



# Field Evaluation of some Molecules for Management of *Brevicoryne brassicae* Linnaeus in Cauliflower, *Brassica oleracea* L var *botrytis*

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## Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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## ABSTRACT

The present study was conducted at Research Farm of ICAR- Research Complex for Eastern Region, Patna, Bihar during *rabi* 2020-21. Eight insecticides were evaluated against aphid, *Brevicoryne brassicae* in cauliflower and found that all insecticidal treatments were significantly superior over untreated control, in reducing the population of aphid however; significant differences existed among the various treatments. Flubendiamide 20% WG @ 0.4gm/l was found most effective followed by lufenuron 5.4% EC @ 1ml/l and others showed intermediated effects in reduction of aphid population. The least effective treatments were neem oil and diafenthiuron in reducing the population of *B. brassicae*.

**Keywords:** Cauliflower; vegetablecrop; *Brevicoryne brassicae*; insecticidal.

## 1. INTRODUCTION

Cauliflower (*Brassica oleracea* L var *botrytis*) is a common cruciferous vegetable crop in India and around the world. India is the second largest vegetable producer in the world next only to China [1]. Farming practices have undergone fundamental transformations in the second half of the last century, with the generalization of mechanization, the massive use of inputs such as fertilizers and plant protection products, the genetic improvement of plant cultivars and the use of hybrid seeds. These fundamental and increasingly rapid changes in farming practices were followed by unexpected consequences such as the loss of plant resistance to insect pests wrongly believed to be acquired, flora and fauna invasions in plant pest's populations, a more or less pronounced decrease in the efficiency of active plant protection products. Due to the climate changes, the population of pest complex and their natural enemies are also changed on horticultural crops. Agro climatic conditions have got a profound influence on seasonal incidence of the insect-pests and diseases infesting orchards. It is evident from the fact that around 13- 14 % of total pesticides used in the country are applied on vegetables [2]. Cole crops are one of the most abundantly consumed vegetables all over the world. Among the various cole crops, cabbage and cauliflower are most widely grown on commercial scale in India. They belong to the genus *Brassica* of the family Brassicaceae. Cabbage (*Brassica oleracea* var. *capitata*) and cauliflower (*Brassica oleracea* var. *botrytis*) is the most widely grown cole crop of India. India is the second leading country in producing cole crops with the production and productivity of 8.5 million tonnes and 19.8 metric tonnes per ha, respectively [1]. Since, cole crops are highly remunerative, intensive plant protection measures involving a number of insecticides and fungicides are common. In spite of large scale and indiscriminate applications of insecticides, the pests have been found to occur in severe form in all cole crop growing areas, especially diamond back moth (DBM), *Plutella xylostella* (L.), common cutworm, *Spodoptera litura* (F.), cabbage butterfly, *Pieris brassicae* (L.), cabbage aphid, *Brevicoryne brassicae* L., cabbage looper, *Trichoplusia ni* H., and head borer, *Hellula undalis* (F.) [3].

Diamondback moth, *P. xylostella* is one of the most important pest of cole crops includes

cauliflower, cabbage, broccoli and Chinese cabbage [4] and larvae feeds from seedling to harvest on the leaves, drastically reducing yield and efficiency. *S. litura* is polyphagous in nature, damaging large number of vegetables and field crops in India and many other countries of Asia [5] and have developed multiple resistance to commonly used insecticides and field control failure has been observed very frequent in recent years [6-9] in cauliflower. *P. brassicae* is a well-known international pest, and is found wherever cruciferous plants are grown [10]. Occasionally, massive outbreaks of this pest may occur and in case of cauliflower crop, injury may be very severe [11]. Aphids are also considered as one of the serious pests of cauliflower under cool and dry conditions. Three species of aphids are of economic importance to cauliflower viz., mustard aphid, *Lipaphis erysimi* (Kaltenbach); green peach aphid, *Myzus persicae* (Sulzer) and cabbage aphid, *Brevicoryne brassicae* (Linnaeus). Aphids can cause both direct and indirect damage to the crops. The feeding of nymphs and adults harms plants directly, while indirect damage can result from the transmission of plant diseases, the secretion of honeydew and the contamination of the harvested crop. Therefore, the present study was undertaken to evaluate the some molecules for management of *Brevicoryne brassicae*.

