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## Research Article

# Evaluation of insect pollinator activity on fennel (*Foeniculum vulgare*) in district Peshawar

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## ABSTRACT

The present study was conducted to record the population density of insect pollinators visiting fennel crop at Agricultural Research Institute (ARI), Tarnab, Peshawar during 2020-21. Study was laid out in Randomized Complete Block Design. Data was collected alternate day at two distinct time frames: morning and evening. It was observed that ten insect pollinators visited fennel crop during the flowering season of fennel crop at mentioned time frames. Total of 10 Species were recorded from the experimental plots including *Apis cerana*, *A. mellifera*, *A. dorsata*, *A. florea*, *Polistes olivaceus*, *Earistalis tenax*, *Eupeodis bacculatus*, *Pieris brassica*, *Zizina otis* and *Coccinella septempunctata*. Order Hymenoptera was the most recorded order of insects with 5 species followed by 2 species each from order Lepidoptera and Diptera while 1 species was reported from order Coleoptera. Highest density of insect pollinators (50.4 and 42.2) in both morning and evening were recorded for *A. mellifera* whereas the lowest numbers of insect pollinators (3.8 and 2) were recorded for *Z. Otis*.

**Keywords:** Pollinators; fennel; activity; bees; wasps; Peshawar.

## INTRODUCTION

Fennel, (*Foeniculum vulgare*) which belongs to the family Apiaceae is an annual herbaceous plant, which is grown for herbal use. It also called as anise. It is native to Southern Europe and Mediterranean region (Chaudhary et al, 2002). It grows almost all over the world, both as an ornamental plant and as a seed. It can grow in marginal areas and is considered tolerant to various insect pests and diseases. It is known for its healing properties and is used specifically to fight flatulence. Although fennel is not grown on a commercial scale in Pakistan, farmers in most of Pakistan only grow fennel on a small scale for domestic use due to its medicinal value. (Anonymous, 2020). Thus there is an urgent need to increase domestic production of fennel to achieve self-sufficiency in this important raw material. Horizontal expansion is not possible due to enormous pressure from a growing population. So enhancement of yield is sole option solution is to increase the yield per unit area. Since fennel is not grown commercially in Pakistan, many aspects of its packaging technology need to be discovered. Among the various factors that can increase yield per unit area, the date and method of sowing are considered the most important, (Leto et al., 1996). Apiaceae plant seeds are the most important ingredients in terms of their healing properties, which can greatly affect the biosynthesis of bioactive compounds. Pollination can have a profound effect on seed production among many factors. The seeds are used in medicine as a carminative, stimulant, stomachic and as a remedy for earachels, toothaches, coughs, asthma and rheumatism. Pollination is one of the limiting factors for crop productivity and contributes significantly to agricultural productivity.



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Pollination, essential for the process of fertilization and fruit and seed production, is defined as the transfer of pollen from the anther of male to the carpel part of a female flower. In nature, only about 5% of flowers are self-pollinating and 95% flowers are currently pollinated by animals (Tewari and Singh, 1983) out of which 90 percent accounts Insect pollination (Buchmann and Nabhan, 1996). As very little information is available on the requirements of fennel for insect pollination, a study on diversity, of insect pollination frequency, influence of abiotic factors on the forage activity of major pollinating insects and evaluation of their pollination efficiency was carried out in Fennel, *Foeniculum vulgare* Miller, in Hissar, India. It was reported that insect pollinators are attracted up to 52% by the higher concentration of sugar in the nectar (Masierowska, 2003). It has been documented that worldwide yield is maximized by the effective activities of pollinators (Freitas et al., 2009). In view of the above facts, current research work was carried out with objectives to record the insect pollinators and their relative abundance in Fennel crop at district Peshawar and to determine the effect of different insect pollinators on fennel yield.

## MATERIALS AND METHODS

### Experimental Area

The study was conducted throughout the flowering season of Fennel crop at Agricultural Research Institute Tarnab, Peshawar.

