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Management of sesame leaf webber and capsule borer (*Antigastra catalaunalis* Dup.) in Meghalaya

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ABSTRACT

Field experiment was carried out at Entomology Research Farm, ICAR Research Complex for NEH Region, Umiam, Meghalaya to evaluate some bio and chemical pesticides against sesame leaf webber and capsule borer during *kharif* season of 2022.The experiment was laid out in randomized block design (RBD) with three replications. Sesame (Var: Nagaland Local) was sown in 12 m^2 areas with 45 cm x 15 cm spacing. Eight treatments *viz*. T1-neem oil 0.03% (5ml/l), T2-*Beauveria bassiana* (5ml/l), T3-*Bacillus thuringiensis* (*Bt*) var kurstaki (2ml/l), T4-spinosad 45% SC (0.5ml/l), T5-*Bacillus thuringiensis* (*Bt*) var kurstaki + *Saccharopolyspora spinosa* 15% (2 ml/l), T6-emamectin benzoate 5% SG (0.4g/l), T7-imidacloprid 17.8SL (0.3ml/l) and T8-control were applied at 45, 60 and 75 days after sowing. Observation on leaf webber and capsule borer larvae was recorded one day before spray and 7 and 14 days after each spray. The pooled results showed that all the treatments were effective against sesame leaf webber and capsule borer and showed significant difference among the treatments. Among the treatments, emamectin benzoate 5SG @0.4g/l recorded the lowest mean population and the highest reduction over control (1.72 larvae/5plants and 72.32%, respectively) followed by spinosad 45 SC @0.5 ml/l (2.11 larvae/5plants and 66.07% reduction), *Bt* var kurstaki + *Saccharopolyspora spinosa* 15% @2.0 ml/l (2.44 larvae/5plants and 60.71% reduction), *Bt*@2.0 ml/l (3.06 larvae/5plants and 5.89% reduction), neem oil 0.03% @5.0 ml/l (3.61 larvae/5plants and 41.96% reduction). The highest yield (7.22 q/ha) was recorded from emamectin benzoate 5SG @0.4 g/l treated plot followed by *Bt* var kurstaki + *Saccharopolyspora spinosa* 15% @ 2ml/l (7.04q/ha) and spinosad 45SC @0.5ml/l (6.94q/ha). The lowest yield was found in control plot (5.28 q/ha).

1. Introduction

Sesame, *Sesamum indicum* L. is the oldest oilseed crop of the world cultivated throughout India and belongs to family Pedaliaceae. Its seeds contain 52-57% oil and 25% protein (Smith *et al.,* 2000). Its cultivation gained impetus because of high quality edible oil, rich source of carbohydrate, protein, calcium and phosphorus, so, also known as 'queen of oil seeds'. The mature seeds are used in confectioneries, cookies, cakes, margarine and for bread making. The oil is used in the manufacture of soaps, cosmetics, perfumes, insecticides as well as pharmaceutical products, and the oilcakes are used to feed livestock as a source of nutrients (Vijaykumar *et al*., 2018). Sesame is rich in natural antioxidants or lignin, which are both oil and water soluble; provide very long shelf life and stable characteristics of sesame seed and oil (Ermias *et al*., 2009). India is the largest producer of sesame in the world with a productivity of 746 $MTha^{-1}$ (FAOSTAT, 2020), Gujarat is the leading state of sesame production followed by West Bengal, Karnataka, Rajasthan, Madhya Pradesh, Tamil Nadu, Andhra Pradesh,

