INFLUENCE OF SPRAY TIMING OF INSECTICIDE ON FORAGING DYNAMICS OF POLLINATORS ON SPONGE GOURD, *LUFFA AEGYPTIACA* MILL.

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ABSTRACT: *A field experiment was conducted to determine the Influence of best spray timing of insecticide on insect pollinators on sponge gourd, Luffa aegyptica Mill. at experimental field of Crop Protection Faculty, Sindh Agriculture University, Tando Jam during 2011. The results displayed that five species including bees, Xyllocopa sp. Apis dorsata, Apis mellifera, Syrphid fly, Eplyrphus baltaetus and Akk butterfly, Danias chrysippus were found on both sprayed and unsprayed plots. The data depicted that maximum population was observed in insect pollinators, Xylocopa sp. and Apis dorsata (0.11/flower) followed by Apis melifera and Syrphid fly (0.07/flower) and Akk butter fly (0.03/flower) at 7 to 10 a.m. whereas, the minimum foraging activity was determined at 1 to 4 p.m. in treated plot in respective insect pollinators. The highest reduction in population was observed in Akk butterfly (69.05%) at 7 a.m. whereas the minimum reduction % was seen (45.24%) in Apis dorsata at 1 p.m. in treated plot. The analysis of the data showed that there is significant difference (P<0.05) among the spray timings and reduction in population in respective insect pollinators. Therefore, the maximum population dynamics was displayed (0.25/flower) in Apis dorsata followed by Xylocopa sp. (0.24/flower), Apis melifera (0.18/flower), Syrphidfly (0.13/flower) and Akk butterfly (0.10/flower) at 7 to 10 a.m. whereas, the minimum population was observed during 1 to 4 p.m. in untreated plot in respective insect pollinators. The correlation of insect pollinators showed positive relationship with temperature ºC and relative humidity % have negative relationship with population at 7 to 10 a.m. in treated and untreated plots respectively. Similarly, insect pollinators has negative correlation with temperature ºC and relative humidity % at 1 to 4 p.m. in treated and untreated plot respectively. The analysis of the data shows highly significant difference (P<0.05) among the spray timings. Whereas, reduction in population also significantly different from each other (P<0.05).*

Keywords: Pollinators, insecticide, Sponge gourd.

INTRODUCTION

The Sponge gourd, *Luffa aegytiaca* Mill. belongs to family cucurbitacea, commonly known as Turai is an annual growing vegetable of tropical and subtropical regions. It is dicot, having separate male and female flowers in the same plant, which are pollinated by various pollinators, specially bee species. The role of insects in the reproduction of plants was first formally discovered in the 18th century [1;2;3]. *Luffa aegyptiaca* is a plant of economic importance in Ghana and in other parts of the world, especially in tropical and subtropical regions particularly, in Northern India as well as Pakistan [4]. It is eaten when the fruit is young. Its juice is used as a natural remedy for jaundice. Pollinators in agricultural landscapes have suffered from intensified land use and adverse use of agro chemicals [5;6]. Unfortunately, recent crashes of colonies have been reported worldwide, also better known as “Colony Collapse Disorders” (CCD). In this contrast many authors pointed out that factors such as parasites and pesticides or combination of these factors might be responsible for decline in honey bee health. Therefore knowledge on appropriate pollinators of a plant has become important especially in the management and conservation of pollinators. The present research work has been planned to investigate the effect of insecticides on the foraging dynamics of pollinators on sponge gourd.

