75)	10.04 (3.04)	10.92 (3.59)
7.	Deltamethrin + Triazophos 36 EC	0.036%	16.60 (8.17)	15.98 (7.58)	14.97 (6.67)	14.04 (5.88)	14.79 (6.52)
8.	Quinalphos 25 EC	0.05%	17.42 (8.96)	16.32 (7.89)	15.31 (6.97)	14.38 (6.17)	14.96 (6.66)
9.	Chlorpyriphos 20 EC	0.05%	17.67 (9.21)	16.73 (8.29)	15.88 (7.49)	14.79 (6.52)	15.33 (6.99)
10.	Control	-	15.69 (7.31)	17.10 (8.64)	17.54 (9.08)	18.01 (9.56)	18.38 (9.94)
S.Em ±			0.95	0.65	0.59	0.53	0.59
C.D. at 5%			NS	1.92	1.74	1.56	1.73
C.V.%			10.63	7.78	7.32	7.05	7.46

DAS = Days After Spray.
The figures in parentheses are retransformed values, those outside are arcsine transformed values.

Table 4: Bio-efficacy of insecticides against infestation of leaf miner (*A. gemoniella*) on sapota leaf during year 2017

Sr No.	Treatment	Concentration (%)	Leaves damage (%) caused by leaf miner (*A. gemoniella*)				
			Before Spray	1 DAS	3 DAS	7 DAS	10 DAS
1.	Indoxacarb 15.8 EC	0.0079%	15.35 (7.01)	14.16 (5.99)	13.10 (5.13)	11.91 (4.26)	12.28 (4.52)
2.	Chlorantraniliprole 18.5 SC	0.006%	16.18 (7.77)	14.52 (6.29)	13.98 (5.84)	12.93 (5.01)	13.54 (5.48)
3.	Flubendiamide 480 SC	0.14%	15.33 (6.99)	12.89 (4.98)	11.65 (4.08)	10.10 (3.08)	10.87 (3.56)
4.	Dichlorovos 76 EC	0.05%	15.10 (6.79)	11.98 (4.31)	10.82 (3.52)	9.72 (2.85)	10.30 (3.20)
5.	Lamdacyhalothrin 5 EC	0.0025%	16.72 (8.28)	15.99 (7.58)	14.51 (6.28)	13.60 (5.53)	14.08 (5.92)
6.	Profenophos + Cypermethrin 44 EC	0.044%	15.71 (7.34)	13.78 (5.67)	12.74 (4.86)	11.30 (3.84)	11.95 (4.29)
7.	Deltamethrin + Triazophos 36 EC	0.036%	13.56 (5.50)	11.40 (3.91)	10.10 (3.07)	8.63 (2.25)	9.40 (2.67)
8.	Quinalphos 25 EC	0.05%	17.39 (8.94)	16.32 (7.90)	15.08 (6.77)	13.97 (5.83)	14.36 (6.15)
9.	Chlorpyriphos 20 EC	0.05%	18.10 (9.65)	16.66 (8.22)	15.79 (7.41)	14.67 (6.41)	15.18 (6.86)
10.	Control	-	16.78 (8.34)	17.64 (9.19)	17.98 (9.52)	18.57 (10.14)	19.01 (10.61)
S.Em ±			0.95	0.67	0.59	0.51	0.55
C.D. at 5%			NS	1.96	1.73	1.50	1.61
C.V.%			10.27	7.93	7.53	7.05	7.23

DAS = Days After Spray.
The figures in parentheses are retransformed values, those outside are arcsine transformed values.

Table 5: Bio-efficacy of insecticides against infestation of midrib folder (*B. myrsusalesearalis*) on sapota leaf during year 2017

Sr No.	Treatment	Concentration (%)	Leaves damage (%) caused by midrib folder (*B. myrsusalesearalis*)				
			Before Spray	1 DAS	3 DAS	7 DAS	10 DAS
1.	Indoxacarb 15.8 EC	0.0079%	21.42 (13.34)	18.13 (9.68)	16.22 (7.80)	14.94 (6.65)	15.74 (7.36)
2.	Chlorantraniliprole 18.5 SC	0.006%	21.78 (13.76)	20.88 (12.70)	18.87 (10.46)	17.54 (9.09)	18.45 (10.01)
3.	Flubendiamide 480 SC	0.14%	21.86 (13.86)	17.47 (9.02)	15.50 (7.14)	14.28 (6.09)	15.00 (6.70)
4.	Dichlorovos 76 EC	0.05%	22.74 (14.94)	21.72 (13.70)	19.64 (11.30)	18.07 (9.62)	19.08 (10.68)
5.	Lamdacyhalothrin 5 EC	0.0025%	25.44 (18.45)	24.36 (17.02)	23.05 (15.33)	21.63 (13.59)	22.29 (14.39)
6.	Profenophos + Cypermethrin 44 EC	0.044%	20.84 (12.65)	16.44 (8.01)	14.73 (6.47)	13.06 (5.10)	14.00 (5.85)
7.	Deltamethrin + Triazophos 36 EC	0.036%	23.42 (15.80)	22.28 (14.37)	20.23 (11.96)	18.96 (10.55)	19.70 (11.36)
8.	Quinalphos 25 EC	0.05%	25.52 (18.56)	24.60 (17.33)	23.53 (15.93)	22.04 (14.09)	22.79 (15.01)
9.	Chlorpyriphos 20 EC	0.05%	26.05 (19.29)	25.22 (18.15)	24.09 (16.66)	22.37 (14.48)	23.36 (15.72)
10.	Control	-	25.53 (18.58)	26.53 (19.96)	26.92 (20.50)	27.32 (21.07)	27.38 (21.15)
S.Em ±			1.30	0.98	0.87	0.79	0.85
C.D. at 5%			NS	2.89	2.57	2.31	2.50
C.V.%			9.63	7.82	7.47	7.16	7.44

DAS = Days After Spray.
The figures in parentheses are retransformed values, those outside are arcsine transformed values.

