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Field efficacy and economics of selected insecticides against gram pod borer [*Helicoverpa armigera* (Hubner)] on greengram [*Vigna radiata* (L.) Wilczek]

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Abstract
A field trial was conducted at central research farm, SHUATS during *kharif* season of 2023. Eight treatments including control were evaluated against *Helicoverpa armigera* i.e. Chlorantraniliprole @ 18.5% SC, Imidacloprid @ 17.8% SL, *Bacillus thuringiensis* @ 4% WSP, Indoxacarb @ 14.5% SC, Spinosad @ 45% SC, Fipronil @ 5% SC, Azadirachtin (Neem oil @ 5%) and Control. Results revealed that, among all the different treatments lowest population of *Helicoverpa armigera* was recorded in Chlorantraniliprole @ 18.5 SC (0.73). Spinosad 45% SC (1.19) was found to be the next best treatment followed by Indoxacarb @ 14.5 SC (1.08), Imidacloprid @ 17.8 SL (1.19), Fipronil @ 5% SC (1.26) . The least effective treatments were *Bacillus thuringiensis* @ 4% WSP (1.35) and Azadirachtin (Neem oil 5%) (1.45) but superior as compared to untreated Control plot. The highest yield was recorded in Chlorantraniliprole 18.5% SC (17.2 q/ha) followed by Spinosad 45% SC (16.2 q/ha), Indoxacarb 14.5 SC (14.7 q/ha), Imidacloprid 17.8% SL (14 q/ha), Fipronil 5% SC (13.2 q/ha), *Bacillus thuringiensis* 4% WSP (12.2 q/ha) and Azadirachtin (Neem oil 5%) (12.1 q/ha), as compared to control plot (4 q/ha). Among the treatments studied, the best and most economical treatment was Chlorantraniliprole 18.5% SC (1:4.00) followed by Spinosad 45% SC (1:3.95), Indoxacarb 14.5 SC (1:3.92), Imidacloprid 17.8% SL (1:3.90), Fipronil 5% SC (1:3.65), *Bacillus thuringiensis* 4% WSP (1:3.23), Azadirachtin (Neem oil 5%) (1:3.14), as compared to control plot (1:1.20).

Keywords: Efficacy, greengram, *Helicoverpa armigera*, insecticides, pod borer

Introduction

Mung bean (*Vigna radiata*) is a plant species of Fabaceae which is also known as green gram. It has chromosome number 2x=2n=22. The green gram is an annual vine with yellow flowers and fuzzy brown pods. There are three subgroups of *Vigna radiata*, including one cultivated (*Vigna radiata* subsp. *radiata*) and two wild ones (*Vigna radiata* subsp. *sublobata* and *Vigna radiata* subsp. *glabra*). It has a height of about 15–125 cm. Mung bean has a well-developed root system. The lateral roots are many and slender, with root nodules grown. Stems are much branched, sometimes twining at the tips. Young stems are purple or green, and mature stems are greyish yellow or brown (Meena *et al.*, 2021) [16].

Mung beans are recognized for their high nutritive value. Mung beans contain about 55%-65% carbohydrate and are rich in protein, fat, vitamins and minerals. It is composed of about 20% to 50% protein of total dry weight, among which globulin (60%) and albumin (25%) are the primary storage proteins. Mung bean is considered to be a substantive source of dietary proteins. The proteolytic cleavage of these proteins are even higher during sprouting (Sireesha and Kumar 2022) [25].

India is the largest producer of greengram in the world. Area under Mungbean cultivation is 46.07 Lha, producing 24.48 LT with a productivity of 531 kg/ha. In total pulses Mungbean contributes 16% in area and 10% in pulse production. Mung production in the country is largely concentrated in five states *viz.* Rajasthan, Maharashtra, Madhya Pradesh, Karnataka and Bihar. Among these states Rajasthan contributes the 51% of the total production of country, Madhya Pradesh (16%), Maharshtra (9%), Karnataka (7%) and Bihar (6%).

Gram pod borer, *Helicoverpa armigera*, is considered as a notorious pest. It also attacks pigeon pea, moong bean, lentil, soybean, okra, maize, berseem, sunflower, sorghum, tobacco and tomato. Besides gram pod borer, it is also known as cotton bollworm, gram caterpillar, tomato fruit worm and tobacco bud worm. Pod borer is the most serious insect pest of greengram (Ullah *et al.*, 2015) [25].

