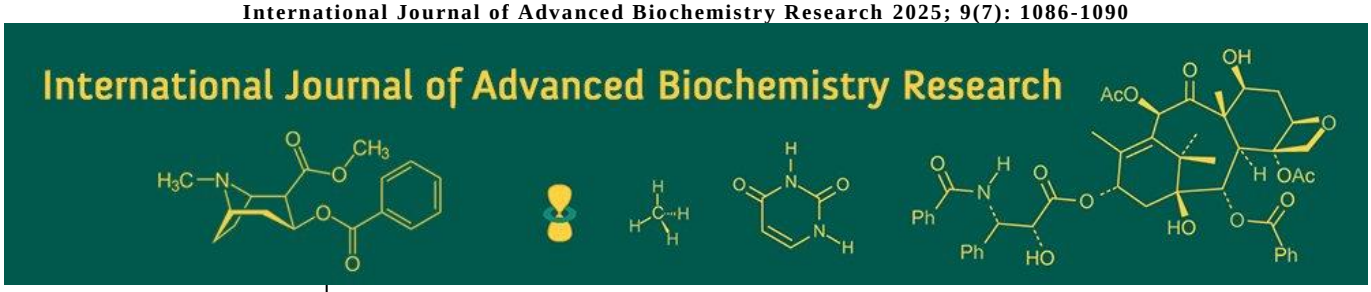

ISSN Print: 2617-4693
ISSN Online: 2617-4707
NAAS Rating: 5.29
IJABR 2025; 9(7): 1086-1090
www.biochemjournal.com
Received: 07-04-2025
Accepted: 11-05-2025

Lokesh Kumar Sen
M.Sc. Scholar, Department of Entomology, COA, Indira Gandhi Krishi Vishwavidyalaya Raipur, Chhattisgarh, India

Dr. Navneet Rana
Professor, Department of Entomology, College of agriculture and Research Station, Indira Gandhi Krishi Vishwavidyalaya Raipur, Chhattisgarh, India

Dr. Richa Choudhary
Assistant Professor, Department of Entomology, College of Agriculture and Research Station, Indira Gandhi Krishi Vishwavidyalaya Raipur, Chhattisgarh, India

Corresponding Author:
Lokesh Kumar Sen
M.Sc. Scholar, Department of Entomology, COA, Indira Gandhi Krishi Vishwavidyalaya Raipur, Chhattisgarh, India

Assessment of the safety of plant-based products and microbial insecticides on beneficial natural enemies of rice pests

Lokesh Kumar Sen, Navneet Rana and Richa Choudhary

DOI: https://www.doi.org/10.33545/26174693.2025.v9.i7n.4885

Abstract
The current study Comparative bio-efficacy of plant derivatives and microbial insecticides against major insect pests of rice crop was carried out at the instructional cum research farm at college of agriculture and research station Kanpa, Mahasamund (C.G.). In bio-safety evaloverall mean of three spray indicates that among the different plant derivatives and microbial insecticides maximum population of Lady Bird Beetles recorded in Bitter gourd leaf Extract-Neem Oil-*Bacillus thuringiensis* (3.07%). All plant derivatives and microbial insecticides are safer treatment against the Lady Bird Beetles and lowest population recorded in Chlorantraniliprole plot (1.86%).

Keywords: Plant derivatives, microbial insecticides, rice pests, bio-efficacy, *Bacillus thuringiensis*, ladybird beetles

Introduction
According to the Ministry of Agriculture and Farmers Welfare, total rice production during 2023-24 is estimated at record 1378.25 LMT. It is higher by 20.70 LMT than previous year's rice production of 1357.55 LMT. While in Chhattisgarh, rice occupies average of 3.6 million ha with the production of 14.7 million metric tons and productivity of the state was about 1106 kg/ha depending upon the rainfall.
The excessive use of pesticides has resulted in reduction of biodiversity of natural enemies, development of pesticide induced resistance and outbreak of secondary pests. Side effects of insecticides on natural enemies and possibility of their integration in plant protection strategies have been well documented. Over 98% of sprayed insecticide sand 95% of herbicides reach a destination other than their target species, as they are sprayed across the entire field. This issue can be sorted out by adopting plant derivatives and microbial insecticides for insect pest management. These are good alternative to synthetic pesticide. Various plant products like neem, Karanja has been known for decades for its potential for insect pest management. This issue can be sorted out by adopting plant derivatives and microbial insecticides for insect pest management. These are good alternative to synthetic pesticide. Various plant products like neem, Karanja has been known for decades for its potential for insect pest management.