MATERIALS AND METHODS

The experiment was conducted at experimental field of Crop Protection Faculty, Sindh Agriculture University Tandojam during 2011. The field was prepared for sowing sponge gourd crop in 10 Ghunta (1000 m²) plot size. This plot was divided in two sub plots, one was treated with commercially synthetic insecticide Profenophos 40 EC at the 500 ml/100 liter water and another plot was kept as untreated (control). The hybrid seed of sponge gourd local variety was grown on ridges. The irrigation was applied at weekly intervals. The unwanted plants were removed after 15 days of sowing the crop. The chemical fertilizer was applied at the ratio of 2:3 kg (DAP + Urea) after first weeding. All agronomic practices were completed timely. For the management of sucking and chewing insect pests (Mealy bug, White fly and leaf miner) synthetic insecticide was sprayed at 10 days intervals on different spray timings i.e. T1= 7 am., T2= 10 am, T3=1pm, T4= 4pm. First spray was done by mixing Profenofos 40 EC insecticide at 50 ml/10 liter water on sponge gourd crop at 7.00 a.m. The data thus obtained after exposure of insecticide at 1 DAS, 3 DAS, 7 DAS and 10 DAS (Days After Spray). After the 10 days intervals the next sprays was done at 10 a.m., 1 p.m. and 4 p.m. at the same dose of insecticide. Both the plots were observe to monitor the foraging activity of pollinators. In each plot, 20 plants were randomly selected and 5

RESULTS

Table.1 Overall mean per flower population and reduction % of insect Pollinators sprayed with insecticide at different timings in sponge gourd field.

Insect pollinators		7 A.M.		10 A.M.		1 P.M.		4 P.M.	
		Mean	Red. %	Mean	Red. %	Mean	Red. %	Mean	Red. %
Xylocopa sp.	T	0.10	56.99	0.11	56.95	0.03	57.14	0.03	51.79
	UT	0.22	-------	0.24	---------	0.07	---------	0.06	-----------
Apis dorsata	T	0.11	45.32	0.10	60.25	0.04	45.24	0.02	57.08
	UT	0.21	-------	0.25	-------	0.07	-------	0.05	------
Apis mellifera	T	0.07	60.97	0.07	56.63	0.02	59.88	0.01	64.58
	UT	0.18	-------	0.14	-------	0.05	-------	0.04	
Syrphid Fly	T	0.06	58.21	0.07	44.60	0.03	51.79	0.02	56.67
	UT	0.13	-------	0.12	-------	0.06	-------	0.04	-------
Akk Butter fly	T	0.03	69.05	0.03	57.71	0.02	65.00	0.02	64.17
	UT	0.10	-------	0.07	-------	0.05	-------	0.04	-------

flowers in each plant were examined for the activities of pollinators. The reduction percent population was calculated by using Abbott's formula [7] as below:

Reduction % = (1- n in T after treatment) ×100 n in Co after treatment

(n= insect population; T= Treated; Co=Control (untreated).

The result depicted in Table.1 that the overall mean population and reduction % of insect pollinators sprayed with insecticide at different timings in sponge gourd field. The insect pollinator, *Xylocopa sp.* displayed maximum foraging activity (0.11/flower) and (0.24/ flower) at 10 a.m. in treated and untreated plot respectively. Similarly the minimum foraging activity was determined (0.03/ flower) and (0.07/flower) during 1 to 4 p.m. in treated and untreated plot respectively. Therefore the maximum reduction in population was recorded (57.14 %) at 1 p.m. and minimum (51.79%) at 4 p.m. The data further revealed that *Apis dorsata* showed that maximum population dynamics was observed (0.11/flower) and (0.25/ flower) during 7 to 10 a.m. in treated and untreated plot respectively, whereas, the minimum activity was seen (0.02/flower) and (0.05/flower) at 4.pm.in treated and un treated plots respectively. The maximum reduction in population was determined (60.25%) at 10 a.m. and minimum (45.32%) at 7 a.m. in respective insect pollinator. The result depicted that the *Apis mellifera* displays maximum foraging dynamics (0.07/flower) and (0.18/flower) at 7 a.m. in treated and untreated plot respectively. Similarly, the minimum population was recorded (0.01/ flower) and (0.04/flower) at 4 p.m. in treated and untreated plot respectively. Therefore, maximum reduction in the population of bees was monitored (64.58%) at 4 p.m., whereas, the minimum reduction in population was seen (56.63%) at 10 a.m. The insect pollinator Syrphid fly displayed maximum population (0.06/flower) and (0.13/leaf) at 7 a.m. in treated and untreated plot respectively. Whereas, the minimum population was recorded (0.02/flower) and (0.04/flower) at 4 p.m. in treated and untreated plot respectively. Therefore, the maximum reduction % in population was (58.21%) at 7 a.m. while the minimum reduction in population was determined (44.60%) at 10.a.m. The result presented in Table.5 displayed maximum number of Akk butterfly insect pollinator was (0.03/flower) and (0.10/flower) at 7 a.m. in treated and untreated plot respectively. Similarly, the minimum population was determined (0.02/flower) and (0.04/flower) at 4 p.m. in treated and untreated plot respectively. The maximum reduction in population dynamics was seen (69.05%) at 7 a.m. and minimum was (57.71%) at 10 a.m. In the light of above result it was observed that the insect pollinators was more active during 7 to 10 a.m. because the temperature relatively favour the visiting bees and insect pollinators with the increase in temperature the insect pollinators declined and highest reduction % was recorded in Akk butter fly (69.05%), whereas, the lowest reduction % was recorded in Syrphidfly (44.60%) and Akk butterfly. The analysis of the data shows highly significant difference ($P<0.05$) among the spray timings. Whereas, reduction in population also significantly different from each other ($P<0.05$).