Gram pod borer, *Helicoverpa armigera* (Hubner) (Lepidoptera: Noctuidae), a global and polyphagous pest equipped with multivoltine, diapauses is magnified due to its attack on reproductive stages, primarily on fruiting bodies, highly mobile and nocturnal in nature spread quickly in wide areas, found to cause economic damage to several cultivated crops *viz*., chickpea, pigeonpea, tomato, chilli, okra, etc throughout the year in India and sub-continent (Singh and Ali, 2006) [24].

The gram pod borer, *Helicoverpa armigera* is a potential and polyphagous pest, with various characteristic features like high fecundity, migratory behavior, high adaptations to various agro climatic conditions and development of resistance to various insecticides, extensively damaging many crops including greengram and chickpea (Kambrekar *et al.*, 2009) [11]. The caterpillar not only defoliates the tender leaves but also makes holes in the pods and feed upon the developing seeds the anterior body portion of the caterpillar remains inside the pod and rest half or so hanging outside. When seeds of one pod are finished, it moves to the next. Unless the pest is controlled in the initial stages of infestation it takes the heavy toll of the crop.

Materials and Methods

The present study was conducted at Central Research Farm, SHUATS, Uttar Pradesh, India during *kharif* season of 2023 for the management of gram pod borer using Samrat variety of greengram keeping row to row and plant to plant distance of 30 x15cm. The field experiment was laid out in randomized block design with eight different treatments replicated thrice . The plot had a dimension of 2x1 m^2.

All of the insecticides used in the study were sprayed as foliar application. In this experiment, eight different treatments, consisting application of T_1 Chlorantraniliprole 18.5% SC (0.3 ml/L), T_2 Imidacloprid 17.8% SL (0.2 ml/L), T_3 *Bacillus thuringiensis* 4% WSP (1 gm/L), T_4 Indoxacarb 14.5 SC (0.3 ml/L), T_5 Spinosad 45% SC (0.3 ml/L), T_6 Fipronil 5% SC (0.4 ml/L), T_7 Azadirachtin (Neem Oil 5%) (2 ml/L) and T_8 untreated Control. Two sprays were carried out at intervals of 14 days during the experiment to assess the effectiveness of pesticides when the *Helicoverpa armigera* larval population reached the ETL threshold. On five randomly chosen and tagged plants in each plot, pre- and post-treatment observations on the larval population were made shortly before 24 hours and 3rd, 7th, and 14th days following application, respectively.

Formulae used

The spray solution of desired concentration should be prepared by adopting the following formula:

$$V = \frac{(C \times A)}{\% \, a.i.}$$

Where,

V=Volume of a formulated pesticide required. C= Concentration required.

A= Volume of total solution to be prepared.

% a.i. = Percentage of active ingredient in commercial product.

$$\text{Cost benefit ratio} = \frac{\text{Gross return}}{\text{Total cost of cultivation}}$$

Thuppukonda and Kumar (2022) [26].

Results and Discussion

The findings of the current investigation demonstrated that after insecticidal applications against gram pod borer, *Helicoverpa armigera* were found significantly superior over control plot. The data on the mean (3,7 and 14 DAS) larval population of *Helicoverpa armigera* on first spray revealed that all the treatments except untreated control are effective and at par with each other. Among all the treatments lowest population of pod borer was recorded in Chlorantraniliprole 18.5% SC (1.13) followed by Spinosad 45% SC (1.31), Indoxacarb 14.5 SC (1.49), Imidacloprid 17.8% SL (1.58), Fipronil 5% SC (1.66), *Bacillus thuringiensis* 4% WSP (1.77) and Azadirachtin (Neem Oil 5%) (1.91) is found to be least effective but comparatively superior over the control. The data on the larval population of *Helicoverpa armigera* on second spray revealed that all the treatments were significantly superior over untreated plot. Among all the treatments lowest population of pod borer was recorded in Chlorantraniliprole 18.5% SC (0.33), Spinosad 45% SC (0.55), Indoxacarb 14.5 SC (0.68) which was significantly superior over control followed by Imidacloprid 17.8% SL (0.80), Fipronil 5% SC (0.86), *Bacillus thuringiensis* 4% WSP (0.93) and Azadirachtin (Neem Oil 5%) (1.00) showed the least effectiveness among all treatments.