### Data Collection

Data was collected on alternate day of intervals from 09:00 am to 12:00 pm, 15:00 pm to 17:30 pm from the beginning of the flowering phase until crop maturity. Each plot in all replications was given five minutes for each observation, during insect pollinators visited were recorded. The following formula was applied to calculate their relative abundance:

$$\text{Relative abundance of species} = \frac{\text{No. of individuals flowers}}{\text{Total no. of pollinators}} \times 100$$

### Collection of Pollinators

During the flowering phase, various types of pollinating insects were encountered for identification purposes. Insect collection nets were utilized for catching pollinating insects. Collected specimens were labelled and identified up to the species level. at the miscellaneous crop section of Agricultural Research Institute Tarnab, Peshawar.

### Identification and Conservation of Pollinators

Collected pollinator specimens were stored in an insect collecting box. The specimens were identified with the help of available literature. All the specimens were brought to the Insect Museum, Department of Entomology, The University of Agriculture Peshawar, and preserved in the collection box of insects.

### Observations of Pollinators

Abundance of pollinators was recorded on Fennel Crop. The data was collected on weekly intervals. All the pollinators were counted with the help of hand counter clicker.

## RESULTS AND DISCUSSION

### Pollinators Recorded on Fennel crop

Table (1) shows the list of pollinators recorded from fennel crop during the year 2021. Maximum numbers of pollinator species (5) were recorded from order hymenoptera, followed by (2) each from order Diptera and Lepidoptera and (1) species was recorded from order Coleoptera. Family wise distribution shows that maximum species (4) were recorded for Apidae followed by (2) for Syrphidae and (1) each for Vespidae, Pieridae, Lycaenidae and Coccinellidae. The species recorded are presented in table 1. Percent relative abundance of insect pollinators in morning on Fennel crop Figure 1 displays the percent relative abundance of different insect pollinators visiting fennel crop at morning time during cropping season of year 2021. It is evident from the figure that *A. mellifera* shows the highest relative abundance of (31.23%) followed by *E. tenax* (16.41%), *A. cerana* (10.9%), *A. dorsata* (9.17%), *E. bacculatus* (8.64%), *A. florea* (8.35%), *P. olivaceus* (5.92%), *P. brassica* (4.03%), *C. septumpunctata* (2.79%) whereas the lowest relative abundance was recorded for *Z. otis* (2.51%). From the figure it is clear that pollinators from family apidae visited the fennel crop in higher density as compared to the rest of pollinators.

Table1. List of Pollinators on Fennel crop at ARI, Tarnab during cropping season of 2021-2022.

| Sr. | Scientific Name                  | Common Name         | Order       | Family        |
|-----|----------------------------------|---------------------|-------------|---------------|
| 1   | <i>Apis cerana</i>               | Eastern honey bees  | Hymenoptera | Apidae        |
| 2   | <i>Apismellifera</i>             | European honey bees | Hymenoptera | Apidae        |
| 3   | <i>Apis dorsata</i>              | Giant honey bees    | Hymenoptera | Apidae        |
| 4   | <i>Apis florea</i>               | Dwarf's honey bees  | Hymenoptera | Apidae        |
| 5   | <i>Polistes olivaceus</i>        | Paper wasp          | Hymenoptera | Vespidae      |
| 6   | <i>Eristalis tenax</i>           | European Hover      | Diptera     | Syrphidae     |
| 7   | <i>Eupeodus bacculatus</i>       | Syrphid fly         | Diptera     | Syrphidae     |
| 8   | <i>Pieris brassica</i>           | Cabbage butterfly   | Lepidoptera | Pieridae      |
| 9   | <i>Zizina Otis</i>               | Blue butterfly      | Lepidoptera | Lycaenidae    |
| 10  | <i>Coccinella septumpunctata</i> | Lady bird beetle    | Coleoptera  | Coccinellidae |