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and Maharashtra. In Northeast, sesame covers area of 27.6 thousand hectare, production of 19.6 thousand metric tonnes and productivity is 706 kg/ha. In Meghalaya, it covers area of 2.35 thousand hectare and production of 2.20 thousand metric tonnes and productivity is 933 kg/ha. (Directorate of Economics & Statistics, Ministry of Agriculture & Farmers Welfare, Government of India, New Delhi 2020). Sesame is a short duration crop and greatly affected by both biotic and abiotic factors. One of the major constraints in sesame production is the immense damage by insect pests leading to deterioration of both quality and quantity (Egonyu *et al.,* 2005 and Ahirwar *et al*., 2010a). The pests attack causes a profound loss (25 to 90%) in seed yield (Ahuja and Kalyan, 2001). As many as 67 insect pests of different groups are recorded damaging the sesame crop from germination to maturity. The important insect species attacking to sesame crop *viz*., leaf webber and capsule borer, *Antigastra catalaunalis* (Dup.), jassid, *Orosius albicinctus* (Distant), whitefly, *Bemisia tabaci* (Genn.), mirid bug, *Nesidiocoris tenuis* (Reuter), til hawk moth, *Acherontia styx* (Westwood), bihar hairy caterpillar, *Diacrisia oblique* (Wlk.), sesame gall fly, *Asphondylia sesame* (Felt.) have been recorded (Sasikumar and Sardana, 1988, Ahirwar *et al.,* 2009). Among these, sesame leaf roller and capsule borer*, A. catalaunalis* is the most important pest because this attacks the crop in all the growth stages after about two weeks of emergence. The attack is more severe during dry seasons and after initiation of flowering. *A. catalaunalis* feeds on tender foliage by webbing the top leaves, bores into the capsule and shoots (Narayanan and Nadarajan, 2005). Under severe attacks at early stage of crop it may cause complete failure of crop especially in rain fed areas (Karuppaiah, 2014). This insect pest causes 10-70 per cent infestation of leaves, 34-62 per cent of flower buds/ flowers and 10-44 per cent infestation of capsules resulting in up to 72 per cent loss in yield (Ahirwar *et al*., 2010b). To fight these huge losses, farmers are regularly using over doses of conventional pesticides that produces many difficulties in the environment. Indiscriminate uses of conventional insecticides for management of these insect pests have been causing different problems like resistance, resurgence and residue problem in food. Therefore, it is necessary to evaluate the new generation insecticides and biopesticides against the major pests of sesame. Keeping these views in mind, the present experiment was conducted to evaluate some bio and chemical pesticides against sesame leaf webber and capsule borer under Meghalaya condition.

2. Materials and methods

Field experiment was carried out at Entomology Research Farm, ICAR Research Complex for NEH Region, Umiam, Meghalaya to evaluate some bio and chemical pesticides against sesame leaf webber and capsule borer during *kharif* season of 2022 (Figure 1). The experiment was laid out in randomized block design (RBD) with three replications. Sesame (Var: Nagaland Local) was sown in 12 m^2 areas with 45 cm x 15 cm spacing. The recommended agronomic management practices were followed for raising the crop except plant protection. Eight treatments viz. T1-neem oil 0.03% (5ml/l), T2-*Beauveria bassiana* (5ml/l), T3-*Bacillus thuringiensis* (*Bt*) var kurstaki (2ml/l), T4-spinosad 45% SC (0.5ml/l), T5-*Bacillus thuringiensis* (*Bt*) var. kurstaki + *Saccharopolyspora spinosa*15% (2 ml/l), T6-emamectin benzoate 5% SG (0.4g/l), T7-imidacloprid 17.8SL (0.3ml/l) and T8-control were applied at 45, 60 and 75 days after sowing. Spraying was done by pneumatic knapsack sprayer using spray fluid @ 500 litre/ha. Observation on leaf webber and capsule borer larvae was recorded from randomly selected 5 plants/plot one day before spray and 7 and 14 days after each spray. Yield of sesame was recorded separately for each plot. The mean data of sesame leaf webber and capsule borer larvae were subjected to square root $\sqrt{(x+0.5)}$ transformation before statistical analysis. Then, mean values were analysed using Duncan's Multiple Range Test (DMRT) at 5% level of probability.

