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The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2023; SP-12(6): 32-36

www.thepharmajournal.com
Received: 12-04-2023
Accepted: 18-05-2023

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Synergist effect of Neem oil with different novel insecticides against diamondback moth, *Plutella xylostella* (Linn.) on cabbage

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Abstract
Background: Cabbage (*Brassica oleracea* var. capitata Linnaeus) is most important cole crop in India. It is attacked by the various important insect pests among them diamondback moth (*P. xylostella)* is major pest of cabbage, so farmers should use recommended management practices to harvest good yield.
Field studies were conducted at BTCCARS, Bilaspur (C.G.), to assess the synergist effect of neem oil with combination of different insecticides *viz*., Spinoza 2.5% SC + Neem oil, Spinoza 2.5% SC, Indoxacarb 14.5% SC + Neem oil, Indoxacarb 14.5% SC, Flubendamide 39.35% SC + Neem oil, Flubendamide 39.35% SC, Emamectin benzoate 5% SG+ Neem oil and Emamectin 5% SG against diamond back moth, *Plutella xylostella* (Linn.) on cabbage during 2021-22.
Result: To work out the efficacy against diamondback moth (*P. xylostella* Linn.) on the basis of one year experimentation it may be stated that treatment T3 Spinosad 2.5% SC+ neem oil was found highly efficious in reducing diamond back moth populations followed by treatment T2 Spinosad 2.5% SC.

Keywords: Efficacy, *Plutella xylostella*, insecticides, *Azadiracta indica*

Introduction
Cabbage (*Brassica oleracea* var. capitata Linnaeus) is an extensively grown vegetable in the world & originated from Cyprus and Mediterranean region. India is the second largest producer of vegetables in the world next only to china. In India, area under cultivation of cabbage is around 4.03 lakh hectares with annual production of 93.69 lakh metric tones during the year 2019-20. (Anonymous, 2021) [1]. However cabbage production is greatly constrained by a number of pest. These include the diamond back moth, *Plutella xylostella* (Linnaeus), cabbage butterfly, *Pieris brassicae* (Linnaeus), cabbage aphid, *Brevicoryne brassicae* (Linnaeus), leaf webber, *Crocidolornia binotalis* (Zeller), cabbage cutworm, *Spodoptera litura* (Fabricius), painted bug, *Bagrada cruciferarwn* (Kirkaldy), head eating caterpillar, *Helicoverpa armigera* (Hubner) and mustard sawfly, *Athalic aproxima* (Klug). The most serious among them, diamond back moth, *P. xylosteIla*, which has a cosmopolitan distribution (Talekar and Shelton, 1993) [3]. It is believed to be the most universally distributed species among the Lapidoptera, and it occurs wherever brassicas are grown.
Sometimes damage percentage reached up to 90 per cent (Verkerk and Wright, 1996) [8]. In India, diamondback moth was first reported in 1914 (Fletcher, 1914) [5] on cruciferous vegetables now it is distributed throughout the country. The loss could be 52%inyield due to the attack of diamond back moth. In India, diamond back moth has national importance on cabbage as it causes50-80 percent annual loss in the marketable yield (Devjani *et al*. 1999) [4]. Under severe cases of infestation, the losses could be more than 80 per cent (Chelliah and Srinivasan, 1986). Diamondback moth is highly migratory, diamondback moth is most destructive in areas where there is frequent application of insecticides. In India the control of diamondback moth relies heavily on the use of synthetic insecticides. However, it has been demonstrated that diamondback moth quickly develops resistance to many new insecticides. It has developed resistance to most synthetic pyrethroids, organophosphates, carbonates, in many cabbage growing areas of the world (Kalra *et al*., 1997) [6]. This represents a serious threat to its effective management. Unfortunately, in India the control of diamondback moth is still heavily dependent on these conventional synthetic pesticides. The major limitations of this method are high cost of cash inputs and insecticidal hazards. On the other hand, control of cabbage insect pests is difficult due to its fast development rate and high reproductive potential. To achieve satisfactory control of this noxious and destructive pest, testing and

Evaluation of newer insecticides along with botanicals is quite necessary. Efforts were therefore, made in the present investigation.

