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Efficacy of chitin synthesis inhibitors on crucifer leaf webber, *Crocidolomia binotalis* (Zell) in cabbage under field condition

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Abstract
The field experiment was conducted to test the efficacy of chitin synthesis inhibitors on crucifer leaf webber, *Crocidolomia binotalis* (Zell) in cabbage, during the *rabi* seasons of 2017-18 and 2018-19. The study revealed that, diflubenzuron 25 WP @1g/l was the best treatment in controlling cabbage leaf webber followed by novaluron 10 EC 1.25ml/l and buprofezin 25 SC @1.25ml/l. The diflubenzuron 1g/l reduced the crucifer leaf webber infestation by 70.57 percent and 72.05 percent in the year 2017-18 and 2018-19, respectively and all the Chitin synthesis inhibitors caused 60 to 71 and 63 to 72 percent reduction in pest population, while neem oil eliminated 45 and 55 percent crucifer leaf webber population during the year 2017-18 and 2018-19, respectively.

Keywords: efficacy, crucifer leaf webber, cabbage, chitin synthesis inhibitors (CSI)'s

Introduction
Cabbage, *Brassica oleracea* L. var. *capitata* belongs to family Brassicaceae is one of the popular vegetable crop grown in India. India stands second position in production after China. Total cabbage production about to 8,971 thousand metric tons, in India with an average productivity of 18.89 metric tons per hectare [5].
Cabbage crop has a high medicinal value, which helps in alleviation of symptoms associated with gastrointestinal disorders as well as in treatment of wounds and mastitis [8]. Being a seasonal crop, there is huge domestic demand by the consumer; it is a rich source of calcium, iron, magnesium, sodium, potassium, phosphorus vitamin A, vitamin C, carbohydrate and dietary fibers. Cabbage is also taken as salad in western countries, though this crop retains a higher yield potential, yet, the production level is not achieved due to the various biotic stresses. Insect pest attack on cabbage due to its high nutritional quality stands as one of major obstructions for lower productivity. In India, a total of 37 insect pests have been reported to cause loss in cabbage. Among them cabbage leaf webber causes significant damage and yield loss [7]. observed 37.2 to 81.8 percent yield loss due to infestation by cabbage leaf webber.
Ignorance of the farmers for pest management in vegetable with non-chemical approach forces them to apply chemical on vegetables like cabbage and dependence on synthetic pesticides for insect pest management has disturbed the ecological balance without any substantial pest control. Non chemical approach including behavior modifying chemical should be given due emphasis. One of these behavior modifying chemicals are chitin synthesis inhibitor's (CSI). Among the various CSI's diflubenzuron, novaluron and buprofezin are widely used chemicals for control of various insect pests and considering importance of CSIs, a field experiment was conducted to evaluate efficacy of chitin synthesis inhibitors on crucifer leaf webber, *Crocidolomia binotalis* (Zell) in cabbage under field condition.

Materials and Methods
The present investigation was carried out at the Central Farm of Odisha University of Agriculture and Technology, Bhubaneswar. In *rabi* seasons of 2017-18 and 2018-19. For this experiment "Rare ball" variety was used. 11 treatments in various concentrations of different insect growth regulators including a control (no application) were imposed. All the treatments were replicated thrice being arranged in a randomized block design (RBD). The details of the treatments are presented in Table 1.

All the treatments were applied in form of foliar spray by a high volume Knapsack sprayer using 500 L of spray fluid per hectare to ensure thorough coverage of plants. Spraying operation was done in the morning hours (7AM-9AM). During both the seasons, the test chemicals were applied at 21, 31 and 41 days after transplanting (DAT) and the population of leaf webber was recorded on 10 randomly selected plants from each plot. The pest population count was taken a day before the spray (Pre-count), seven and ten days after each spray (DAS). The data collected from field experiment was subjected to necessary transformation and analyzed as per RBD procedure [2].

Table 1: Details of various Insect growth regulators applied during *Rabi*, 2017-18 and 2018-19

Treatments	Insecticide	Dose
T_1	Diflubenzuron 25 WP	0.5 g/l
T_2	Diflubenzuron 25 WP	0.75 g/l
T_3	Diflubenzuron 25 WP	1 g/l
T_4	Novaluron 10 EC	0.75 ml/l
T_5	Novaluron 10 EC	1 ml/l
T_6	Novaluron 10 EC	1.25 ml/l
T_7	Buprofezin 25 SC	0.75 ml/l
T_8	Buprofezin 25 SC	1 ml/l
T_9	Buprofezin 25 SC	1.25 ml/l
T_{10}	Neem oil (Multi neem 300 ppm)	4 ml/l
T_{11}	Control	