3. Results and discussion

Efficacy of different treatments against sesame leaf webber and capsule borer

The results of the efficacy of different treatments against sesame leaf webber and capsule is presented in Table 1. There was no significant difference in the leaf webber population among the treatments before spray, which ranged from 1.00 to 2.33 larvae/5plants. The population of leaf webber after the first spray ranged from 1.50 to 4.50 larvae/5 plants and the per cent reduction over control ranged from 18.52 to 66.67%. The most effective result was recorded from emamectin benzoate 5SG @0.4 g/l with mean population of 1.50 larvae/5plants and 66.67% reduction over untreated control. This was followed by spinosad 45SC @0.5ml/l, *Bt* var. kurstaki + *Saccharopolyspora spinosa* 15% @2.0 ml/l, *Bacillus thuringiensis* @2.0 ml/l with 1.67, 2.17 and 2.83 larvae/5plants and 62.96, 51.85 and 37.04% reduction over untreated control, respectively. The least effective treatment was *Beauveria bassiana* @5.0 ml/l with 3.67 larvae/5plants and 18.52 % reduction over untreated control. The maximum population of leaf webber and capsule borer was observed in control plot with 4.50 larvae/5 plants. After the second spray, the results of leaf webber and capsule borer were found in the range of 2.33 to 8.00 larvae/5 plants. The per cent reduction over control among the different treatments ranged from 41.67 to 70.83%. Similar to the results in the first spray, emamectin benzoate 5SG @0.4 g/l was the most effective with mean population of 2.33 larvae/5 plants and 70.83% reduction over untreated control. The results of the treatments were found to be at par with each other and significantly superior over control. The least effective among the treatments was imidacloprid 17.8 SL @0.3 ml/l and *Beauveria bassiana* @5.0 ml/l with 4.67 larvae/5 plants and 41.67% reduction in each over untreated control (8.00 larvae/5 plants). After the third spray, the mean population of leaf webber/5 plants ranged from 1.33 to 6.17. The highest mean population was recorded from control (6.17 larvae/5 plants) and the lowest from emamectin benzoate 5SG @0.4 g/l (1.33 larvae/5 plants). Both the imidacloprid 17.8 SL and *B. bassiana* treated plots showed the maximum population after third spray. Emamectin benzoate 5SG @0.4 g/l showed the most effective result with 78.38% reduction over untreated control followed by spinosad 45 SC @0.5 ml/l (72.97%) and *Bt* var. kurstaki + *Saccharopolyspora spinosa* 15% @2.0 ml/l (67.57%). Imidacloprid17.8 SL @0.3ml/l was least effective with 43.24% reduction over untreated control. The results of the pooled data of the three sprays are presented in Figure 2. The pooled results showed that all the treatments were effective against sesame leaf webber and capsule borer and showed significant difference among the treatments. Among the treatments emamectin benzoate 5SG @0.4g/l recorded the lowest mean population and the highest reduction over control (1.72 larvae/5 plants and 72.32%, respectively) followed by spinosad 45 SC @0.5ml/l (2.11 larvae/5 plants and 66.07% reduction), *Bt* var. kurstaki + *Saccharopolyspora spinosa* 15% @2.0 ml/l (2.44 larvae/5 plants and 60.71% reduction), *Bacillus thuringiensis* @2.0 ml/l (3.06 larvae/5 plants and 5.89% reduction), neem oil 0.03% @5.0 ml/l (3.61 larvae/5 plants and 41.96% reduction) and imidacloprid 17.8 SL @0.3 ml/l (3.72 larvae/5 plants and 40.18% reduction). *Beauveria bassiana* @5.0 ml/l (3.89 larvae/5 plants and 37.50% reduction) was the least effective among the treatments.

Effects of different treatments on yield of sesame

The effects of different treatments on yield of sesame are presented in Figure 3. There was significant difference among the treatments in terms of yield of sesame and all treatments were superior over untreated control. Yield of sesame in the different treatments were ranged from 5.98 to 7.22 q/ha. The highest yield (7.22 q/ha) was recorded from emamectin benzoate 5SG @0.4 g/l treated plot followed by *Bt* var. kurstaki + *Saccharopolyspora spinosa* 15% @ 2ml/l (7.04q/ha) and spinosad 45SC @0.5ml/l (6.94q/ha). The lowest yield was found in control plot (5.28 q/ha).

