Research Article

Population response of *Helicoverpa armigera* on sunflower treated with botanical synthetic insecticides

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Abstract

To study the population response of *Helicoverpa armigera* on sunflower treated with botanical and synthetic insecticides. Four treatments with T₁=Neem kernel powder, T₂=Garlic solution, T₃=Steward and control (untreated). T₃ showed highest reduction percentage (53.25%) and (47.64%) after three and five days spray, followed by T₁ the plots treated with neem seed kernel extracts (49.39%) and (41.13%), T₂ (32.60%) and (28.44%). The minimum reduction percentage was recorded in untreated plot (13.47%) and (15.33%) three and five days after spray, respectively. In the second spray T₃ also showed highest reduction percentage (64.39%) and (58.99%) after three and five days spray followed by T₁, (61.46%) and (54.23%), T₂ Garlic solution (47.42%) and (42.39%). The minimum reduction percentage was recorded in the control plot (14.11%) and (11.43%) respectively. However, in 3rd spray the highest reduction percentage was recorded in T₃ (54.11%) and (48.67%) after three and seven days followed by T₁ (50.15%) and (47.81%), T₂ (38.61%) and (35.16%) The minimum reduction percentage was recorded in the untreated plot (13.60%) and (12.51%) after three and seven respectively. While, in fourth spray, the highest reduction percentage was recorded in T₃ (70.62%) and (39.40%) after three and five days followed by T₁ (39.37%) and (24.44%), T₂ (22.37%) and (7.53%). The minimum reduction percentage was recorded in untreated plot (14.28%) and (13.35%) after three and five days respectively. The overall results showed that the bio pesticides reduced *Helicoverpa armigera* population progressively, as compare to control.

Keywords: *Helicoverpa armigera*; Spray; Sunflower; Organic Pesticide

Introduction

Sunflower, *Helianthus annuus* (L.) belongs

to the family Compositae, locally it is known as Surajmukhi [1, 2]. The oil is

palatable, contains soluble vitamins A, D, E and K seed meal of sunflower is rich source of food for fattening animals and poultry birds. There is a need of the day that its area, production and protection should be enhanced [3]. Among these sucking pests the leafhopper, *Amrasca biguttula biguttula*, Ishida (Hemiptera: Cicadellidae) is economically important Pest [4]. *Amrasca biguttula biguttula* is polyphagous pest of many agricultural and nonagricultural plants. It sucks the cell sap from leaves, flowers, fruits and tender stems and affects the growth of crop plants adversely. It also creates sooty mould on crop leaves which affect photosynthesis, growth and yield of the crops [5].

Helicoverpa armigera (Hub.) is a major pest of important crops and vegetables in Pakistan. It has been recorded to damage more than 100 plants species including cultivated and non cultivated plants of 39 families across the world [6]. Host species for *H. armigera* come from a broad spectrum of families and include important agricultural. It invades and voraciously feeds on cash crops such as cotton, maize, chickpea, pigeonpea, sorghum, sunflower, soyabean and groundnuts around the world [7].

The indiscriminate use of chemical poisons has disturbed the natural ecosystem and the natural balance ratio of pests and its natural enemies. The pesticides do not kill the pests alone but also destroy the predator; parasites, animals, birds, and some time human being get seriously affected while using the spray material. The pesticides are the only readily available source for destroying pest population in many developing countries [8]. In the present study, neem seed kernel and garlic solution will be tested against *Helicoverpa armigera* on sunflower which will not destroy natural enemies and is safe to environment. The products will be compared with control plot where Steward pesticide will be applied for comparison. The proposed IPM

strategy will be useful information for the management of *Helicoverpa armigera* on sunflower crop. Bio-pesticides natural substance occurring compounds non-toxic which are used for control of insect pests. Synthetic pesticides (conventional) has been also known for killing / inactivation of insect pests. On the other hand biochemical pesticides which consists of plant growth regulators for control of growth or mating as well as repel or in attract pests such as pheromones [9].

