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(1): 1613-1616

Received: 22-11-2019
Accepted: 24-12-2019

Chaitra HS
Ph.D. Scholar (Entomology), Indian Agricultural Research Institute, New Delhi, India

PK Borad
Professor and Head (Entomology), B. A. College of Agriculture, Anand Agricultural University, Anand, Gujarat, India

Sushma Deb
Assistant Professor (Entomology), C. P. College of Agriculture, Dantiwada Agricultural University, Sardarkrushinagar, Gujarat, India

Corresponding Author:
Chaitra HS
Ph.D. Scholar (Entomology), Indian Agricultural Research Institute, New Delhi, India

Ecofriendly management of important pests of sesame

Chaitra HS, PK Borad and Sushma Deb

Abstract
A study was conducted at B. A. College of Agriculture, Anand Agricultural University, Anand during summer and kharif seasons of 2015 to evaluate nine biopesticides against pests of sesame. Among the tested biopesticides, Neem Seed Kernel Extract (NSKE) 5%, neem oil 0.3% and *B. bassiana* 0.1% effectively managed whitefly and leaf webber incidence in both the seasons and also produced higher seed yield than control *viz.* 56.65, 50.23 and 26.08% in plots treated with NSKE 5%, neem oil 0.3% and *B. bassiana* 0.1%, respectively during summer. In kharif, seed yield over control was 93.27, 72.21 and 71.61% in NSKE 5%, *B. bassiana* 0.1% and neem oil 0.3%, respectively. Avoidable losses in neem oil 0.3% and *B. bassiana* 0.1% were 4.10 and 19.51% during summer and 11.21 and 10.90% during kharif, respectively. The NICBR of NSKE 5%, neem oil 0.3% and *B. bassiana* 0.1% were 1:5.93, 1:8.50 and 1:1.87 during summer, whereas it was 1:7.90, 1:9.36 and 1:6.12 in kharif season, respectively.

Keywords: Sesame, biopesticides, whitefly, leaf webber

Introduction
Sesame is an important and oldest oil seed crop grown in India [1]. This wonder oilseed has both nutritive and medicinal properties [2]. Sesame seeds are used in confectioneries, cookies, cake, bread, soaps, cosmetics, insecticides, pharmaceutical products etc. Although sesame is widely used for different purposes, the productivity has been miserably low as compared to other oilseed crops [3]. There is a great need to boost up the productivity of sesame but insect pests are one of the major constraints in achieving it. The crop is reported to be damaged by 29 insect pests [4]. Synthetic insecticides are widely used in most developing countries for controlling these pests. However, use of certain pesticides in sesame can result in the accumulation of their residues in seeds, oil and oil cake [5]. Along with pesticide residues in food, they also contribute to the environmental pollution. Changing scenario in pest management concept has brought the natural products to the forefront as effective and reliable pesticide molecules for controlling pests. Therefore, an eco-friendly alternative is need of the hour. Keeping these points in mind, the present study was conducted to evaluate biopesticides against pest complex of sesame.

Materials and methods
Experiment was conducted at Anand Agricultural University, Anand during summer and kharif seasons of 2015, laid out in Randomized Block Design with three replications and nine treatments including control *viz.*,Neem seed kernel extract 5%, Azadirachtin 1500 ppm 0.0006%, Neem oil 0.3%, Mahua oil 0.3%, Tobacco decoction 2%, *Metarrhizium anisopliae* (1×10^{10} cfu/g) 0.1%, *Beauveria bassiana* (1×10^{10} cfu/g) 0.1%, *Verticillium leccani* (1×10^{10} cfu/g) 0.1% and Control. Plot size was kept 5.00 m × 3.60 m with spacing of 45 cm × 10 cm and for this purpose, sesame variety G. TIL-3 was raised by adopting standard recommended agronomical practices. Two sprays of all treatments were applied on the experimental trial field at 15 days interval. For recording observations on number of nymphs and adults of white fly (*Bemisia tabaci*), three leaves (upper, middle and lower) each from five randomly selected plants were examined and for leaf webber (*Antigastra catalaunalis*), leaf, flower and capsule damage was recorded before as well as 3, 7, 10 and 15 days after spraying from five randomly selected plants in each plot. Mean percentage damage was calculated by dividing number of damaged capsules by total number of capsules, and the result multiplied by one hundred [6].
Crop was harvested at proper maturity stage and seed yield was recorded treatment-wise. On the basis of sesame seed yield harvested from various treatments under study, the avoidable

