

International Journal of Advanced Biochemistry Research



ISSN Print: 2617-4693
ISSN Online: 2617-4707
NAAS Rating (2026): 5.29
IJABR 2026; 10(9): 444-451
www.biochemjournal.com
Received: 23-07-2026
Accepted: 24-08-2026

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Impact of various insecticides on major insect pests of sesame

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DOI: <https://www.doi.org/10.33545/26174693.2026.v10.i9f.10019>

Abstract

The field experiment was conducted in the field of the Department of Botany Research Unit, Post Graduate Institute, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Maharashtra during *kharif* 2025 to evaluate different insecticide modules against major insect pests of sesame. Among the seven insecticidal modules evaluated, M3 (Spinosad 45 SC @ 0.15 ml/L fb Chlorantraniliprole 18.5 SC @ 0.4 ml/L) recorded the lowest cumulative capsule borer population (0.42 larvae/plant), followed by M4 and M5 (0.58 larvae/plant each). The lowest cumulative leafhopper population (1.50 nymphs and adults/3 leaves) was recorded in M4 (Chlorantraniliprole 18.5 SC @ 0.4 ml/L fb Novaluron 10 EC @ 2 ml/L), whereas M2 (Profenophos 50 EC @ 2 ml/L fb Spinosad 45 SC @ 0.15 ml/L) was most effective against whitefly (1.83 nymphs and adults/3 leaves). M7 (Quinalphos 25% EC @ 4 ml/L fb NSE 5%) recorded the lowest aphid population (1.54 nymphs and adults/3 leaves). The highest sesame seed yield (5.89 q/ha) was obtained from M3, followed by M4 (5.85 q/ha) and M2 (5.48 q/ha). Module M3 (Spinosad 45 SC @ 0.15 ml/L fb Chlorantraniliprole 18.5 SC @ 0.4 ml/L) was also the most economical, recording the highest ICBR of 1:7.83 with a net gain of ₹29,789/ha. Followed by Module M2 (Profenophos 50 EC @ 2 ml/L fb Spinosad 45 SC @ 0.15 ml/L) with an ICBR ratio of 1:5.61 and Module M4 (Chlorantraniliprole 18.5 SC @ 0.4 ml/L fb Novaluron 10 EC @ 2 ml/L) with 1:4.48. Thus, Module M3 (Spinosad 45 SC @ 0.15 ml/L fb Chlorantraniliprole 18.5 SC @ 0.4 ml/L) was found to be the most effective and economical module for managing major insect pests and improving sesame productivity under field conditions.

Keywords: *Antigastra catalaunalis*, *Orosius albicinctus*, *Bemisia tabaci*, *Aphis gossypii*, sesame, insecticide modules, yield, ICBR

Introduction

Sesame (*Sesamum indicum* L.) 2n = 26 belongs to the family Pedaliaceae, which comprises about 16 genera and 60 species, and is an important oilseed crop cultivated for its high-quality edible oil and nutritious seeds. The seeds contain about 45-55 per cent oil along with carbohydrates, fibre, minerals, vitamins and antioxidants such as sesamin and sesamolin (Wei *et al.*, 2022) [35]. Sesame oil is widely used for cooking, bakery products, pharmaceuticals, cosmetics and traditional medicine (Anilkumar *et al.*, 2010) [3]. In India, the seed is eaten fried or mixed with sugar. Sesame is cultivated in tropical and subtropical regions under diverse agro-climatic conditions and is grown during the *kharif*, *rabi*, and *summer* seasons in India, depending on rainfall and irrigation facilities (Wacal *et al.*, 2021; Pandey *et al.*, 2021) [34, 21]. Globally, sesame is cultivated on about 11.71 million ha with an annual production of approximately 6.7 million tonnes and average productivity of 523 kg/ha (FAOSTAT, 2024-25) [10]. In India, sesame is grown on about 1.52 million ha with an annual production of approximately 0.86 million tonnes and average productivity of 545 kg/ha (FAOSTAT, 2024-25) [10]. The major sesame-growing states in India are Rajasthan, Uttar Pradesh, Madhya Pradesh, Gujarat, Maharashtra, West Bengal, Andhra Pradesh, Tamil Nadu and Karnataka. In Maharashtra, sesame is mainly cultivated during the *kharif* season, particularly in the Vidarbha region. The area of Maharashtra cultivated under *kharif* sesame is 4.66 ha, and production is 1.24 tonnes with average productivity 265.43 Kg/ha (DES, Govt. of MH), where it is an important rainfed oilseed crop.

Sesamum is attacked by about 65 species of insect pests in different stages of plant growth. Major insect pests attacking sesame include leaf webber and capsule borer, *Antigastra catalaunalis* Duponchel; leafhopper, *Orosius albicinctus* Distant; whitefly, *Bemisia tabaci*

Gennadius; aphid, *Aphis gossypii* Glover; linseed bud fly, *Dasineura lini*; and gall fly, *Asphondylia sesame* Felt. Among these, the leaf webber and capsule borer are considered among the most destructive pests, causing damage to tender leaves, flower buds, and developing capsules, resulting in considerable yield loss (Ahuja and Bakhetia, 1995; Omprakash *et al.*, 2022) [2, 19]. Sucking pests such as leafhoppers, whiteflies, and aphids also cause considerable damage by extracting plant sap, while leafhoppers are associated with the transmission of phyllody disease, which can severely reduce sesame yield (Ahirwar *et al.*, 2010; Selvanarayanan and Selvanuthukumaran, 2000) [1, 28].

