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Efficacy of newer insecticides against major insect pests of *Sesamum*

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Abstract
The present experiment was carried out on efficacy of newer insecticides on against major insect pests of *Sesamum* at the field of Department of Entomology, Dr. PDKV, Akola, during *kharif* 2014. Two sprays of insecticides were taken against major pests of *Sesamum*. Results revealed that on the basis of average percent infestation of gall fly, treatments chlorantraniliprole 18.5% SC @ 0.006% followed by fenvalerate 20% EC @ 0.012% and novaluron 5.25% + indoxacarb 4.5% SC @ 0.014% were found to be most effective in order of merit. In case of capsule borer, treatments chlorantraniliprole 18.5% SC @ 0.006% followed by fenvalerate 20% EC @ 0.012% and novaluron 5.25% + indoxacarb 4.5% SC @ 0.014% were found to be most effective.

Keywords: *Sesamum*, gall fly, capsule borer, newer insecticides etc.

Introduction
Sesamum (2n = 26) belongs to the family Pediliaceae which consist of about 16 genera and 60 species. *Sesamum* is self pollinated crop (Singh *et al*. 1990) [10] and cultivated for its seeds which contain 48 to 55 percent oil of very high quality and 25 to 28 percent protein. In India, seed is eaten fried or mixed with sugar. The oil is used for cooking and medicinal purpose.
Sesamum is growing in 24 percent area with about 1.8 million ha in the world with annual production of 4.76 million metric tonnes (FAI, 2014) [5]. *Sesamum* grown in 2012-13 in India in the area of 1.7 lakh ha with productivity of 402 kg/ha and production of 7.15 lakh tones (Anon., 2014a) [1]. In Maharashtra in 2012- 13 *Sesamum* grown with area of 0.40 lakh ha with productivity of 300 kg/ha and production of 0.12 lakh tones (Anon., 2014b) [2].
Sesamum is attacked by about 65 species of insect pests in different stages of plant growth. Amongst all, *Sesamum* leaf webber and capsule borer (*Antigastra catalaunalis* Duponchel) Lepidoptera: Pyraustidae was considered to be most destructive pest, throughout India. Fletcher (1914) [6] for the first time reported the occurrence of this pest on *Sesamum* plants from South India.
Another serious pest of *Sesamum* is *Asphondylia sesami* Felt. (Diptera: Cecidomyiidae) commonly known as *Sesamum* gall fly and is widely distributed in South part of country noticed during September, 1970 at Regional Station of Agricultural Research, Sumedhpur (Pali, U.P.) This appears to be the first report of this pest infestation to *Sesamum* in Rajasthan (Verma and Mathur, 1973) [13]. It is reported as a major pest from Maharashtra and Andhra Pradesh, as a moderate pest from Tamil Nadu and as a minor from Rajasthan. It is also reported that it causes serious damage to *Sesamum* in South India (Madras), Andhra Pradesh and Gujarat (Singh *et al*. 1990) [10].
The sesame crop is attacked by a large number of insect pests of which the leaf roller and capsule borer (*Antigastra catalaunalis* Dup.) is the most serious pest in India. It occurs regularly and infests the crop during seedling, flowering and maturity stages of crop growth and causes up to 90 percent yield losses (Cheema and Singh, 1987) [3].
Sesamum is an important oilseed crop and is reported to be attacked by number of pests among which *Sesamum* gall fly and capsule borer are major pests. Gall fly and capsule borer are internal feeders and needs to be managed in time to avoid heavy losses. Pest management continues to be an important effort to deal with pests with the different insecticides and new approaches need to be made for fulfilling the existing research gaps. However, the published information about these pests to manage with different insecticides is very limited.

Looking towards the biology and nature of damage of the *Sesamum* gall fly and capsule borer, no much work has been reported by the workers and therefore it is necessitated to undertake the present investigation to evaluate the performance of different insecticides against these pests.

Material and Methods

Experimental Details

Design of experiment	:	Randomized Block Design (RBD)
Treatments	:	Seven
Replications	:	Three
Season	:	*Kharif* 2014
Crop	:	*Sesamum*
Variety	:	AKT – 64
Spacing	:	45 cm X 10 cm
Marginal spacing	:	a) Between replications – 1.0 m
	:	b) Between treatments – 0.5 m
Plot size	:	Gross – 4.5 X 3 m^2
	:	Net – 3.6 X 2.8 m^2
Seed rate	:	1.5 – 2 Kg/ha
Fertilizer Dose	:	25:25:0 NPK Kg/ha
Date of sowing	:	28th July, 2014