The yields among the different treatments were significant. All the treatments were superior over control The highest yield was recorded in Chlorantraniliprole 18.5% SC (17.2 q/ha) followed by Spinosad 45% SC (16.2 q/ha), Indoxacarb 14.5 SC (14.7 q/ha), Imidacloprid 17.8% SL (14 q/ha), Fipronil 5% SC (13.2 q/ha), Bacillus thuringiensis 4% WSP (12.2 q/ha) and Azadirachtin (Neem oil 5%) (12.1 q/ha), as compared to control plot (4 q/ha).

When cost benefit ratio was worked out, interesting result was achieved. Among the treatments studied, the best and most economical treatment was Chlorantraniliprole 18.5% SC (1:4.00) followed by Spinosad 45% SC (1:3.95), Indoxacarb 14.5 SC (1:3.92), Imidacloprid 17.8% SL (1:43.90), Fipronil 5% SC (1:3.65), *Bacillus thuringiensis* 4% WSP (1:3.23), Azadirachtin (Neem oil 5%) (1:3.14), as compared to control plot (1:1.20).

Among all the treatments lowest larval population of gram pod borer was recorded in Chlorantraniliprole @ 18.5 SC (0.730), similar findings were made by Alok *et al.* (2022) [3], Rajendra and Kumar (2022) [21], Aleem and Yadav (2023) [2] and Nagalakshmi and Yadav (2023) [19] who reported that Chlorantraniliprole @ 18.5% SC was the most effective treatment indicating recorded lowest population of *Helicoverpa armigera*. Spinosad @ 45% SC (0.930) is found to be the next best treatment which is in line with the findings of Kachave *et al.* (2020) [10], Ray and Banerjee (2021) [22], Antala *et al.* (2022) [4] and Kumar and Kumar (2023) [14] who reported that that Spinosad 45% SC was found to be most effective in reducing population of *Helicoverpa armigera* as well as increasing the yield.

Inodxacarb @ 14.5 SC (1.085) was the next effective treatment which is in line with the findings of Yogeeswardu *et al.* (2014) [30], Gautam *et al.* (2018) [8] and Das and Tayde

(2022) [6]. Imidacloprid @ 17.8% SL (1.190) was found to be the next effective treatment which is in line with the findings of Kumar *et al.* (2020) [10], Farooq *et al.* (2022) [7] and Patil and Yadav (2023) [20]. Fipronil @ 5% SC (1.455) was found to be the next effective treatment which is in line with findings of Adsure and Mohite (2014) [1], Sathish *et al.* (2018) [23] and Tripathi *et al.* (2023) [27]. *Bacillus thuringiensis* @ 4% WSP (1.360) was found to be the next effective treatment which is line with the findings of Golvankar *et al.* (2015) [9], Kumar *et al.* (2019) [12], Mutlag and AL-Haddad (2019) [18] and Yadav *et al.* (2022) [29]. The result of Azadirachtin (Neem oil 5%) (1.455) was found to be the least effective but comparatively superior over the control, these findings are supported by Bhushan *et al.* (2011) [5], Lakshminath and Kumar (2018) [15] and Moosan and Kumar (2022) [17].

Table 1: Effect of selected insecticides against larval population of *Helicoverpa armigera* on greengram (1st and 2nd spray):

S. No.	Treatments	Number of larvae (*Helicoverpa armigera*) / five plants									Overall mean	Yield (q/ha)	C:B Ratio
		Dosage	First spray				Second spray						
			1 DBS	3 DAS	7 DAS	14 DAS	1 DBS	3 DAS	7 DAS	14 DAS			
T1	Chlorantraniliprole 18.5% SC	0.3 ml/L	2.27	1.27	1.00	1.07	1.07	0.40	0.27	0.33	0.73	17.2	1:4.00
T2	Imidacloprid 17.8 SL	0.2 ml/L	2.40	1.67	1.60	1.47	1.47	0.80	0.73	0.87	1.19	14	1:3.90
T3	*Bacillus thuringiensis* 4%WSP	1 gm/ L	2.40	1.86	1.73	1.80	1.80	0.93	0.87	1.00	1.35	12.1	1:3.23
T4	Indoxacarb 14.5% SC	0.3 ml/L	2.33	1.60	1.47	1.40	1.40	0.73	0.60	0.73	1.08	14.7	1:3.92
T5	Spinosad 45% SC	0.2 ml/L	2.40	1.47	1.20	1.27	1.27	0.60	0.47	0.60	0.93	16.20	1:3.95
T6	Fipronil 5% SC	0.4 ml/L	2.27	1.80	1.67	1.60	1.60	0.87	0.80	0.93	1.26	13.2	1:3.65
T7	Azadirachtin (Neem Oil 5%)	2 ml/L	2.27	1.93	1.87	1.93	1.93	1.00	0.93	1.07	1.45	12.20	1:3.14
T8	Control	….	2.40	2.46	2.6	2.6	2.6	2.6	2.53	2.67	2.56	4	1:1.20
	F-test		NS	S	S	S	S	S	S	S	S	…..	…..
	S. Ed (±)			0.9	0.08	0.05	0.05	0.05	0.08	0.09	0.23	…..	…..
	C.D. (P = 0.5)		_	0.19	0.16	0.12	0.12	0.11	0.18	0.19	0.53	…..	…..