Result and Discussion

Effect of various CSIs on the incidence of crucifer leaf webber during *Rabi*, 2017-18

The data on the incidence of crucifer leaf webber on cabbage being influenced by various treatments imposed during *Rabi* season 2017-18 has been depicted in Table 2. It can be perused that the larvae population range from 3.20 to 4.90 per plant at 1 DAS and there was difference among the treatments. The data revealed that at 7 DAS of first spray, all the treatments were at par with each other and significantly differed from control (5.70 larvae/ plant) having significant difference with control treatment. At 10 DAS of first spray, the least larval population was witnessed in T_5 (2.00) which were at par with T_3, T_2, T_6 and T_1 treatments. Neem oil could not afford better control as compared to CSIs but remained distinctly different from control treatment (6.50 larvae/ plant).

At 7 DAS of second spray, the treatment T_3 retained 1.80 larvae per plant which was more or less similar to the efficacy of T_2, T_5, T_4, T_8 and T_1 treatments. The control treatment at this stage supported highest number of larvae (7.20/ plant). At 10 DAS of second spray, both T_6 and T_9 treatments supported each of 1.80 larvae per plant being very close to T_3 (1.90 larvae/plant) and rest other treatments without any difference among themselves statistically. The neem oil treatment which supported only 3.30 larvae per plant was inferior to CSIs but superior to the control treatment. At 7 DAS of third spray, T_6 supported only 1 larva per plant and was found to be at par with T_3 and T_9 treatments (1.60 larvae/ plant). The larvae number was observed to swing between 1.80 larvae per plant in T_2 to 2.80 in T_{10}. The control treatment at this stage had 5.80 larvae per plant which was significantly more than all the treatments applied. A comparative data or mean population regardless of the spray formulation, spraying number etc. stated that diflubenzuron 1g/l (T_3) accounted for 1.78 larvae/ plant which was the least and caused 70.5% reduction in pest incidence. The next better treatment was T_6 (1.96 larvae/ plant). Rest of the treatments supported more than 2.0 larvae per plant while the neem oil and control treatments retained 3.31 and 6.05 larvae per plant, respectively.

Effect of various CSIs on the incidence of crucifer leaf webber during *Rabi*, 2018-19

The incidence of crucifer leaf webber being subjected to various treatments in the field experiment conducted during *Rabi* 2018-19 has been presented in Table 3. While the treatments exercised a significant difference for larva population at 1 DBS, the difference was also existed among the treatments at 7 DAS of first spray wherein, 3.1 larvae/ plant were noticed in T_3 that remained at par with most of the treatments excluding control.

At 7 DAS of 2nd spray, the trend was almost similar wherein, a minimum of 2 larvae/plant was noticed in T_3 and 3.10 larvae/ plant was noticed in T_{10} having no difference among the treatments. However, the control treatment retained 7.8 larvae/ plant which were significantly different from rest of treatments. At 10 DAS of 2nd spray T_3 was best treatment and remained at par with all other treatments except control.

At 7 DAS of 3rd spray, T_3 supported 1.10 larvae/ plant and was statistically at par with all test treatments except for neem oil (T_{10}) and control (6.80). At 10 DAS of 3rd spray, the trend was almost same with regard to mean performance T_3 supported a mean of 1.90 larvae/ plant, whereas other treatments supported a mean of 3.05 larvae/ plant and control treatment had a mean of 6.80 larvae/ plant. All the CSIs caused 63% to 72% reduction in pest population, while neem oil eliminated 55% crucifer leaf webber population.

From the data presented in Table 2 and 3, it can be observed that diflubenzuron 1g/l in both the years was the best treatment which could reduce the infestation by 70.57 and 72.05 percent, respectively. In both the years novaluron 10 EC @ 1.25ml/l was next best treatment. All the CSIs reduced crucifer leaf webber population by 58.67 to 72.05 percent during both the years. Similarly, neem oil could eliminate 45.28 and 55.14 percent of crucifer leaf webber during both the years. This clearly indicated that CSIs were superior than neem oil. [6] studied the efficacy of diflubenzuron against *Crocidolomia binotalis*. Similarly [4], also studied the efficacy of diflubenzuron against *Crocidolomia binotalis* [3]. studied that novaluron, flufenoxuron and lufenuron were also effective against crucifer leaf webber and proved superiority over neem oil [9]. studied the bioefficacy of novaluron against bollworms and showed that IGR's were significantly superior to rest of the treatments to reduce larval population. Similarly, [1] found that Emamectin benzoate, methoxyfenozide, also performed well in reducing damage of diamondback moth. The present finding derived ample support from the above findings.

