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POLLINATORS VISITING CARROT (*DAUCUS CAROTA* L.) SEED CROP

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Abstract: Foraging activity of the pollinating insects belonging to Hymenoptera, Diptera, Coleoptera and Lepidoptera orders was observed at carrot umbels from 15 March to 15 April, 2000 at four time periods i.e., 8-9 am, 11-12 am, 2-3 pm and 5-6 pm. Number of insects belonging to Hymenoptera was higher followed by Diptera, Coleoptera and Lepidoptera during 8-9 and 11-12 am. Number of Dipterans was higher in the afternoon, i.e., at 2-3 pm and 5-6 pm. Total number of pollinators was highest at 8-9 am followed by that at 11-12 am, 2-3 pm and 5-6 pm. Among the bees, the number of *Apis florea* was maximum and that of *Apis mellifera* and *Apis cerana* was negligible at all time periods. It was also evident that temperature and relative humidity also affect the number of insects visiting carrot umbels.

Keywords: Coleoptera, *Daucus carota,* Diptera, Hymenoptera, Lepidoptera, pollination, relative humidity and temperature.

INTRODUCTION

Carrot (*Daucus carota* L.), a cool season crop, is grown during winter in tropical and subtropical climate. It is one of the most ancient and now one of the most popular vegetables [Bose and Som 1990]. Antibacterial property of essential oils extracted from carrot roots has been reported [Schuphan and Weiller 1967], whereas its seeds are known to be aromatic, stimulant and carminative [Chopra 1933, Kirtikar and Basu 1935]. Carrot plants bear compound umbels. The carrot flower is protandrous; hence it requires cross-pollination. It has been reported that more than 95% crossing occurs in the field [Thompson 1962]. Insect pollinators were proved to be essential for commercial seed production [Hawthorn *et al.* 1960] as 85% increase in yield was obtained with honeybees' pollination. Pankratova [1964] found that plots visited by insects produced 15 times more number of seeds and ten times more weight of seed as compared to that of plants covered with muslin cloth. Whitaker *et al*. [1970] reported that for large scale production of seeds, where male sterile plants are used, there is a need for pollinating agents for maximum cross-pollination. Slate [1927] concluded that only 15 per cent of the carrot plants set seed from their own pollen.

Insects are the main pollinating agents of carrot. A combination of honeybees' colonies adjacent to carrot seed fields and elimination of competing flowers has been recommended as the most practical methods of pollination of carrot [Bohart and Nye 1968]. The same workers noticed occurrence and pollinating activities of 334 species from 71 families of insects in carrot fields. Seventy-one insect species from 31 families were

observed by Goyal *et al*. [1989] with peak foraging activity during 10-11hr. Syrphids, *Musca* spp. and honeybees seemed to be the most important flower visitors in carrot [Singh 1983, Misra *et al.* 1993, Abrol 1997]. In open pollinated plots, 85-90% Dipterous visitors and 7.7-10.9% *Apis florea* were observed [Sinha and Chakrabacti 1992], resulting in 25-33% higher seed yield. Sharma and Sharma [1968] found that houseflies were more prominent and more active than honeybees in the pollination of carrot in Kalpa Valley, India. For better economic returns, the use of honeybees in tunnels has been reported [Rodel 1990, Rodel *et al*. 1991, Sihag 1991]. The objectives of the present study were to observe major pollinators visiting carrot crop and their peak foraging period.

MATERIALS AND METHODS

The study was conducted at Horticulture Research Area, University of Agriculture, Faisalabad from March 15 to April 15, 2000. Mirpurkhas Selection variety of carrot (*Daucus carota*) was sown for seed production on January 12, 2000 in five plots measuring 5.4 x 5.4 m, with planting geometry of 1 x 0.75 m. At the time of pollination, a sweep net of 30 cm radius was used to collect the pollinating insects at four different times, i.e., 8-9 am, 11-12 am, 2-3 pm and 5-6 pm. Fifty sweeps per plot were taken to check the pollinators. Record of daily mean temperature and relative humidity was taken from the Department of Meteorology. The collected specimens were killed in a killing bottle. After collection, the large insects were pinned, labeled and preserved in the collection box. The smaller insects were mounted, labeled and preserved with other insects. Data were recorded for pollinators belonging to different insect orders. Honeybee species present in the field were also recorded. The correlation coefficient of number of *Apis florea* visiting carrot umbels with temperature and relative humidity was calculated.