DBS** - Day Before Spray**, DAS**- Day After Spray***

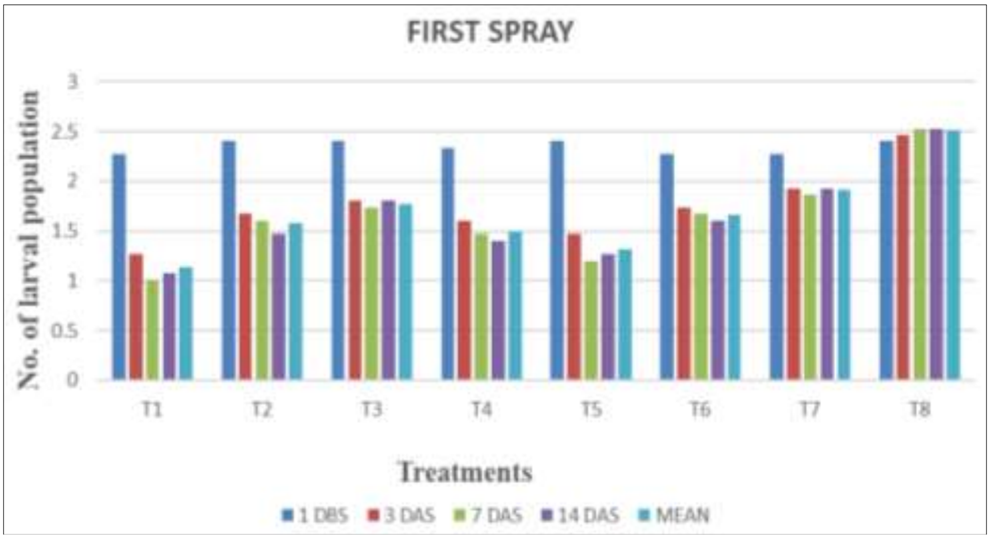

Fig 1: Larval population of gram pod borer (*Helicoverpa armigera)* after 1st spray

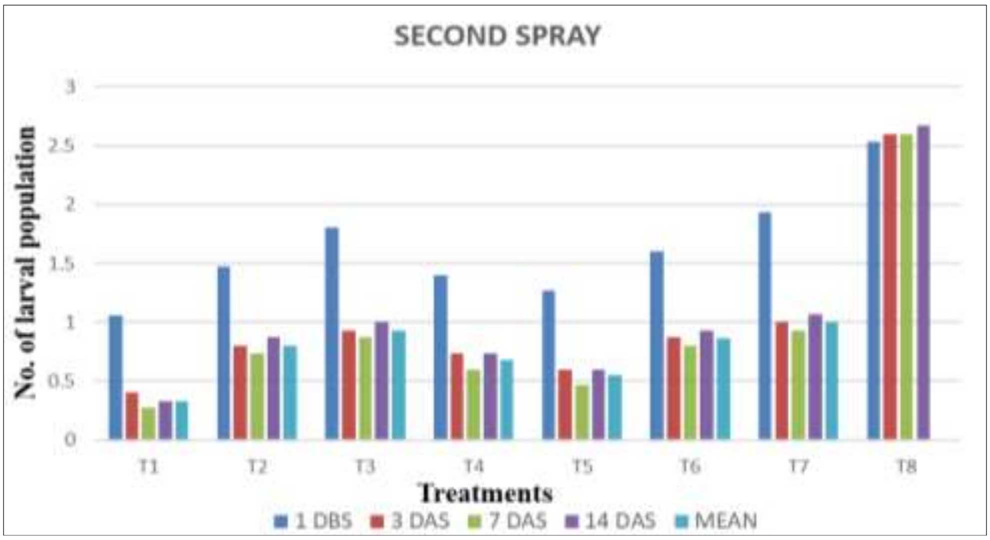

Fig 2: Larval population of gram pod borer (*Helicoverpa armigera*) after second spray