Table 2: Effect of various chitin synthesis inhibitors on the incidence of crucifer leaf webber infestation on cabbage during *Rabi*, 2017-18 at Bhubaneswar.

Sl. No	Treatments	Crucifer leaf webber larval population per plant							Mean population (Number/ plant)	Reduction (%) Over control
		1 DBS	First spray		Second spray		Third spray			
			7 DAS	10 DAS	7 DAS	10 DAS	7 DAS	10 DAS		
T_1	Diflubenzuron 25 WP @ 0.5g/l	03.81 (2.1)	03.10 (1.9)	02.90 (1.8)	02.40 (1.7)	02.28 (1.7)	02.08 (1.6)	01.68 (1.5)	02.27	62.47
T_2	Diflubenzuron 25 WP @ 0.75g/l	03.62 (2.0)	03.01 (1.9)	02.40 (1.7)	02.10 (1.6)	02.00 (1.6)	01.80 (1.5)	01.66 (1.5)	02.16	64.29
T_3	Diflubenzuron 25 WP @ 1.00g/l	03.20 (1.9)	02.40 (1.7)	02.10 (1.6)	01.80 (1.5)	01.90 (1.5)	01.60 (1.4)	00.88 (1.2)	01.78	70.57
T_4	Novaluron 10 EC @ 0.75ml/l	04.10 (2.1)	03.30 (1.9)	03.10 (1.9)	02.61 (1.8)	02.46 (1.7)	02.12 (1.6)	01.41 (1.4)	02.50	58.67
T_5	Novaluron 10 EC @ 1ml/l	03.80 (2.1)	03.10 (1.9)	02.00 (1.6)	02.20 (1.6)	02.10 (1.6)	01.80 (1.5)	01.30 (1.3)	02.21	63.47
T_6	Novaluron 10 EC @1.25ml/l	04.20 (2.2)	03.40 (2.0)	02.80 (1.8)	02.10 (1.6)	01.80 (1.5)	01.00 (1.2)	00.90 (1.2)	01.96	67.60
T_7	Buprofezin 25 SC @0.75ml/l	04.80 (2.3)	03.90 (2.1)	03.20 (1.9)	02.80 (1.8)	02.10 (1.6)	01.80 (1.5)	01.20 (1.3)	02.50	58.67
T_8	Buprofezin 25 SC @ 1ml/l	04.60 (2.3)	3.60 (2.0)	03.00 (1.9)	02.30 (1.7)	02.00 (1.6)	01.82 (1.5)	01.80 (1.5)	02.42	60.00
T_9	Buprofezin 25 SC @1.25ml/l	04.30 (2.2)	03.50 (2.0)	03.00 (1.9)	02.20 (1.6)	01.80 (1.5)	01.60 (1.4)	01.10 (1.3)	02.20	63.63
T_{10}	Neem oil (multi neem 300 ppm) @ 4ml/l	04.20 (2.2)	04.00 (2.1)	03.80 (2.1)	03.50 (2.0)	03.30 (1.9)	02.80 (1.8)	02.50 (1.7)	03.31	45.28
T_{11}	Control	4.90 (2.3)	05.70 (2.5)	06.80 (2.7)	7.20 (2.7)	06.60 (2.7)	5.80 (2.5)	04.20 (2.2)	06.05	
	SE (m) ±	0.08	0.10	0.07	0.09	0.09	0.08	0.06		
	CD (0.05)	NS	0.28	0.20	0.25	0.26	0.22	0.16		

*Figures in the parentheses are transformed values $\sqrt{x+0.5}$

Table 3: Effect of various chitin synthesis inhibitor on the incidence of crucifer leaf webber infestation on cabbage during Rabi, 2018-19 at Bhubaneswar.

