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Evaluate the efficacy of some novel insecticides against *Bagrada hilaris*, (Burm) in *brassica* sp. under natural condition in west UP, India

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Abstract
In this investigation the bio-efficacy of different insecticides against painted bug on mustard crop during both *Rabi* season 2016-17 and 2017-18 at Crop Research centre in SVP University of Agriculture and Technology, Meerut. Mustard is a major oilseed crop in India. The numbers of insects –pests are attacked on a mustard crop; out of those painted bug (*Bagrada hilaris*) is a major pest in western Uttar Pradesh. Imidacloprid17.8 SL was found most effective compare to all other treatments.

Keywords: insecticides, *Bagrada hilaris*, (Burm), bio-efficacy, mustard crop

Introduction
Rapeseed-mustard (*Brassica* sp.) is a major group of oilseed crop of the world being grown in 53 countries across the six continents. India contributes 28.3% in world acreage and 19.8% in world production. Mustard (*Brassica juncea* (L) Coss) is grown mainly for its seeds, which yield a good quality of edible oil led to 30 to 48%. The average yield of mustard in-country is 1069 kg ha^{-1} (Anonymous, 2017) [2]. In U.P. mustard is grown an area of 7.85 lakh hectare with production of 8.48 lakh tonnes and productivity of 1080 kg ha^{-1} (Anonymous, 2017) [2]. Mustard is attacked by a number of insect- pests out of those painted bug (*Bagrada hilaris*) is a major insect in western Uttar Pradesh (Singh. 2008) [3]. Both nymph and adult suck the cell sap from leaves at the seedling stage as well as developing pods, which gradually wilt and dry up. The attack at the pod formation and maturity stages are much more alarming as it results in losses to the tune of 30.1 percent in yield and 3.4 percent in oil content (Reed and Perring 2012).

Material and Methods
Field experiments were laid out in randomize block design (RBD) to study the efficacy of insecticides and biorational against painted bug, *Bagrada hilaris* on mustard crop during *Rabi* season, 2016-17 and 2017-18 at Crop Research Centre of S. V. P. University of Agriculture and Technology, Meerut (India) with three replication and nine treatments *viz*. Thiamethoxam 25 WDG, Novaluron 10 EC, Spinosad 45 SC, Dimethoate 30 EC, Imidacloprid 17.8 SL, NSKE, Neemarin 1500 PPM, *B. bassiana* @ $2x10^9$ CFU, *M. anisopliae* @ $2x10^9$ CFUand untreated plot with water spray. The crop variety Pusa bold was sown during 3rd week of November20, 2016 with row to row distance 30 X 30 cm.

Results and Discussion
Effect of different treatments against painted bug, *B. hilaris* during Rabi, 2016-17 and Rabi, 2017-2018
Painted bug population was recorded on 3rd day after the first application revealed that all the treatments were found significantly effective compare to control. The minimum population (1.00/plant) of the painted bug was recorded in Imidacloprid and Thiamethoxam. The maximum and similar population (5.00/plant) of painted bugs was recorded in *M. anisopliae* and *B. bassiana* followed by NSKE (4.33/plant) and Neemarin (3.33/plant).
Data recorded on the 7th day after the first application, revealed that all the treatments were significantly superior compare to control. The minimum (0.67/plant) painted bug population was observed in Imidacloprid which was found significantly superior over the rest of the treatments (Ahuja and Joshi, 1995) [1].

A similar trend in the reduction of painted bug population was observed in the 10th day after application and all the treatment proved better than control. The minimum (0.33/plant) population of the painted bug was recorded in Imidacloprid followed by Thiamethoxam (0.67 bugs/plant) and Dimethoate (1.33 bugs/plants) and significantly superior over rest of treatments.

Observation recorded on the 3rd day of the second spray, the minimum (0.67) number of painted bug/plant population was observed in Imidacloprid, followed by Thiamethoxam (1.00 bugs/plant) which was statistically at par with each other.

