Journal of Entomology and Zoology Studies

Available online at www.entomoljournal.com

E-ISSN: 2320-7078
P-ISSN: 2349-6800
www.entomoljournal.com
JEZS 2020; 8(6): 1933-1936

Received: 24-09-2020
Accepted: 27-10-2020

IM Hirapara
Ph.D. Scholar, Department of Entomology, N. M. College of Agriculture, Navsari Agricultural University, Navsari, Gujrat, India

DM Jethva
Associate Research Scientist, Department of Entomology, College of Agriculture, JAU, Junagadh, Gujarat, India

RV Bavisa
Ph. D. Scholar. Department of Entomology, College of Agriculture, JAU, Junagadh, Gujarat, India

Corresponding Author:
IM Hirapara
Ph.D. Scholar, Department of Entomology, N. M. College of Agriculture, Navsari Agricultural University, Navsari, Gujrat, India

Evaluation of insecticidal spray schedules against *Helicoverpa armigera* (Hübner) and *Spodoptera litura* (Fabricius) in groundnut

IM Hirapara, DM Jethva and RV Bavisa

Abstract
A field experiment on the different spray schedules against groundnut defoliators was conducted at Instructional Farm, College of Agriculture, Junagadh Agricultural University, Junagadh during *kharif*, 2018. Among the different spray schedules tested for their efficacy against *Helicoverpa armigera* (Hübner) three sprays in schedule 4 [*B. bassiana* 1.15 WP @ 0.003% + chlorantraniliprole 18.5 SC @ 0.003% in 1st spray, *B. bassiana* 1.15 WP @ 0.003% + novaluron 10 EC @ 0.005% in 2nd spray and *B. bassiana* 1.15 WP @ 0.003% + quinalphos 25 EC @ 0.025% in 3rd spray] or schedule 3 [*B. bassiana* 1.15 WP @ 0.003% + novaluron 10 EC @ 0.005% in 1st spray, *B. bassiana* 1.15 WP @ 0.003% + quinalphos 25 EC @ 0.025% in 2nd spray and *B. bassiana* 1.15 WP @ 0.003% + chlorantraniliprole 18.5 SC @ 0.003% in 3rd spray] were found to be the most effective against *H. armigera* at 30, 45 and 60 DAS in groundnut. While, in case of *Spodoptera litura* (Fabricius) schedule 2 [*B. bassiana* 1.15 WP @ 0.003% + quinalphos 25 EC @ 0.025% in 1st spray, *B. bassiana* 1.15 WP @ 0.003% + chlorantraniliprole 18.5 SC @ 0.003% in 2nd spray and *B. bassiana* 1.15 WP @ 0.003% + novaluron 10 EC @ 0.005% in 3rd spray] or schedule 3 [*B. bassiana* 1.15 WP @ 0.003% + novaluron 10 EC @ 0.005% in 1st spray, *B. bassiana* 1.15 WP @ 0.003% + quinalphos 25 EC @ 0.025% in 2nd spray and *B. bassiana* 1.15 WP @ 0.003% + chlorantraniliprole 18.5 SC @ 0.003% in 3rd spray] were found to be the most effective and can be recommended for the management of *S. litura* in groundnut at 30, 45 and 60 DAS, respectively. Highest yield of groundnut pod was obtained in the schedule 4 (2083 kg/ha), which was followed by schedule 3 (1979 kg/ha) and schedule 2 (1823 kg/ha).

Keywords: *Beauveria bassiana* (Balsamo) Vuillemin, Groundnut, *H. armigera*, *S. litura*