Chemical insecticides offer rapid suppression of sesame insect pests, but their excessive use may lead to resistance, pest resurgence, environmental contamination and harmful effects on beneficial organisms. Hence, the present study was undertaken to identify effective, economical and comparatively safer insecticides for managing major insect pests of sesame under field conditions.

Materials and Methods

The present investigation was conducted during the *Kharif* season of 2025 at the Botany Research Field, Post Graduate

Institute, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Maharashtra, to evaluate the efficacy of various insecticides against major insect pests of sesame, namely Capsule borer, leafhopper, whitefly, and aphids.

Experimental details

Design of experiment	:	Randomized Block Design (RBD)
Treatments	:	Eight
Replications	:	Three
Season	:	Kharif 2025
Crop	:	<i>Sesamum indicum</i> L.
Variety	:	AKT - 64
Spacing	:	45 cm X 10 cm
Marginal spacing	:	a) Between replications - 1.0 m
	:	b) Between treatments - 0.5m
Plot Size	:	Gross - 4.0 m x 3.0 m
	:	Net - 3.0 m x 2.25 m
Seed rate	:	2.5 Kg/ha
Fertilizer Dose	:	25 : 25 : 0 NPK Kg/ha
Date of sowing	:	20th June, 2025

Treatment Details:

Treatment details (Module details)	Insecticide Details
M1	NSE 5% @ 100 ml/L fb Profenophos 50 EC @ 2 ml/L
M2	Profenophos 50 EC @ 2 ml/L fb Spinosad 45 SC 0.15 ml/L
M3	Spinosad 45 SC 0.15 ml/L fb Chlorantraniliprole 18.5 SC @ 0.4 ml/L
M4	Chlorantraniliprole 18.5 SC @ 0.4 ml/L fb Novaluron 10 EC @ 2 ml/L
M5	Novaluron 10 EC @ 2 ml/L fb Flubendiamide 480 SC @ 0.3 ml/L
M6	Flubendiamide 480 SC @ 0.3 ml/L fb Quinalphos 25% EC @ 4 ml/L
M7	Quinalphos 25%EC @ 4 ml/L fb NSE 5% @ 100 ml/L
M8	Untreated Control

Application of newer insecticides

All the insecticides were applied as a foliar spray. The spraying was done using a knapsack sprayer. The first spraying was given on 30 DAE on 30th July, 2025, and the second spray after 15 days of the first spray, i.e., (45 DAE) on 18th August, 2025. The quantity of spray solution was 500 l/ha in each spray application. The insecticidal solution was prepared according to the following formula.

$$V = \frac{C \times A}{\% \text{ a.i.}}$$

Where,

V = Volume or mass of the commercial product (mL or g).

C = Desired concentration of the spray solution (%).

A = Total volume of spray solution required (L).

% a.i. = Percentage of active ingredient present in the commercial formulation.

Method of recording observation

Seeds were treated with Imidacloprid 600 FS @ 5 g/kg seed before sowing, and two foliar sprays of the respective insecticides were applied against the major insect pests of sesame, with the first spray at 30 DAE and the second spray 15 days after the first spray, i.e., 45 DAE.

The observations were recorded 24 hours before the application of the spray, and post-treatment observations will be recorded at 3, 7, and 14 days after spray.

For whitefly, Leaf Hoppers, and aphids: The populations of Whitefly, Leaf Hoppers, and aphids were counted on upper, middle, and lower leaves of 10 randomly selected plants from each plot.

For til leaf roller/ capsule borer: The number of webbed leaf per ten plants were counted for leaf roller, and 50 capsules randomly selected from each plot were observed, and damaged capsules were counted from the randomly selected plants.

Crop Yield:

Sesame crop yield data were collected from each plot for different treatments, and the total yield estimated per hectare was computed according to the following formula (Bondre *et al.*, 2017).

Yield, kg/ha = Factor x seed yield (per plot) Where,

$$\text{Factor} = \frac{10,000}{\text{Net plot size}}, \text{ m}^2$$

Benefit - cost ratio

Benefit-cost ratio (B: C ratio) was calculated with respect to different treatments imposed for managing major insect pests of sesame according to the following formula (Bondre *et al.*, 2017)

$$B: C \text{ ratio} = \frac{\text{Net Profit}}{\text{Cost of treatments}}$$

The data obtained from the field observations were statistically analysed according to the experimental design following the procedure of Gomez and Gomez (1984) ^[13] to determine the significance of differences among the treatments.

