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Effectiveness of *B. bassiana* formulations against major defoliators of groundnut

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Abstract

This study evaluates the efficacy of different formulations of *Beauveria bassiana* against major defoliators of groundnut, specifically *Spodoptera litura* and *Helicoverpa armigera*, under laboratory conditions. The experiment was conducted at the Biocontrol Research Laboratory, Junagadh Agricultural University. The study compared four formulations of *B. bassiana* (5% WP, 5% OD, 5% WDG, and 5% Gel) and a control. The results revealed that the *B. bassiana* 5% OD and *B. bassiana* 5% WDG formulations were the most effective, achieving 100% mortality of *S. litura* and *H. armigera* larvae after seven days. The *B. bassiana* 5% Gel and *B. bassiana* 5% WP formulations also demonstrated significant larval mortality. The findings suggest that *B. bassiana* formulations can serve as eco-friendly alternatives to chemical pesticides in groundnut cultivation, contributing to sustainable pest management practices.

Keywords: *Beauveria bassiana*, groundnut defoliators, *Spodoptera litura*

Introduction

Groundnut (*Arachis hypogea* L.) is one of the premier oilseed crops of India and tropical and subtropical regions of the world (Gadad *et al.*, 2013) [3]. It is known by various names like peanut, monkeynut, earthnut and is famously known as the King of oilseeds. The kernels are rich sources of 43-45% edible oil, 25-28% protein, and also a valuable source of vitamins *viz.*, B, K, E. Groundnut is the 13th most important food crop of the world and 4th most important source of edible oil. In India, it was cultivated in an area of 4.81 million hectares with production and productivity of 6.69 million tons and 1393 kg per hectare, respectively (Anonymous, 2019) [1]. In India, groundnut is mostly grown in five states *viz.*, Gujarat, Andhra Pradesh, Tamil Nadu, Karnataka, and Maharashtra. Among the groundnut-growing states in the country, Gujarat is the leading state in area and production. In Gujarat, the groundnut crop is grown in an area of 1.68 million hectares with a production of 3.94 million tons and average productivity of 2345 kg per hectare (Anonymous, 2019) [1]. The crop is grown as a mono-crop in the Saurashtra region of Gujarat such as Junagadh, Amreli, Rajkot, Bhavnagar, Porbandar, Gir Somnath, and Kutch districts of Gujarat state contributing about 88% of the total production of groundnut in Gujarat state.

The tobacco caterpillar, *S. litura* (Lepidoptera: Noctuidae) is a major polyphagous pest that attacks a variety of economically important crops namely, cotton, groundnut, rice, tomato, tobacco, and other vegetables (Ramaiah and Maheswari, 2018). It is a serious pest distributed throughout the tropical and subtropical parts of the world including India, Japan, China and South East Asia causing damage to more than 150 species of host plants. In India, *S. litura* has been reported as an increasingly important pest during the rainy seasons causing heavy yield loss (Ferry *et al.*, 2004) [2].

Gram caterpillar, *H. armigera* (Lepidoptera: Noctuidae), is a cosmopolitan insect and has gained importance as a major devastating pest due to its capacity to feed on many varieties of plant species, some of which are important crops. It is commonly known as gram pod borer, American bollworm of cotton, tomato fruit borer, maize cob borer and sunflower head borer. The major host crops of this pest include tomato, groundnut, cotton, pigeon pea, chickpea, sorghum, soybean and cowpea (Kakimoto *et al.*, 2003) [6].

Looking at the importance of biopesticides as eco-friendly control agents the seriousness of defoliators in groundnut and the hazards of chemical pesticides, it is highly necessary to evaluate the bio-efficacy of *B. bassiana* against these economic pests in the groundnut ecosystem.

Evaluation of different formulations of *B. bassiana* against major defoliators of groundnut under laboratory conditions

The present laboratory experiment was carried out to determine the effectiveness of different prepared formulations of *B. bassiana* against major defoliators of groundnut at the Biocontrol Research Laboratory, Department of Entomology, Junagadh Agricultural University, Junagadh during the year 2023-24.

Efficacy of formulations against *S. litura*

The mortality recorded at 1, 3, 5 and 7 days after the application of treatments presented in Table 1 revealed that there was no mortality observed after 1 day of treatment in all the treatments. While, there was a significant difference in per cent larval mortality on 3, 5 and 7 days after treatment. All the formulations of *B. bassiana* were found

significantly superior by giving higher mortality of larva over the control.

After 3 days, the treatment of *B. bassiana* 5% OD was found superior among all the treatments, which gave 24.00% mortality and it was found statistically at par with *B. Bassiana* 5% WDG with 20.00% mortality. The treatments of *B. bassiana* 5% gel (16.00%) and *B. bassiana* 5% WP (10.00%) were found next effective in mortality.

Data recorded at 5 days after treatment indicated that treatments of *B. bassiana* 5% OD and *B. Bassiana* 5% WDG gave 80.00% and 75.56% mortality, respectively. The treatments of *B. bassiana* 5% gel and *B. bassiana* 5% WP were found next better treatments with larval mortality of 60.00 and 55.56%, respectively.

A perusal of results (Table 1) on mortality of *S. litura* larvae after 7 days of treatment revealed that the treatments of *B. bassiana* 5% OD and *B. Bassiana* 5% WDG recorded a cent per cent mortality of *S. litura* larvae. However, the treatments, *B. bassiana* 5% gel (88.06%) and *B. bassiana* 5% WP (85.56%) were found next in order.

The overall results showed that the treatments of *B. bassiana* 5% OD and *B. bassiana* 5% WDG were found the most effective against *H. armigera* and *S. litura*.