losses due to sesame pest complex was calculated with the help of formula described by Poul (1976) [7] and the economics of each treatment was worked out by calculating the Incremental Cost Benefit Ratio (ICBR). For the purpose, total cost of biopesticide treatment per hectare was calculated for each treatment based on prevailing market price and cost of labour required for spraying one hectare area. The increase in yield over control was calculated by subtracting the yield obtained in control treatment from the yield obtained in each biopesticide treatment. Then, the gross realization in treatment over control was worked out by multiplying the increased yield over control with price of sesame seeds for each treatment. Net gain (₹/ ha) for each treatment was computed by deducting the cost of biopesticide treatment from the values of gross realization over control. The ICBR values *i.e.* net gain in rupees per rupee cost of biopesticide treatment was calculated by dividing net gain with total cost of treatments. Net ICBR (NICBR) *i.e.* additional profit gained per rupee cost of treatment was calculated by subtracting one rupee from ICBR obtained in each treatment.

Results and Discussion

Whitefly and Leaf webber

The observations revealed that all treatments were found effective over the control (Table 1). Lowest population of whitefly was recorded in Neem Seed Kernel Extract (NSKE) 5% and it was at par with neem oil 0.3%, *V. leccani* 0.1% and *M. anisopliae* 0.1% during first spray in summer (Table 1). In second spray, NSKE 5% was superior in checking the whitefly incidence but at par with all the remaining biopesticides except mahua oil. Pooled over periods and sprays of summer season indicated higher effectiveness of NSKE 5% and it was at par with neem oil 0.3% (Table 1).

During kharif season, the lowest incidence of whitefly was found in plots treated with NSKE 5% in first and second spray as well as in pooled over periods and sprays. This treatment was at par with neem oil 0.3% only in first spray. Significant reduction in whitefly population was recorded after treatment with NSKE. Net profit and also incremental cost benefit ratio (ICBR) was highest in NSKE treatment [8]. Considerable reduction in whitefly, *Bemisia tabaci* population was noticed with *Beauveria bassiana* (Racer at 5g/lit) however, neem based product, Neemazal 10000 ppm at 3 ml/lit was moderately effective in cotton [9].

Leaf webber, *A. catalaunalis* appeared only in kharif season crop. Application of NSKE 5% effectively checked the population of leaf webber in both the sprays and pooled over periods and sprays which also reflected on leaf, flower and capsule damage in sesame crop and it was at par with *B. bassiana* 0.1%, neem oil 0.3% and Azadirachtin 0.0006% (Table 2). In an experiment with neem based formulations and NSKE, it was found that NSKE 5% effectively reduced the pests of sesame and nimbecidine among the commercial formulations tested proved effective against sesame leaf webber [10]. Neem oil at 10 ml/l, Neem Leaf Extract (in cow urine) at 30 ml/l and NSKE (in cow urine) at 30 ml/l are highly effective in controlling the larval population of *A. catalaunalis*, percent flower and capsule damage and also increased grain yield in sesame [11].

Seed yield

Highest yield of sesame was produced from NSKE 5% treated plots followed by neem oil 0.3%, *V. leccani* 0.1% and *M. anisopliae* 0.1% during summer season. In these treatments, yield increased 41.16 to 56.65% over control and avoidable loss was up to 9.88%. In kharif season, highest yield of sesame was noticed in plots treated with NSKE 5% and it was at par with *B. bassiana* 0.1%, neem oil 0.3%, Azadirachtin 0.0006% and Tobacco decoction 2%. Yield increased from 63.18 to 93.27% with up to 15.57% avoidable losses.