Results and Discussion

Cumulative mean effect of different insecticide modules against capsule borer (*Antigastra catalaunalis*) after two sprays

The cumulative mean data after two sprays revealed significant variation among the different insecticide modules in their effectiveness against the larval population of capsule borer (*Antigastra catalaunalis*), as presented in Table 1. Module M3 (Spinosad 45 SC @ 0.15 ml/L fb Chlorantraniliprole 18.5 SC @ 0.4 ml/L) recorded the lowest cumulative mean population of 0.42 larvae/plant and was statistically at par with M4 (Chlorantraniliprole 18.5 SC @ 0.4 ml/L fb Novaluron 10 EC @ 2 ml/L) and M5 (Novaluron 10 EC @ 2 ml/L fb Flubendiamide 480 SC @ 0.3 ml/L), which recorded 0.58 larvae/plant each. Module M2 (Profenophos 50 EC @ 2 ml/L fb Spinosad 45 SC @ 0.15 ml/L) and M6 (Flubendiamide 480 SC @ 0.3 ml/L fb Quinalphos 25% EC @ 4 ml/L) which was at par with each other and recorded 0.75 and 0.86 larvae/plant, respectively, followed by M1 (1.13 larvae/plant) and M7 (1.26 larvae/plant). The untreated control (M8) recorded the highest cumulative mean population of 2.21 larvae/plant, which was significantly higher than all the treated modules. Thus, M3 was the most effective module against capsule borer, followed by M4 and M5.

The present findings are in agreement with Divya *et al.* (2022) ^[8], who reported chlorantraniliprole 18.5 SC @ 0.3 ml/L as the most effective treatment against *Antigastra catalaunalis*, followed by spinosad 45 SC and novaluron 10 EC. Omprakash *et al.* (2022) ^[19] also recorded maximum reduction of *A. catalaunalis* larval population with chlorantraniliprole 18.5 SC @ 0.3 ml/L, followed by spinosad 45 SC @ 0.3 ml/L and profenofos 50 EC. Saravanan and Selvanarayanan (2023) reported significant reduction in leaf and capsule damage with chlorantraniliprole 18.5 SC @ 22.75 g a.i./ha. Similarly, Naveen *et al.* (2018) ^[18] found chlorantraniliprole 20 SC @ 0.20 ml/L and spinosad 45 SC @ 0.12 ml/L to be highly effective against *A. catalaunalis*. Choudhary *et al.* (2017) ^[5] reported superior efficacy of spinosad against *A. catalaunalis*, while Rabari *et al.* (2024) observed effective suppression of leaf webber and capsule borer with chlorantraniliprole 18.5 SC.

Cumulative mean effect of different insecticide modules against sesame leafhopper (*Orosius albicinctus*) after two sprays

The cumulative effect of two sprays (Table 2) revealed that all the insecticidal modules significantly reduced the leafhopper population compared with the untreated control. Among the evaluated modules, M4 (Chlorantraniliprole 18.5 SC @ 0.4 ml/L fb Novaluron 10 EC @ 2 ml/L) recorded the lowest cumulative mean population (1.50 nymphs and adults/3 leaves) and was the most effective treatment. It was statistically at par with M2 (Profenophos 50 EC @ 2 ml/L fb

Spinosad 45 SC @ 0.15 ml/L), M1 (NSE 5% @ 100 ml/L fb Profenophos 50 EC @ 2 ml/L) and M7 (Quinalphos 25% EC @ 4 ml/L fb NSE 5% @ 100 ml/L), which recorded 1.52, 1.63 and 1.66 nymphs and adults/3 leaves, respectively. M3 (Spinosad 45 SC @ 0.15 ml/L fb Chlorantraniliprole 18.5 SC @ 0.4 ml/L), M6 (Flubendiamide 480 SC @ 0.3 ml/L fb Quinalphos 25% EC @ 4 ml/L) and M5 (Novaluron 10 EC @ 2 ml/L fb Flubendiamide 480 SC @ 0.3 ml/L) recorded 1.87, 2.11 and 2.32 nymphs and adults/3 leaves, respectively. The untreated control (M8) recorded the highest cumulative mean population (4.32 nymphs and adults/3 leaves).

The present findings are supported by Thakur *et al.* (2023) ^[33], who recorded a 76.47 per cent reduction in *Orosius albicinctus* population with imidacloprid 600 FS @ 5 g/kg seed + profenofos 50 EC @ 2 ml/L + NSKE 5% in sesame. Jasmine *et al.* (2023) ^[14] reported quinalphos 25 EC @ 2 ml/L as effective against sesame leafhopper, recording 1.15 insects/plant. Kumar *et al.* (2022) ^[17] observed effective suppression of the sesame sucking pest complex with imidacloprid 17.8 SC, chlorantraniliprole

18.5 SC and NSKE 5%. Pandey *et al.* (2018) found imidacloprid seed treatment followed by foliar spray to be highly effective against leafhopper, mirid bug and whitefly in sesame. Supporting evidence was also reported by Deepak *et al.* (2017) ^[6] and Soratur *et al.* (2017) ^[31], who recorded effective suppression of leafhoppers with profenofos 50 EC in okra and cowpea, m respectively. Sharma *et al.* (2023) ^[29] further reported significant reduction in sesame phyllody incidence following imidacloprid seed treatment and foliar application.