Conclusion
From the critical analysis of the present findings, it can be concluded that among the treatments studied, the best and most economical treatment was Chlorantraniliprole 18.5SC (1:4.00) and marketable yield (17.2 q/ha) followed by Spinosad 45% SC (1:3.95 and 16.2 q/ha), Indoxacarb 14.5 SC (1:3.92 and 14.7 q/ha), Imidacloprid 17.8% SL (1:3.90 and 14 q/ha), Fipronil 5% SC (1:3.65 and 13.2 q/ha), *Bacillus thuringiensis* 4% WSP (1:3.23 and 12.2 q/ha) and Azadirachtin (Neem oil 5%) (1:3.14 and 12.1 q/ha), as compared to control plot (1:1.20and 4 q/ha) respectively. Hence this can be a part of integrated pest management in order to avoid indiscriminate use of pesticides for ecofriendly management and to balance flora and fauna of eco system which causes pollution in the environment and also it will be less harmful to beneficial insects and human beings.

References

1. Adsure SP, Mohite PB. Efficacy of newer molecules of insecticides against Gram Pod Borer, *Helicoverpa armigera* (Hub.) on Chickpea. International Journal of Science and Research. 2014;6(14):2319-7064.
2. Aleem SA, Yadav U. Efficacy of Bio-Pesticides and Chemicals against Gram Pod Borer [*Helicoverpa armigera* (Hubner)] on Greengram (*Vigna radiata* (L.) Wilczel). International Journal of Plant and Soil Science. 2023;35(17):606-614.
3. Alok NS, Singh SK, Chandra U. Bioefficacy and economics of certain new molecule of insecticides against Gram pod borer, *Helicoverpa armigera* (Hubner) in chickpea. Environment Conservation Journal. 2022;23(3):404-411.
4. Antala DH, Patel DR, Makvana LL. Evaluation of insecticides against *Helicoverpa armigera* Hubner in chickpea. Journal of Entomology and Zoology Studies. 2022;10(5):115-117.
5. Bhushan S, Singh RP, Shanker R. Bioefficacy of neem and Bt against pod borer, *Helicoverpa armigera* in chickpea. Journal of Biopesticides. 2011;4(1):87-89.
6. Das K, Tayde AR. Comparative effect of selected insecticides and biopesticides against Gram Pod Borer, *Helicoverpa armigera* (Hubner) on Chickpea (*Cicer arietinum* (L.)). Journal of Experimental Zoology. 2022;25(2):2611-2616.
7. Farooq Z, Mantoo MA, Yaqoob M, Ayoub L, Irshad SS, Bhati TA, et al. Efficacy of insecticides against Gram Pod Borer *Helicoverpa armigera* on Soybean. Indian Journal of Entomology. 2022;10:554-546.
8. Gautam MP, Chandra U, Singh SN, Yadav SK, Giri SK. Studies on Efficacy of Botanicals against *Helicoverpa armigera* (Hubner) on Chickpea (*Cicer arietinum* L.). International Journal of Current Microbiology and Applied Sciences. 2018;7:612-618.
9. Golvankar GM, Desai VS, Dhobe NS. Management of Chickpea Pod Borer, *Helicoverpa armigera* Hubner by using Microbial Pesticides and Botanicals. Trends in Biosciences. 2015;8(4):887-890.
10. Kachave DR, Sonkamble MM, Patil SK. Bioefficacy of newer insecticides against tomato fruit borer (*Helicoverpa armigera* Hubner) and leaf miner (*Tuta absoluta* Meyrick). Journal of Entomology and Zoology Studies. 2020;8(3):346-352.
11. Kambrekar DN, Kulkarni KA, Giraddi RS, Kulkarni JH, Fakrudin B. Management of chickpea pod borer, *Helicoverpa armigera* (Hubner) through Nuclear Polyhedral Virus isolates. Precision Agriculture. 2009;10:450-457.
12. Kumar A, Tripathi MK, Chandra U, Veer R. Efficacy of botanicals and bio-pesticide against *Helicoverpa armigera* in chickpea. Journal of Entomology and Zoology Studies. 2019;7(1):54-57.
13. Kumar S, Umrao RS, Kumar A, Patel VK, Debnath R, Kumar A. Evaluation of the efficacy of insecticides and bio-pesticides against *Helicoverpa armigera* (Hubner) on tomato. Journal of Entomology and Zoology Studies. 2020;8(3):555-558.
14. Kumar KP, Kumar A. Comparative Efficacy and Economics of Selected Chemicals and Neem Oil against Gram Pod Borer [*Helicoverpa armigera* (Hubner)] on Cowpea [*Vigna unguiculata* (L.) Walp.]. International Journal of Environment and Climate Change. 2023;13(9):1113-1118.
15. Lakshminath R, Kumar A. Comparative efficacy of selected chemicals and biopesticides against gram pod borer [*Helicoverpa armigera* (Hubner)] (Lepidoptera: Noctuidae) on cowpea [*Vigna unguiculata* (L.) Walp.]. Journal of Pharmacognosy and Phytochemistry. 2018;7(3):3307-3309.
16. Meena VP, Khinchi SK, Kumawat KC, Choudhary S. Seasonal incidence of gram pod borer, *Helicoverpa armigera* (Hubner) and spotted pod borer, *Maruca testulalis* (Geyer) on greengram in relation to weather parameters. The Pharma Innovation Journal. 2021;10(10):696-699.
17. Moosan M, Kumar A. Efficacy and economics of different insecticides against gram pod borer, *Helicoverpa armigera* (Hubner). The Pharma Innovation. 2022;11(7):4471-4474.
18. Mutlag NH, Al-Haddad AS. Field efficacy of Certain Biopesticides and Neem Based Products Against *Helicoverpa armigera* (Hubner) on Chickpea (*Cicer arietinum* L.). International Journal of Pharmaceutical Quality Assurance. 2019;10(1):156-159.
19. Nagalakshmi, Yadav U. Comparative efficacy of selected insecticides against gram pod borer, *Helicoverpa armigera* (Hubner). The Pharma Innovation. 2023;12(6):3536-3539.
20. Patil RP, Yadav U. Bio-efficacy of certain insecticides against *Helicoverpa armigera* (Hubner) on greengram (*Vigna radiata* L.). The Pharma Innovation Journal. 2023;12(6):4059-4062.
21. Rajendra GS, Kumar A. Field efficacy and economics of different insecticides against pod borer [*Helicoverpa armigera* (Hubner)] on Chickpea (*Cicer arietinum* L.). The Pharma Innovation. 2022;11(7):3401-3404.
22. Ray S, Banerjee A. Efficacy of some novel insecticides against gram pod borer (*Helicoverpa armigera* Hubn.) infesting chickpea. Journal of Crop and Weed. 2021;17(3):130-135.
23. Sathish BN, Singh VV, Kumar S, Kumar S. Efficacy of different chemicals and bio-pesticides against tomato fruit borer *Helicoverpa armigera* (Hubner) on tomato crop. Bulletin of Environment, Pharmacology and Life Sciences. 2018;7(12):107-110.