Economics of treatments

NSKE 5%, neem oil 0.3%, *V. leccani* 0.1% and *M. anisopliae* 0.1% treated plots gave 1:4.11 to 1:8.50 returns with one rupee investment in summer. Net return was 1:3.91 to 1:9.86 in NSKE 5%, *B. bassiana* 0.1%, neem oil 0.3%, Azadirachtin 0.0006% and Tobacco decoction 2% treated plots (Table 3).

Table 1: Efficacy of biopesticides against *B. tabaci* infesting sesame during summer and kharif, 2015

Treatment	No. of whiteflies/ 3 leaves					
	Summer			Kharif		
	Pooled over periods		Pooled over periods and sprays	Pooled over periods		Pooled over periods and sprays
	First spray	Second spray		First spray	Second spray	
T1	1.72^{a}	1.60^{a}	1.66^{a}	0.23^{a}	0.18^{a}	0.21^{a}
T2	2.10^{b}	1.95^{ab}	2.02^{bc}	0.34^{de}	0.30^{ef}	0.32^{ef}
T3	1.88^{ab}	1.71^{ab}	1.80^{ab}	0.26^{ab}	0.22^{b}	0.24^{b}
T4	2.14^{b}	1.99^{b}	2.06^{c}	0.36^{e}	0.32^{f}	0.34^{f}
T5	2.06^{b}	1.93^{ab}	2.00^{bc}	0.33^{de}	0.27^{de}	0.30^{de}
T6	2.02^{ab}	1.92^{ab}	1.97^{bc}	0.31^{cd}	0.26^{cd}	0.28^{cd}
T7	2.12^{b}	1.97^{ab}	2.04^{c}	0.35^{e}	0.31^{f}	0.33^{ef}
T8	1.96^{ab}	1.80^{ab}	1.88^{bc}	0.29^{bc}	0.23^{bc}	0.26^{bc}
T9	2.54^{c}	2.39^{c}	2.47^{d}	0.46^{f}	0.39^{g}	0.42^{g}
S. Em. ± Treatments (T)	0.10	0.11	0.07	0.01	0.01	0.01
Periods (P)	0.03	0.02	0.07	0.01	0.01	0.03
Spray (S)	-	-	0.03	-	-	0.00
T×P	0.08	0.06	0.05	0.02	0.02	0.01
P×S	-	-	0.02	-	-	0.01
T×S	-	-	0.04	-	-	0.01
T×P×S	-	-	0.07	-	-	0.02
C. V.%	16.65	19.38	17.98	13.03	16.52	14.64

Note: Figures in letter(s) in common are statistically at par as per DNMRT

T1- Neem seed kernel extract 5%, T2- Azadirachtin 1500 ppm 0.0006%, T3- Neem oil 0.3%, T4- Mahua oil-0.3%, T5- Tobacco decoction 2%, T6- *Metarrhizium anisopliae* (1× 10^{10} cfu/g) 0.1%, T7- *Beauveria bassiana* (1× 10^{10} cfu/g) 0.1%, T8- *Verticillium leccani* (1× 10^{10} cfu/g) 0.1%, T9- Control

Table 2: Efficacy of biopesticides on incidence of *A. catalaunalis* in sesame during kharif, 2015