Treatment Details

Tr. No.	Insecticide	Dose/ lit	Conc. (%)	a.i./ha
T_1	Flubendamide 20% WG	0.3g	0.006	30
T_2	Flubendamide 39.35% SC	0.25ml	0.01	49
T_3	Novaluron 5.25% + Indoxacarb 4.5% SC	1.5 ml	0.014	69
T_4	Fenvalerate 20% EC	0.6ml	0.012	60
T_5	Chlorantraniliprole 18.5% SC	0.3 ml	0.006	28
T_6	Triazophos 40 EC	1.5 ml	0.06	300
T_7	Untreated Control	-	-	-

Method of recording observation

Two sprays of newer insecticides were taken against major pests of *Sesamum* when initiation noticed. The treatments were applied twice on the crop starting with the first application 30 days after sowing of crop followed by second application after 15 days of first application of treatments.

Five randomly selected plants from each plot, after seven days after germination. Pre count observation was recorded on total buds, flowers, capsules i.e. total numbers of fruiting bodies and total numbers of galls form on plant from bud initiation stages, 24 hrs before 1st spraying. For gall fly the observation was recorded on the total number of healthy galls formed on the plant and total number of damage galls in case of gall fly at 3, 7, 10 and 14 days after 1st spraying. While, in capsule borer observations were recorded on the total number of healthy capsule formed on the plant and total number of damage capsule due to capsule borer at 3, 7, 10 and 14 days after 2nd spraying.

The field data collected during the course of experimentation were subjected to statistical analysis as per the statistical design used, in order to test level of significance among the various treatments as per Gomez and Gomez (1984) [7].

Results and Discussion

Effect of treatments on percent infestation of *Sesamum* gall fly *Asphondylia sesami* Felt

First spray

The infestations of the *Sesamum* gall fly prior to application of insecticides ranged from 3.92 to 6.93 percent. The differences among the treatments and replications were non-significant indicating uniform distribution of pest in both treatments and replications.

The data presented in Table 1 indicated that all the treatments were significantly superior over the untreated control in recording minimum percent infestation of *A. sesami* at 3 days after first spraying. The treatment with chlorantraniliprole 18.5% SC @ 0.006% recorded significantly minimum percent infestation (1.58%) and was at par with fenvalerate 20% EC @ 0.012% (1.89%) and superior over rest of the treatment. However, novaluron 5.25% + indoxacarb 4.5% SC @ 0.014%, flubendiamide 39.35% SC @ 0.01% and flubendiamide 20% WG @ 0.006% recorded 2.95, 3.36, and 3.64 percent infestation, respectively and were found at par with each other and superior over untreated control. The next best was treatment was triazophos 40 EC @ 0.06% recording 4.04 percent infestation. This was significantly superior over untreated control. Maximum percent infestation (7.35%) was recorded in untreated control.

At 7 days after spraying among the various treatments chlorantraniliprole 18.5% SC @ 0.006% recorded significantly minimum percent infestation of *Sesamum* gall fly (2.62%) and was at par with fenvalerate 20% EC @ 0.012% (2.84%), novaluron 5.25% + indoxacarb 4.5% SC @ 0.014% (3.95%) and flubendiamide 39.35% SC @ 0.01% (4.36%) and found significantly superior over rest of all treatments. However, flubendiamide 20% WG @ 0.006% and triazophos 40 EC @ 0.06% recorded 4.52, and 4.61 percent infestation, respectively and were found at par with each other and superior over untreated control. Whereas significantly maximum percent infestation (9.30%) was recorded in untreated control.

Data recorded at 10 days after spraying among the various treatments chlorantraniliprole 18.5% SC @ 0.006% recorded significantly minimum percent infestation of gall fly (3.22%) and was found at par with fenvalerate 20% EC @ 0.012% (3.71%) and novaluron 5.25% + indoxacarb 4.5% SC @ 0.014% (4.59%). However it was found significantly superior over rest of all treatments. However, flubendiamide 20% WG @ 0.006%, flubendiamide 39.35% SC @ 0.01%, and triazophos 40 EC @ 0.06%, recorded 5.08, 5.31 and 6.19 percent infestation, respectively and were found at par with each other and superior over control. Whereas significantly maximum percent infestation (15.1%) was recorded in untreated control.

At 14 days after spraying data indicated that all the treatments were significantly superior over the untreated control in recording minimum percent infestation of *A. sesami*. The treatment with chlorantraniliprole 18.5% SC @ 0.006% recorded significantly minimum percent infestation (4.21%) and was at par with fenvalerate 20% EC @ 0.012% (4.73%), novaluron 5.25% + indoxacarb 4.5% SC @ 0.014% (6.15%) and flubendiamide 39.35% SC @ 0.01% (6.37%). However, the next best treatments in respect of recording minimum infestation of gall fly were flubendiamide 20% WG @ 0.006% (7.13%) and triazophos 40 EC @ 0.06% (8.17%). Whereas significantly maximum percent infestation (18.55%) was recorded in untreated control.