Methods and Materials

Bilaspur comes under the tropical region of India is situated in central part of Chhattisgarh plains. The experiment was conducted at Instructional farm of Barrister Thakur Chhedilal College of Agriculture and Research Station, Bilaspur, a constituent college of Indira Gandhi Krishi Vishwavidyalaya, Raipur (Chhattisgarh), during *rabi* season 2021-2022**.** Bilaspur, the place of investigation, is situated in the central part of Chhattisgarh at 21°47' and 23°8' N latitude, 81°14' and 83°15' E longitude and at altitude of 263 meters above the mean sea level. This place falls under dry sub humid region of the country. Following randomized block design with ten treatments.

Table 1: Details of insecticidal treatments

S.N.	Treatments	Dose	Concentration
1.	Neem Oil (Azadirachtin 10000ppm)	3ml./l.	0.03%
2.	Spinosad 2.5% SC	1.2 ml./l.	0.12%
3.	Spinosad 2.5% SC +Neem Oil	0.6 ml/l.+3ml./l.	0.06+0.03%
4.	Indoxacarb 14.5 % SC	0.5ml /l	0.05%
5.	Indoxacarb 14.5% SC + Neem Oil	0.25ml /l+3 ml./l.	0.025+0.03%
6.	Flubendamide 39.35% SC	0.1ml /l	0.01%
7.	Flubendamide 39.35% SC + Neem Oil	0.05ml /l+3 ml./l.	0.005+0.03%
8.	Emamectin benzoate 5% SG	0.36ml /l	0.036%
9.	Emamectin benzoate 5% SG + Neem Oil	0.18 ml./l+3 ml./l	0.018+0.03%
10.	Control (plain water)		

To determine relative bio-efficacy of some insecticides against diamondback moth were recorded on randomly selected five plants /plot before spray and 3, 7 and 14 days after each spray and mean number of larvae per plant was worked out. Pre and post treatments were transformed to square root transformation and subjected to statistical analysis under Randomized block design as per formula suggested by Gomez and Gomez (1984) for interpretation of results.

Results and Discussions

The field experiment was conducted during *rabi*, 2021-22 to assess the bio-efficacy of different insecticides against diamondback moth population at different intervals. Total two sprays of insecticides were applied during 2021-22. The larval population was recorded from randomly selected five plants from each plot, one day before application of insecticides as pretreatment observation and after three days, seven days and fourteen days of spray as post treatment observations.

Table 2: Performance of different insecticides alone and combination with neem oil on diamondback moth, *Plutella xylostella* (Linn.) on cabbage during *rabi*, 2021-22after first spray.