Materials and Methods
An experimental area of 770 m2 was selected, and it well be ploughed and prepared as per the recommended agronomical practices. Swarna variety of rice was planted. Entire experimental area was divided in three replicated manners with a plot size of 5 m x 4 m. Total ten treatments was planned. In each plot the observation for the natural enemies was taken after emergence up to maturity of the crop. Different plant derivatives and microbial insecticides were evaluated for the safety of Lady bird beetle of major insect pest of rice Pretreatment observation was recorded on 10 randomly selected hills a day prior to insecticidal application while, post treatment observations were recorded at 1, 3,7,10 and 15 days after spraying.

Results

Bio-safety evaluation of plant derivatives and microbial insecticides against Lady bird beetle (first spray)

Data of the (table 1) illustrate that in pre-treatment observation average Lady bird beetle population ranged from 2.33 to 4.03 per hill which differs non significantly among all the treatments including untreated control One day after first application of the treatments all plant derivatives and microbial insecticides are safer treatments against the lady bird beetles. Among plant derivatives and microbial insecticides highest population was recorded in Bitter gourd leaf Extract-Neem Oil-*Bacillus thuringiensis* (T_3) plot with the average number of 3.96 which is significantly at par with T_2 Minimum population of lady bird beetle was recorded from plot treated with Chlorantraniliprole with 2.15 lady bird beetle per hill.

Three days after first application of the treatments plant derivatives and microbial insecticides are safer treatments against the lady bird beetles. Among plant derivatives and microbial insecticides highest population was recorded in Neem leaf Extract-Eucalyptus oil-*Beauveria bassiana* (T_2) plot with the average number of 3.49. Minimum population of lady bird beetle was recorded from plot treated with Chlorantraniliprole with 2.11 lady bird beetle per hill.

Seven days after first application of the treatments plant derivatives and microbial insecticides are safer treatments against the lady bird beetles. Among plant derivatives and microbial insecticides highest population was recorded in Bitter gourd leaf Extract-Neem Oil-*Bacillus thuringiensis* (T_3) plot with the average number of 4.33 which is significantly at par with T_2. Minimum population of lady bird beetle was recorded from plot treated with Chlorantraniliprole with 2.11 lady bird beetle per hill.

Ten days after first application of the treatments plant derivatives and microbial insecticides are safer treatments against the lady bird beetles. Among plant derivatives and microbial insecticides highest population was recorded in Bitter gourd leaf Extract-Neem Oil-*Bacillus thuringiensis* (T_3) plot with the average number of 4.54. Minimum population of lady bird beetle was recorded from plot treated with Chlorantraniliprole with 2.02 lady bird beetle per hill.

Fifteen days after first application of the treatments plant derivatives and microbial insecticides are safer treatments against the lady bird beetles. Among plant derivatives and microbial insecticides highest population was recorded in Neem leaf Extract-Eucalyptus oil-*Beauveria bassiana* (T_2) plot with the average number of 4.39 which is significantly at par with T_3. Minimum population of lady bird beetle was recorded from plot treated with Chlorantraniliprole with 1.70 lady bird beetle per hill.

Data in the (table 1) showed that Overall mean of first spray implies that Among plant derivatives and microbial insecticides highest population was recorded in Bitter gourd leaf Extract-Neem Oil-*Bacillus thuringiensis* (T_3) plot with the average number of 3.92 which is significantly at par with T_2. Minimum population of lady bird beetle was recorded from plot treated with Chlorantraniliprole with 2.09 lady bird beetle per hill.

Table 1: Effects of plant derivatives and microbial insecticides application on Lady Bird Beetles of rice ecosystem. (First spray)