Table 1: Bio-efficacy of different formulations of *B. bassiana* against *S. litura* infesting groundnut under laboratory conditions

Sr. No.	Treatments	Percent corrected mortality (%)			
		1DAT	3 DAT	5 DAT	7 DAT
T ₁	<i>B. bassiana</i> 5% WP	0.00	18.43 (10.00)	48.19 (55.56)	67.93 (85.56)
T ₂	<i>B. bassiana</i> 5% OD	0.00	29.22 (24.00)	63.61 (80.00)	80.90 (100.00)
T ₃	<i>B. bassiana</i> 5% WDG	0.00	26.57 (20.00)	60.45 (75.56)	80.9 (100.00)
T ₄	<i>B. bassiana</i> 5% Gel	0.00	23.31 (16.00)	50.81 (60.00)	69.79 (88.06)
T ₅	Control	0.00	9.10 (0.00)	9.10 (0.00)	9.10 (0.00)
	S.Em.±	-	1.15	1.23	0.91
	C.D. at 5%	-	3.39	3.64	2.67
	C.V. %	-	12.06	5.94	3.28

*Figures in parenthesis are original values, while outside are arcsine transformed values. DAT –Days after Treatment

Efficacy of formulations against *H. armigera*

The mortality recorded at 1, 3, 5 and 7 days after the application of treatments presented in Table 2 revealed that there was no mortality observed after 1 day of treatment in all the treatments. While, there was a significant difference in per cent larval mortality on 3, 5 and 7 days after treatment. All the formulations of *B. bassiana* were found significantly superior by giving higher mortality of larva over the control.

After 3 days, the treatment of *B. bassiana* 5% OD was found superior among all the treatments, which gave

22.00% mortality and it was found statistically at par with *B. Bassiana* 5% WDG with 20.00% mortality. The treatments of *B. bassiana* 5% gel (14.00%) and *B. bassiana* 5% WP (10.00%) were found next effective in mortality.

Data recorded at 5 days after treatment indicated that treatments of *B. bassiana* 5% OD and *B. Bassiana* 5% WDG gave 74.00% and 69.56% mortality, respectively. The treatments of *B. bassiana* 5% gel and *B. bassiana* 5% WP were found next better treatments with larval mortality of 56.44 and 54.22%, respectively.

Table 2: Bio-efficacy of different formulations of *B. bassiana* against *H. armigera* infesting groundnut under laboratory conditions

Sr. No.	Treatments	Percent corrected mortality (%)			
		1 DAT	3 DAT	5 DAT	7 DAT
T ₁	<i>B. bassiana</i> 5% WP	0.00	18.43 (10.00)	47.43 (54.22)	64.59 (81.11)
T ₂	<i>B. bassiana</i> 5% OD	0.00	27.89 (22.00)	59.43 (74.00)	80.90 (100.00)
T ₃	<i>B. bassiana</i> 5% WDG	0.00	26.57 (20.00)	56.57 (69.56)	78.83 (95.78)
T ₄	<i>B. bassiana</i> 5% Gel	0.00	21.69 (14.00)	48.71 (56.44)	68.18 (85.83)
T ₅	Control	0.00	9.10 (0.00)	9.10 (0.00)	9.10 (0.00)
	S.Em.±	-	1.07	1.16	1.71
	C.D. at 5%	-	3.16	3.43	5.03
	C.V. %	-	11.55	5.87	6.32

*Figures in parenthesis are original values, while outside are arcsine transformed values. DAT – Days after treatment.

A perusal of results (Table 2) on mortality of *H. armigera* larvae after 7 days of treatment revealed that the treatments of *B. bassiana* 5% OD recorded cent per cent mortality and

B. Bassiana 5% WDG gave the 95.78% mortality of *H. armigera* larvae. However, the treatments, *B. bassiana* 5% gel (85.83%) and *B. bassiana* 5% WP (81.11%) were found

next in order. The present findings are in conformation with Gulsar and Gopalakrishnan (2012) ^[4] who reported that spraying an oil-based formulation of *L. lecanii* rather than talc formulation significantly increases the mortality of papaya mealybug. According to Leela (2020) ^[7], who observed that mortality of *H. armigera* larvae started the second day after the application of *B. bassiana* and reached up to 96.67% on 8th day. This result is in line with our findings. A similar trend was also observed by Gupta and Kumar (2014) ^[5], who reported the 80.00% mortality of third-instar larvae of *S. litura* when treated with *B. bassiana* 0.2×10^8 spore ml⁻¹. The present results are also in conformity with the work of Shankarmurthy *et al.* (2003) ^[9], who reported that oil-based formulation of *B. bassiana* gave 93.30% larval mortality against diamond back moth. But in the contrary they found the WP formulation to be equally effective as OD formulation. Thus, the present findings are more or less in agreement with the results reported by earlier workers, slight variations may be due to differences in components used for formulation development.

Conclusion

The treatments of *B. bassiana* 5% and *B. Bassiana* 5% OD formulation and *B. Bassiana* 5% WDG were found the most effective against *H. armigera* as they recorded cent per cent and 95.78% mortality after 7 days of treatment under laboratory condition. However, it was followed by *B. bassiana* 5% gel and *B. bassiana* 5% WP in which mortality of 85.83% and 81.11% was recorded after 7 days, respectively.

Similarly, against the larvae of *S. litura* the treatment of *B. bassiana* 5% OD formulation and *B. Bassiana* 5% WDG were found the most lethal with cent per cent larval mortality after 7 days of treatment. While, the treatments *B. bassiana* 5% gel and *B. bassiana* 5% WP were found next better treatments as they recorded 88.06% and 85.56% mortality after 7 days, respectively.

Based on the results obtained, *B. bassiana* 5% OD formulation and *B. Bassiana* 5% WDG were found the most effective against *H. armigera* and *S. litura* under laboratory condition.

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