The different treatments used in the study against sesame leaf webber and capsule borer showed effective results in terms of mean population and per cent reduction over control. Among the different treatments, emamectin benzoate 5SG @0.4 g/l showed the most effective result against leaf webber infestation followed by spinosad 45 SC @0.5 ml/l, *Bt* var. kurstaki + *Saccharopolyspora spinosa* 15% @2.0 ml/l, *Bt* @2.0 ml/l, neem oil 0.03% @5.0 ml/l, and imidacloprid 17.8 SL @0.3 ml/l. The present findings may be compared with the efficacy results on target pest of sesame or other lepidopteran pests on different crops. Similar reports on the effectiveness of emamectin benzoate against *Antigastra catalaunalis* on sesame was reported by Varma *et al*. (2013). Chaitra (2016) also reported that emamectin benzoate can effectively control the incidence of leaf webber and whitefly in sesame. Sasikumar and Kumar (2015a, 2015b) studied the efficacy of spinosad 45 SC and reported that spinosad 45 SC as foliar application was effective against shoot and leaf webber of sesame. Patra *et al*. (2016) reported the effectiveness of emamectin benzoate, *B. thuringiensis* and azadirachtin against brinjal shoot and fruit borer. The present results may be supported with the findings of Ameta and Bunker (2007), who revealed that spinosad was significantly superior to untreated control in reducing *Helicoverpa armigera* infestation in tomato. Singh and Yadav (2006) reported the efficacy of spinosad, 2 *Bacillus thuringiensis* based insecticides (Halt and Biolep), and 3 neem-based formulations (Nimbicidine, Neemarine and Achook) against *H. armigera* on pigeon pea. The results of neem oil and *B. thuringiensis* may be compared with the findings of Rani *et al*. (2018) against *Chilo partellus*; efficacy of *Bt* is in agreement with the results of Dhaliwal *et al*. (2018). Sarkar *et al*. (2015) showed the effectiveness of spinosad, azadirachtin, *Bt* and *Bb* against fruit borer in okra.

4. Conclusion

From the present study, it was found that emamectin benzoate recorded the lowest mean population of sesame leaf webber and capsule borer as well as highest reduction over control plots followed by spinosad, combination of spinosad + *Bt*, *Bacillus thuringiensis*, neem oil. Therefore, it is concluded that these treatments may be incorporated in the integrated pest management of sesame leaf webber and capsule borer.

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6. References

Ahirwar RM, Banerjee S, and Gupta MP (2009) Seasonal incidence of Insect pests of Sesame in relation to Abiotic factors. Annals of Plant Protection Sciences 17(2): 351-356.

Ahirwar RM, Gupta MP, and Banerjee S (2010a) Field efficacy of natural and indigenous products on sucking pests of sesame. Indian Journal of Natural Products and Resources 1 (2): 221-226.

Ahirwar RM, Gupta MP, and Smita B (2010b) Bio ecology of leaf roller/ capsule borer, *Antigastra catalaunalis* (Dupochel). Advanced Bioresearch 1(2): 90-104.

Ahuja DB and Kalyan RK (2001) Seasonal incidence of gall fly, *Asphondylia sesami* and efficacy of various neem-based formulations, against it on sesame, *Sesamum indicum.* Indian Journal of Entomology 63(4): 409-412.

Ameta OP and Bunker GK (2007) Efficacy of flubendiamide against fruit borer, *Helicoverpa armigera* in tomato with safety to natural enemies. Indian Journal of Plant Protection 35: 235–237.

Chaitra HS (2016) Bionomics of sesame leaf webber, *Antigastra catalaunalis* (Dup.) and management of pest complex of sesame. M.Sc. (Ag.) thesis, submitted to Department of Agricultural Entomology, Anand Agriculture University, Gujrat.

Dhaliwal AK, Brar DS, and Jindal J (2018) Evaluation of new insecticides against maize stem borer, *Chilo partellus* (Swinhoe). Indian Journal of Entomology 80(3): 975-978

Egonyu JP, Kyamanywa S, Anyanga W, and Ssekabembe CK (2005) Review of pests and diseases of sesame in Uganda. African Crop Science Conference Proceedings **7**: 1411-1416.

Ermias S, Geremew T, Bayeh M, Zeray M, and Bayou B (2009) Research on insect pests of oil crops in Ethiopia. In: Increasing crop production through improved plant protection. Volume II. (Abraham Tadesse edited). Plant Protection Society of Ethiopia, Addis Ababa.

Food and Agriculture Organization Statistical Databases (FAOSTAT). http://faostat.fao.org/ (accessed on 5 February 2020).

Karuppaiah V (2014) Eco-friendly management of Leaf webber and capsule borer (*Antigastra catalaunalis*) Menace in sesame. Popular Kheti 2 (2): 127-130.