	Average no. of Lady Bird Beetles Population per hill						
	Treatment details	**PTO**	**1 DAS**	**3 DAS**	**7 DAS**	**10 DAS**	**15 DAS**	**Mean**
T_1	Karanja leaf Extract-Neem Oil-*Bacillus thuringiensis*	2.50 (1.87)	2.53 (1.82)	2.07 (1.75)	2.11 (1.76)	1.85 (1.68)	1.77 (1.66)	2.10 (1.76)
T_2	Neem leaf Extract-Eucalyptus oil-*Beauveria bassiana*	3.00 (2.00)	3.41 (2.09)	3.49 (2.11)	3.35 (2.08)	4.28 (2.29)	4.39 (2.32)	3.65 (2.15)
T_3	Bitter gourd leaf Extract-Neem Oil-*Bacillus thuringiensis*	4.03 (2.24)	3.96 (2.22)	2.78 (1.94)	4.33 (2.30)	4.54 (2.35)	4.37 (2.31)	3.92 (2.23)
T_4	Neem oil-*Bacillus thuringiensis*-Karanja leaf Extract	2.50 (1.87)	2.54 (1.87)	2.64 (1.90)	2.75 (1.93)	2.87 (1.96)	2.86 (1.96)	2.69 (1.92)
T_5	Eucalyptus oil-*Beauveria bassiana*-Neem leaf Extract	2.33 (1.82)	2.43 (1.84)	2.44 (1.85)	2.50 (1.87)	2.49 (1.86)	2.64 (1.90)	2.47 (1.86)
T_6	*Bacillus thuringiensis*-Karanja leaf Extract-Neem oil	2.53 (1.87)	2.60 (1.90)	2.64 (1.90)	2.67 (1.91)	2.74 (1.93)	2.74 (1.93)	2.65 (1.91)
T_7	*Beauveria bassiana*-Neem leaf Extract-Eucalyptus oil	2.62 (1.90)	2.66 (1.91)	2.60 (1.89)	2.70 (1.92)	2.80 (1.95)	2.83 (1.95)	2.70 (1.92)
T_8	NSKE-NSKE-NSKE	2.52 (1.87)	2.53 (1.87)	2.63 (1.90)	2.76 (1.93)	2.60 (1.89)	2.70 (1.92)	2.62 (1.90)
T_9	Chlorantraniliprole-Chlorantraniliprole-Chlorantraniliprole	2.55 (1.88)	2.15 (1.77)	2.11 (1.76)	2.11 (1.76)	2.02 (1.66)	1.70 (1.50)	2.09 (1.75)
T_{10}	Untreated Control	3.54 (2.87)	3.67 (2.91)	4.10 (3.75)	4.23 (3.80)	4.33 (3.91)	4.41 (3.93)	4.04 (3.71)
	SE(m)±	0.039	0.044	0.148	0.033	0.018	0.031	0.052
	CD at 5%	NS	0.13	0.11	0.10	0.05	0.08	0.09

Bio-safety evaluation of plant derivatives and microbial insecticides against Lady bird beetle (second spray)

Data of the (Table 2) illustrate that in pre-treatment observation average Lady bird beetle population ranged from 2.07 to 2.73 per hill which differs non significantly among all the treatments including untreated control One day after second application of the treatments plant derivatives and microbial insecticides are safer treatments against the lady bird beetles. Among plant derivatives and microbial insecticides highest population was recorded in *Beauveria bassiana*-Neem leaf Extract-Eucalyptus oil (T_7) plot with the average number of 2.81. Minimum population of lady bird beetle was recorded from plot treated with Chlorantraniliprole with 2.27 lady bird beetle per hill.

Three days after second application of the treatments plant derivatives and microbial insecticides are safer treatments against the lady bird beetles. Among plant derivatives and microbial insecticides highest population was recorded in

Beauveria bassiana-Neem leaf Extract-Eucalyptus oil (T_7) plot with the average number of 2.84. Minimum population of lady bird beetle was recorded from plot treated with Chlorantraniliprole with 1.79 lady bird beetle per hill.

Seven days after second application of the treatments plant derivatives and microbial insecticides are safer treatments against the lady bird beetles.Among plant derivatives and microbial insecticides highest population was recorded in *Beauveria bassiana*-Neem leaf Extract-Eucalyptus oil (T_7) plot with the average number of 2.91. Minimum population of lady bird beetle was recorded from plot treated with Chlorantraniliprole with 1.55 lady bird beetle per hill.

Ten days after second application of the treatments plant derivatives and microbial insecticides are safer treatments against the lady bird beetles. Among plant derivatives and microbial insecticides highest population was recorded in Neem oil-*Bacillus thuringiensis*-Karanja leaf Extract (T_4) plot with the average number of 2.64. Minimum population of lady bird beetle was recorded from plot treated with Chlorantraniliprole with 1.24 lady bird beetle per hill.

Fifteen days after second application of the treatments plant derivatives and microbial insecticides are safer treatments against the lady bird beetles. Among plant derivatives and microbial insecticides highest population was recorded in Eucalyptus oil-*Beauveria bassiana*-Neem leaf Extract (T_5) plot with the average number of 3.33. Minimum population of lady bird beetle was recorded from plot treated with Chlorantraniliprole with 0.92 lady bird beetle per hill.