Data recorded on 7th days after the second application revealed that all the treatments were found significantly superior compare to control. Imidacloprid maintained its efficacy and recorded a minimum population of painted bug (0.33 bugs/plant) followed by Thiamethoxam (0.67 bugs/plant) which were found significantly superior all over the rest of the treatments. The maximum population of painted bug (5.00 bus/ plant) was observed in *M. anisopliae* and *B. bassiana*, (4.67 bugs/plant) treatment respectively.

The observation recorded on the 10th day after application revealed that all the treatments maintained their efficacy and significance over control. There was no painted bug found in the Imidacloprid treated plot, which differ significantly from the rest of the treatments (Chauhan and Yadav. 2007) [4].

Rabi, 2017-18

All the treatments were found significantly superior over control on 3rd day after the first application. The minimum (1.33) painted bugs/plant was recorded in Imidacloprid and it was significantly superior over rest of treatments followed by Thiamethoxam (1.67 bugs/plant) which were found significantly at par with each other.

The population 7th day after application of painted bugs/plants varied from 0.67 to 5.67 in different treatments. The minimum (0.67 bugs/plant) population was recorded in Imidacloprid and it was significantly superior over rest of treatments followed by Thiamethoxam (1.00 bugs/plant), Dimethoate (1.67 bugs/plant), Spinosad (2.00 bugs/plant) and Novaluron (2.67 bugs/plant) which were significantly different from each other.

The results revealed that all the treatments maintained their efficacy and significance over control on the 10th days of application. The minimum (1.00 painted bugs/plant) number was recorded in Imidacloprid.

The data recorded on the 3rd day after application revealed that all the treatments were found significantly superior over control and the painted bug population varied from 0.67 to 6.00 per plant. The minimum population of painted bug (0.67 bugs/plant) was observed in Imidacloprid and Thiamethoxam (1.00 bugs/plant) which were found significantly superior all over the rest of the treatments.

Seventh-day after the second spray, the painted bug population was not recorded in Imidacloprid treated plot followed by Thiamethoxam (0.33 bugs/plant), which were at par with each other and significantly superior over control. The next effective treatment was Dimethoate (1.00 bugs/plant) and Spinosad (1.33 bugs/plant). The maximum population of painted bug (4.33 bugs/plant) was recorded in *M. anisopliae*.

The observation recorded on after the 10th day of the second application showed that all the treatments maintained their superiority over control. No bug population was recorded in Imidacloprid and Thiamethoxam treated plot which significantly superior all over the rest of the treatments.

Table 1: Effect of different treatments against painted bug, *Bagrada hilaris* during *Rabi*, 2016-2017 and 2017-18.

Treatments	Dose/ ha	No of Painted Bugs						Mean
		First spray pool data 2016-17			Second spray pool data 2017-18			
		3 DAS	7 DAS	10 DAS	3 DAS	7 DAS	10 DAS	
Thiamethoxam 25 WDG	100 gm.	1.33	1.00	1.00	1.00	0.5	0.16	0.83
Imidacloprid 17.8 SL	150 ml	1.16	0.67	0.66	0.67	0.16	0.00	0.55
Novaluron 10 EC	500 ml	3	2.83	3.00	2.67	2.16	1.83	2.58
Spinosad 45 SC	200 ml	2.5	2.16	2.16	2.33	1.5	1.16	1.96
NSKE	2 litre	4.66	4.33	4.5	4.33	3.33	3.00	4.02
Neemarin1500 PPM	3 litre	3.83	3.83	3.83	4.00	3.16	2.66	3.55
Beauveria bassiana @ $2x10^9$ CFU	2.5 kg	5.33	5.66	5.83	5.33	4.33	4.33	5.13
Metarhizium anisopliae @ $2x10^9$ CFU	2.5 kg	5.5	6.00	6.16	5.66	4.66	4.66	5.44
Dimethoate30 EC	660 ml	2	1.67	1.66	1.67	1.16	0.83	1.49
Control	-	6.66	7.16	7.5	6.66	5.83	5.33	6.52
SE(m) ±	-	0.05	0.05	0.05	0.05	0.06	0.05	0.05
CD at 5 %	-	0.15	0.16	0.16	0.15	0.18	0.16	0.16

Figure in parentheses is square root values
DAS = Day after spray

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