## 2. MATERIALS AND METHODS

Cauliflower seedlings were raised in nursery beds. Nursery beds of 2x 1 m<sup>2</sup> size were prepared by mixing well rotten farms yard manure in the soil @ 10 kg/ m<sup>2</sup>. To avoid mortality of seedling due to damping off, drenching of the beds was done with Bavistin @ 15 g per litre of water. The seeds of cauliflower variety "Snow Ball" were sown at the rate of 600 g ha<sup>-1</sup> in seed beds on 15<sup>th</sup> November in field during 2020-21. The experimental field was thoroughly ploughed with the help of mould board plough and cross-harrowing was done with tractor, followed by planking and leveling to bring the good tilth. The recommended dose of NPK for cauliflower was applied @120:80:60 kg ha<sup>-1</sup>. Nitrogen was applied through urea, half as basal dose and remaining half in two equal spits at 30 days and 50 days of transplanting. Phosphorus and potassium fertilizers were applied through single super phosphate and murate of potash, respectively just before transplanting and well

rotten FYM was incorporated in the soil at the time of field preparation @ 20 t ha<sup>-1</sup>. Beds (3.0 x 2.50 m<sup>2</sup>), paths and channels were prepared according to the layout of the experiments. Four weeks old seedlings were transplanted at row to row and plant to plant distance of 40 x 40 cm, respectively. The transplanting was done on 15<sup>th</sup> December followed by light irrigation. Other cultural practices, as recommended in package of practices were also adopted during the experimental period as and when needed.

## 2.1 Experimental Details

Year	: 2020-21
Season	: Rabi
Crop	: Cauliflower ( <i>Brassica oleracea</i> var. <i>botrytis</i> )
Variety	: Snow Ball
Spacing	: 40 cm x 40 cm
Gross plot size	: 3 m x 2.50 m (7.50 m <sup>2</sup> )
Date of sowing in nursery	: 15/11/2020
Spraying schedule	: 1 <sup>st</sup> spray- 15/01/2021 2 <sup>nd</sup> spray- 07/02/2021
Observations	: Pre-treatment (24 hr before insecticide application) Post treatment (1,7,15 and 21 DAT)
Sprayer used	: Knapsack sprayer
Design	: RBD
Replications	: 3
Treatments	: 9

### 2.1.1 Field evaluation of insecticides against aphid, *Brevicoryne brassicae* on cauliflower:

The field trial was conducted in the experimental farm at ICAR-RCER, Patna during Rabi 2020-21. The experiment was laid out in Randomized

Block Design, replicated thrice with eight insecticidal treatments along with one untreated control (Table 1). The crop was sown in a plot size of 3.0 m x 2.50 m with planting distance of 40 cm x 40 cm on 15<sup>th</sup> December 2020 following all recommended horticultural practices for raising the crop. The insecticide was applied with the help of knapsack sprayer (Fig. 1). The pre and post treatment observation was recorded on ten plants per plot prior to the treatment and 1, 7, 15 and 21 days after treatment, respectively (Fig 2).

## 2.2 Application of Insecticides

Pre-calibrated knap sack sprayer was used for spraying the insecticides on the crop. The total two sprays were applied, first on 15<sup>th</sup> January, 2021 and second spray was applied at three weeks interval on 7<sup>th</sup> February, 2021.

## 2.3 Statistical Analysis

The data on aphid population were transformed into  $\sqrt{x + 0.5}$  value [12] and were subjected to analysis of variance. Further the data of insect population were subjected for determination of per cent reduction (per cent control) by using following formula given by [13] referring it to be modification of [14].

$$\text{Per cent reduction in population} = \frac{(T_a \times C_b) \times 100}{1 - (T_b \times C_a)}$$

Where

T<sub>a</sub> = Number of insects on treated plots after insecticidal application

T<sub>b</sub>=Number of insects in treated plots before insecticidal application

C<sub>a</sub>=Number of insects in untreated plots after insecticidal application

C<sub>b</sub>=Number of insects in untreated plots before insecticidal application

**Table 1. Details of the treatments**

Treatments	Insecticides
T <sub>1</sub>	: Flubendiamide 20% WG @ 0.4gm/L
T <sub>2</sub>	: Lufenuron 5.4% EC @ 1ml/L
T <sub>3</sub>	: Spinosad @0.3ml/L
T <sub>4</sub>	: Indoxacarb 14.5 SC @ 1.0 ml/l
T <sub>5</sub>	: Cypermethrin 25 EC @2.0ml/L
T <sub>6</sub>	: Profenophos 50EC @ 2.0ml/L
T <sub>7</sub>	: Diafenthiuron @1 g/L
T <sub>8</sub>	: Neem oil @2.0 ml/L
T <sub>9</sub>	: Control (Water spray only)