F	Treatments	Crucifer leaf webber larval population per plant							Mean population (Number/plant)	Reduction (%) Over control
		1 DBS	First spray		Second spray		Third spray			
			7 DAS	10 DAS	7 DAS	10 DAS	7 DAS	10 DAS		
T_1	Diflubenzuron 25 WP @ 0.5g/l	03.70 (2.0)	03.20 (1.9)	02.90 (1.8)	02.20 (1.6)	02.10 (1.6)	01.80 (1.5)	01.72 (1.5)	02.32	65.88
T_2	Diflubenzuron 25 WP @ 0.75g/l	03.80 (2.1)	03.00 (1.9)	02.68 (1.8)	02.00 (1.5)	02.10 (1.6)	01.82 (1.5)	01.60 (1.4)	02.2	67.64
T_3	Diflubenzuron 25 WP @ 1.00g/l	03.50 (2.0)	03.10 (1.9)	02.70 (1.8)	02.00 (1.5)	01.80 (1.5)	01.10 (1.2)	00.70 (1.1)	01.90	72.05
T_4	Novaluron 10 EC @ 0.75ml/l	04.10 (2.1)	03.60 (2.0)	03.00 (1.9)	02.40 (1.7)	02.30 (1.7)	02.00 (1.5)	01.10 (1.3)	02.40	64.70
T_5	Novaluron 10 EC @ 1ml/l	03.90 (2.1)	03.20 (1.9)	03.03 (1.9)	02.30 (1.7)	02.00 (1.5)	01.60 (1.4)	00.95 (1.2)	02.18	67.94
T_6	Novaluron 10 EC @1.25ml/l	03.60 (2.0)	03.10 (1.8)	02.60 (1.8)	02.20 (1.6)	01.80 (1.5)	01.40 (1.4)	00.90 (1.2)	02.00	70.58
T_7	Buprofezin 25 SC @0.75ml/l	04.00 (2.1)	03.30 (1.9)	03.01 (1.9)	02.80 (1.8)	02.00 (1.5)	01.80 (1.5)	01.30 (1.3)	02.45	63.97
T_8	Buprofezin 25 SC @ 1ml/l	03.80 (2.1)	03.18 (1.9)	03.12 (1.9)	02.60 (1.7)	02.38 (1.7)	01.66 (1.5)	00.86 (1.2)	02.30	66.17
T_9	Buprofezin 25 SC @1.25ml/l	03.60 (2.0)	03.20 (1.9)	02.80 (1.8)	02.40 (1.6)	02.16 (1.6)	01.42 (1.4)	00.66 (1.1)	02.10	69.11
T_{10}	Neem oil (multi neem 300 ppm) @ 4ml/l	04.40 (2.2)	03.80 (2.1)	03.61 (2.0)	03.10 (1.9)	03.00 (1.9)	02.60 (1.8)	02.20 (1.6)	03.05	55.14
T_{11}	Control	05.20 (2.4)	06.20 (2.6)	07.40 (2.8)	07.80 (2.9)	07.10 (2.7)	06.80 (2.7)	05.60 (2.5)	06.80	
	SE (m)±	0.12	0.17	0.15	0.17	0.16	0.13	0.10		
	CD (0.05)	NS	0.46	0.43	0.48	0.45	0.36	0.27		

*Figures in the parentheses are transformed values $\sqrt{x+0.5}$

Conclusion

The result of these field trials showed that, diflubenzuron @ 1g/l was showed strong capability in decreasing insect populations and protecting cabbage from crucifer leaf webber, *Crocidolomia binotalis* (Zell) in cabbage under field condition and it also showed higher level of control, as compare with other insecticides were tested. Therefore, it could be used as the substitute to broad-spectrum neurotoxic insecticides for integrated pest management of *Crocidolomia binotalis* and lab experiments are needed to verify the present

field experiment findings.

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Reference

1. Chatterjee ML, Mondal S. Sustainable management of key lepidopteran insect pests of vegetables. Acta Horticulturae 2012;(958):147-153.
2. Gomez KK, Gomez AA. Statistical procedure for agricultural research, John Wiley and sons, New York 1984, 67-81.
3. Gouda R, Rao SRK, Chiranjeevi CH, Rao SKT. Bioefficacy of chitin synthesis inhibitors alone and in combination with cartap hydrochloride against lepidopterous pests of cabbage, Pestology 2006;30(11):45-47.
4. Murty BN, Rao PA, Krishnaiah PV. Efficacy of different insecticides alone and in combination with diflubenzuron against cabbage leaf webber, *Crocidolomia binotalis* (Zell) on cauliflower, Pestology 1997;21:8-11.
5. National Horticulture Board. Ministry of Agriculture, Government of India, Institutional Area, Sector-18, India 2017, 141.
6. Rath LK. Bioefficacy of diflubenzuron against mustard leaf webber, *Crocidolomia binotalis* (Zell). M.Sc. (Agri.) Thesis, Orissa University of Agricultural and Technology, Bhubaneshwar (India) 1985.
7. Reddy AS, Ali MH. Chemical control of mustard leaf webber, *Crocidolomia binotalis* Zeller (Lepidoptera), Oilseed Journal 1997;7(3):19-21.
8. Rokayya S, Li CJ, Zhao Y, Li Y, Sun CH. Cabbage (*Brassica oleracea* L. var. capitate) phytochemicals with antioxidant and anti-inflammatory potential Asian pacific, Journal of Cancer Prevention. 2013;14(11):6657-6662.
9. Udikeri SS, Patil SB, Rachappa V, Khadi BM, Pachabhavi KS. Novaluron: An Ideal IGR For Management of Cotton Bollworms, Pestology 2004;28:12.