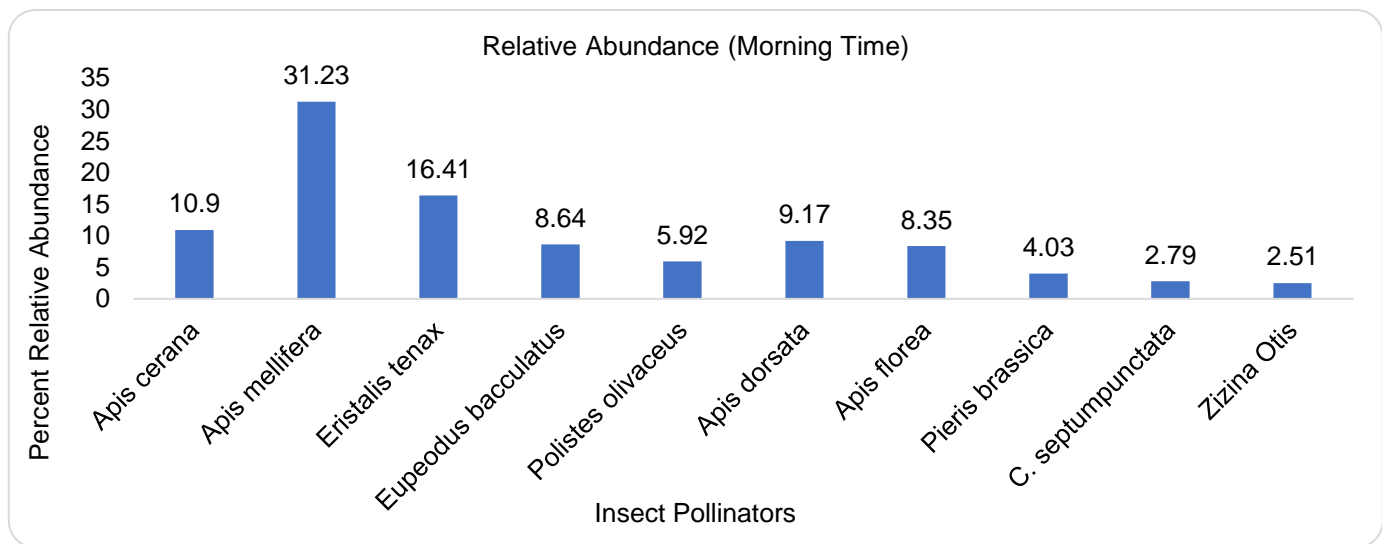


Figure 1. Percent relative abundance (morning time) of insect pollinators in evening on Fennel crop.

Figure (2) shows the percent relative abundance of various insect pollinators on fennel crop at evening time during 2021. It is evident from the figure that *A. mellifera* shows the highest relative abundance of (32.13%) followed by *E. tenax* (17.18%), *P. brassica* (11.16%), *A. cerana* (10.86%), *A. florea* (7.22%), *A. dorsata* (6.36%), *P. olivaceus* (4.59%), *E. bacculatus* (4.24%), *C. septumpunctata* (4.19%) whereas the lowest relative abundance was recorded for *Z. Otis* (2.02%). From the figure it is clear that pollinators from family Apidae visited the fennel crop in higher density as compared to the rest of pollinators.

Pollinators were present in the morning as opposed to the evening, according to Sajjad et al. (2008). They also reported that *E. balteatus* is an excellent pollinator. Pole et al., (2012) studied pollinators and recorded that *A. mellifera* is an effective pollinator and aid in the yield. The results are also similar to Saeed et al. (2012) Morning is the main feeding time for pollinators. Other researchers have also found that the peak for pollinator foraging during the summer is in the morning (Ahmad and Aslam, 2002). Our findings are also supported by Aras et al., (1996) who studied the relation of honey bees which are important insect pollinators and that of blueberry. Findings revealed that *A. mellifera* had a positive impact on the parameters in study and seed set, fruit set, berry weight, and maturation rate increased by the activity of the insect pollinators. Study also revealed that feeding on berries also aided in the increase in the population of *A. mellifera*. Our results were in line with Deuri et al. (2018) who reported that *Apis cerana* was recorded to be maximum (46.66%) followed by *Apis mellifera* (08.00%). Major pollinators included *Apis cerana*, *A. mellifera* of the Apidae and sweat bees of Halictidae among the Hymenoptera were considered to be the dominant species due to their frequent appearance (Sung et al., 2006; Kumar et al., 2016). Other foragers which were found but in lesser number.