**Fig. 1. Spraying of cauliflower crop with insecticides**



**Fig. 2. Aphid feeding on cauliflower leaf**

### **3. RESULTS AND DISCUSSION**

#### **3.1 Per Cent Reduction of Aphid Population in Cauliflower during Rabi 2020-21 after First Spray**

One day after application of insecticides, it was observed that all the insecticidal treatments were found significantly superior to untreated control, in reducing the population of aphid however, significant difference existed among them (Table 2). The maximum reduction of 82.12 per cent in aphid population was recorded in the treatment of flubendiamide

followed by lufenuron which resulted in 79.84 per cent reduction and both these treatments were at par with each other in their efficacy and significantly superior to rest of the treatments. The next effective treatments were spinosad, indoxacarb and profenophos, which registered 66.81, 64.21 and 62.10 per cent reduction, respectively. However, these were statistically at par with each other and categorized as moderately effective group of insecticides in reducing the aphid population. The minimum reduction of 40.14 per cent was recorded in the treatment of neem oil followed by diafenthiuron and cypermethrin which gave 43.18 and 46.42

**Table 2. Bio-efficacy of insecticides against aphid, *Brevicoryne brassicae* on cauliflower crop during Rabi 2020-21**

Sl. No.	Treatments	Per cent reduction in population of aphid, <i>Brevicoryne brassicae</i> after									
		First Spray					Second Spray				
		1-day	7-days	14-days	21-days	Mean	1-day	7-days	14-days	21-days	Mean
1.	Flubendiamide (T <sub>1</sub> )	82.12 (64.99)	87.75 (69.51)	85.25 (67.41)	78.27 (62.22)	83.35	80.15 (63.54)	94.50 (76.44)	90.15 (71.71)	85.33 (67.48)	87.53
2.	Lufenuron (T <sub>2</sub> )	79.84 (63.32)	83.75 (66.28)	80.25 (63.61)	74.58 (59.72)	79.60	72.65 (58.47)	89.12 (70.74)	87.75 (69.51)	82.46 (65.24)	82.99
3.	Spinosad (T <sub>3</sub> )	66.81 (54.82)	70.15 (56.88)	73.20 (58.82)	68.84 (56.07)	69.75	54.80 (47.75)	72.87 (58.61)	80.93 (64.11)	70.15 (56.88)	69.69
4.	Indoxacarb (T <sub>4</sub> )	64.21 (53.49)	72.10 (58.12)	74.15 (59.44)	69.21 (56.30)	69.92	56.44 (48.70)	76.30 (60.82)	80.56 (63.84)	72.12 (58.19)	71.35
5.	Cypermethrin (T <sub>5</sub> )	46.42 (42.95)	64.22 (53.26)	72.20 (58.18)	63.12 (52.61)	61.49	53.38 (46.94)	69.50 (56.48)	75.85 (60.56)	63.50 (52.83)	65.56
6.	Profenophos (T <sub>6</sub> )	62.10 (52.00)	72.40 (58.31)	74.20 (59.47)	69.13 (56.25)	69.46	58.25 (49.75)	78.25 (62.00)	81.30 (64.68)	74.15 (59.44)	72.99
7.	Diafenthiuron (T <sub>7</sub> )	43.18 (41.08)	55.12 (47.94)	62.55 (52.27)	62.18 (52.04)	55.91	40.12 (39.30)	54.20 (47.41)	64.55 (53.46)	62.79 (52.41)	55.16
8.	Neem oil (T <sub>8</sub> )	40.14 (39.31)	51.67 (45.96)	60.78 (51.22)	58.75 (50.04)	52.83	38.10 (38.12)	52.85 (46.63)	64.35 (53.34)	58.94 (50.15)	53.56
9.	Control (Water spray only) (T <sub>9</sub> )	-	-	-	-	-	-	-	-	-	-
	S.Em ±	1.02	1.58	1.21	1.14		1.10	1.68	1.35	1.15	
	C.D. (5%)	3.12	4.78	3.78	3.41		3.26	5.17	4.12	3.48	