Cumulative mean effect of different insecticide modules on population of whitefly (*Bemisia tabaci*) on sesame crop after two sprays

The cumulative effect of two sprays (Table 3) revealed that Module M2 (Profenophos 50 EC @ 2 ml/L fb Spinosad 45 SC @ 0.15 ml/L) was the most effective, recording the lowest cumulative mean whitefly population (1.83 nymphs and adults/3 leaves). It was statistically at par with M1 (NSE 5% @ 100 ml/L fb Profenophos 50 EC @ 2 ml/L), M7 (Quinalphos 25% EC @ 4 ml/L fb NSE 5% @ 100 ml/L), M6 (Flubendiamide 480 SC @ 0.3 ml/L fb Quinalphos 25% EC @ 4 ml/L) and M3 (Spinosad 45 SC @ 0.15 ml/L fb Chlorantraniliprole 18.5 SC @ 0.4 ml/L), which recorded 1.93, 1.95, 2.95 and 3.00 nymphs and adults/3 leaves, respectively. M4 (Chlorantraniliprole 18.5 SC @ 0.4 ml/L fb Novaluron 10 EC @ 2 ml/L) and M5 (Novaluron 10 EC @ 2 ml/L fb Flubendiamide 480 SC @ 0.3 ml/L) recorded 3.40 and 3.60 nymphs and adults/3 leaves, respectively. The untreated control (M8) recorded the highest cumulative mean population (6.43 nymphs and adults per 3 leaves).

The present findings are supported by Singh *et al.* (2018) ^[30], who reported effective suppression of *Bemisia tabaci* with profenophos 50 EC and spinosad 45 SC in kharif mungbean. Ram *et al.* (2020) ^[25] reported spinosad 45 SC, fipronil 5 SC and imidacloprid 17.8 SL as effective treatments against the sucking pest complex of sesame. Kumar *et al.* (2022) ^[17] also recorded effective suppression of sesame sucking pests with imidacloprid 17.8 SL, chlorantraniliprole 18.5 SC and NSKE 5%. Geetha *et al.* (2020) ^[11] observed 67.5 per cent reduction in castor whitefly population with profenophos 50 EC @ 2 ml/L, while buprofezin 25 SC @ 1.5 ml/L recorded 71.2 per cent

reduction. Rajveer *et al.* (2017) ^[24] reported significant reduction of *B. tabaci* on okra with insecticides, with quinalphos 25 EC @ 250 g a.i. /ha recording 2.23 whiteflies/3 leaves compared with 7.85 in the untreated control.

Cumulative mean effect of different insecticide modules on population of aphid (*Aphis gossypii*) on sesame crop after two sprays

The data (Table 4) on the cumulative effect of two sprays revealed that Module M7 (Quinalphos 25% EC @ 4 ml/L fb NSE 5% @ 100 ml/L) was the most effective, recording the lowest cumulative mean aphid population (1.54 nymphs and adults/3 leaves). It was at par with M1 (NSE 5% @ 100 ml/L fb Profenophos 50 EC @ 2 ml/L), M2 (Profenophos 50 EC @ 2 ml/L fb Spinosad 45 SC @ 0.15 ml/L), M6 (Flubendiamide 480 SC @ 0.3 ml/L fb Quinalphos 25% EC @ 4 ml/L) and M3 (Spinosad 45 SC @ 0.15 ml/L fb Chlorantraniliprole 18.5 SC @ 0.4 ml/L), which recorded 1.91, 2.02, 2.35 and 2.55 nymphs and adults/3 leaves, respectively. It was followed by M4 (Chlorantraniliprole 18.5 SC @ 0.4 ml/L fb Novaluron 10 EC @ 2 ml/L) and M5 (Novaluron 10 EC @ 2 ml/L fb Flubendiamide 480 SC @ 0.3 ml/L) recorded 2.82 and 3.08 nymphs and adults/3

leaves, respectively. The untreated control (M8) recorded the highest aphid population (5.03 nymphs and adults/3 leaves).

The present findings are in agreement with Ram *et al.* (2020) ^[25], who reported spinosad 45 SC, fipronil 5 SC, and imidacloprid 17.8 SL as effective treatments against the sucking pest complex of sesame. Kumar *et al.* (2022) ^[17] also reported effective suppression of sesame sucking pests with imidacloprid 17.8 SL, chlorantraniliprole 18.5 SC and NSKE 5%. Saritha *et al.* (2020) ^[27] recorded effective suppression of aphids and other sucking pests in sesame with imidacloprid 17.8 SL, while difenthiuron 50 WP @ 1.25 g/L was the next effective treatment. Kalmath and Hadimani (2017) reported quinalphos 25 EC

@ 750 g a.i. /ha as highly effective against aphids and other sucking pests of chilli. Srivastava *et al.* (2016) ^[32] also recorded the lowest wheat aphid population with quinalphos 25 EC @ 1600 ml/ha, which was at par with spinosad 45 EC @ 125 ml/ha. Soratur *et al.* (2017) ^[31] reported profenophos 50 EC as highly effective against cowpea aphid under field conditions. Patel *et al.* (2017) ^[22] observed effective suppression of mustard aphid with thiamethoxam 25 WG, imidacloprid 17.8 SL and quinalphos 25 EC.