In view of the environmental and health issues the bio-pesticides are holding attention by scientists and researchers as they are safe and environment friendly [10]. Although numerous methods are employed to combat insect pests, but controlling these insect pests through pesticidal application is yet more efficacious compared to rest of the methods. However, pesticide application is only recommended when insect buildup crosses ETL [11] because synthetic insecticides has contributed to the environmental pollution through air or as residues in food [12]. Hence, inclusion of environmental friendly biopesticides in the spray program, such as plant extracts could be best option to minimize reliance on synthetic pesticides for insect pest management in okra. The diverse biological activities of plant extracts include feeding and oviposition deterrence, repellency, growth disruption, reduced fitness, and sterility [13]. The rapid increase in pesticide use on field crops is alarming and emphasizes farmers' concern with insect pests. The trends also highlight the need for safe and effective management strategies. The difficulty in managing insecticide resistant populations of *Helicoverpa armigera* has given impetus to the development and use of alternative, and has less negative impact on beneficial organisms than conventional insecticides.

Materials and Methods

An experiment was carried out to assess the

population response of *Helicoverpa armigera* on sunflower treated with botanical and synthetic insecticides at experimental area of Pussia Goth near Tandojam, during 2016. Four treatments such as T1= Neem kernel powder, T2= Garlic solution, T3= Steward 150 SC (Indoxacarb) and T4= control (Untreated) was evolved against the *H. armigera* on sunflower crop. Variety HO-1 was sown on 1st March 2016 for this purpose. The experiment was laid out in a Randomized Complete Block Design with four treatments and three replications, in a field measuring about plot size was 1245m² (12 ghuna) and sub plot size was 207m² (2 ghunta). Eight kgs of neem kernel was grounded through grinder and soaked for 24 hours, 15 liters of 5% EC suspension was obtained. As such, 20 gm grinded garlic bulbs with 10 gm detergent were put separately in muslin cloth and added to one liter of water and kept for 24 hours which gave us 5% solution were sprayed against *H. armigera* as compare with untreated control. The synthetic pesticide "Steward " was obtained from the market. The Steward applied with the dose of 175 ml per acre. Four sprays were done during the morning hours, the 1st spray was done on 15-04-2016, while second, third and fourth sprays was applied after 15 days intervals respectively. For this purpose, a hand operated knapsack sprayer was used. For recording observation on population of *Helicoverpa armigera* twenty-five plants were selected randomly from each sub plot and tagged were examined carefully and their average was workout. Three observations were taken for each application i.e. one day before spray (Pre-treatment observation) and two observations after sprays (Post treatment) at the intervals of three and five days. The effect of pesticides reduction percentage was calculated as per the standard formula of [14].

$$\text{Percent mortality} = \frac{1 - T_a \times C_a}{T_b \times C_b} \times 100$$

Where

Tb = Number of pest in treated plots before treatment.

Ta = Number of pest in treated plots after treatment.

Cb = Pest population in the control plots before treatment.

Ca = Pest population in the control plots after treatment.

The data thus collected were subjected to analysis of various to test superiority of treatment mean LSD test was applied as per the method outline by [15]. For this purpose, a Microsoft computer package "MSTATC" was used.

Results

In order to evaluate the efficacy of different pesticides against *Helicoverpa armigera* on sunflower crop was carried out during the year 2016, at the experimental area of Pussia goth near Tandojam. The biopesticides and synthetic pesticide included T1= Neem kernel powder, T2= Garlic solution, T3= Steward 150 SC (Indoxacarb) and T=4 Control (Untreated). Sprays was done when *Helicoverpa armigera* were appeared on sunflower crop, sprays were carried out in the months of mid-April to mid-June, respectively. The results of present studies are given below.

Reduction %age of different pesticides against *H. armigera* on sunflower crop was recorded before and after different time intervals of 1st spray

The result on reduction %age of *Helicoverpa armigera* recorded after three and five days after 1st spray of different treatments are shown in the (Table 1). It may be seen from the results that the biopesticides reduce *Helicoverpa armigera* population progressively, as compared to control. The neem seed kernel extracts showed maximum reduction %age after three and five days of 1st sprays as compared garlic solution. The maximum reduction percentage was recorded

in the plots treated with Steward (53.25%) and (47.64%) after three and five days spray, followed by the plots treated with Neem seed kernel extracts (49.39%) and (41.13%), Garlic solution (32.60%) and (28.44%) and the minimum reduction percentage was recorded in the control (untreated) plots (13.47%) and (15.33%) three and five days after spray, respectively.