Figures in the parentheses are angular transformation value.  
Mean of three replication

per cent reduction, respectively; however, neem oil differed significantly with cypermethrin. The maximum reduction of 87.75 per cent was also found in the treatment of flubendiamide after 7-days of application followed by lufenuron (83.75%) and both these treatments were comparable with each other in their efficacy. The next effective treatments were profenophos, indoxacarb and spinosad which gave 72.40, 72.10 and 70.15 per cent reduction, respectively and found at par with each other. The treatment of cypermethrin (64.22%) was also found at par with spinosad. Neem oil with 51.67 per cent reduction in aphid population was found least effective, however, differed non-significantly with diafenthiuron. After 14-days of spray flubendiamide proved most effective and significantly superior over rest of the treatments with 85.25 per cent reduction followed by lufenuron (80.25%) and both the treatments were comparable to each other in their efficacy. The next effective non-significantly group of insecticides were profenophos, indoxacarb, spinosad and cypermethrin which registered, 74.20, 74.15, 73.20 and 72.20 per cent reduction in aphid population, respectively. The minimum reduction of 60.78 per cent was noticed in the treatment neem oil, however, it was comparable with diafenthiuron (62.55%). All the insecticidal treatments were also found significantly superior over untreated control even after 21-days of spray. The maximum reduction of 78.27 per cent was found in the treatment of flubendiamide followed by lufenuron (74.58%) and stood at par with each other in their efficacy. The next effective non-significant group of insecticides was indoxacarb, profenophos and spinosad with 69.21, 69.13 and 68.84 per cent reduction, respectively. The minimum reduction of 58.75 per cent was recorded in neem oil followed by diafenthiuron and cypermethrin which resulted in 62.18 and 63.12 per cent reduction, respectively.

### 3.2 Per Cent Reduction of Aphid Population in Cauliflower during Rabi 2020-21 after Second Spray

One day after application of insecticides, it was observed that all the insecticidal treatments were found significantly superior over untreated control (Table 2). The maximum reduction of 80.15 per cent in aphid population was recorded in the treatment of flubendiamide which proved most effective and significantly superior over rest of the treatments followed by lufenuron with 72.65 per cent reduction. The next effective

treatments were profenophos, indoxacarb, spinosad and cypermethrin which gave 58.25, 56.44, 54.80 and 53.38 per cent reduction, respectively and these were statistically at par with each other. The least effective treatment was neem oil which gave only 38.10 per cent reduction in aphid population, however, it was comparable with diafenthiuron (40.12%). After 7-days of spray flubendiamide also proved most effective with 94.50 percent reduction followed by lufenuron (89.12%). The next effective group of insecticides was profenophos, indoxacarb, spinosad and cypermethrin which registered, 78.25, 76.30, 72.87 and 69.50 per cent reduction, respectively, however, cypermethrin differed significantly with profenophos. The minimum reduction of 52.85 per cent was recorded in the treatment of neem oil; however, it was at par with diafenthiuron (54.20%). Similarly, 14-days after spray, the treatment of flubendiamide with 90.15 per cent reduction in aphid population too proved most effective followed by malathion (87.75%) and stood at par with each other. The next effective group of insecticides was profenophos, spinosad, indoxacarb and cypermethrin which exhibited 81.30, 80.93, 80.56 and 75.85 per cent reduction in aphid population, respectively and these were comparable with each other. The minimum reduction of 64.35 per cent was recorded in neem oil, however, it was comparable with diafenthiuron (64.55%). All the insecticidal treatments were also found significantly superior to untreated control even after 21-days of spray with 58.94 to 85.33 percent reduction in aphid population being, maximum in flubendiamide and minimum in neem oil. The moderately effective groups of insecticides were profenophos, indoxacarb and spinosad with 74.15, 72.12 and 70.15 per cent reduction, respectively and these were found statistically at par with each other.

### 4. CONCLUSION

Field evaluation of eight insecticides was carried out against aphid, *Brevicoryne brassicae* on cauliflower. The result showed that all insecticidal treatments were significantly superior over untreated control, in reducing the population of aphid however; significant differences existed among the various treatments. Flubendiamide 20% WG @ 0.4gm/l was found most effective followed by lufenuron 5.4% EC @ 1ml/l and others showed intermediated effects in reduction of aphid



population. The next effective treatments were profenophos, indoxacarb, spinosad and cypermethrin. The least effective treatments were neem oil and diafenthiuron in reducing the population of *B. brassicae*.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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