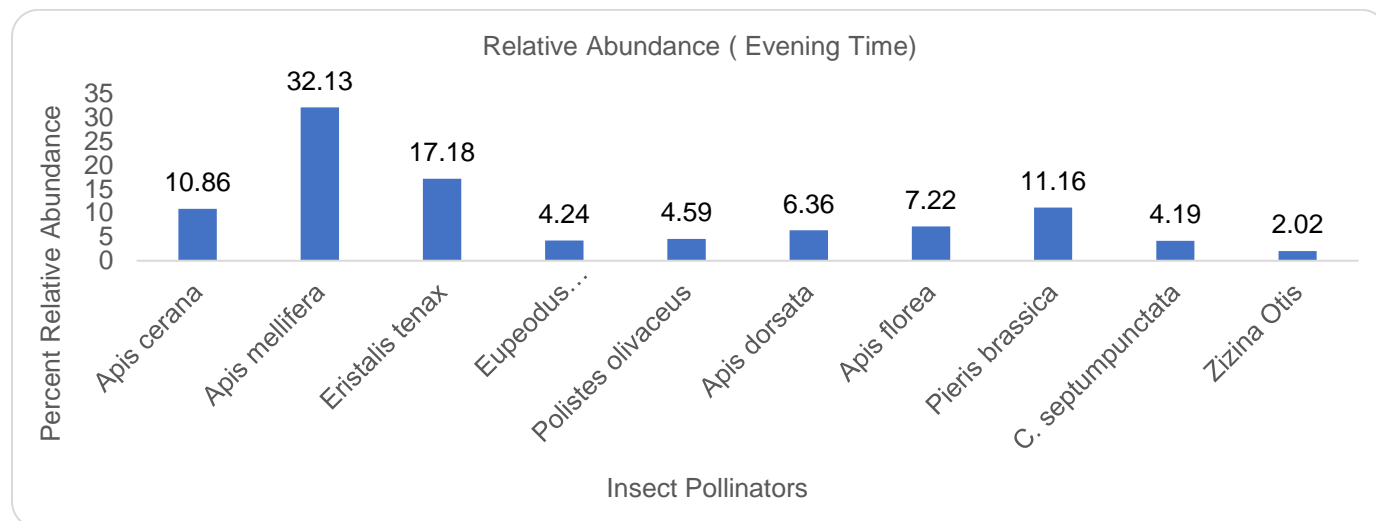


Figure 2. Percent relative abundance (evening time) of insect pollinators in evening on Fennel crop.

The honeybees were found the chief pollinator followed by the Vespid wasps (Patnaik et al., 2012). In addition to finding butterflies and syrphid flies pollinating flowers, Munawar et al. (2009) discovered honey bees and honey bee colonies. Honey bees and butterflies were noted by Mukherjee et al. (2013) as pollinators of black cumin. According to studies by Pole et al. (2012) and Breez et al. (2011) in the United Kingdom, *Apis mellifera* is the best pollinator. Thirty species of insect pollinators were discovered by Rashmi et al. (2010), of which twenty-one species belonged to the Hymenopteran order, four to the Lepidopteran order, and one to the Coleopteran order, and the remaining species belonged to other orders.

## CONCLUSION

The results of the current study indicate that the order Hymenoptera was abundant, with *A. mellifera* being the most abundant species among all the collected insect specimen. The frequency of the pollinators was high in the morning as compared to evening.

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