Introduction
Oilseed crops have a specific place in Indian agriculture because edible oils are next to food grains in indian diet. Groundnut *(Arachis hypogaea* Linnaneus) is an important leguminous as well as oilseed crop. The damage in groundnut caused by a many species of insects depends on population of damaging stage of insect, crop growth stage of insect, cropping pattern in the area and climate etc. (Patel and Patel, 1983) [1]. As many as 52 species of insect pests are recorded infesting the groundnut crop in India. (Singh *et al.*, 1990) [2]. Among them *H. armigera* and *S. litura* are important pest infesting the groundnut. Preference of insecticides depends on their easy availability and applicability, but their excessive and indiscriminate use has resulted in the development of insecticidal resistance in the pests and environmental pollution (Phokela *et al.*, 1990) [3]. There is a need to explore alternatives, encompassing available pest control methods and techniques in order to reduce the sole dependence on insecticides. Among such eco-friendly approaches, entomopathogenic fungi form one of the most important components which are being employed to control noxious insect pest of groundnut ecosystem *viz., H. armigera* and *S. litura*. Among several entomopathogenic fungi, *B. bassiana* is the most important entomopathogenic fungus for its control as well as reducing the chances of development of resistance against *H. armigera* and *S. litura*. Parameswaran and Sankaran (1977) [4] have first time recorded of this fungus occurring naturally in India. Likewise, Dutky (1959) [5] stated that with its wide undefined host range, *B. bassiana* referred as "Magnificent pathogen". Looking to the importance of the groundnut crop in agricultural economy of Gujarat state and importance of *B. bassiana* as microbial control agent against *H. armigera* and *S. litura* and seriousness of using hazardous chemical pesticides, it is becomes absolutely necessary to evaluate of insecticidal spray schedules against *H. armigera* and *S. litura* in groundnut..

Therefore, during the present study, efforts have been made to test the various bio pesticides under field conditions against *H. armigera* and *S. litura* in groundnut.

Materials and Methods

A field experiment on the different spray schedules against *H. armigera* and *S. litura in* groundnut (var. GJG-22) was conducted at Instructional Farm, College of Agriculture, Junagadh Agricultural University, Junagadh during *kharif*, 2018.

All the spray schedules were applied in the form of foliar spray with the help of knapsack sprayer (15 litre capacity). For deciding the quantity of spray fluid required per plot, the control plots were sprayed with water and calculated exact quantity of chemical required for spray. The spray schedules were done at 30 DAS (Days After Sowing), 45 DAS, and 60 DAS for *B. bassiana* alone and combination with different insecticides.

To evaluate the spray schedule, ten plants were randomly selected from each treated plot and were tagged for the observation of *H. armigera* and *S. litura*. The observations on larval population were recorded at 24 hours before and after 3, 7 and 10 days of spraying in different treatments. The average data recorded on *H. armigera* and *S. litura* was subjected to statistical analysis.

The pod yield received from each treatment along with control was weighed and recorded and the data was converted on hectare basis. The data on larval population obtained was transformed into square root transformation and analyzed statistically.

Results

Effectiveness of different insecticidal spray schedules against *H. armigera*

Data presented in Table 1 revealed that effectiveness of various insecticidal spray schedules tested against *H. armigera*, it can be concluded that the spraying of schedule 4 [*B. bassiana* 1.15 WP @ 0.003% + chlorantraniliprole 18.5 SC @ 0.003% in 1st spray, *B. bassiana* 1.15 WP @ 0.003% + novaluron 10 EC @ 0.005% in 2nd spray and *B. bassiana* 1.15 WP @ 0.003% + quinalphos 25 EC @ 0.025% in 3rd spray] and schedule 3 **[***B. bassiana* 1.15 WP @ 0.003% + novaluron 10 EC @ 0.005% in 1st spray, *B.bassiana* 1.15 WP @ 0.003% + quinalphos 25 EC @ 0.025% in 2nd spray and *B. bassiana* 1.15 WP @ 0.003% + chlorantraniliprole 18.5 SC @ 0.003% in 3rd spray] at all DAS (30, 45 and 60 DAS) showed the lowest population of *H. armigera*.

The next effective spray schedule at various DAS was schedule 2 [*B. bassiana* 1.15 WP @ 0.003% + quinalphos 25 EC @ 0.025% in 1st spray, *B. bassiana* 1.15 WP @ 0.003% + chlorantraniliprole 18.5 SC @ 0.003% in 2nd spray and *B. bassiana* 1.15 WP @ 0.003% + novaluron 10 EC @ 0.005% in 3rd spray]. The rest of the spray schedule like schedule 1 consisted of three sprays of *B. bassiana*1.15% WP 0.006%in various DAS was found poor in performance for the control of *H. armigera*.