Table 1. Cumulative mean effect of different modules against capsule borer on sesame crop after two sprays

Tr. No.	Modules		Pre-count	Population of Capsule borer larvae /plant						Mean
				1 st spray			2 nd spray			
				3DAS	7DAS	14DAS	3DAS	7DAS	14DAS	
M1	NSE 5% @ 100ml/L fb Profenophos50 EC @ 2ml/L		1.53 (1.42)	1.20 (1.30)	0.86 (1.17)	1.00 (1.22)	1.58 (1.44)	0.95 (1.20)	1.19 (1.30)	1.13 (1.27)
M2	Profenophos 50 EC @ 2ml/L fb Spinosad 45 SC 0.15ml/L		1.54 (1.43)	0.96 (1.21)	0.62 (1.06)	0.74 (1.11)	1.08 (1.26)	0.45 (0.97)	0.68 (1.08)	0.75 (1.11)
M3	Spinosad 45 SC 0.15ml/L fbChlorantraniliprole 18.5SC @ 0.4ml/L		1.54 (1.43)	0.64 (1.07)	0.32 (0.91)	0.44 (0.97)	0.65 (1.07)	0.18 (0.82)	0.30 (0.90)	0.42 (0.95)
M4	Chlorantraniliprole 18.5SC @0.4ml/L fb Novaluron 10 EC @ 2ml/L		1.55 (1.43)	0.32 (0.91)	0.10 (0.77)	0.18 (0.82)	1.30 (1.34)	0.70 (1.10)	0.91 (1.19)	0.58 (1.02)
M5	Novaluron 10 EC @ 2ml/L fb Flubendiamide 480 SC @ 0.3ml/L		1.53 (1.42)	0.78 (1.13)	0.50 (1.00)	0.60 (1.05)	0.85 (1.16)	0.29 (0.89)	0.48 (0.99)	0.58 (1.03)
M6	Flubendiamide 480 SC @ 0.3ml/L fb Quinalphos 25%EC @ 4ml/L		1.55 (1.43)	0.46 (0.98)	0.20 (0.84)	0.30 (0.89)	1.75 (1.50)	1.10 (1.27)	1.35 (1.36)	0.86 (1.14)
M7	Quinalphos 25%EC @ 4ml/L fbNSE 5% @ 100ml/L		1.52 (1.42)	1.06 (1.25)	0.74 (1.11)	0.86 (1.17)	1.91 (1.55)	1.39 (1.37)	1.61 (1.45)	1.26 (1.31)
M8	Untreated Control		1.63 (1.45)	1.77 (1.48)	1.93 (1.55)	2.10 (1.60)	2.51 (1.74)	2.78 (1.80)	2.19 (1.61)	2.21 (1.63)
	'F' Test		NS	Sig	Sig	Sig	Sig	Sig	Sig	Sig
	SE (m)±		-	0.08	0.05	0.06	0.07	0.07	0.06	0.06
	CD at 5%		-	0.22	0.14	0.19	0.23	0.21	0.20	0.19
	CV %		-	10.79	7.75	9.76	9.70	10.31	9.17	9.58

Note: Figures in parentheses are corresponding square root ($\sqrt{x+0.5}$) transformation values. DAS: Days after spray

Table 2: Cumulative effect of different insecticide modules on the population of sesame leafhopper after two sprays

Tr. No.	Modules	Population of Leafhopper Nymph and adult /3 leaves							Mean
		Pre-count	1 st spray			2 nd spray			
			3DAS	7DAS	14DAS	3DAS	7DAS	14DAS	
M1	NSE 5% @ 100ml/L fb Profenophos 50 EC @ 2ml/L	3.24 (1.96)	2.18 (1.64)	2.14 (1.62)	2.42 (1.71)	1.18 (1.30)	0.82 (1.15)	1.08 (1.26)	1.63 (1.44)
M2	Profenophos 50 EC @ 2ml/L fb Spinosad 45 SC 0.15ml/L	3.28 (1.94)	1.08 (1.26)	0.82 (1.15)	1.16 (1.29)	2.20 (1.64)	1.76 (1.50)	2.10 (1.61)	1.52 (1.40)
M3	Spinosad 45 SC 0.15ml/L fbChlorantraniliprole 18.5SC @ 0.4ml/L	3.33 (1.96)	2.60 (1.76)	2.44 (1.71)	2.74 (1.80)	1.34 (1.36)	0.94 (1.20)	1.21 (1.31)	1.87 (1.52)
M4	Chlorantraniliprole 18.5SC @0.4ml/L fb Novaluron 10 EC @ 2ml/L	3.30 (1.95)	1.24 (1.32)	0.96 (1.21)	1.30 (1.34)	2.02 (1.59)	1.58 (1.44)	1.94 (1.56)	1.50 (1.41)
M5	Novaluron 10 EC @ 2ml/L fb Flubendiamide 480 SC @ 0.3ml/L	3.35 (1.96)	2.36 (1.69)	2.32 (1.68)	2.60 (1.76)	2.38 (1.70)	1.96 (1.57)	2.30 (1.67)	2.32 (1.67)
M6	Flubendiamide 480 SC @ 0.3ml/L fb Quinalphos 25%EC @ 4ml/L	3.29 (1.95)	2.86 (1.83)	2.70 (1.79)	3.00 (1.87)	1.56 (1.44)	1.12 (1.27)	1.42 (1.39)	2.11 (1.59)
M7	Quinalphos 25%EC @ 4ml/L fb NSE 5% @ 100ml/L	3.32 (1.95)	1.76 (1.48)	1.48 (1.21)	1.82 (1.34)	1.84 (1.38)	1.38 (1.17)	1.72 (1.39)	1.66 (1.29)

