

Studies on the role of honeybees in hybrid seed production of safflower

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ABSTRACT

The experiment to study the effect of honeybee pollination in maximization of productivity in safflower (*Carthamus tinctorius*) was carried at Seed Technology Research Unit Farm, MPKV, Rahuri during Rabi 2008-09. Experimental area was divided into 4 parts i.e. open pollination, completely covered with nylon net with 4 frame colony, partially covered with nylon net with 4 frame colony and partially covered with nylon net with 8 frame colony of honeybees. The numbers of honeybee visits on selected ten plants of safflower were recorded. The numbers of honeybee visits were higher in the morning hours (196.24 visits) than in evening hours (156.62 visits). Safflower crop partially caged with 8 frame colony of *Apis cerena indica* recorded high yield of safflower seeds (2.67q/ha) followed by the crop which was completely caged with 4 frame colony of *Apis cerena indica* (1.77q/ha) which was followed by the crop partially caged with 4 frame colony (1.13 q/ha). The least safflower yield was given by the crop which was kept open for visits of natural pollinators.

Key words : Honeybees, Safflower

INTRODUCTION

Safflower (*Carthamus tinctorius*) is predominantly a self pollinated oilseed crop but cross pollination generally occurs to an extent of 10-20 per cent through insect (Vishnuvardhan *et al.*, 2003). For centuries, it has been under cultivation in India either for its orange red dye (carthamin) extracted from its brilliantly coloured florets and or for its much valued oil. Safflower produces oil rich in poly unsaturated fatty acids (linoleic acid 78%) which play an important role in reducing the blood cholesterol level (Hedge, 2004).

Wind is not considered of much importance in pollinating the crop. The insects, particularly the honeybees are known to play an important role in its pollination. (Rao and Suryanarayan, 1983; Sihag, 1986). Honeybee accounts for over 65% cross pollination of various crops and their role is far more decisive in polyhouses and hybrid seed production. Further, amongst the bees, honey bees are the most common, predominant, efficient and also the most easily manageable ones whose population can be precisely manipulated as per the pollination requirement of crops (Verma *et al.*, 2006). Present study was, therefore, planned with the objective to study the role of honeybees in hybrid seed production of safflower.

MATERIALS AND METHODS

The present studies on the role of honeybees in hybrid seed production of safflower crop was conducted during Rabi 2008-09 at Seed Technology Research Unit farm, Mahatma Phule Krishi Vidyapeeth, Rahuri, Dist-Ahmednagar (Maharashtra). The seeds of parental lines of safflower hybrid NARI-NH-I was collected from

Nimbkar Agriculture Research Institute, Tal- Phaltan, Dist- Satara (M.S.). The seeds contained the parental lines C 2829-5-3a-8 as male and MMS (white) as females. The seeds were sown on an area of 800sq.m. at 45 x 20 cm spacing in ratio of 3 female lines: 2 male lines. All the recommended cultural practices were followed for growing seed crop. The seed plot was divided into 4 parts. The first part was kept as open pollination with all pollinating vectors including naturally present honeybees (T_1). The second part was covered with nylon net and four frame colonies of honeybees were kept on raised platforms/machan. One side of nylon net, opening was kept open for free movement of honeybees. The third part was completely caged with nylon net and four frame colonies of honeybees were kept on raised platform. The fourth part was also partially caged with nylon net and eight frame colonies of honeybees were kept and opening on one side of a net was kept in order to have free movement of honeybees.

As in safflower hybrid seed production the female line used is genetical male sterile and segregating 50% male fertile and 50% male sterile. The seed produced on male fertile plant is only self seeds and not useful in growing commercial crop. The male fertile plants were identified and tagged as per the procedure given by Vishnuvardan *et al.*, 2003.

