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The Importance of Plants Belonging to Asteraceae Family as a Pollen Source in Beekeeping

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Abstract

In beekeeping, flowering plants grown in flora are important in terms of nectar and pollen. These plants are the only basic food sources for honey bees. This research was carried out in an area of approximately 2000 ha in Ordu, Altınordu District, and Dedeli Locality to identify the existing taxa and pollen sources in the flora. Hazelnut (*Corylus avellana* L.) is grown intensively in the study area. Along with hazelnut gardens, there are also forest areas consisting of several decares. Plant taxa were identified during the flowering period in March, April, and May the growing period and flight activity time of honeybees. Additionally, 200 samples were collected from the pollen pellets of three bee colonies placed in the area between 07.00 am and 03.00 pm, one day a week for three months. As a result of a two-year study, 156 taxa belonging to the Asteraceae family were identified. Considering the number of taxa (with five taxa) and pollen pellet density (16.53%), it was observed that the taxa belonging to Asteraceae family were preferred more than other taxa. *Taraxacum officinale* W., *Bellis perennis* L., *Doronicum* spp. B., *Sonchus asper* L., and *Calendula arvensis* L. have been found to be important by honey bees as a source of pollen for the Asteraceae family. Thus, it has been determined that honey bees do not prefer every taxa equally in the flora as a source of pollen.

Introduction

Beekeeping is an agricultural activity that involves the use of honey bee (*Apis mellifera* L.) colonies to produce honey, pollen, and royal jelly, and facilitate pollination during periods of high nectar flow in the region (Güler, 2017). Bees and flowering plants are natural partners, with each performing certain functions for the other's survival and reproduction, creating a bond of coexistence (Sorkun et al., 2012).

Many flowering plants are pollinated by insects, with bees being the most important. Of the approximately 250000 flowering plant taxa in the world, it is known that 20000 are visited by bees (Kaufman, 1989).

The honey bee (*Apis mellifera* L.) collects pollen from flowers' stamens of seed plants and combines this pollen with their oral secretions into pellets (Çobanoğlu et al., 2021). Pollen is the only natural protein source for honey bees. The need for pollen also varies with the seasonal changes in the reproduction activities and production of larval food in the bee colony. The times when they have the greatest need for pollen are the beginning of spring and summer, when the colonies show reproductive, larval rearing, comb building, and multiplication behaviors (Güler, 2017).

In the flora of Türkiye, plants such as milkvetch, ivy, henbit, thyme, lavender, mint, mustard, clover, white clover, red clover, crimson clover, sweet clover, and bird's-foot trefoil are also very important nectar and pollen sources for bees (Genç & Dodoloğlu, 2011).

The Asteraceae family has a worldwide distribution, with special relevance in the Mediterranean, Eastern Europe and Asia Minor, being acknowledged about 25000 species integrated in approximately 1000 genera (Bessada et al., 2015).

In beekeeping, for high productivity to be achieved, the region where beekeeping is conducted should be rich in pollen and nectar sources. Additionally, the beekeeper should have knowledge about the flora of the area where beekeeping is practiced and should be familiar with the nectar and pollen sources that the bees utilize. The identification of local nectar and pollen sources is important in this regard.

In this study, it is aimed to determine the flower plants that are belonging to Asteraceae family and also

important for local pollen sources for honeybees in the spring season in Dedeli Locacity in Ordu.

Material and Methods

The study was conducted between 2013 and 2015. In 2014, data could not be collected due to unfavorable weather conditions. The research was conducted in Altınordu District, Ordu Province, using three Langstroth type wooden (Anonymous, 1979) beehives with pollen traps (with a diameter of 5 mm and made of plastic material) during the flowering periods of March, April, and May, when the honey bees start their flight activities and development phases. Pollen samples were collected from each of the three hives every week for three months, between 7.00 am - 03.00 pm and stored in -18°C deep freezer. On the days when the traps were active, 200 pollen pellets were randomly selected from each of the three hives according to Sawyer (1988), and those with a density of more than 45% were evaluated in the dominant (D) group, those between 16% and 45% in the secondary (S) group, those between 3% and 15% in the minor (M) group, and those less than 3% in the trace (T) group. To prepare sample pollen preparations, the pollen pellets collected from the traps were mixed with 15 mL of 0.7% physiological saline solution in 50 mL Falcon tubes using a shaker. From this mixture, a drop was placed on a slide using a 3 mL Pasteur pipette (made of polyethylene) and covered with a coverslip. Then, the slide was examined under a camera-equipped light microscope with a 40x/0.65 objective to identify the pollen grains and determine their sizes in horizontal and vertical directions (in micrometers, µm). The prepared slides, where the measurement and photography processes were performed, were secured with balsam on the slide-slide mount to create sample preparations. Ten measurements were made for each plant species' pollen (Anonymous, 2005).