		*Mean larval population of *P.xylostella* per plant					Overall mean	Percent reduction over control	Percent reduction over pre treatment
				Post treatment population					
S. no.	Treatments	Dose	Pretreatment population	3rdDAS	7thDAS	14th DAS			
T1	Neem oil	3ml./l.	6.35 (2.72)	5.32 (2.51)	5.8 (2.61)	7.33 (2.88)	6.15 (2.67)	25.36	7.3
T2	Spinosad 2.5%SC	1.2ml./l.	5.36 (2.62)	1.10 (1.45)	1.70 (1.64)	2.50 (1.870	1.77 (1.65)	78.52	54.9
T3	Spinosad 2.5% SC+Neem oil	0.6ml/l.+3ml./l.	5.23 (2.60)	.95 (1.40)	1.50 (1.58)	2.10 (1.76)	1.52 (1.58)	81.55	71.6
T4	Indoxacarb 14.5% SC	0.5ml /l	6.45 (2.72)	3.53 2.13)	3.92 (2.20)	5.67 (2.58)	4.35 (2.30)	47.21	16.8
T5	Indoxacarb 14.5% SC+Neem oil	0.25ml /l+3ml./l.	6.02 (2.66)	3.26 (2.07)	3.80 (2.19)	5.36 (2.52)	4.15 (2.26)	49.64	31.1
T6	Flubendamide 39.35% SC	0.1ml /l	5.89 (2.62)	2.30 (1.82)	2.80 (1.95)	3.58 (2.13)	2.88 (1.97)	65.05	51.1
T7	Flubendamide 39.35% SC + Neem oil	0.05ml /l+3ml./l.	5.36 (2.61)	1.75 (1.66)	2.10 (1.76)	2.89 (1.98)	2.25 (1.80)	72.69	58.0
T8	Emamectinbenzoate 5% SG	0.36gm /l	5.87 (2.60)	3.10 (2.03)	3.60 (2.14)	5.10 (2.48)	3.94 (2.22)	52.18	32.9
T9	Emamectin benzoate 5% SG+Neem oil	0.18 gm./l+3ml./l	6.23 (2.72)	2.80 (1.96)	3.20 (2.05)	4.80 (2.41)	3.61 (2.14)	56.19	42.1
T10	Control		6.45 (2.72)	7.20 (2.86)	8.36 (3.05)	9.20 (3.20)	8.24 (3.04)	-	-
S.Em.±		-	0.038	0.039	0.035	0.038	0.026		
CDat5%		-	NS	0.118	0.105	0.113	0.078		

*Mean of three replications, Figures inparenthesesare square root transformed values, DAS=days after spraying