The finding of present investigation are in close conformity with the finding of Deshmukh (2009) [4] who also reported that, fenvalerate 20 EC were recorded minimum average percent infestation of *Sesamum* gall fly at 7 and 14 days after treatment.

Thakare *et al*. (2005) [11] and Shamshad (2010) [9] also observed that, fenvalerate 20 EC @ 0.01% was found most effective in control of *Sesamum* gall fly.

Effect of treatments on percent infestation of *Sesamum* capsule borer *Antigastra catalaunalis* Dup.

Second spray

The infestation of the *Sesamum* capsule borer prior to application of insecticides ranged from 2.95 to 4.78 percent. The differences among the treatments and replications were non-significant indicating uniform distribution of pest in both treatments and replications.

It is evident from the data presented in Table 2 and that the data was found statistically significant with respect to the infestation of *A. catalaunalis* at 3 days after second spray. The treatment with chlorantraniliprole 18.5% SC @ 0.006% recorded significantly minimum percent infestation (2.07%) and was found at par with fenvalerate 20% EC @ 0.012% (2.93%) followed by novaluron 5.25% + indoxacarb 4.5% SC @ 0.014% (4.37%) which was at par with flubendiamide 20% WG @ 0.006% (5.60%), flubendiamide 39.35% SC @ 0.01% (5.63%), and found significantly superior over triazophos 40 EC @ 0.06% and untreated control. However, the next best treatment was triazophos 40 EC @ 0.06% (6.25%) which was also found significantly superior over untreated control (14.39%).

At 7 days after spraying data indicated that all the treatments were significantly superior over the untreated control in recording minimum percent infestation of *A. catalaunalis.* The treatment with chlorantraniliprole 18.5% SC @ 0.006% recorded significantly minimum percent infestation of capsule borer (2.29%) which was found at par with fenvalerate 20% EC @ 0.012% (2.41%). The next best treatment was novaluron 5.25% + indoxacarb 4.5% SC @ 0.014% which was found at par with flubendiamide 20% WG @ 0.006% and flubendiamide 39.35% SC @ 0.01% recorded 4.24, 5.24, and 5.43 percent infestation respectively and found significantly superior over untreated control. The next best treatment in respect of recording minimum infestation of capsule borer was triazophos 40 EC @ 0.06% (6.31%) infestation which was also found significantly superior over untreated control. Significantly maximum percent infestation (16.30%) was recorded in untreated control.

Data revealed that all the treatments were significantly superior over the untreated control in recording minimum percent infestation of *A. catalaunalis* at 10 days after second spraying**.** The treatment with chlorantraniliprole 18.5% SC @ 0.006% recorded significantly minimum percent infestation (3.02%) which was found at par with fenvalerate 20% EC @ 0.012% (3.37%). These two treatments are significantly superior over rest of the treatments. Next effective treatment was, novaluron 5.25% + indoxacarb 4.5% SC @ 0.014% (4.92%) which was found at par with flubendiamide 20% WG @ 0.006% (5.21%) and followed by flubendiamide 39.35% SC @ 0.01% (6.56%) and triazophos 4 EC @ 0.06% (7.07%) and found significantly superior over untreated control. Significantly maximum percent infestation (17.72%) was recorded in untreated control.

At 14 days after spraying data indicated that all the treatments were significantly superior over the untreated control in recording minimum percent infestation of *A. catalaunalis.* Significantly minimum percent infestation (4.42%) of capsule borer, *A. catalaunalis* was found in the treatment chlorantaniliprole 18.5% SC @ 0.006%, which was significantly superior over rest of the treatment excluding fenvalerate 20% EC @ 0.012% (4.94 percent infestation). These two treatments were found at par with each other. The next effective treatment was flubendiamide 20% WG @ 0.006% (6.33%) which was found at par with novaluron 5.25% + indoxacarb 4.5% SC @ 0.014% (6.49%), flubendiamide 39.35% SC @ 0.01% (6.83%) and triazophos 40 EC @ 0.06% (7.07%). However these treatments are significantly superior over untreated control (18.53%). Significantly maximum percent infestation (18.53%) was recorded in untreated control.

The present findings are in agreement with those of Deshmukh (2009) [4] also reported the effectiveness of fenvalerate 20 EC against *Sesamum* capsule borer at 7 and 14 days after treatment.