Data in the (Table 2) showed that Overall mean of first spray implies that Highest population was recorded in *Beauveria bassiana*-Neem leaf Extract-Eucalyptus oil (T_7) plot with the average number of 2.93. Minimum population of lady bird beetle was recorded from plot treated with Chlorantraniliprole with 1.68 lady bird beetle per hill.

Table 2: Effects of plant derivatives and microbial insecticides application on Lady Bird Beetles of rice ecosystem. (Second spray)

	Average no. of Lady Bird Beetles Population per hill							
	Treatment details	**PTO**	**1 DAS**	**3 DAS**	**7 DAS**	**10 DAS**	**15 DAS**	**Mean**
T_1	Karanja leaf Extract-Neem Oil-*Bacillus thuringiensis*	2.07 (1.75)	2.33 (1.82)	2.56 (1.88)	2.67 (1.91)	2.75 (1.93)	2.93 (1.98)	2.55 (1.88)
T_2	Neem leaf Extract-Eucalyptus oil-*Beauveria bassiana*	2.38 (1.83)	2.58 (1.88)	2.60 (1.89)	2.64 (1.90)	2.74 (1.93)	2.87 (1.96)	2.63 (1.90)
T_3	Bitter gourd leafExtract-Neem Oil-*Bacillus thuringiensis*	2.3 (1.81)	2.66 (1.91)	2.66 (1.91)	2.75 (1.93)	2.82 (1.95)	2.92 (1.98)	2.68 (1.91)
T_4	Neem oil-*Bacillus thuringiensis*-Karanja leaf Extract	2.23 (1.79)	2.43 (1.84)	2.55 (1.88)	2.58 (1.89)	2.64 (1.90)	2.75 (1.93)	2.53 (1.87)
T_5	Eucalyptus oil-*Beauveria bassiana*-Neem leaf Extract	2.44 (1.84)	2.49 (1.86)	2.54 (1.88)	2.75 (1.93)	3.13 (2.03)	3.33 (2.07)	2.78 (1.94)
T_6	*Bacillus thuringiensis*-Karanja leaf Extract-Neem oil	2.22 (1.80)	2.33 (1.81)	2.05 (1.74)	2.07 (1.75)	1.90 (1.70)	1.75 (1.65)	2.05 (1.74)
T_7	*Beauveria bassiana*-Neem leaf Extract-Eucalyptus oil	2.73 (1.92)	2.81 (1.95)	2.84 (1.95)	2.91 (1.97)	3.05 (2.01)	3.26 (2.06)	2.93 (1.98)
T_8	NSKE-NSKE-NSKE	2.31 (1.81)	2.44 (1.84)	2.51 (1.87)	2.63 (1.90)	3.11 (2.02)	3.12 (2.02)	2.68 (1.91)
T_9	Chlorantraniliprole-Chlorantraniliprole-Chlorantraniliprole	2.33 (1.82)	2.27 (1.80)	1.79 (0.97)	1.55 (0.88)	1.24 (0.79)	0.92 (0.71)	1.68 (0.99)
T_{10}	Untreated Control	3.34 (2.82)	3.52 (2.87)	3.64 (2.90)	3.71 (2.71)	3.80 (2.79)	4.30 (3.82)	3.73 (2.67)
	SE(m)±	0.029	0.037	0.033	0.033	0.022	0.036	0.031
	CD at 5%	NS	0.10	0.09	0.09	0.06	0.10	0.08

Bio-safety evaluation of plant derivatives and microbial insecticides against Lady bird beetle (third spray)

Data of the (table 3) illustrate that in pre-treatment observation average Lady bird beetle population ranged from 2.09 to 2.47 per hill which differs non significantly among all the treatments including untreated control

One day after third application of the treatments plant derivatives and microbial insecticides are safer treatments against the lady bird beetles. Among plant derivatives and microbial insecticides highest population was recorded in Bitter gourd leaf Extract-Neem Oil-*Bacillus thuringiensis* (T_3) plot with the average number of 2.51 which is significantly at par with T_2, T_5 and T_7.. Minimum population of lady bird beetle was recorded from plot treated with Chlorantraniliprole with 2.03 lady bird beetle per hill.

Three days after third application of the treatments plant derivatives and microbial insecticides are safer treatments against the lady bird beetles. Among plant derivatives and microbial insecticides highest population was recorded Bitter gourd leaf Extract-Neem Oil-*Bacillus thuringiensis* (T_3) plot with the average number of 2.92. Minimum population of lady bird beetle was recorded from plot treated with Chlorantraniliprole with 1.97 lady bird beetle per hill.