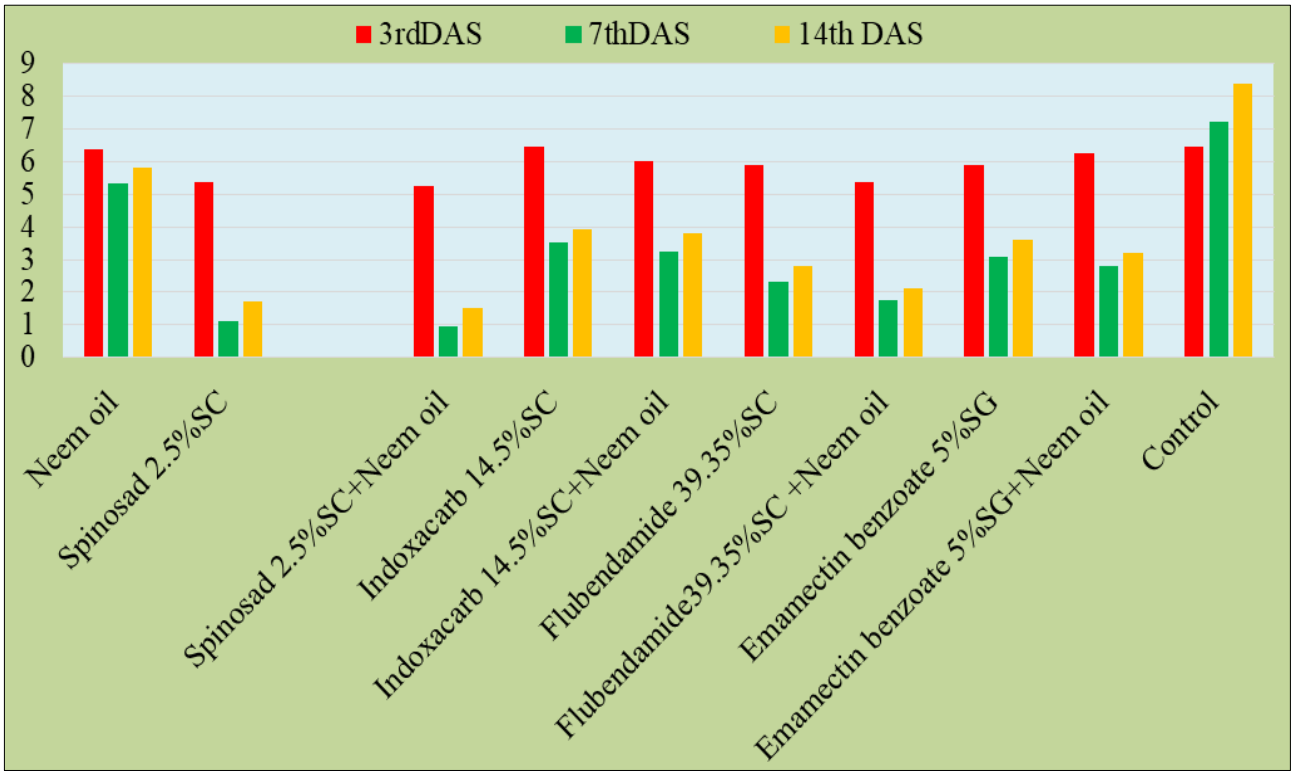

Fig 1: Relative efficacy of different insecticide against DBM after first spray2021-22

Pre-treatment observation

The larval population of diamondback moth in the pre-treatment, varied from5.23 to 6.45 larvae per plant in different treatments including control. The variation in larval population in different treatments was found to be non-significant indicating thereby uniform distribution of the pest population.

Post treatment observation

Over all mean population of *Plutella xylostella* first spray

Mean larval population during first spray indicated that among the different treatments, treatment (T3) *i.e.*, Spinosad 2.5% SC+ neem oil recorded the minimum population of (1.52larvae/plant) followed by treatment no.(T2) *i.e.*, Spinosad 2.5% SC (1.77 larvae/plant), treatment no.(T7)*i.e.*, Flubendamide 39.35% SC + neem oil recorded larval population (2.25larvae/plant), treatment no. (T6) *i.e.*, Flubendamide 39.35% SC (2.88 larvae/plant), treatment no. (T9) *i.e.*, Emamectin benzoate 5% SG+neem oil (3.61 larvae/plant), treatment no. (T8) *i.e.*, Emamectin benzoate 5% SG (3.94larvae/plant) and (T5) *i.e.* Indoxacarb 14.5% SC+ neem oil (4.15 larvae/plant). The Maximum larval population was observed in treatment no. (T1) *i.e.*, neem oil (6.15 larvae/plant) followed by treatment no. (T4) *i.e.*, Indoxacarb 14.5% SC (4.35 larva/plant). Whereas (8.24 larvae/plant) on untreated control.

Percent reduction over control

The impact of different insecticides treatments on the infestation of DBM larvae was also assessed and its order of effectiveness were arranged on the basis off first spray percent reduction over control for first spray as treatment no. (T3) *i.e.*, Spinosad 2.5%SC+ neem oil (81.55%) > treatment no.(T2) *i.e.*, Spinosad2.5%SC(78.2%) >treatment no. (T7) *i.e.*, Flubendamide 39.35%SC + neem oil (72.69%) > treatment no. (T6) *i.e.*, Flubendamide 39.35%SC (65.05%) > treatment no. (T9) *i.e.*, Emamectin benzoate5%SG+ neem oil (56.19%)> treatments no. *i.e.* (T8) Emamectin benzoate5%SG (52.18%)> treatment no.(T5)*i.e.*, Indoxacarb14.5%SC+ neem oil (49.64%) > treatments no. (T4) *i.e.* Indoxacarb 14.5%SC (47.21%) treatments no. (T1) *i.e.*, neem oil (25.36%). This data present in table 2.