4. Discussions

The results of present investigation are in conformation with bio-efficacy of new synthetic insecticides against *N. eugraphella* and *A. achrasella*, the treatment of Polytrin-C 0.044 percent was the most effective followed by lamda-cyhalothrin 0.05 percent, Nurella-D 0.055 percent, profenophos 0.05 percent, monocrotophos 0.05 percent and DDVP 0.035 percent [6]. Nine different insecticides against *A. achrasella* on sapota, the insecticides Polytrin- C @ 0.044 percent (0.69%) and Nurella-D @ 0.055 percent (1.40%) were superior to rest of the insecticides, but it was at par with *B. thuringiensis*@ 0.05 percent (1.75%) [11]. Treatment with profenophos + cypermethrin 0.044 percent was most effective against *N. eugraphella* on the basis of percent shoot damage [8]. Efficacy of insecticides against the bud borer, results showed that among different treatments spinosad 45 SC (0.0169%), *B. thuringiensis* 5 WP (0.0075%) and Polytrin-C 44 EC (0.044%) were recorded lowest fruit infestation of 2.99, 4.51 and 5.35 percent, 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 (8.54%), followed by indoxacarb 14.5 SC (7.92% fruit infestation) [7]. The treatment with profenophos + cypermethrin 0.044 percent and flubendiamide 480 SC 0.15 percent was the most effective against *N. eugraphella* on the basis of percent leaf and bud damage [4].

5. Conclusion

Among the nine insecticides evaluated against sapota insect pest complex, the treatment of profenophos + cypermethrin 0.044 percent, flubendiamide 0.14 percent and indoxacarb 0.0079 percent were found the most effective. The treatments of chlorantraniliprole 0.006 percent, dichlorovos 0.05 percent and deltamethrin + triazophos 0.036 percent were mediocre in effectiveness, while treatments of lamda cyhalothrin 0.0025 percent, quinalphos 0.05 percent and chlorpyriphos 0.05 percent were found least effective against infestation of chiku moth, bud borer and midrib folder. The treatment of deltamethrin + triazophos 0.036 percent, dichlorovos 0.05 percent and flubendiamide 0.14 percent were found most effective, while treatment of lamdacyhalothrin 0.0025 percent, quinalphos 0.05 percent and chlorpyriphos 0.05 percent were found least effective against infestation of leaf miner.

6. References

1. Anonymous. Final estimate of area and production of horticulture crops National Horticultural Board, Gurgaon, India, 2016-2017. http://nhb.gov.in/statistics/State_Level/2016-17(Final).pdf. 2018a.
2. Anonymous. District wise estimated data in area and production of fruits crops in Gujarat state during 2016-17. Retrieved https://doh.gujarat.gov.in/horticulture-census-guj.htm, 2018 b.
3. Butani DK. Insects and fruits. Periodical Expert Book Agency, Delhi-110032, 1979, 87-94.
4. Chaudhary HK. Bionomics, population dynamics and management of chiku moth, *Nephopteryx eugraphella* (Ragonot) infesting sapota, *Manilkara achras* (Mill.) Forsberg. M.Sc. (Agri.) thesis submitted to AAU, Anand, 2016.
5. Cheema GS, Bhat SS, Naik KC. Commercial fruit of India. McMillan and Co., Calcutta, 1954, 1-422.
6. Deshmukh DV. Varietal screening of sapota against pest complex, comparative biology of *Anarsia achrasella* and bio-efficacy of chemical insecticides against bud boring insects of sapota. M.Sc. (Agri.) thesis submitted to GAU, Sardarkrushinagar, 2001.
7. Ghirtlahre SK, Sahu CM, Nirala YPS, Kerketta A. and Paikra KL. Bio-efficacy of different insecticides against sapota bud worm, *Anarsia achrasella* (Lepidoptera: *Gelechidae*). International Journal of Tropical Agriculture. 2015; 33(2):537-540.
8. Hajare AR, Patel JI, More PE, Dighule SB. Chemical control of chiku moth (*Nephopteryx eugraphella*) in North Gujarat Condition. International Journal of Plant Protection. 2011; 4(2):349-352.
9. Reddy MG. Physico chemical investigations on sapota and its products. M.Sc. (Food Tech.) thesis submitted to, C.F.T.R.I., Mysore, Karnataka, 1959.
10. Singh S, Krishnamurthy S, Katyal SI. Fruit culture in India. ICAR, New Delhi, 1963, 192-198.
11. Suryavanshi SS, Patel BR. Evaluation of different insecticides against sapota bud borar, *Anarsia achrasella* Bradlay. Karnataka Journal of Agricultural Sciences. 2009; 22(3):722-729.
12. Tsomu T, Patel HC, Thakkar RM, Ajang M, Vasara RP. Response of post-harvest treatments of chemical and plant growth regulators on biochemical characteristics of sapota fruit cv. kalipatti. The Bioscan. 2015; 10(1):33-36.