24. Singh R, Ali S. Seasonal incidence of *Helicoverpa armigera* and *Campoletis chlorideae* on chickpea. *Annual Plant Protection Sciences*. 2006;14(4):234-235.
25. Sireesha BS, Kumar A. Efficacy of selected insecticides against pod borer (*Helicoverpa armigera*) on greengram. The Pharma Journal. 2022;12(6):4059-4062.
26. Thuppukonda M, Kumar A. Efficacy of selected insecticides against chilli thrips (*Scirtothrips dorsalis* Hood). The Pharma Innovation Journal. 2022;11(5):591-595.
27. Tripathi V, Kumar A, Singh S, Singh R, Baghel KS, Pandey AK. Efficacy of New Generation Insecticides in Comparison with Biopesticides and their Economics against Chickpea Pod Borer (*Helicoverpa armigera* Hub.). Indian Journal of Agricultural Research. 2023;57(3):394-398.
28. Ullah F, Ali M, Ahmad S, Badshah H. Impact of light traps on population density of gram pod borer, *Helicoverpa armigera* (Hub.) and its larval parasitoid (*Campoletis chlorideae* Uchida) in Rod Kohi area of Dera Ismail Khan, Pakistan. Journal of Entomology and Zoology Studies. 2015;3(2):203-207.
29. Yadav S, Pal RK, Yadav AK, Yadav AS, Singh G. Field assessment of insecticides as well as Bio-pesticides to manage the tomato fruit borer *Helicoverpa armigera* Hubner. International Journal of Environment and Climate Change. 2022;12(11):2573-2580.
30. Yogeeswarudu B, Krishna VK. Field studies on efficacy of novel insecticides against *Helicoverpa armigera* (Hubner) infesting on Chickpea. Journal of Entomology and Zoology Studies. 2014;2(5):35-38.