Percent reduction over pre-treatment

The impact of different insecticides treatments on the infestation of DBM larvae was also assessed and its order of effectiveness were arranged on the basis of first spray percent reduction over pre-treatment as treatment no. (T3) *i.e.*, Spinosad 2.5% SC+ neem oil (71.6%) > treatment no. (T2) *i.e.*, Spinosad 2.5% SC (66.97%) >treatment no. (T7) *i.e.*, Flubendamide 39.35% SC+neem oil (58.00%)>treatment no. (T6) *i.e.*, Flubendamide 39.35%SC (51.1%) >treatment no. (T9) *i.e.*, Emamectin benzoate 5% SG+ neem oil (42.1%)> treatments noi*se.* (T8) Emamectin benzoate 5%SG (32.9%) >treatment no. (T5) *i.e.*, Indoxacarb 14.5%SC+ neem oil (31.1%) > treatments no. (T4) *i.e.*, Indoxacarb 14.5%SC (16.8%) treatments no. (T1) *i.e.*, neem oil (7.3%).This data present in (table 2)

Table 3: Performance of different insecticides alone and in combination with neem oil diamondback moth, *Plutella xylostella* (Linn.) on cabbage during *rabi season* 2021-22 after second spray

		*Meanlarvalpopulationof*P.xylostella*perplant					Percent reduction over control	Percent reduction over pretreatment
				Post treatment population				
S.no.	Treatments	Dose	Pretreatment population	3rdDAS	7thDAS	14thDAS	Over all mean	
T1	Neem oil	3ml./l.	6.02 (2.65)	4.86 (2.42)	5.32 (2.51)	6.56 (2.75)	5.57 (2.56)	39.39	13.91
T2	Spinosad 2.5%SC	1.2ml./l.	5.36 (2.52)	.75 (1.32)	1.02 (1.44)	1.85 (1.69)	1.23 (1.49)	86.62	77.05
T3	Spinosad 2.5%SC+Neem oil	0.6 ml/l.+3ml./l.	5.02 (2.54)	.60 (1.26)	.92 (1.38)	1.58 (1.61)	1.03 (1.42)	88.79	79.48
T4	Indoxacarb14.5%SC	0.5ml /l	6.02 (2.65)	2.59 (1.89)	3.1 (2.02)	4.45 (2.34)	3.37 (2.08)	63.33	44.02
T5	Indoxacarb 14.5%SC+Neem oil	0.25ml /l+3ml./l.	6.23 (2.63)	2.30 (1.82)	2.80 (1.95)	4.40 (2.32)	3.17 (1.03)	65.51	49.12
T6	Flubendamide39.35%SC	0.1ml /l	5.80 (2.61)	1.80 (1.67)	2.30 (1.82)	3.01 (2.02)	2.39 (1.84)	73.99	58.79
T7	Flubendamide39.35%SC +Neem oil	0.05ml /l+3ml./l.	5.35 (2.59)	1.20 (1.48)	1.57 (1.59)	2.10 (1.77)	1.63 (1.62)	82.26	69.53
T8	Emamectinbenzoate5%SG	0.36gm /l	5.40 (2.58)	2.18 (1.78)	2.82 (1.96)	4.20 (2.28)	3.07 (2.01)	66.59	43.15
T9	Emamectin benzoate5%SG+Neem oil	0.18 gm./l+3ml./l	6.23 (2.69)	2.00 (1.73)	2.56 (1.89)	3.80 (2.19)	2.79 (1.94)	69.64	55.22
T10	Control		6.47 (2.73)	8.23 (3.06)	9.02 (3.16)	10.23 (3.35)	9.19 (3.19)	-	-
S.Em.±			0.057	0.056	0.059	0.055			
CD at 5%			NS	0.169	0.178	0.165			

*Mean of three replications, Figures in parentheses are square root transformed values, DAS=days after spraying