Treatment	No. of larvae/ plant*			Leaf damage (%) **			Flower damage (%) **	Capsule damage (%) **
	Pooled over periods		Pooled over periods and sprays	Pooled over periods		Pooled over periods and sprays	Pooled over periods	Pooled over periods
	First spray	Second spray		First spray	Second spray			
T1	1.49^{a} (1.72)	1.41^{a} (1.49)	1.45^{a} (1.60)	21.01^{a} (12.85)	20.04^{a} (11.74)	20.53^{a} (12.30)	21.07^{a} (12.92)	19.17^{a} (10.78)
T2	1.64^{ab} (2.19)	1.63^{abc} (2.16)	1.63^{abc} (2.16)	22.56^{ab} (14.72)	21.86^{ab} (13.86)	22.21^{abc} (14.29)	22.31^{a} (14.41)	19.86^{ab} (11.54)
T3	1.54^{ab} (1.87)	1.51^{abc} (1.78)	1.53^{ab} (1.84)	22.18^{ab} (14.25)	21.23^{ab} (13.11)	21.70^{abc} (13.67)	22.23^{a} (14.31)	19.55^{ab} (11.20)
T4	1.75^{ab} (2.56)	1.75^{bc} (2.56)	1.75^{bc} (2.56)	23.57^{ab} (15.99)	23.10^{ab} (15.39)	23.33^{bcd} (15.68)	23.32^{a} (15.67)	22.65^{c} (14.83)
T5	1.66^{ab} (2.26)	1.67^{abc} (2.29)	1.66^{abc} (2.26)	22.62^{ab} (14.79)	22.08^{ab} (14.13)	22.35^{abcd} (14.46)	23.19^{a} (15.51)	22.07^{bc} (14.12)
T6	1.84^{b} (2.89)	1.83^{cd} (2.85)	1.83^{c} (2.85)	25.02^{b} (17.89)	24.68^{b} (17.43)	24.85^{d} (17.66)	23.52^{a} (15.93)	23.15^{c} (15.46)
T7	1.53^{a} (1.84)	1.48^{ab} (1.69)	1.50^{a} (1.75)	22.05^{ab} (14.09)	21.06^{ab} (12.91)	21.55^{ab} (13.49)	22.05^{a} (14.09)	19.30^{a} (10.92)
T8	1.79^{ab} (2.70)	1.81^{bcd} (2.78)	1.80^{c} (2.74)	24.30^{ab} (16.93)	23.98^{b} (16.52)	24.14^{cd} (16.73)	23.46^{a} (15.85)	23.07^{c} (15.36)
T9	2.17^{c} (4.20)	2.15^{d} (4.12)	2.16^{d} (4.17)	30.91^{c} (26.39)	32.40^{c} (28.71)	31.66^{e} (27.55)	29.74^{b} (24.61)	29.74^{d} (24.61)
S. Em. ± Treatments (T)	0.09	0.10	0.07	1.09	1.10	0.78	1.33	0.81
Periods (P)	0.02	0.01	0.03	0.17	0.09	0.27	0.06	0.37
Spray (S)	-	-	0.03	-	-	0.37	-	-
T × P	0.06	0.03	0.04	0.52	0.26	0.29	0.17	1.11
P × S	-	-	0.02	-	-	0.14	-	-
T × S	-	-	0.09	-	-	1.10	-	-
T×P×S	-	-	0.05	-	-	0.41	-	-
C. V. %	17.63	19.67	18.67	15.87	16.34	16.10	19.73	12.82

Note: Figures in parentheses are retransformed values; those outside are * $\sqrt{X+0.5}$ or ** arc sine transformed values, Figures in letter(s) in common are statistically at par as per DNMRT

T1- Neem seed kernel extract 5%, T2- Azadirachtin 1500 ppm 0.0006%, T3- Neem oil 0.3%, T4- Mahua oil-0.3%, T5- Tobacco decoction 2%, T6- *Metarrhizium anisopliae* (1× 10^{10} cfu/g) 0.1%, T7- *Beauveria bassiana* (1× 10^{10} cfu/g) 0.1%, T8- *Verticillium leccani* (1× 10^{10} cfu/g) 0.1%, T9- Control

Table 3: Effect of biopesticides on seed yield of sesame, avoidable losses due to insect pests and economics