DISCUSSION

The result of the present study depicted that the pesticide influenced on foraging activity of insect pollinators. The maximum number was observed *Apis dorsata* as compare to rest of insect pollinators. Our findings have the conformity with [8] who reported that *A. indica* was the dominant pollinator of Indian mustard, followed by *A. dorsata*, *A. mellifera* and *A. florea*. The maximum number of visits was recorded with *A. indica* (34 to 43%), followed by *A. dorsata* (20 to 26%).. Our finding also supported with [9] who reported that Bees foraged from 06.00 to 18.00 h with a peak from 09.00 to 11.00 h. The foraging periods of pollen collectors and nectar collectors of each species were reported. The number of seeds/head and seed weight were much higher on open-pollinated flower heads than on those bagged to exclude insects. The highest reduction in population dynamics was seen (69.05%) at 7 a.m. and lowest was (57.71%) at 10.am. In the light of above result it was observe**d** that the insect pollinators was more active during 7 to 10 a.m. because the temperature relatively favour the visiting bees and insect pollinators with the increase in temperature the insect pollinators declined and highest reduction % was recorded in Akk butterfly (69.05%), whereas, the lowest reduction % was recorded in Syrphidfly (44.60%) and Akk butterfly. Our findings also have an agreement with [10] who indicated that the use of pesticides reduces pollinator populations directly through poisoning, and also contaminates their principal food supplies resulting in early death, behavioral changes and reduced mobility. The result of present study have partial agreement with [11] who reported that the efficacy of neem oil at 1, 2 and 3% concentrations and imidacloprid, a commonly used synthetic insecticide, on populations of thrips and their toxicities to mango pollinators. Daily periodicities of several pollinators that frequently visited mango panicles were studied prior to the insecticide trial to determine the appropriate time of insecticide application. Pollinators were collected at 2-h intervals for 2 months in the dry season and 1 month in the wet season of 2009. Mean numbers of all pollinators were greater in the morning (0800 h) and peaked in the late afternoon, but remained low during other times of the day. After two consecutive applications at 7-day interval, both neem oil and imidacloprid effectively reduced thrips populations compared to an untreated plot. Imidacloprid was the most effective insecticide reducing 68.7% thrips adult and 80.7% larval populations, respectively. However, it caused 92.5% mortality in pollinator populations**.** This is also in accordance with the results elsewhere[12,13]. They exposed that many pesticides are extremely toxic to honey bees and other beneficial insects. Honey bees forage during daylight hours when the temperatures are above 55-60°F. As the sun begins to set, they return to their hives for the evening. Thus, spraying pesticides in the evening hours can greatly reduce honey bee mortality because the bees are not in the fields.

CONCLUSION

The maximum population of insect pollinators was observed during 7 to 10 a.m. in treated and untreated (Control) plots. The minimum foraging activity of insect pollinators was determined during 1 to 4 p.m. in treated and untreated (Control) plot. The maximum reduction % was seen in Akk butterfly followed by *Apis mellifera*, *Apis dorsata*, Syrphid fly and *Xylocopa sp.*

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