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Effect of different insecticides on the management of diamond back moth (*Plutella xylostella* Linn.) on winter cabbage

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Abstract
For control of Diamond back moth on winter cabbage, all the treatments were significantly superior over control. Spinosad (0.3ml/lit) was the most superior treatment followed by Indoxacarb (0.5ml/lit.). The treatments Novaleuron (T_1), Flubendiamide (T_3), Emamectin Benzoate (T_5) and Profenophos (T_6) were at par with each other. The bio-pesticide, NSKE 5% (T_7) showed poor result as compared to chemical pesticides in controlling Diamond back moth on Winter cabbage.

Keywords: diamond back moth, bio-pesticide, NSKE (5%), chemical pesticides, winter cabbage

Introduction
Cabbage is an economically important crop but it seriously suffers from attack of Cabbage aphids (*Brevicornye brassicae* Linn.), Diamond back moth (*Plutella xylostella* Linn.) and Tobacco leaf eating caterpillar (*Spodoptera litura* Fab.). Diamond back moth, (*Plutella xylostella* Linn.), is one of the most destructive insect pests and is the major limiting factor for successful cultivation of cruciferous crops resulting in loss of quality and production (Patil *et al.*, 1999) [1]. *P. xylostella* has national importance on cabbage as it causes 50-80% annual loss in the marketable yield (Devjani and Singh, 1999) [2]. Hence, farmers are compelled to use chemical insecticides in order to cultivate lucratively, as traditional and cultural practices alone cannot give satisfactory control over the pest menace. Frequent use of chemical insecticides at higher doses results in depredation of natural enemies and development of insecticide resistance in *P. xylostella* against a wide range of insecticides in different parts of India (Talekar *et al.* 1990 [3] and Vastrad *et al.* 2003 [4]. Together with high-yielding crop varieties and fertilizers, pesticides have helped the Indian farmers in achieving a substantial increase in agricultural productivity (Birthal *et al.*, 2000) [5] .Hence the present investigation was undertaken with a view to study the effect of different newer insecticides on the management of diamond back moth on winter cabbage.

Materials and Methods
The experiment was laid out in randomised block design with eight treatments each replicated thrice. The net plot size was 3 m x 3 m. Row to row and plant to plant distance was 50 and 45 cm. The experiment was conducted in Rabi season of 2020 at Research farm of Nalanda College of Horticulture, Noorsarai (Nalanda). Agronomic practices were followed as per recommended schedule. The seedlings of variety , NS-22 (F_1 Hybrid) grown on raised beds were transplanted in the main field after one month. Transplanting was done on the flat beds with 50 x 45 cm spacing. Healthy and vigorous seedlings were preferred for transplanting. Protective irrigation was given immediately after transplanting and thereafter irrigations were given at an interval of 15 days. Marigold was grown as border crop around the whole experimental field.

Administration of treatments

T_1	Novaleuron (01 ml/lit.)
T_2	Spinosad (0.3 ml/lit.)
T_3	Flubendiamide (0.4 gm/lit.)
T_4	Indoxacarb (0.5 ml/lit.)
T_5	Emamectin Benzoate (0.4 gm/lit.)
T_6	Profenophos (1.5 ml/lit.)
T_7	NSKE 5%
T_8	Control

Application of insecticidal treatments was initiated one month after transplanting i.e. on 05-02-2021 and continued thereafter at 10 days interval. In all, five sprays were applied during the crop season. Spraying was done in early morning hours to avoid mid day heat. The spray volume ranged from 250-550 lit per hectare depending upon crop stage. Measured quantity of insecticide was taken in 250 ml capacity beaker and mixed in small quantity of water, and then it was added to a bucket containing known quantity of water. Spraying was done using knapsack sprayer, fitted with solid cone nozzle. Due care was taken to cover the lower side of leaves for effective control of Diamond back moth on cabbage. Five plants were selected randomly in each plot. They were provided with coloured lebels. Population diamond back moth was recorded seven days after each spray.

Results and Discussion

The observations on population of diamond back moth after insecticidal spray are presented in Table 1. From Table 1, it is found that for controlling diamond back moth of cabbage, all the treatments were significantly superior over control. Spinosad (0.3ml/lit.) was the most superior treatment followed by Indoxacarb (0.5 ml/lit.) The treatments Novaleuron (T_1), Flubendiamide (T_3), Enamectin Benzoate (T_5) and Profenophos(T_6) were at par with each other . The bio-pesticide, NSKE 5% (T_7) showed poor result as compared to chemical pesticides in controlling diamond back moth. on winter cabbage. Sawant and Patil, 2018 [6] also reported that among the insecticidal treatments, significantly highest per cent larval reduction of *P. xylostella* over control was recorded in spinosad treated plots (87.55% with 1.46 larvae / plant followed by flubendiamide (86.61% with 1.57 larvae /plant). The present studies are also supported by Dotasara *et.al.* 2017 [7] who revealed that all the treatments were superior over untreated control. Spinosad 45 SC @ 0.5ml/lit. had it's superiority and provided 85.27 per cent reduction in larval population over untreated control. Flubendiamide 48 SC @ 0.3ml / lit. was statistically at par with Emamectin benzoate 5 SC @ 02.g / lit. was also effective with 76.05 per cent reduction in larval population over untreated control. Our findings are contradicted by Mandal *et. al.*2009 [8] who reported the superiority of Spinosad (Spinotor 45 SC ; 04 ml/lit.) against diamond back Moth, *P. xylostella* on cabbage. Shankara Murthy and Sannaveerappanavar, 2013 [9] also reported that the new molecules, flubendiamide, spinosad and emamectin benzoate were highly toxic to the susceptible DBM strain. Nikam *et.al.*2014 [10] also reported effectiveness of Spinosad against this pest, who observed the better efficacy of Spinosad against DBM on winter cabbage.

In general, it can be concluded that spraying with Spinosad (0.3ml/lit.), Indoxacarb (0.5ml/lit.) and NSKE(5%) were effective measures for the control of Diamond back moth on winter cabbage.

Table 1: Effect of different insecticides on Diamond back moth of winter cabbage.

Sr. No.	Treatments	Dose	Diamond back moth (Mean of three replications)
1.	Novaleuron	1.0 ml/lit.	1.34 (1.35)
2.	Spinosad	0.3 ml/lit.	0.80 (1.14)
3.	Flubendiamide	0.4 gm/lit.	1.22 (1.31)
4.	Indoxacarb	0.5 ml/lit.	0.90 (1.18)
5.	Emamectin Benzoate	0.4 gm/lit.	1.15 (1.28)
6.	Profenophos	1.5 ml/lit	1.30 (1.34)
7.	NSKE	(5%)	1.66 (1.46)
8.	Control	----	2.00 (1.58)
S.E±C.D. at 5%	--- ---	--- ---	0.040 0.132
(Figures in Parenthesis are √x+0.5 values.)			

Conclusion

Spinosad (0.3ml/lit.) was the most superior treatment followed by indoxacarb (0.5 ml/lit). The treatments, Novaleuron (T_1), Flubendiamide (T_3), Emamection Benzoate (T_5) and Profenophos (T_6) were at par with each other. The bio-pesticide NSKE 5% (T_7) showed poor result as compared to chemical pesticides in controlling diamond back moth on winter cabbage.

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