The pollen preparations were prepared according to the Wodehouse (1935) method. In this method, the pollen collected from the anthers of flowers is placed on a clean slide and 2-3 drops of 96% ethanol are added to remove resin, oil, and air bubbles by heating in an oven (30-40°C). The pollen detected on the slide is then dropped with 1-2 mm^3 of basic fuchsin-glycerin gelatin, heated to melt. In this way, the pollen is evenly distributed on the slide and sealed with a lamella without any air bubbles (Aytuğ et al., 1971). In order to facilitate the freezing of preparations through labeling, they kept upside down at room temperature for 1-2 days. These preparations were examined under a light microscope (Zeiss Axio Scope A1) with a camera (40x/0.65) to determine the pollen. In addition, during this period, pollen from the anthers of flowers of plants in the region was collected to determine the plant taxa in the field, and photographs were taken.

Results and Discussion

In this study, 10 plant taxa belonging to the Asteraceae family were identified. It was observed that the number of plant taxa (with five taxa) and pollen pellet density (16.53%) from the Asteraceae family were preferred more than other flowers. *Taraxacum officinale* W. (dandelion), *Bellis perennis* L. (daisy), *Doronicum* spp. B. (leopard's bane), *Sonchus asper* L. (prickly sow thistle) and *Calendula arvensis* L. (marigold) from the Asteraceae family gained importance as pollen sources for honey bees (*Apis mellifera* L.). Images belonging to some defined pollen are given in Figure 1 and Figure 2.

Although various plants belonging to the Asteraceae family were found in the flora, such as *Cirsium arvense* (field thistle), *Matricaria chamomilla* (chamomile), *Tanacetum parthenium* (feverfew), *Tussilago farfara* (coltsfoot), and *Senecio vulgaris* (common groundsel), none of these specific plant species were observed in the pollen gathered by the bees. It was once again confirmed that honey bees do not prefer every plant in the flora as a pollen source. The pollen density of plants belonging to the Asteraceae taxa between 2013 and 2015 is shown in Table 1.

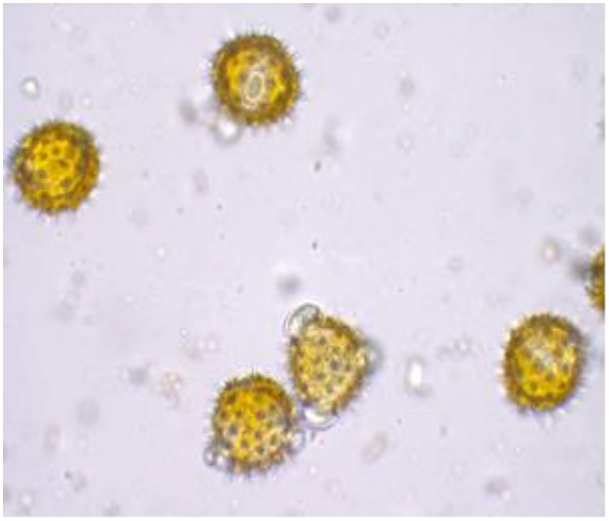

Figure 1. *Calendula arvensis* L. (marigold)

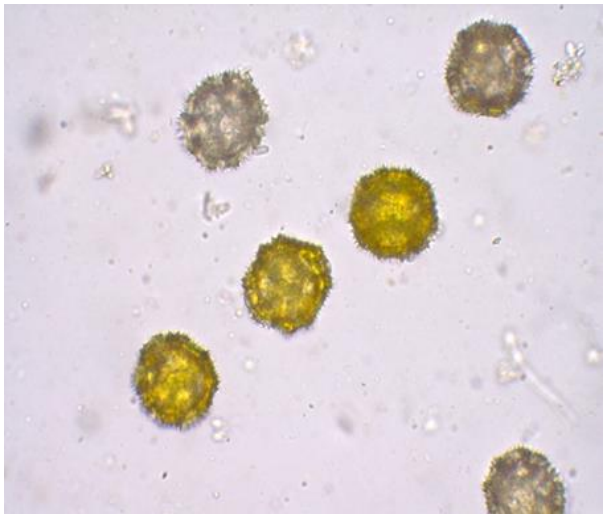

Figure 2. *Sonchus asper L. (prickly sow thistle)*

It has been observed that pollen from other plant species is not preferred by honey bees as a dominant pollen source (>45%) during these periods.

As can be seen from the table, there is a difference in the pollen density between years and months of the same year. The reason for the difference between months may be due to differences in the flowering periods of the species. The difference between years, on the other hand, can be explained by changes in climatic conditions. In a similar manner, it has been reported in a study conducted by Yaşar et al. (2006) in the Anzer Plateau of Rize province that climate factors have an impact on the foraging activity of bees in collecting nectar and pollen.