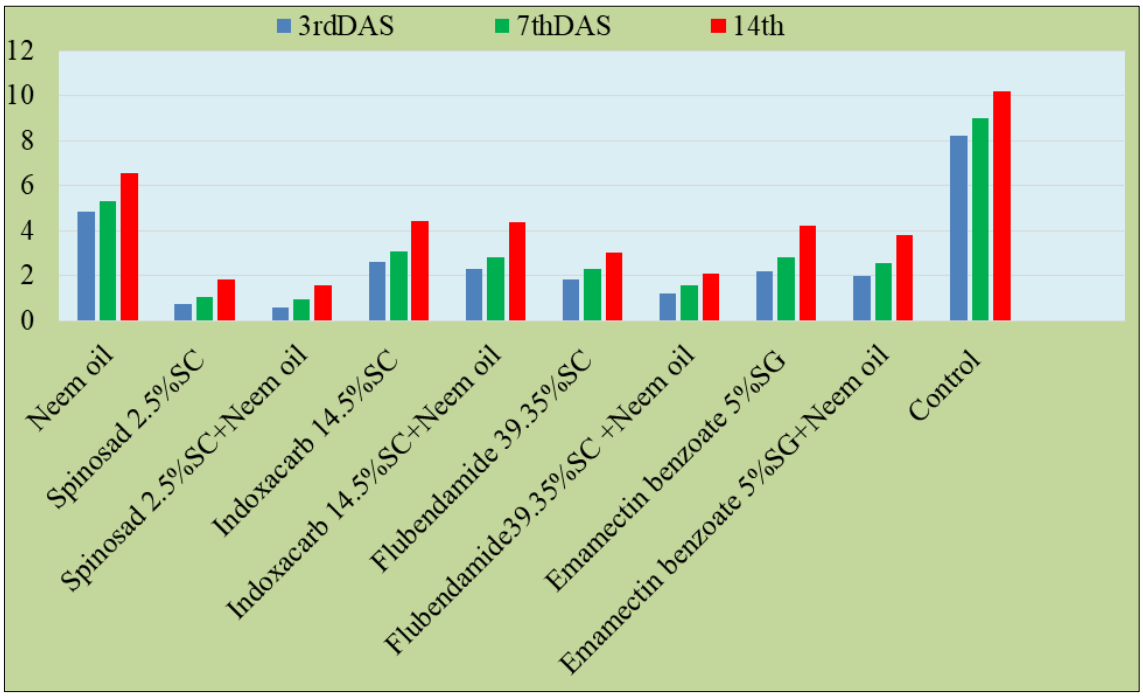

Fig 2: Relative efficacy of different insecticide against DBM after second spray 2021-22

Pretreatment observation

In the pre- treatment observation, the larval population ranged from 5.02 to 6.47larvae per plant among different treatments and it was found statistically non-significant.

Post treatment observation

Overall mean population of *Plutella xylostella* in second spray

Similarly, as result of first spray, mean larval population during second spray indicated that among the different insecticides treatments, treatment no. (T3) *i.e.*, Spinosad 2.5% SC+Neem oil recorded the minimum population of (1.03larvae/plant). Next effective treatment no. (T2) *i.e.*, *Spinosad* 2.5%SC (1.23larvae/plant), treatmentno. (T7) *i.e.*, Flubendamide 39.35% SC+neemoil recorded minimum population (1.63 larvae/plant), treatment no. (T6) *i.e.*, Flubendamide 39.35% SC (2.39 larvae / plant) treatment no. (T9) *i.e.*, Emamectin benzoate 5%SG+ neem oil (2.79 larvae/plant), treatment no. (T8) *i.e.*, Emamectinbenzoate 5% SG (3.07larvae/plant) and treatment no. (T5) *i.e.*, Indoxacarb 14.5% SC+neemoil (3.17 larvae/ plant).The maximum number of larval populations was recorded in treatment no.

(T1) *i.e* neem oil (5.57larvae/plant) followed by treatments no. (T4) *i.e.,* Indoxacarb14.5%SC (3.37larvae/plant).

Percent reduction over control

The impact of different insecticides treatments on the infestation of DBM larvae was also assessed and its order of effectiveness were arranged on the basis of second spray per cent reduction over control for second spray as treatment no. (T3) *i.e*., Spinosad 2.5%SC+ neem oil (88.79%)>treatment no. (T2) *i.e*., Spinosad 2.5% SC (86.62%)>treatment no. (T7) *i.e.,* Flubendamide 39.35% SC+neem oil (82.26%)>treatment no. (T6) *i.e*., Flubendamide 39.35% SC (73.99%) > treatment no. (T9) *i.e.,* Emamectin benzoate 5%SG+ neem oil (69.64%)>treatments no. *i.e.,* (T8) Emamectin benzoate 5% SG (66.59%)>treatment no. (T5) *i.e.,* Indoxacarb 14.5% SC+neem oil (65.51%)>treatments no. (T4) *i.e.,* Indoxacarb 14.5% SC (63.33%) treatments no. (T1) *i.e.,* neem oil (39.39%). This data present on table 3.