Narayanan US and Nadarajan L (2005) Evidence for a male-produced sex pheromone in sesame leaf webber, *Antigastra catalaunalis* (Duponchel) (Pyraustidae: Lepidoptera). Journal of Current Sciences 88(4): 631-634.

Patra S, Azad Thakur NS, and Firake DM (2016) Evaluation of Bio-pesticides and Insecticides Against Brinjal Shoot and Fruit Borer (*Leucinodes orbonalis* Guenee) in Meghalaya of North-Eastern India. International Journal of Bio-resource and Stress Management 7(5): 1032-1036.

Rani DS, Sri CNS, Kumar KA, and Venkatesh M N (2018) Economic evaluation and efficacy of various insecticides against maize stem borers. Journal of Pharmacognosy and Phytochemistry 7(3): 15-20.

Sarkar S, Patra S, and Samanta A (2015) Evaluation of biopesticides against red cotton bug and fruit borer of okra. The Bioscan 10(2): 601-604.

Sasikumar B and Sardana S (1988) Sipingborok (Jhum til) - source of some valuable genes. Journal of Oilseeds Research 5(2): 183-184.

Sasikumar K and Kumar K (2015a) Bio-efficacy of insecticide against shoot and leaf webber, *Antigastra catalaunalis* Duponchel on leaf damage basis in Sesame. Annals of Plant Protection Sciences 23(2): 237-240.

Sasikumar K and Kumar K (2015b) Bio efficacy of newer insecticide against the Sesame Shoot and Leaf Webber, *Antigastra catalaunalis* Duponchel (Pyraustidae: Lepidoptera) on flower and pod damage basis in Sesame. Trends in Biosciences 8(17): 4747- 4750.

Singh SS and Yadav SK (2006) Efficacy and economics of some modern insecticides, bioinsecticides and neem- based formulations against pod borer, *Helicoverpa armigera*, in pigeon pea. Indian Journal of Entomology 68:139–143.

Smith, D.T., Grichar, W.J., and McCallum, A.A. (2000) Texas Agricultural Experiment Station, College Station and Yoakum prepared.

Varma HS, Patel IS, and Shinde YA (2013) Efficacy of certain insecticidal molecules against *Antigastra catalaunalis* (dup.) in sesamum. Indian Journal of Entomology 75(2): 137-140.

Vijaykumar L, Jyothi J, Madhusudan K, and Shivanna B (2018) New source of resistance against sesame leaf webber and capsule borer, *Antigastra catalaunalis* Dupounchel (Pyraustidae: Lepidoptera) inKarnataka. Journal of Entomology and Zoology Studies 6(1): 942- 946.