		(1.95)	(1.50)	(1.41)	(1.52)	(1.53)	(1.37)	(1.49)	(1.47)
M8	Untreated Control	3.41 (1.95)	3.89 (2.05)	4.24 (2.14)	4.52 (2.29)	4.89 (2.28)	5.12 (2.31)	3.29 (1.96)	4.32 (2.17)
	'F' Test	NS	Sig	Sig	Sig	Sig	Sig	Sig	Sig
	SE (m)±	-	0.10	0.10	0.14	0.09	0.13	0.10	0.11
	CD at 5%	-	0.31	0.31	0.41	0.27	0.39	0.31	0.33
	CV %	-	10.98	11.16	13.92	9.83	14.93	10.90	11.95

Note: Figures in parentheses are corresponding square root ($\sqrt{x+0.5}$) transformation values. DAS: Days after spray

Table 3: Cumulative mean effect of different insecticide modules on population of whitefly on sesame crop after two sprays

Tr.No.	Modules	Population of Whitefly Nymph and adult /3 leaves							Mean
		Pre-count	1 st spray			2 nd spray			
			3DAS	7DAS	14DAS	3DAS	7DAS	14DAS	
M1	NSE 5% @ 100ml/L fb Profenophos 50 EC @ 2ml/L	7.04 (2.75)	3.30 (1.95)	2.30 (1.67)	3.00 (1.87)	1.30 (1.34)	0.70 (1.09)	1.00 (1.22)	1.93 (1.52)
M2	Profenophos 50 EC @ 2ml/L fb Spinosad 45 SC 0.15ml/L	7.01 (2.74)	2.10 (1.61)	1.30 (1.34)	1.90 (1.55)	2.20 (1.64)	1.60 (1.45)	1.90 (1.55)	1.83 (1.52)
M3	Spinosad 45 SC 0.15ml/L fbChlorantraniliprole 18.5SC @ 0.4ml/L	7.05 (2.75)	3.90 (2.10)	2.80 (1.82)	3.60 (2.02)	2.90 (1.84)	2.20 (1.64)	2.60 (1.76)	3.00 (1.86)
M4	Chlorantraniliprole 18.5SC @0.4ml/L fb Novaluron 10 EC @ 2ml/L	7.06 (2.75)	4.30 (2.19)	3.40 (1.97)	4.10 (2.14)	3.20 (1.92)	2.50 (1.73)	2.90 (1.84)	3.40 (1.96)
M5	Novaluron 10 EC @ 2ml/L fb Flubendiamide 480 SC @ 0.3ml/L	7.07 (2.76)	5.40 (2.43)	4.60 (2.26)	5.20 (2.39)	2.40 (1.70)	1.80 (1.52)	2.20 (1.64)	3.60 (1.98)
M6	Flubendiamide 480 SC @ 0.3ml/L fb Quinalphos 25%EC @ 4ml/L	7.07 (2.76)	5.00 (2.35)	4.00 (2.12)	4.80 (2.30)	1.60 (1.45)	1.00 (1.22)	1.30 (1.34)	2.95 (1.79)
M7	Quinalphos 25%EC @ 4ml/L fb NSE 5% @ 100ml/L	7.02 (2.74)	2.80 (1.82)	1.80 (1.52)	2.40 (1.70)	1.90 (1.55)	1.20 (1.30)	1.60 (1.45)	1.95 (1.50)
M8	Untreated Control	7.07 (2.76)	7.51 (2.83)	8.04 (2.87)	5.47 (2.52)	6.17 (2.55)	6.50 (2.60)	4.93 (2.14)	6.43 (2.58)
	‘F’ Test	NS	Sig	Sig	Sig	Sig	Sig	Sig	Sig
	SE (m)±	-	0.12	0.14	0.14	0.10	0.13	0.12	0.12
	CD at 5%	-	0.39	0.43	0.42	0.32	0.39	0.36	0.40
	CV %	-	10.20	12.51	11.42	10.59	14.38	12.34	11.90

Table 4: Cumulative mean effect of different insecticide modules on the population of aphids on sesame crop after two sprays