Reduction %age of different pesticides against *Helicoverpa armigera* on sunflower crop was recorded before and after different time intervals of 2nd spray.

The result on reduction %age of *Helicoverpa armigera* was recorded after the different time intervals of 2nd spray of different treatments was shown in the (Table 2). It could be seen from the results of 2nd spray; in the same way of the 1st spray. The neem seed kernel extracts showed maximum reduction percentage after three and five days after 2nd spray as compare to garlic and control plots. The maximum reduction percentage was recorded in the plots treated with Steward (64.39%) and (58.99%) after three and five days after 2nd spray, followed by the plots treated with neem seed kernel extracts (61.46%) and (54.23%), garlic solution (47.42%) and (42.39%) and the minimum reduction percentage was recorded in the control plot (14.11%) and (11.43%) after three and five days after 2nd spray, respectively.

Reduction %age of different pesticides against *Helicoverpa armigera* on sunflower crop before and after different time intervals of 3rd spray.

After 3rd spray the results showed that the reduction %age of *Helicoverpa armigera* was recorded after the different time intervals of 3rd spray of different treatments was shown in the (Table 3). After the 3rd spray neem seed

kernel extracts showed maximum reduction %age after three and seven days after spray as compare to garlic and control plots. The maximum reduction percentage was recorded in the plots treated with Steward (54.11%) and (48.67%) after three and seven days after 3rd spray, followed by the plots treated with neem seed kernel extracts (50.15%) and (47.81%), garlic solution (38.61%) and (35.16%) and the minimum reduction percentage was recorded in the untreated plot (13.60%) and (12.51%) after three and seven days after 3rd spray, respectively.

Reduction %age of different pesticides against *Helicoverpa armigera* on sunflower crop before and after different time intervals of 4th spray

After 4th spray the results showed that the reduction %age of *Helicoverpa armigera* was recorded after the different time intervals of 4th spray of different treatments was shown in the (Table 4). After the 4th spray the maximum reduction percentage was recorded in the plots treated with Steward (70.62%) and (39.40%) after three and five days after 4th spray, followed by the plots treated with Neem seed kernel extracts (39.37%) and (24.44%), Garlic solution (22.37%) and (7.53%) and the minimum reduction percentage was recorded in the control plots (14.28%) and (13.35%) after three and five days after 4th spray, respectively.

Yield per plot/acre⁻¹

Yield per plot/acre⁻¹ was higher (23.20 per plot and 464 kg acre⁻¹) in plot sprayed with Steward and the lowest yield of 7.10 kgs per plot and 142 kgs acre⁻¹ was recorded in control, while among treated plots the lowest sunflower yield of 19.58 Kgs per plot and 391.60 kgs acre⁻¹ was recorded in plots sprayed with garlic solution (Table 5).

Table 1. Mean and reduction %age of different pesticides against *H. armigera* on sunflower crop was recorded before and after different time intervals of 1^s spray

Treatments	Pretreatment Observation	3 Day After Spray	5 Day After Spray
Steward	2.63c	53.25a	47.64a
Neem seed kernel	2.53d	49.39b	41.13b
Garlic solution	2.83b	32.60c	28.44c
Control	3.23a	13.47d	15.33d
SE±	0.4142		
LSD 0.05	3.6846		

Table 2. Mean and reduction %age of different pesticides against *H. armigera* on sunflower crop was recorded before and after different time intervals of 2nd spray

Treatments	Pre-treatment Observation	3 Day After Spray	5 Day After Spray
Steward	2.13d	64.39a	58.99a
Neem seed kernel	2.26c	61.46b	54.23b
Garlic solution	2.36b	47.42c	42.39c
Control	2.68a	14.11d	11.43d
SE±	0.3245		
LSD 0.05	3.2451		

Table 3. Mean and reduction %age of different pesticides against *H. armigera* on sunflower crop before and after different time intervals of 3rd spray