Table 1: Mean effect of spray schedules against *H. armigera* at different days after sowing

Sr. No.	Treatments (Schedules)	Overall mean number of *H. armigera*/plant			
		30 DAS	45 DAS	60 DAS	Pooled
1.	Schedule 1	1.29 (1.73)	1.20 (1.49)	1.18 (1.46)	1.22 (1.56)
2.	Schedule 2	1.14 (1.32)	0.85 (0.74)	0.93 (0.89)	0.97 (0.98)
3.	Schedule 3	0.93 (0.89)	1.13 (1.30)	0.80 (0.68)	0.95 (0.96)
4.	Schedule 4	0.80 (0.67)	0.97 (0.96)	1.09 (1.22)	0.95 (0.95)
5.	Control	1.84 (3.38)	1.79 (3.23)	1.81 (3.33)	1.81 (3.31)
S.Em. ±		0.05	0.05	0.05	0.08
C.D. at 5%		0.17	0.18	0.17	0.26
C.V. %		7.49	7.86	7.66	11.45

Figures in parenthesis are original values, while outside values are square root transformed.
DAS – Days After Spraying
Local strain of *B. bassiana* @ 2×10^6 cfu/g was used.

Schedule 1: *B. bassiana* 1.15 WP @ 0.006% at 30 DAS, 45 DAS and 60 DAS.

Schedule 2: [*B. bassiana* 1.15 WP @ 0.003% + quinalphos 25 EC @ 0.025% at 30 DAS, *B. bassiana* 1.15 WP @ 0.003% + chlorantraniliprole 18.5 SC @ 0.003% at 45 DAS and *B. bassiana* 1.15 WP @ 0.003% + novaluron 10 EC @ 0.005% at 60 DAS]

Schedule 3: [*B. bassiana* 1.15 WP @ 0.003% + novaluron 10 EC @ 0.005% at 30 DAS, *B. bassiana* 1.15 WP @ 0.003% + quinalphos 25 EC @ 0.025% at 45 DAS and *B. bassiana* 1.15 WP @ 0.003% + chlorantraniliprole 18.5 SC @ 0.003% at 60 DAS]

Schedule 4: [*B. bassiana* 1.15 WP @ 0.003% + chlorantraniliprole 18.5 SC @ 0.003% at 30 DAS, *B. bassiana* 1.15 WP @ 0.003% + novaluron 10 EC @ 0.005% at 45 DAS and *B. bassiana* 1.15 WP @ 0.003% + quinalphos 25 EC @ 0.025% at 60 DAS]

Effectiveness of different insecticidal spray schedules against *S. litura*

Data presented in Table 2 revealed that effectiveness of various insecticidal spray schedules tested against *S. litura*, it can be concluded that the spraying of schedule 2 [*B. bassiana* 1.15 WP @ 0.003% + chlorantraniliprole 18.5 SC @ 0.003% in 2nd spray and *B. bassiana* 1.15 WP @ 0.003% + novaluron 10 EC @ 0.005% in 3rd spray] and schedule 3 [*B. bassiana* 1.15 WP @ 0.003% + quinalphos 25 EC @ 0.025% in 2nd spray and *B. bassiana* 1.15 WP @ 0.003% + chlorantraniliprole 18.5 SC @ 0.003% in 3rd spray] at all DAS (45 and 60 DAS) showed the lowest population of *S. litura*.

The next effective spray schedule at various DAS was schedule 4 [*B. bassiana* 1.15 WP @ 0.003% + novaluron 10 EC @ 0.005% in 2nd spray and *B. bassiana* 1.15 WP @ 0.003% + quinalphos 25 EC @ 0.025% in 3rd spray]. The rest of the spray schedule like schedule 1 consisted of three sprays of *B. bassiana*1.15% WP 0.006%in various DAS was found poor in performance for the control of *S. litura*.