Percent reduction over pre-treatment

The impact of different insecticides treatments on the infestation of DBM larvae was also assessed and its order of effectiveness were arranged on the basis of second spray per cent reduction pre-treatment for second spray as treatment no. (T3) *i.e.,* Spinosad 2.5% SC+ neem oil (79.48%) > treatment no. (T2) *i.e.,* Spinosad 2.5% SC (77.05%)> treatment no. (T7) *i.e.,* Flubendamide39.35%SC+neem oil (69.53%)>treatment no. (T6) *i.e.,* Flubendamide 39.35% SC (58.79%) > treatment no. (T9) *i.e.,* Emamectin benzoate 5%SG+ neem oil (55.22%)> treatments no. *i.e.,* (T8) Emamectin benzoate 5% SG (43.15%) > treatment no. (T5) *i.e.,* Indoxacarb 14.5% SC+ neem oil (49.12%)>treatments no. (T4) *i.e.,* Indoxacarb 14.5% SC (44.02%) treatments no. (T1) *i.e.,* neem oil (13.91%). This data present on table 3.

Meena *et al*. (2018) [7] also reported that spinosad (0.3ml/l) was the most effective treatments against *Plutella xylostella* (Linn.), followed closely by Indoxacarb, Novaleuron, Flubendamide, Emamectin benzoate and Profenophos.

Similarly, Bengal and Damtew (2015) [2] revealed that four locally available botanicals for diamondback moth management among which, neem was the best treatment.

Conclusion

Plutella xylostella is a serious threat to successful prediction of cruciferous vegetables. Diamondback moth quickly develops resistance to many new insecticides so evaluation of newer insecticides along with neem oil as synergist which is cost effective & helpful to delay resistance so it would give better result for proper management of this insect.

References

1. Anonymous. Statistics: Area and production statistics national Horticulture Board. www.http://nhb.gov.in/database; c2021.
2. Begna F, Damtew T. Evaluation of four botanical insecticides against diamondback moth, *Plutella xylostella* L. (Lapidoptera: Plutellidae) on head cabbage in the central rift valley of Ethiopia. Sky journal of Agriculture Research. 2015;4(5):97-105.
3. Chelliah S, Srinivasan K. In: Diamondback moth management. (Talekar, N.S and Griggs, T.D., eds.): Proceedings of the First International Workshop, 1985, AVRDC, Taiwan; c1986. p. 63-76.
4. Devjani P, Singh TK. field density and biology of diamond back moth, *Plutella xylostella* (L.) (Lepidoptera: Plutellidae) on cauliflower in Manipur. J Adv. Zool. 1999;20(I):53-55. (Fide: A.A.U. CAB abstracts-1990-20\O, ovidsp.tx.ovid.com).
5. Fletcher TB. Some South Indian Insects. Superintd. Govt. Press, Madras. Acad Sci., USA. 1914;88:5119-5123.
6. Kalra VK, Sharma SS, Chauhan R, Bhanot JP. Shift in the level of resistance together with relative toxicity of some commonly used and important insecticides to diamondback moth, *Plutella xylostella* L. in Haryana. J Entomology. 1997;21:351-354.
7. Meena KA. Bio-efficacy of some newer insecticides against insect pests of cabbage. Journal of Entomology and Zoology Studies. 2018;6(5):1102-1106.
8. Verkerk RH, Wright DJ. Multitrophic interactions and management of the diamondback moth: a review bulletin of Entomological Research. 1996;86(3):205-2016.