RESULTS AND DISCUSSION

Comparison of the number of pollinating insects belonging to different orders indicates that number of Hymenoptera was higher, followed by Diptera, Coleoptera and Lepidoptera during 8-9 and 11-12 am (Fig. 1). Number of Dipterans was higher followed by Hymenopterans, Coleopterans and Lepidopterans at 2-3 and at 5-6 pm. The results indicate that Hymenopterans and Dipterans are the major pollinators visiting carrot. Higher number of Hymenopterans and Dipterans was also reported by earlier workers [Singh 1983, Goyal *et al*. 1989, Misra *et al.* 1993]. Our results are different from those of Sinha and Chakrabacti [1992], who found 85-90% Dipterans and 7.7-10.9% *Apis florea* on carrot. The number of Coleopterans and Lepidopterans was lower at four various time periods i.e., 8-9 am, 11-12 am, 2-3 pm and 5-6 pm. Peak for aging activity was observed during 10-11 am by Goyal *et al.* [1989], whereas peak foraging activity was noticed at 8-9 am in our study.

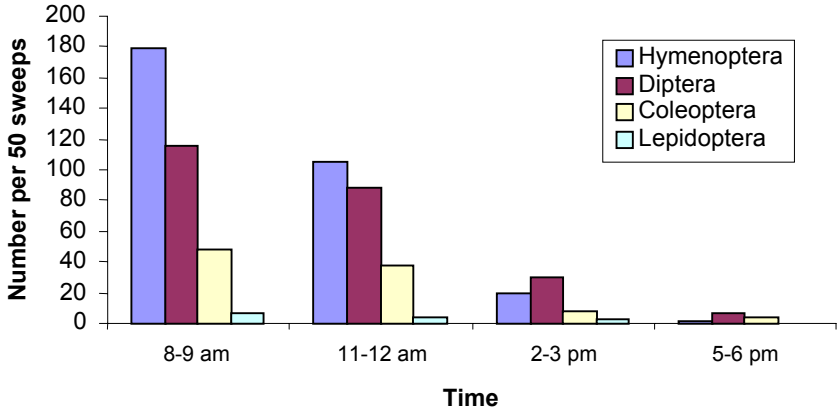

Fig. 1: Composition of the major insect orders visiting carrot during blooming period from March 15 to April 15, 2000.

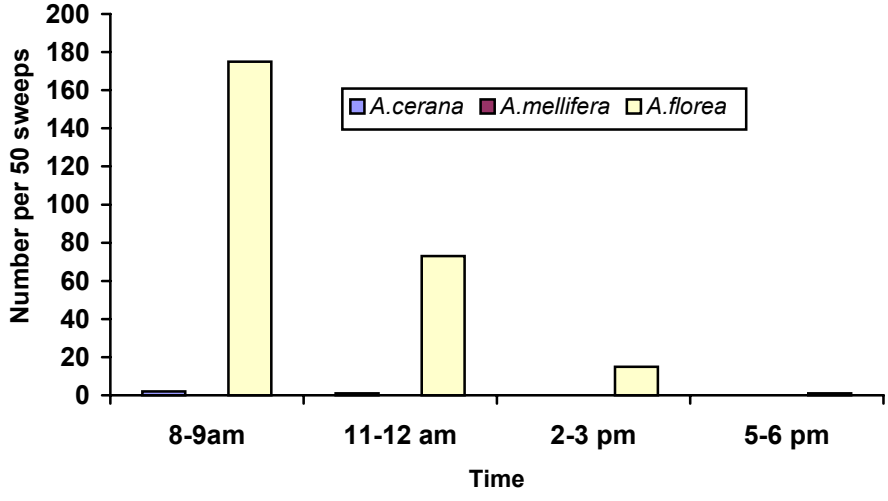

Fig. 2: Composition of honeybees species visiting carrot during blooming period from March 15 to April 15, 2002.

The comparison among number of different honeybee species clearly showed that the number of *Apis florae* was higher than others at all four time periods i.e., 8-9 am, 11-12 am, 2-3 pm and 5-6 pm (Fig. 2). The maximum number of *Apis florea* was observed during 8-9 am and decreased with time during the day. On the other hand, the population of *Apis mellifera* and *Apis cerana* was negligible at all time periods in open pollinated plots. The results indicate that *Apis florea* was the most important pollinator in carrot crop. Other bee species, although present in the field, might not have an important role in pollination because their

number was negligible. Number of bees was drastically reduced at 2-3 and 5-6 pm. These findings can help to save the pollinators by applying insecticides late in the afternoon. By protecting the pollinators higher yields can be ensured. A significant negative correlation was noted between mean temperature and bees visiting the umbels (r^2 = 0.5627, P = 0.05), whereas there was a significant positive correlation between relative humidity and bee visitors (r^2 = 0.5289, P = 0.05) indicating that relative humidity and temperature affect the insect visits on carrot umbels. It is clear from the results that the population of Hymenopterans and Dipterans was more during early hours of the day on carrot. Thus, these pollinators could be protected or well utilized by intelligent pest management tactics, i.e., pesticide application, if needed, should be done in the late afternoon to protect the pollinators for higher seed yield.

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