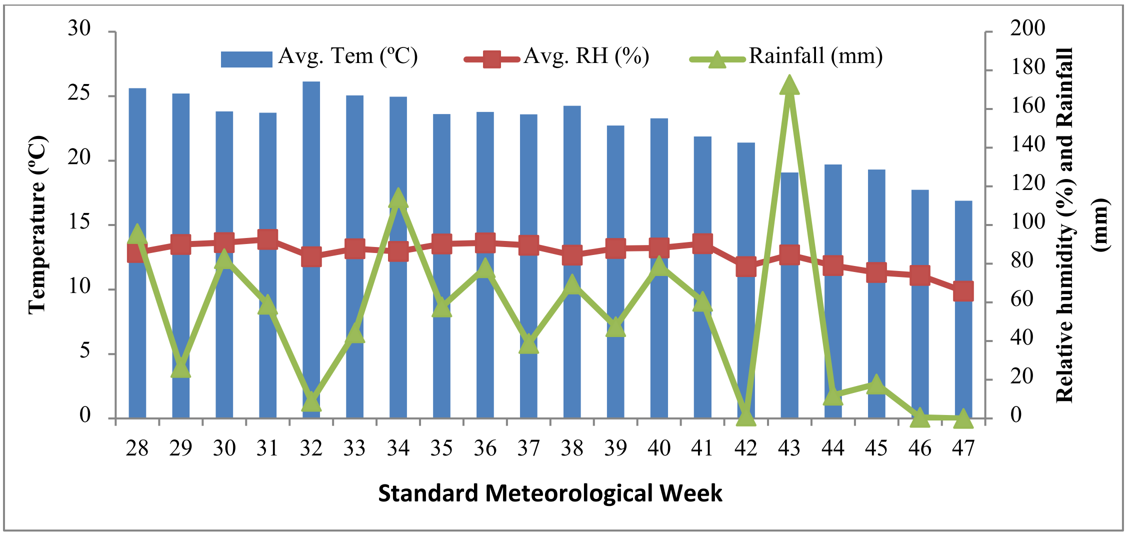

Figure 1. Average weather parameters prevailed during study period in 2022

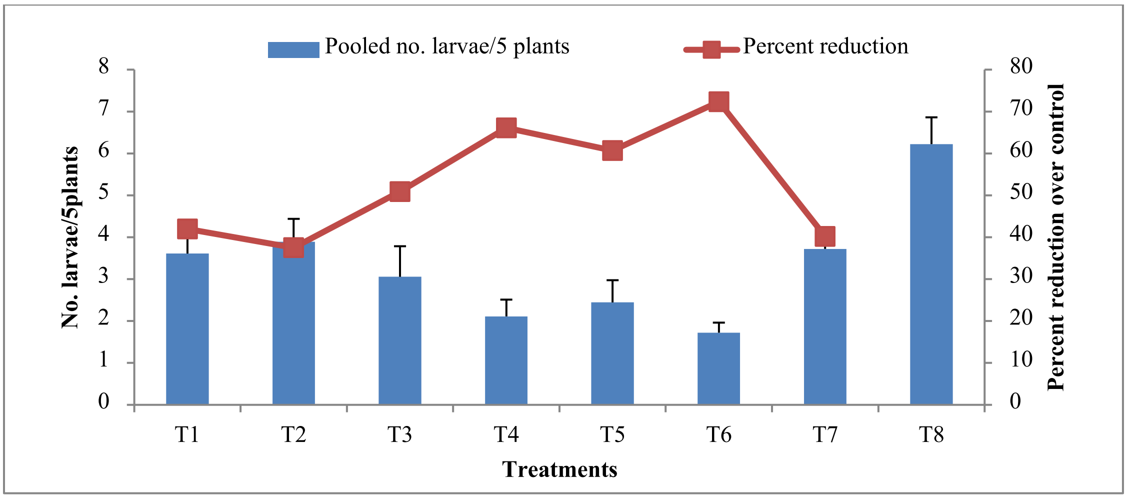

Figure 2. Pooled effects of treatments on larvae of leaf webber and capsule borer in sesame