Treatments	Pre-treatment observation	3 Day After Spray	5 Day After Spray
Steward	1.57a	54.11a	48.67a
Neem seed kernel	2.13b	50.15b	47.81b
Garlic solution	1.57c	38.61c	35.16c
Control	2.54a	13.60d	12.51d
SE±	0.3621		
LSD 0.05	3.4712		

Table 4. Mean and reduction %age of different pesticides against *H. armigera* on sunflower crop before and after different time intervals of 4th spray

Treatments	Pre-treatment Observation	3 Day After Spray	5 Day After Spray
Steward	0.99d	70.62a	39.40a
Neem seed kernel	1.03c	39.37b	24.44b
Garlic solution	1.40b	22.37c	7.53c
Control	2.29a	14.28d	13.35d
SE±	0.3416		
LSD 0.05	2.4160		

Table 5. Yield per plot/acre⁻¹ sprayed with various pesticides

Treatments	RI	RII	RIII	Average yield per plot (kg)	Average yield acre ⁻¹ (kg)
Steward	24	22.60	23	23.20a	464.00a
Neem seed kernel	22.50	23	21.50	22.33a	446.60a
Garlic solution	20.50	19.75	18.50	19.58b	391.60b
Control	7.5	8.00	6.00	7.10c	142.00c
S.E ±	25.759				
LSD 0.05	57.394				
LSD 0.01	81.636				

Discussion

The indiscriminate use of chemical poisons has disturbed the natural ecosystem and the natural balance ratio of pests and its natural enemies. The pesticides do not kill the pests alone but also destroy the predator; parasites, animals, birds, and some time human being get seriously affected while using the spray material. The pesticides are the only readily available source for destroying pest population in many developing countries [8]. In the present study, neem seed kernel and garlic solution will be tested against *Helicoverpa armigera* on sunflower which will not destroy natural enemies and is safe to environment. The products will be compared with control plot where Steward pesticide will be applied for comparison. The proposed IPM strategy will be useful information for the management of *Helicoverpa armigera* on sunflower crop. The present results showed that Neem Seed Kernel Extracts reduce the maximum reduction percentage of *H. armigera* on sunflower followed by Garlic solution and control but their effect was nonsignificant with control. The results are partially in agreement with those of [16] also stated that the neem seed kernel extract can be used against *H. armigera* instead of highly toxic synthetic insecticides. [17] proved that the neem seed kernel extract in chloroform: methanol (9:1) was the most promising in causing adverse effects on *Helicoverpa armigera*.

There are reports where neem seed kernel extract and pure compounds obtained from neem seed kernel extract had been found to produce diverse biological effects on insects: antifeedant oviposition deterrent etc. Of these antifeedant activity of neem was considered very important. [18] found Bollcure fraction (0.15%), Bollcure fraction (0.25%) and neem seed kernel extract (az 1500 ppm) are relevant as most effective and economical treatments in reducing the larval population of *Helicoverpa armigera* in chickpea. Our findings are agreed with the findings of [19] they reported that effect of bio-pesticides at 10 days' intervals and recorded the highest yield.

Conclusion and Recommendations

On the basis of results obtained from field trials among the pesticide/biopesticides applied, Neem Seed Kernel extracts and Garlic solution significantly reduced the *Helicoverpa armigera* population on sunflower field. Neem Seed Kernel Extracts proved to be most effective bio-pesticide against *Helicoverpa armigera* to suppress the population as compared to Garlic solution and control, after 1st, 2nd, 3rd and 4th spray. Garlic solution was also found the most effective to suppress the population of *Helicoverpa armigera* as compared to control on sunflower. On the basis of findings of the present research it is suggested that Neem Seed Kernel extracts may be applied more preferable against *Helicoverpa armigera* on

sunflower field, followed by Garlic solution and synthetic pesticides.

Authors' contributions

Conceived and designed the experiments: M Ibrahim & S Ahmed, Performed the experiments: M Ibrahim & S Ahmed, Analyzed the data: F Muhammad, Contributed reagents/ materials/ analysis tools: N Alizai, M Ahmed & A Nabi, Wrote the paper: M Ibrahim & S Ahmed.

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