Tr. No.	Modules	Population of Aphids Nymph and adult /3 leaves							Mean
		Pre-count	1 st spray			2 nd spray			
			3DAS	7DAS	14DAS	3DAS	7DAS	14DAS	
M1	NSE 5% @ 100ml/L fb Profenophos 50 EC @ 2ml/L	5.63 (2.48)	3.10 (1.90)	2.15 (1.63)	2.65 (1.77)	1.38 (1.37)	1.00 (1.22)	1.50 (1.41)	1.91 (1.62)
M2	Profenophos 50 EC @ 2ml/L fb Spinosad 45 SC 0.15ml/L	5.66 (2.48)	2.51 (1.73)	1.61 (1.45)	2.18 (1.64)	2.14 (1.62)	1.70 (1.48)	2.04 (1.59)	2.02 (1.58)
M3	Spinosad 45 SC 0.15ml/L fbChlorantraniliprole 18.5SC @ 0.4ml/L	5.70 (2.49)	3.66 (2.04)	2.89 (1.84)	3.58 (2.02)	1.84 (1.53)	1.44 (1.39)	1.90 (1.55)	2.55 (1.72)
M4	Chlorantraniliprole 18.5SC @ 0.4ml/L fb Novaluron 10 EC @ 2ml/L	5.65 (2.48)	3.39 (1.97)	2.58 (1.76)	3.30 (1.95)	2.64 (1.77)	2.26 (1.66)	2.80 (1.82)	2.82 (2.73)
M5	Novaluron 10 EC @ 2ml/L fb Flubendiamide 480 SC @ 0.3ml/L	5.74 (2.50)	4.08 (2.14)	3.39 (1.97)	4.23 (2.17)	2.36 (1.69)	1.94 (1.56)	2.50 (1.73)	3.08 (1.87)
M6	Flubendiamide 480 SC @ 0.3ml/L fb Quinalphos 25%EC @ 4ml/L	5.68 (2.49)	3.84 (2.08)	3.10 (1.90)	3.85 (2.08)	1.19 (1.30)	0.80 (1.14)	1.38 (1.37)	2.35 (1.64)
M7	Quinalphos 25%EC @ 4ml/L fb NSE 5% @ 100ml/L	5.71 (2.49)	2.01 (1.58)	1.20 (1.31)	1.74 (1.50)	1.54 (1.43)	1.14 (1.28)	1.64 (1.46)	1.54 (1.42)
M8	Untreated Control	5.76 (2.50)	6.48 (2.58)	6.91 (2.68)	5.45 (2.35)	4.27 (2.24)	4.93 (2.39)	2.20 (1.57)	5.03 (2.30)
	‘F’ Test	NS	Sig	Sig	Sig	Sig	Sig	Sig	Sig
	SE (m)±	-	0.13	0.11	0.15	0.09	0.11	0.11	0.11
	CD at 5%	-	0.42	0.34	0.46	0.29	0.34	0.34	0.36
	CV %	-	12.02	10.95	13.50	10.52	12.98	11.88	11.97

Note: Figures in parentheses are corresponding square root ($\sqrt{x+0.5}$) transformation values. DAS: Days after spray

Effect of different insecticide modules on yield of sesame

The data presented in Table 5 revealed significant differences among the insecticidal modules with respect to sesame seed yield. Module M3 (Spinosad 45 SC @ 0.15 ml/L fb Chlorantraniliprole 18.5 SC @ 0.4 ml/L) recorded the highest seed yield (5.89 q/ha) and was statistically at par with M4 (Chlorantraniliprole 18.5 SC @ 0.4 ml/L fb

Novaluron 10 EC @ 2 ml/L) and M2 (Profenophos 50 EC @ 2 ml/L fb Spinosad 45 SC @ 0.15 ml/L), which recorded 5.85 and 5.48 q/ha, respectively. These were followed by M6 (Flubendiamide 480 SC @ 0.3 ml/L fb Quinalphos 25% EC @ 4 ml/L), M5 (Novaluron 10 EC @ 2 ml/L fb Flubendiamide 480 SC @ 0.3 ml/L), M7 (Quinalphos 25% EC @ 4 ml/L fb NSE 5% @ 100 ml/L) and M1 (NSE 5% @

100 ml/L fb Profenophos 50 EC @ 2 ml/L), which recorded 5.33, 4.78, 4.29 and 3.92 q/ha, respectively. The untreated control (M8) recorded the lowest seed yield (2.48 q/ha).

The present findings are in agreement with Kalathiya *et al.* (2025) ^[15], who reported chlorantraniliprole 18.5 SC as the most effective treatment against *Antigastra catalaunalis* in sesame, producing the highest seed yield (672 kg/ha). Rabari *et al.* (2024) also recorded the highest seed yield (806.06 kg/ha) with chlorantraniliprole 18.5 SC @ 3.75 ml/10 L water, along with minimum capsule damage (3.25%). Similarly, Omprakash *et al.* (2022) ^[19] reported that chlorantraniliprole 18.5 SC followed by spinosad 45 SC effectively suppressed *A. catalaunalis* and resulted in higher sesame seed yield.

Economics

The economics of different insecticidal modules presented in Table 6 revealed significant differences in their economic performance. Among the evaluated modules, M3 (Spinosad 45 SC @ 0.15 ml/L fb Chlorantraniliprole 18.5 SC @ 0.4 ml/L) was the most economical, recording the highest ICBR of 1:7.83 with a net gain of ₹29,789/ha. It was followed by

M2 (Profenophos 50 EC @ 2 ml/L fb Spinosad 45 SC @ 0.15 ml/L), which recorded an ICBR of 1:5.61 and a net gain of ₹25,086/ha. M4 (Chlorantraniliprole 18.5 SC @ 0.4 ml/L fb Novaluron 10 EC @ 2 ml/L) recorded an ICBR of 1:4.48 with a net gain of ₹27,138/ha, followed by M6 (Flubendiamide 480 SC @ 0.3 ml/L fb Quinalphos 25% EC @ 4 ml/L) with an ICBR of 1:3.71 and a net gain of ₹22,122/ha. M5 (Novaluron 10 EC @ 2 ml/L fb Flubendiamide 480 SC @ 0.3 ml/L), M7 (Quinalphos 25% EC @ 4 ml/L fb NSE 5% @ 100 ml/L) and M1 (NSE 5% @ 100 ml/L fb Profenophos 50 EC @ 2 ml/L) recorded ICBRs of 1:2.13, 1:1.89 and 1:1.16, with net gains of ₹16,765, ₹11,678 and ₹7,634/ha, respectively.