Seven days after third application of the treatments plant derivatives and microbial insecticides are safer treatments against the lady bird beetles. Among plant derivatives and microbial insecticides highest population was recorded in Bitter gourd leaf Extract-Neem Oil-*Bacillus thuringiensis* (T_3) plot with the average number of 2.96. Minimum population of lady bird beetle was recorded from plot treated with Chlorantraniliprole with 1.93 lady bird beetle per hill.

Ten days after third application of the treatments plant derivatives and microbial insecticides are safer treatments against the lady bird beetles. Among plant derivatives and microbial insecticides highest population was recorded in Bitter gourd leaf Extract-Neem Oil-*Bacillus thuringiensis* (T_3) plot with the average number of 3.05. Minimum population of lady bird beetle was recorded from plot treated with Chlorantraniliprole with 1.48 lady bird beetle per hill.

Fifteen days after third application of the treatments plant derivatives and microbial insecticides are safer treatments

against the lady bird beetles. Among plant derivatives and microbial insecticides highest population was recorded Karanja leaf Extract-Neem Oil-*Bacillus thuringiensis* (T_1) plot with the average number of 3.33. Minimum population of lady bird beetle was recorded from plot treated with Chlorantraniliprole with 1.30 lady bird beetle per hill.

Data in the (Table 3) showed that Overall mean of first spray implies that Highest population was recorded in Eucalyptus oil-*Beauveria bassiana*-Neem leaf Extract (T_5) plot with the average number of 2.68. Minimum population of lady bird beetle was recorded from plot treated with Chlorantraniliprole with 1.83 lady bird beetle per hill.

Table 3: Effects of plant derivatives and microbial insecticides application on Lady Bird Beetles of rice ecosystem. (Third spray)

Average no. of Lady Bird Beetles Population per hill								
	Treatment details	**PTO**	**1 DAS**	**3 DAS**	**7 DAS**	**10 DAS**	**15 DAS**	**Mean**
T_1	Karanja leaf Extract-Neem Oil-*Bacillus thuringiensis*	2.09 (1.75)	2.33 (1.82)	2.40 (1.84)	2.77 (1.94)	2.40 (1.84)	3.33 (2.07)	2.55 (1.88)
T_2	Neem leaf Extract-Eucalyptus oil-*Beauveria bassiana*	2.37 (1.82)	2.44 (1.84)	2.54 (1.87)	2.48 (1.86)	2.60 (1.89)	2.64 (1.90)	2.51 (1.87)
T_3	Bitter gourd leaf Extract-Neem Oil-*Bacillus thuringiensis*	2.41 (1.84)	2.51 (1.86)	2.92 (1.97)	2.96 (1.99)	3.05 (2.01)	1.85 (1.68)	2.61 (1.89)
T_4	Neem oil-*Bacillus thuringiensis*-Karanja leaf Extract	2.32 (1.82)	2.21 (1.79)	1.84 (1.68)	1.63 (1.62)	1.53 (1.59)	1.54 (1.59)	1.84 (1.68)
T_5	Eucalyptus oil-*Beauveria bassiana*-Neem leaf Extract	2.47 (1.86)	2.48 (1.86)	2.60 (1.89)	2.80 (1.94)	2.82 (1.95)	2.91 (1.97)	2.68 (1.91)
T_6	*Bacillus thuringiensis*-Karanja leaf Extract-Neem oil	2.33 (1.82)	2.22 (1.79)	2.32 (1.82)	2.40 (1.84)	2.66 (1.91)	2.60 (1.89)	2.42 (1.84)
T_7	*Beauveria bassiana*-Neem leaf Extract-Eucalyptus oil	2.37 (1.82)	2.47 (1.86)	2.40 (1.84)	2.50 (1.87)	2.55 (1.88)	2.85 (1.96)	2.52 (1.87)
T_8	NSKE-NSKE-NSKE	2.13 (1.76)	2.31 (1.81)	2.35 (1.83)	2.50 (1.87)	2.60 (1.89)	2.72 (1.92)	2.43 (1.85)
T_9	Chlorantraniliprole-Chlorantraniliprole-Chlorantraniliprole	2.31 (1.82)	2.03 (1.79)	1.97 (1.74)	1.93 (1.71)	1.48 (1.43)	1.30 (1.74)	1.83 (1.61)
T_{10}	Untreated Control	2.44 (1.84)	2.47 (1.86)	2.57 (1.88)	2.75 (1.93)	2.75 (1.93)	2.85 (1.96)	2.63 (1.90)
	SE(m)±	0.045	0.059	0.034	0.026	0.024	0.049	0.039
	CD at 5%	NS	0.10	0.10	0.07	0.07	0.14	0.09

Overall effects of plant derivatives and microbial insecticides application on Lady Bird Beetles of rice ecosystem.