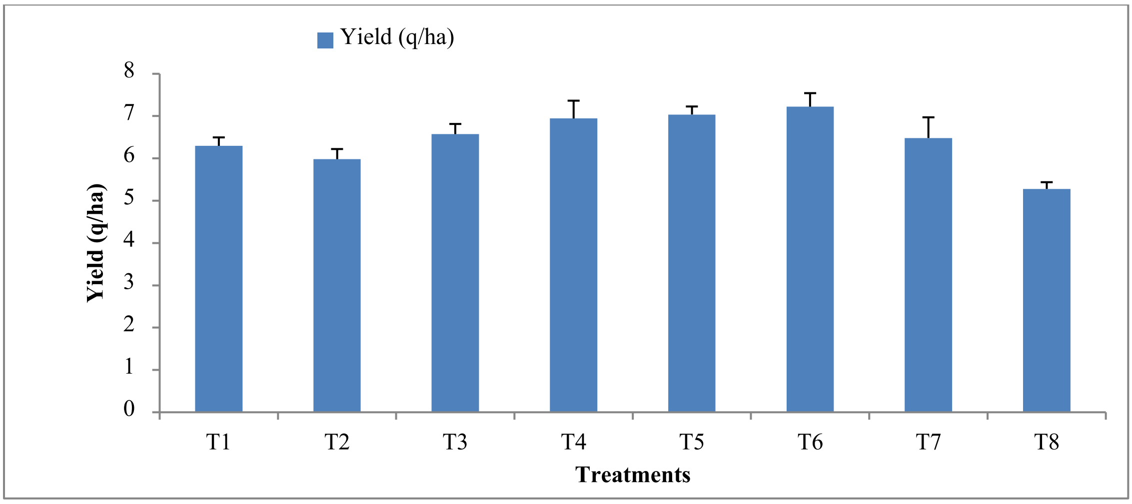

Figure 3. Effect of different treatments on yield of sesame

Table 1. Efficacy of different treatments against leaf webber larvae in sesame

Treatments	Dose (g or ml/l)	No. leaf webber larvae/5 plant before treatment	No. leaf webber larvae/5 plants after spray											
			First spray				Second spray				Third spray			
			7DAS	14DAS	Mean	Per cent reduction over control	7DAS	14DAS	Mean	Percent reduction over control	7DAS	14DAS	Mean	Percent reduction over control
Neem oil 0.03%	5.0	1.33^{a} (1.35)	2.33^{ab} (1.68)	4.00^{bc} (2.12)	3.17^{abc} (1.91)	29.63	4.67^{a} (2.27)	4.33^{ab} (2.20)	4.50^{a} (2.24)	43.75	3.67^{ab} (2.04)	2.67^{abc} (1.78)	3.17^{ab} (1.91)	48.65
Beauveria bassiana	5.0	2.00^{a} (1.58)	3.00^{ab} (1.87)	4.33^{bc} (2.20)	3.67^{bc} (2.04)	18.52	5.00^{ab} (2.35)	4.33^{ab} (2.20)	4.67^{a} (2.27)	41.67	3.33^{ab} (1.96)	3.67 (2.04)	3.50^{b} (2.00)	45.95
Bacillus thuringiensis (*Bt*)	2.0	2.33^{a} (1.68)	2.00^{ab} (1.58)	3.67^{abc} (2.04)	2.83^{abc} (1.83)	37.04	4.00^{a} (2.12)	3.33^{a} (1.96)	3.67^{a} (2.04)	54.17	3.33^{ab} (1.96)	2.00^{ab} (1.58)	2.67^{ab} (1.78)	56.76
Spinosad 45SC	0.5	2.00^{a} (1.58)	1.33^{a} (1.35)	2.00^{ab} (1.58)	1.67^{a} (1.47)	62.96	3.33^{a} (1.96)	2.67^{a} (1.78)	3.00^{a} (1.87)	62.50	2.00^{ab} (1.58)	1.33^{ab} (1.35)	1.67^{ab} (1.47)	72.97
Bt var. kurstaki + *Saccharopolyspora spinosa* 15%	2.0	1.67^{a} (1.47)	2.00^{ab} (1.58)	2.33^{ab} (1.68)	2.17^{ab} (1.63)	51.85	3.33^{a} (1.96)	3.00^{a} (1.87)	3.17^{a} (1.91)	60.42	2.33^{ab} (1.68)	1.67^{ab} (1.47)	2.00^{ab} (1.58)	67.57
Emamectin benzoate 5 SG	0.4	2.33^{a} (1.68)	1.33^{a} (1.35)	1.67^{a} (1.47)	1.50^{a} (1.41)	66.67	2.67^{a} (1.78)	2.00^{a} (1.58)	2.33^{a} (1.68)	70.83	1.67^{a} (1.47)	1.00^{a} (1.22)	1.33^{a} (1.35)	78.38
Imidacloprid 17.8SL	0.3	1.00^{a} (1.22)	2.67^{ab} (1.78)	3.33^{abc} (1.96)	3.00^{abc} (1.87)	33.33	5.00^{ab} (2.35)	4.33^{ab} (2.20)	4.67^{a} (2.27)	41.67	4.00^{c} (2.12)	3.00^{abc} (1.87)	3.50^{b} (2.00)	43.24
Control	-	1.33^{a} (1.35)	3.67^{b} (2.04)	5.33^{c} (2.42)	4.50^{c} (2.24)		8.67^{b} (3.03)	7.33^{b} (2.80)	8.00^{b} (2.92)		6.67^{c} (2.68)	5.67^{c} (2.48)	6.17^{c} (2.58)	

Data in the parenthesis are square root $\{\sqrt{(x+0.5)}\}$ transformed values; Difference in mean values was determined by DMR test. Means sharing same superscript in a column are not significantly different at 5% level of significance.