Baydar and Gürel (1998) reported that, in a study conducted by placing pollen traps on four colonies throughout the year in the natural flora of Antalya, it was determined that honey bees meet their pollen needs from 40 plant taxa belonging to 16 families. The most preferred taxa were those belonging to the

Table 1. The pollen density of plants belonging to the Asteraceae taxa between 2013 and 2015

Pollen Sources		Months					
Family	Taxa	March		April		May	
		2013	2015	2013	2015	2013	2015
Asteraceae	*Taraxacum officinale* W.	S	M	T	T	T	-
	Bellis perennis L.	T	-	S	M	M	M
	Doronicum spp.	T	-	T	-	-	-
	Sonchus asper L.	-	-	-	-	M	-
	Calendula arvensis L.	-	-	-	-	T	-

** Dominant (D) >45%, Secondary (S) 16-45%, Minor (M) 3-15%, Trace (T) <3%*

Asteraceae and Fabaceae families. *Euphorbia characias*, *Taraxacum* spp., *Daphne sericea*, *Asphodelus fistolosus, Sinapsis arvensis, Raphanus raphanistrum, Calicotome villosa, Cistus creticus, Cistus salviifolius, Crepis* spp*., Acacia cyanophylla, Papaver rhoeas, Rubus sanctus, Myrtus communi, Vitex agnus-castus, Inula viscosa, Urginea maritima, Cerotonia siliqua* and *Eucalyptus* spp. were identified as the most important pollen sources.

In a study of 45 honey samples collected from various areas of the Rize-Anzer Plateau, microscopic analysis found 19 families (with the most common families being Asteraceae at 16%, Fabaceae at 14%, Lamiaceae at 14%, and Rosaceae at 8%) with 42 pollen taxa (Sorkun, 2003).

In studies conducted in various regions of New Zealand to determine pollen preferences of bees in the spring, it was found that *Cordyline australis, Taraxacum* spp*., Trifolium* spp*., Ulex europaeus, Pseudopanax crassifolius, Salix* spp. plants were highly preferred in the Kaitaia region, *Ranunculus* spp*., Taraxacum* spp. plants were preferred in the Raetihi region, taxa from the Asteraceae family were preferred in the North Canterbury region, the *Ulex europaeus* taxa was preferred in the Wainuimata region, and the *Pennantia corymbosa* taxa were preferred in the Dunedin region (Webby, 2004).

In a study conducted by Dimou and Thrasyvoulou (2007), pollen pellets were collected daily from 4 colonies and the flowering plants around the apiary were recorded. Based on field records, it was found that 204 taxa belonging to the Asteraceae, Fabaceae and Rosaceae families were the most important taxa.

Karaca (2008) identified 595 plant taxa belonging to 73 families that honey bees (*Apis mellifera* L.) could use in the Aydın region. Based on previous studies, the plant taxa in the top three were; 129 taxa from the Fabaceae family (22%), 57 taxa from the Asteraceae family (10%), and 49 taxa from the Labiateae family (8%), while other families followed.

Sorkun and Süer (2013) identified 54 taxa belonging to 31 families from the pollen collected from three regions in Bursa. Of these taxa, the most was found in the Asteraceae family (16%).

Baydar and Gürel (1998) have stated that *Taraxacum* spp*., Sinapsis arvensis, Cistus salviifolius, Calendula arvensis, Trifolium* spp. *and Salvia* spp. are preferred by bees as pollen sources, and Webby (2004) has indicated that *Taraxacum* spp., *Trifolium* spp., and *Salix* spp. are also preferred. At the family level, Sorkun (2003) found that Asteraceae was the most important family, comprising 16% of the pollen collected, Dimou and Thrasyvoulou (2007) found that Asteraceae, Fabaceae, and Rosaceae were important, Karaca (2008) found that Asteraceae was the most important family, comprising 57 taxa (10% of the total) and Sorkun and Süer (2013) found that Asteraceae was an important pollen source for bees. These results show similar trends in the pollen preferences of bees.

Conclusion

In this study, ten plants taxa belonging to the Asteraceae family were identified. Although several plants from the Asteraceae family were found in the flora, some of them were not observed in the pollen collected by bees. This confirms that honeybees do not choose every plant in the flora as a pollen source. The variation in pollen density throughout the years and months may be due to differences in flowering periods and climatic conditions.

Ethical Statement

Not applicable.

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Conflict of Interest

The authors declare there are no conflict of interest.

Author Contributions

Author 1: Investigation, Writing – review & editing; Supervision, Formal Analysis

Author 2: Investigation, Writing – review & editing

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