Treatment	Summer				Kharif			
	Yield	Yield over control (%)	Avoidable losses (%)	NICBR	Yield	Yield over control (%)	Avoidable losses (%)	NICBR
T1	529.80^{a}	56.65	0.00	1 : 5.93	495.66^{a}	93.27	0.00	1 : 7.90
T2	437.99^{bc}	29.50	17.33	1 : 1.47	426.21^{ab}	66.19	14.01	1 : 3.91
T3	508.09^{ab}	50.23	4.10	1 : 8.50	440.10^{ab}	71.61	11.21	1 : 9.36
T4	409.89^{cd}	21.19	22.63	1 : 2.63	409.24^{ab}	59.57	17.44	1 : 7.87
T5	464.23^{abc}	37.26	12.38	1 : 7.23	418.50^{ab}	63.18	15.57	1 : 9.86
T6	477.43^{abc}	41.16	9.88	1 : 4.11	355.23^{b}	38.51	28.33	1 : 2.33
T7	426.42^{bc}	26.08	19.51	1 : 1.87	441.65^{ab}	72.21	10.90	1 : 6.12
T8	499.63^{abc}	47.73	5.69	1 : 5.08	364.49^{b}	42.12	26.46	1 : 2.74
T9	338.21^{d}	-	36.16	-	256.46^{c}	0.00	48.26	-
S. Em.	26.85	-	-	-	28.30	-	-	-
C. V. %	10.23	-	-	-	12.23	-	-	-

Note: Figures in letter(s) in common are statistically at par as per DNMRT

T1- Neem seed kernel extract 5%, T2- Azadirachtin 1500 ppm 0.0006%, T3- Neem oil 0.3%, T4- Mahua oil-0.3%, T5- Tobacco decoction 2%, T6- *Metarrhizium anisopliae* (1× 10^{10} cfu/g) 0.1%, T7- *Beauveria bassiana* (1× 10^{10} cfu/g) 0.1%, T8- *Verticillium leccani* (1× 10^{10} cfu/g) 0.1%, T9- Control

Conclusion

Among the nine biopesticides evaluated against pest complex of sesame, NSKE 5%, neem oil 0.3% and *B. bassiana* 0.1% were effective in managing the whitefly and leaf webber incidence on sesame in both summer and kharif seasons. Remaining biopesticides were less effective in controlling the pests and recorded low mortality. Effective biopesticides also produced higher seed yield with higher net returns per rupee spent on control measures in both the seasons.

References

1. Karuppaiah V. Eco-friendly management of leaf webber

and capsule borer (*Antigastra catalaunalis* Duponchel) menace in Sesame. Popular Kheti. 2014; 2(2):127-130.
2. Prakash K, Naik SN. Bioactive Constituents as a Potential Agent in Sesame for Functional and Nutritional Application. Journal of Bioresource Engineering and Technology. 2014; 1:48-66.
3. Yoll E, Karaman E, Furat S, Uzun B. Assessment of selection criteria in sesame by using correlation coefficients, path and factor analyses. Australian Journal of Crop Science. 2010; 4:592-602.
4. Rai HS, Verma ML, Gupta MP. Efficacy of some dust formulations against the incidence of *Antigastra catalaunalis*. Annals of Plant Protection Sciences. 2001; 9:117-119.
5. Bhatnagar A, Gupta A. Chlorpyriphos, Quinalphos, and Lindane Residues in Sesame Seed and Oil (*Sesamum indicum* L.). Bulletin of Environmental Contamination and Toxicology. 1998; 60:596-600.
6. Egonyu JP, Kyamanywa S, Anyang W, Sekabembe CK. Review of pests and diseases of sesame in Uganda. African Crop Science Conference Proceedings. 2005; 7:1411-1416.
7. Poul MD. Studies on the chemical control of mustard pests. Indian Journal of Plant Protection. 1976; 4:44-47.
8. Ahirwar RM, Banerjee S, Gupta MP. Seasonal incidence of insect pests of sesame in relation to abiotic factors. Annals of Plant Protection Sciences. 2009; 17(2):351-356.
9. Ghosal, A. Studies on the potency of some biopesticides against whitefly in cotton and tomato. Journal of Biopesticides. 2018; 11(1):60-68.
10. Nath P, Bhushan S, Singh AK. Evaluation of neem based formulations and neem seed kernel extract against the insect pests of sesamum. Annals of Plant Protection Sciences. 2002; 10:207-211.
11. Ahirwar RM, Gupta MP, Banerjee S. Evaluation of natural products and endosulfan against incidence of *Antigastra catalaunalis* (Dup.) in sesame. Annals of Plant Protection Sciences. 2008; 16:25-28.