Varma *et al*. (2013) [12] they also reported the fenvalerate 0.01% was effective for capsule damage of *Sesamum* against *Antigastra catalaunalis*. Rao *et al*. (2007) [8] stated that indoxacarb 14.5 SC was found most effective against legume pod borer (Lepidoptera).

Table 1: Effect of treatments on infestation of *Sesamum* gall fly *A. sesami* at first spray

Treatments	Percent infestation of *Sesamum* gall fly *A. sesami*				
	Pre-count	3 DAS	7 DAS	10 DAS	14 DAS
T_1: Flubendiamide 20% WG @ 0.006%	5.48 (2.34)	3.64 (1.89)	4.52 (2.10)	5.08 (2.25)	7.13 (2.66)
T_2: Flubendiamide 39.35% SC @ 0.01%	5.17 (2.27)	3.36 (1.83)	4.36 (2.04)	5.31 (2.30)	6.37 (2.51)
T_3: Novaluron 5.25% + Indoxacarb 4.5% SC @ 0.014%	5.42 (2.33)	2.95 (1.71)	3.95 (1.99)	4.59 (2.12)	6.15 (2.46)
T_4: Fenvalerate 20% EC @ 0.012%	5.70 (2.39)	1.89 (1.37)	2.84 (1.69)	3.71 (1.93)	4.73 (2.17)
T_5: Chlorantaniliprole 18.5% SC @ 0.006%	3.92 (1.98)	1.58 (1.25)	2.62 (1.62)	3.22 (1.79)	4.21 (2.05)
T_6: Triazophos 40 EC @ 0.06%	5.29 (2.30)	4.04 (2.01)	4.61 (2.15)	6.19 (2.49)	8.17 (2.86)
T_7: Untreated control	6.93 (2.63)	7.35 (2.71)	9.30 (3.05)	15.12 (3.88)	18.55 (4.30)
'F' test	NS	Sig.	Sig.	Sig	Sig
SE(m)±	1.13	0.09	0.15	0.12	0.18
C.D.(0.05)	-	0.28	0.45	0.38	0.57

(*Figures in the parenthesis are corresponding square root transformed values)

Table 2: Effect of treatments on infestation of *Sesamum* capsule borer *A. catalaunalis* at second spray

Treatments	Percent infestation of capsule borer *A. catalaunalis*				
	Pre-count	3 DAS	7 DAS	10 DAS	14 DAS
T_1: Flubendiamide 20% WG @ 0.006%	3.91 (2.94)	5.60 (2.37)	5.24 (2.28)	5.21 (2.28)	6.33 (2.51)
T_2: Flubendiamide 39.35% SC @ 0.01%	3.72 (2.99)	5.63 (2.37)	5.43 (2.33)	6.56 (2.56)	6.83 (2.61)
T_3: Novaluron 5.25% + Indoxacarb 4.5% SC @ 0.014%	3.87 (3.01)	4.37 (2.06)	4.24 (2.06)	4.92 (2.20)	6.49 (2.52)
T_4: Fenvalerate 20% EC @ 0.012%	4.05 (3.08)	2.93 (1.71)	2.41 (1.52)	3.37 (1.83)	4.94 (2.22)
T_5: Chlorantaniliprole 18.5% SC @ 0.006%	2.95 (3.10)	2.07 (1.40)	2.29 (1.50)	3.02 (1.73)	4.42 (2.10)
T_6: Triazophos 40 EC @ 0.06%	3.80 (2.95)	6.25 (2.50)	6.31 (2.51)	7.07 (2.66)	7.07 (2.66)
T_7: Untreated control	4.78 (3.71)	14.39 (3.79)	16.30 (4.03)	17.72 (4.21)	18.53 (4.30)
'F' test	NS	Sig	Sig	Sig	Sig
SE(m)+	1.16	0.12	0.12	0.11	0.12
C.D.(0.05)	-	0.38	0.37	0.34	0.38

(*Figures in the parenthesis are corresponding square root transformed values)

Conclusion

From the findings of the present, investigations, it is concluded that lowest average percent infestation of gall fly was observed in chlorantraniliprole 18.5% w/w SC closely followed by fenvalerate 20% EC and novaluron 5.25% + indoxacarb 4.5% SC at 3,7,10 and 14 days after first spray. In case of capsule borer lowest average percent infestation was observed in chlorantraniliprole 18.5% w/w SC closely followed by fenvalerate 20% EC and novaluron 5.25% + indoxacarb 4.5% SC at 3,7,10 and 14 days after second spray.

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