Table 2: Mean effect of spray schedules against *S. litura* at different days after sowing

Sr. No.	Treatments (Schedules)	Overall mean number of *S. litura*/plant		
		45 DAS	60 DAS	Pooled
1.	Schedule 1	1.24 (1.90)	1.27 (1.15)	1.26 (1.53)
2.	Schedule 2	0.87 (0.88)	0.94 (0.91)	0.91 (0.90)
3.	Schedule 3	1.02 (1.21)	0.75 (0.60)	0.89 (0.91)
4.	Schedule 4	0.93 (1.03)	1.02 (1.08)	0.98 (1.06)
5.	Control	1.70 (2.19)	1.80 (3.24)	1.75 (2.72)
S.Em. ±		0.06	0.06	-
C.D. at 5%		0.19	0.21	-
C.V. %		8.71	9.82	-

Figures in parenthesis are original values, while outside values are square root transformed.
DAS – Days After Spraying
Local strain of *B. bassiana* @ 2×10^6 cfu/g was used.

Schedule 1: *B. bassiana* 1.15 WP @ 0.006% at 45 DAS and 60 DAS

Schedule 2: [*B. bassiana* 1.15 WP @ 0.003% + chlorantraniliprole 18.5 SC @ 0.003% at 45 DAS and *B. bassiana* 1.15 WP @ 0.003% + novaluron 10 EC @ 0.005% at 60 DAS]

Schedule 3: [*B. bassiana* 1.15 WP @ 0.003% + quinalphos 25 EC @ 0.025% at 45 DAS and *B. bassiana* 1.15 WP @ 0.003% + chlorantraniliprole 18.5 SC @ 0.003% at 60 DAS]

Schedule 4: [*B. bassiana* 1.15 WP @ 0.003% + novaluron 10 EC @ 0.005% at 45 DAS and *B. Bassiana* 1.15 WP @ 0.003% + quinalphos 25 EC @ 0.025% at 60 DAS]

Table 3 indicated that the highest yield of groundnut pod was obtained in the schedule 4 (2083 kg/ha), which was followed by schedule 3 (1979 kg/ha) and schedule 2 (1823 kg/ha). Schedule 1 (1614 kg/ha) was found least effective and it showed the lowest yield as compared to other treatments.

Table 3: Effectiveness of spray schedules on the pod yield of groundnut

Sr. No.	Schedules	Yield (Kg per hectare)	Yield increase over control (%)
1.	Schedule 1	1614	47.53
2.	Schedule 2	1823	66.64
3.	Schedule 3	1979	80.89
4.	Schedule 4	2083	90.40
5.	Control	1094	-
S.Em.±		108	-
C. D. at 5%		333	-
C.V. %		12.57	-

Discussion

Effectiveness of different insecticidal spray schedules against *H. armigera*

During present study, *B. bassiana* 1.15 WP @ 0.003% + chlorantraniliprole 18.5 SC @ 0.003% found to be the most effective. It recorded the highest mortality than other treatments, which in close agreement with the work of Rathod *et al.* (2014) [6] who stated that chlorantraniliprole 0.006% (76.24%) proved to be the most effective treatment against *H. armigera* and was found statistically at par with indoxacarb 0.008% (73.33%), while, in case of *B. bassiana* @ 1 kg/ha + chlorantraniliprole 0.003% were found moderately effective against *H. armigera*. Gadhiya *et al.* (2014) [7] showed that chlorantraniliprole 0.006% (0.62 larvae/plant), spinosad 0.018% (0.82 larvae/plant) and emamectin benzoate 0.002% (1.19 larvae/plant) were very effective and statistically at par with each other in protecting the groundnut crop from the infestation of *H. armigera* and *S. litura* which is in line with results of present studies.

Effectiveness of different insecticidal spray schedules against *S. litura*

From all sprays, the treatment *B. bassiana* 1.15 WP @ 0.003% + chlorantraniliprole 18.5 SC @ 0.002775% was highly effective which is in complete conformity with the results found by Gadhiya *et al.* (2014) [7] who reported that chlorantraniliprole 0.006% (0.62 larvae/plant), spinosad 0.018% (0.82 larvae/plant) and emamectin benzoate 0.002% (1.19 larvae/plant) were very effective and statistically at par with each other in protecting the groundnut crop from the infestation of *H. armigera* and *S. litura.* Vinaykumar *et al*. (2013) [8] who reported that the newer insecticides, spinosad @ 0.025%, rynaxypyr @ 0.006%, thiodicarb @ 0.15%, indoxacarb @ 0.0029% and flubendiamide @ 0.05% were found to be most effective against *S. litura* in soybean.