The observations were started on female flowers with start of flowering. In open pollination plot (control) ten female plants were randomly selected and the number of honeybee visits on safflower was recorded for 5 minutes per plant. This observation was recorded daily in the morning (9-10am) and in the evening (3-4pm) from start of flowering. In caged plots with honeybee colonies, 10% sugar solution was kept in glass petridishes as

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supplementary food for honeybees. At maturity the tagged male fertile plants from female line were cut at ground level and were removed from the field. The plants of male parent were also removed from field by cutting at ground level. Finally male sterile female plants were harvested, dried and threshing was done by beating the capitulum's with wooden sticks for the seed yield (qt/ha). Yield was calculated as given in Table 1.

RESULTS AND DISCUSSION

From the data presented in Table 1 it is observed that the number of honeybee visits were increased with progressive flowering. As the number of flowers open was increased the numbers of honeybee visits were also increased (18.23-45.34) and when flowering span was old (after 3rd week) it was again decreased. Hence, it can be concluded that the honeybees are dependent on period of flowering in safflower.

The weather parameters *viz.*, temperature, relative humidity, sunshine hrs. also influence the honeybee's activity. In the morning when temperature was low and R.H. was more the honeybee activity was more as compared to afternoon. Brar *et al.* (2008) found that with respect to time the bees collecting pollen and nectar was maximum at 10.00 hrs whereas minimum nectar plus pollen was at 12.00 hrs and 14.00hrs. Raj and Rana (1993) reported that on the rape seed bloom, pollen collection by *A.mellifera* was highest at 9.00hrs and

lowest at 15.00 hrs. The present results are also by and large in accordance with the finding of these workers. The minor variations may be because of climatic variation in the plant species cultivars involved in these studies.

The hybrid safflower was more in all the treatments where honey bee colonies were kept as compared to open pollination. Viraktamath and Patil (2002) also reported that the sunflower crop caged with four frame colony of *A.mellifera* were recorded significantly high yield over control.

Mohana Rao *et al.* (1984), Jones and Rhodes (1988) and Burgstaller (1989) reported that, there is increase in seed yield due to honey bee pollination over control. When the 8 frame honeybee colonies were kept in hybrid seed plot of safflower the highest yield (2.67q/ha) was obtained which may be due to abundant population of honeybees at the time of flowering.

The Hybrid seed yield (1.77q/ha) was more in completely caged 4 frame colony as compared to partially caged 4 frame colony which may be due to presence of lavish food (honey) preferred by honeybees in the surrounding area of experimental plot.

Safflower is predominately self pollinated crop and wind is not useful in cross pollination. Insect including honeybees plays very important role as cross pollinators and seed setting in hybrid seed production of safflower.

Table 1 : Number of honeybees visited on 10 plants per 5 minutes per week

Met. weeks	No. of honeybees visited on 10 plants		Weather Parameters						
	Morning (AM)	Evening (PM)	Temperature (°C)		Relative Humidity		Sunshine hrs	Rain-fall	Rainy days
			Max	Min	RH I	RH-II			
5 (29 Jan.- 4 Feb.)	18.23	18.28	32.9	14.2	66.6	24.4	8.7	-	-
6 (5 – 11 Feb.)	25.54	22.7	32.4	11.7	69.3	23.8	9.8	-	-
7 (12-18 Feb.)	45.34	39.00	31.2	13.1	68.3	26.7	9.5	-	-
8 (19- 25 Feb.)	40.38	45.34	35.00	16.3	68.0	20.9	9.4	-	-
9 (26 Feb- 4 March)	34.97	29.28	35.9	15.1	35.9	16.9	10.0	-	-
Total	196.24	156.62							

Table 2 : Effect of different treatments on safflower yield

Sr. No.	Treatments	Yield (Q/ha)
1.	Open pollination left for natural pollinators	1.11
2.	Partially caged with <i>A.cerena indica</i> with 4 frame colony at the time of flowering	1.13
3.	Completely caged with <i>A.cerena indica</i> 4 frame colony at the time of flowering	1.77
4.	Partially caged with <i>A.cerena indica</i> 8 frame colony at the time of flowering	2.67

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