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Insecticidal Mortality, Foraging Behavior and Pollination Role of Honeybee *(Apis mellifera* L.) on Sarson (*Brassica campestris* L.) Crop

NIGHAT PERVEEN, MUHAMMAD ALHARIRI, MUNIR AHMAD AND ANJUM SUHAIL
Department of Agricultural Entomology, University of Agriculture, Faisalabad–38040, Pakistan

ABSTRACT

Studies were carried out to observe the insecticidal mortality, foraging behavior and pollination role of honeybee (*Apis mellifera* L.) in sarson, *Brassica campestris* L. Polo 500EC (Diafenthiuron) and Pirimor 50DP (Pirimicarb) were applied twice @ 617.5 ml/ha with seven days interval at 10-15% blooming period. Maximum bee mortality i.e. 24.67/25 was observed due to Pirimor; whereas, Polo caused 8.67/25 bees mortality 96 h after insecticide treatment. However, in case of Polo, bee mortality decreased gradually to 4/25 and proved safer than that of Pirimor i.e. 10/25, 144 h after treatment. Foragers visited the crop between 8-19 h with most intense visitation between 10-12 h (24.24/flower/10 minutes). The foraging of honeybees resulted in maximum yield, 1000-grain weight and germination percentage of 1990 kg/ha, 3.81 g and 95.8%, respectively. Thus, honeybee foraging caused a significant increase in quantity and quality of sarson crop.

Key Words: *Apis mellifera* L.; *Brassica campestris* L.; Insecticidal mortality; Foraging; Pollination; Yield; Diafenthiuron; Pirimicarb

INTRODUCTION

Sarson (*Brassica campestris* L.) is a rich source of oil and fats in winter crops. There are many reasons for its poor yield in developing countries including the lack of proper pollination that is greatly accomplished by honeybee visitation (Bukheit, 1989). The use of synthetic insecticide may cause alteration in the social behavior of honeybees *Apis mellifera* L. For instance, an increase in agitation, aggressiveness and pollen contamination in honeybees treated with insecticides (Johansen, 1984). Use of certain insecticides like fenvalerate, phosphomidon, monocrotophos and methamidophos has resulted in delayed foraging (3-4 days) due to the repellant effects to honeybees (Gary & Lorenzen, 1989; Vaidya *et al.*, 1996). The objective of this study was to observe the effect of certain insecticides on honeybees, foraging behaviour and pollination role in *Brassica campestris* L. for seed yield.

MATERIALS AND METHODS

Study was conducted at Entomological Research Area, Post Graduate Agricultural Research Station (PARS), University of Agriculture, Faisalabad. The sarson crop was sown on October 15, 1997 on plots (4 × 4 m) and planting geometry was 75 × 30 cm. Three treatments with three replications each, in both experiments, were laid out in RCBD. For toxicological and foraging studies, all three treatments (T1, T2 and T3) were covered with polyethylene sheets. Small beehives were provided in each plot. In each treatment, T1 and T2, two insecticides i.e. Diafenthiuron[1] and Pirimicarb[2] @ 617.5 ml/ha, were sprayed at 10-15% blooming period with seven days interval. Data were recorded before application and after 24, 48, 72, 96 and 120 h of insecticide application. In control (T3), foraging bees were counted from 8 a.m. to 6 p.m. with 10 minutes interval, at alternate days during blooming period. Pollination studies were carried out using the same lay out as described above. In T1, plots were covered with polyethylene sheets provided with small beehives. In T2, plots were sprayed with Pirimor 50DP @ 617.5 ml/ha and then covered with mosquito net bags; whereas, the plots in T3 were left open. Seed yield per hectare, 1000 seed weight and percent germination were recorded and analysed statistically.