Overall mean of three spray indicates that gave best result among the different plant derivatives and microbial insecticides maximum population of Lady Bird Beetles recorded in Bitter gourd leaf Extract-Neem Oil-*Bacillus thuringiensis* (T_3). Even so lowest population recorded in Chlorantraniliprole plot (1.86%).

Table 4: Overall effects of plant derivatives and microbial insecticides application on Lady Bird Beetles of rice ecosystem.

Average no. of Lady Bird Beetles Population per hill					
	Treatment details	**Mean of first spray**	**Mean of second spray**	**Mean of third spray**	**overall mean**
T_1	Karanja leaf Extract-Neem Oil-*Bacillus thuringiensis*	2.10 (1.76)	2.55 (1.88)	2.55 (1.88)	2.40 (1.84)
T_2	Neem leaf Extract-Eucalyptus oil-*Beauveria bassiana*	3.65 (2.15)	2.63 (1.90)	2.51 (1.87)	2.93 (1.97)
T_3	Bitter gourd leaf Extract-Neem Oil-*Bacillus thuringiensis*	3.92 (2.23)	2.68 (1.91)	2.61 (1.89)	3.07 (2.01)
T_4	Neem oil-*Bacillus thuringiensis*-Karanja leaf Extract	2.69 (1.92)	2.53 (1.87)	1.84 (1.68)	2.35 (1.82)
T_5	Eucalyptus oil-*Beauveria bassiana*-Neem leaf Extract	2.47 (1.86)	2.78 (1.94)	2.68 (1.91)	2.64 (1.90)
T_6	*Bacillus thuringiensis*-Karanja leaf Extract-Neem oil	2.65 (1.91)	2.05 (1.74)	2.42 (1.84)	2.71 (1.83)
T_7	*Beauveria bassiana*-Neem leaf Extract-Eucalyptus oil	2.70 (1.92)	2.93 (1.98)	2.52 (1.87)	2.71 (1.92)
T_8	NSKE-NSKE-NSKE	2.62 (1.90)	2.68 (1.91)	2.43 (1.85)	2.57 (1.89)
T_9	Chlorantraniliprole-Chlorantraniliprole-Chlorantraniliprole	2.09 (1.75)	1.68 (0.99)	1.83 (1.61)	1.86 (1.69)
T_{10}	Untreated Control	4.04 (3.71)	3.73 (2.67)	2.63 (1.90)	3.46 (2.43)

References

1. Anonymous. Area and production of rice in Chhattisgarh. Rice Extension Division, Department of Agriculture and Farmer Welfare, Government of Chhattisgarh. 2023a;10(2):1620.
2. Anonymous. Area and production of paddy in India. Agriculture Statistics Division, Department of Agriculture, Cooperation and Farmers Welfare. 2023b;43(10):13-18.
3. Islam S. Evaluation of different insecticides and botanical extracts against yellow stem borer (*Scirpophaga incertulas* Walk.) and its natural enemies in rice field [M.Sc. thesis]. Mymensingh: Bangladesh Agricultural University; 2012. p. 74.
4. Singh P, Singh R, Dhaka SS, Kumar D, Kumar H, Kumari N. Bioefficacy of insecticides and bio-pesticides against yellow stem borer (*Scirpophaga incertulas* Walk.) and their effect on spiders in rice crop. South Asian Journal of Food Technology and Environment. 2015;1(2):179-183.
5. Singh D, Thayil SM, Sohal SK, Kesavan AK. Exploration of insecticidal potential of Cry protein purified from *Bacillus thuringiensis* VIID1. International Journal of Biological Macromolecules. 2021;174:362-369.
6. Saikia R, Borah SR, Konwar MJ, Bharali A, Hussain S. Efficacy of insecticides against yellow stem borer (*Scirpophaga incertulas* Walker) and rice leaf folder (*Cnaphalocrocis medinalis* Guenée) and their impact on natural enemies in rice ecosystem. Journal of Experimental Agriculture International. 2024;46(10):284-289. https://doi.org/10.9734/jeai/2024/v46i102948.