Conclusion

Looking to the overall effectiveness of various insecticidal spray schedules tested against *H. armigera*, it can be concluded that the spraying of schedule 4 [(*B. bassiana* 1.15 WP @ 0.003% + chlorantraniliprole 18.5 SC @ 0.003%) + (*B. bassiana* 1.15 WP @ 0.003% + novaluron 10 EC @ 0.005%) + (*B. bassiana* 1.15 WP @ 0.003% + quinalphos 25 EC @ 0.025%)] and schedule 3 **[**(*B. bassiana* 1.15 WP @ 0.003% + novaluron 10 EC @ 0.005%) + (*B. bassiana* 1.15 WP @ 0.003% + quinalphos 25 EC @ 0.025%) + (*B. bassiana* 1.15 WP @ 0.003% + chlorantraniliprole 18.5 SC @ 0.003%)] at all DAS (30 DAS, 45 DAS and 60 DAS) showed the lowest population of *H. armigera*. While, in case of *S. litura*, it can be concluded that the spraying of schedule 2 [(*B. bassiana* 1.15 WP @ 0.003% + chlorantraniliprole 18.5 SC @ 0.003%) + (*B. bassiana* 1.15 WP @ 0.003% + novaluron 10 EC @ 0.005%)] and schedule 3 [(*B. bassiana* 1.15 WP @ 0.003% + quinalphos 25 EC @ 0.025%) + (*B. bassiana* 1.15 WP @ 0.003% + chlorantraniliprole 18.5 SC @ 0.003%)] at all DAS (45 DAS and 60 DAS) showed the lowest population of *S. litura*.

The highest yield of groundnut pod was obtained in the schedule 4 (2083 kg/ha), which was followed by schedule 3 (1979 kg/ha) and schedule 2 (1823 kg/ha). Schedule 1 (1614 kg/ha) was found least effective and it showed the lowest yield as compared to other treatments.

References

1. Patel RC and Patel JR. Crops losses due to insect pests in Gujarat State. Indian Journal of Entomology 1983;3(1):27-32.
2. Singh TVK, Singh KM and Singh RN. Groundnut pest complex: III. Incidence of insect pests in relation to agro climatic condition as determined by graphical super imposition technique. Indian Journal of Entomology 1990;52(2):686-692.
3. Phokela A, Dhingra S, Sinha SN, Mehrotra KN. Pyrethroid resistance in *Heliothis armigera* Hub. III Development of resistance in field. Pesticide Research Journal 1990;2(l):28-30.
4. Parameswaran G, Sankaran T. Record of *Beauveria*

bassiana (Bals.) Vuill. on *Linschcosteus sp.* (Hemiptera: Reduviidae: Triatominae) in India. Journal of entomological Research 1977;1(1):113-114.
5. Dutky SR. Test of pathogen for the control of tobacco insects. Advance Applied Microbiology 1959;1(2):175-200.
6. Rathod NP, Vala GS, Dudhat AS, Kachhadiya NM. Field efficacy of bio-pesticides alone and in combination with newer insecticides against *Helicoverpa armigera* (Hübner) of Pigeon pea. International Journal of Plant Protection 2014;7(1):128-131.
7. Gadhiya HA, Borad PK, Bhut JB. Effectiveness of synthetic insecticides against *Helicoverpa armigera* (Hübner) Hardwick and *Spodoptera litura* (Fabricius) infecting groundnut. The Bioscan 2014;9(1):23-26.
8. Vinaykumar MM, Raghvani KL, Krishna Naik L, Abdul Khadar Biradar, Chandrashekar GS. Management of *Spodoptera litura* (Fabr.) and *Helicoverpa armigera* (Mats.) in soybean with newer insecticides. International Journal of Green and Herbal Chemistry 2013;2(3):665-674.