RESULTS AND DISCUSSION

Polo 500EC and Pirimor 50DP @ 617.5 ml/ha each, caused 6/25 and 15/25 bees mortality as compared to that of 3/25 in control 24 h after treatment (Table I). Maximum bee mortality i.e., 24.67/25 was observed due to Pirimor 50DP; whereas, Polo 500EC caused 8.67/25 bee mortality 96 h after insecticide application, respectively. In case of Polo 500EC, it later on decreased gradually. There was a clear decrease in bee mortality i.e. 9.67/25 bees 144 h after Pirimor 50DP as compared to its high mortality for the first four days. However, bee mortality remained lowest and did not exceed above 4/25 in control. Overall results of bee mortality revealed that Polo was relatively safer to honeybee foragers

[1]Polo 500EC (Diafenthiuron), NOVARTIS, Pakistan Limited
[2]Pirimor 50DP (Pirimicarb), ICI, Pakistan Limited

Table I. Effect of insecticides on the honeybee mortality at 0, 24, 48, 72, 96 and 120 hrs.

Treatments	Dose ml/ha	Honeybees mortality (out of 25 bees) 0 hr	24 hrs	48 hrs	72 hrs	96 hrs	120 hrs
Polo 500EC	617.5	6.00 b	7.40 b	9.00 b	8.67 b	7.33 b	4.00 b
Pirimor 50DP	617.5	15.00 a	18.67 a	24.00 a	24.67 a	22.00 a	9.67 a
Control	-	3.00 b	2.00 c	3.67 c	4.00 c	2.67 c	3.33 c

Means within a column not sharing a letter in common differ significantly (P=0.05, DMRT)

where mortality did not exceed above 36% as compared to that of Pirimor causing more than 80% mortality. Due to the application of Pirimor, foraging was delayed and practices like agitation, aggressiveness and increase in self-cleaning were also observed. Similar results have also been reported by Johansen (1984), Gary and Lorenzen (1989) and Vaidya *et al.* (1996). The comparison of treatments with respect to germination percentage revealed that seed crop foraged by honeybees showed maximum germination percentage i.e. 95.8% as compared to that with treatment (honeybees + wind + pollinators etc.) showed 91.16% (Table II). However, the wind pollination caused the least effect on germination i.e. 47.5%. Thousand grain weight was the highest i.e. 3.81 g due to honeybee visit as compared to that of all pollinating agents giving 3.19 gm. Only 1.86 g was observed in wind pollination treatment. Maximum yield of 19.90 kg/ha was obtained in treatment with honeybees. It was statistically non-significant with respect to the yield obtained due to all pollinating agents, which yielded 18.36 kg/ha. Minimum yield of 8.85 kg/ha was calculated in wind pollinated treatment. These results are in partial accordance with those of Misra *et al.* (1988) who obtained 9.76 times increase in yield due to honeybee's visitation. The results revealed non-statistical difference in yield with respect to other pollinators to that with honeybees. However, there was a clear difference between the yield of plots treated with bees and that of without bees i.e. wind pollination.

Table II. Effect of different pollinating agents in yield of sarson (*Brassica campestris* L.)

Pollinating agents	1000 grain weight (g)	Germination percentage (%)	Yield (kg/ha)
Honeybees (T1)	3.81 a	95.8 a	19.90 a
Wind (T2)	1.86 c	47.51 c	8.85 b
Honeybees + Wind & other pollinators (T3)	3.19 b	91.16 b	18.36 a

Means within a column not sharing a letter in common differ significantly (P=0.05,DMRT)

Maximum average foraging activity during January and February was observed during 10-12 h, resulting in 25-28 honeybees per ten minutes (Fig.1). The foraging was minimum during 17-18 h during which only 2.99 bees foraged. From these results, it can be assessed that the best time of honeybee foraging was between 10-12 hours.

It is concluded that the use of safer insecticides like Polo 500EC should be preferred so that an increase in yield can be obtained by avoiding the least contact of pollinators especially honeybees by spraying at the least hours of their activity.

Fig. 1. Average visits of honeybees (*Apis mellifera* L.) at blooming period of sarson (*Brassica campestris* L.)

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