The present findings are supported by Omprakash *et al.* (2022) ^[19], who recorded the highest ICBR with profenofos 50 EC (1:3.22), followed by chlorantraniliprole 18.5 SC (1:3.12) and spinosad 45 SC (1:2.96) against *Antigastra catalaunalis* in sesame. Chopade *et al.* (2018) ^[4] also reported chlorantraniliprole 18.5 SC and fenvalerate 20 EC as effective treatments for improving sesame yield, with fenvalerate recording an ICBR of 1:18.53.

Table 5: Economics (ICBR) of different insecticide modules

Tr. No.	Treatments	Cost of treatments					Yield of sesame (qt/ha)	Incre. yield over control (qt/ha)	Value of Incre. yield over control (Rs/qt @ 9850 (B))	Net gain over control (C= B-A)	ICBR (C/A)	Rank
		Quantity of insecticides (Dose/500 litres of water)	No. of sprays	Cost of insecticides (Rs/ha)	Labour and Sprayer Charges (Rs/ha)	Cost of Plant Protection (Rs/ha) (A)						
M1	NSE 5% @ 100ml/L fb Profenophos 50 EC @ 2ml/L	25000 gm+ 1000 ml	2	3550+1400 = 4950	1600	6550	3.92	1.44	14184	7634	1: 1.16	7
M2	Profenophos 50 EC @ 2ml/L fb Spinosad 45 SC 0.15ml/L	1000 ml+ 75 ml	2	1400+1464 =2864	1600	4464	5.48	3.00	29550	25086	1: 5.61	2
M3	Spinosad 45 SC 0.15ml/L fb Chlorantraniliprole 18.5SC @ 0.4ml/L	75 ml+ 200 ml	2	1464+736 = 2200	1600	3800	5.89	3.41	33589	29789	1: 7.83	1
M4	Chlorantraniliprole 18.5SC @ 0.4ml/L fb Novaluron 10 EC@ 2ml/L	200 ml+ 1000 ml	2	736+3720 = 4456	1600	6056	5.85	3.37	33194	27138	1: 4.48	3
M5	Novaluron 10 EC @ 2ml/L fb Flubendiamide 480 SC @ 0.3ml/L	1000 ml+ 150 ml	2	3720+2550 = 6270	1600	7870	4.78	2.30	22655	16765	1: 2.13	5
M6	Flubendiamide 480 SC @ 0.3ml/L fb Quinalphos 25%EC @ 4ml/L	150 ml+2000 ml	2	2550+1800 = 4350	1600	5950	5.33	2.85	28072	22122	1: 3.71	4
M7	Quinalphos 25%EC @ 4ml/L fb NSE 5% @ 100ml/L	2000 ml+ 25000 gm	2	1800+2750 = 4550	1600	6150	4.29	1.81	17828	11678	1: 1.89	6
M8	Untreated Control	-	-	-	-	-	2.48	-	-	-	-	-

1) Labour charges Rs.350/day. 2) Spray pump charges Rs. 50/day. 3) Two labour/spray. 4) NSKE 5%: Rs.100/kg 5) Profenofos 50 EC (250ml): Rs. 350 6) Spinosad 45 SC (250 ml): Rs. 4880 7) Chlorantraniliprole 18.5 SC (250ml): Rs. 920 8) Novaluron 10 EC (250ml) Rs.930 9) Flubendiamide 480 SC (250ml): Rs.4250 10) Quinalphos 25% EC (250ml): Rs. 225 11) Sale price of sesame crop @ 9,850 /qt.

Conclusion:

Among the seven insecticidal modules evaluated, significantly lower pest populations were recorded with different modules depending on the target pest. The lowest capsule borer population (0.42 larvae/plant) was recorded in M3 (Spinosad 45 SC @ 0.15 ml/L fb Chlorantraniliprole 18.5 SC @ 0.4 ml/L), while M4 (Chlorantraniliprole 18.5 SC @ 0.4 ml/L fb Novaluron 10 EC @ 2 ml/L) recorded the lowest leafhopper population (1.50 nymphs and adults/3 leaves). The lowest whitefly population (1.83 nymphs and adults/3 leaves) was observed in M2 (Profenophos 50 EC @ 2 ml/L fb Spinosad 45 SC @ 0.15 ml/L), whereas the lowest

aphid population (1.54 nymphs and adults/3 leaves) was recorded in M7 (Quinalphos 25% EC @ 4 ml/L fb NSE 5% @ 100 ml/L). The highest sesame seed yield was recorded in M3 (5.89 q/ha) followed by M4 (5.85 q/ha) and M2 (5.48 q/ha), whereas the untreated control recorded the lowest yield (2.48 q/ha). The maximum ICBR (1:7.83) was obtained with M3, followed by M2 (1:5.61) and M4 (1:4.48), indicating that Spinosad 45 SC followed by Chlorantraniliprole 18.5 SC was the most effective and economically viable insecticidal module for managing the major insect pests of sesame under the conditions of the present investigation.

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