

## Seasonal activity of *Bombus terrestris* L. in east Mediterranean region, Turkey

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**Abstract:** Bumblebees have economical importance in most of wild and cultivated plants. They can be abundant in suitable habitats and have a broad flower choice. *Bombus terrestris* was collected at intervals during 2002 and 2003 from various flora and ecosystems of east Mediterranean region of Turkey. In this study, plants visited by *Bombus terrestris*, seasonal activities, distribution and altitudes were determined. *Bombus terrestris* have been seen throughout Turkey in a wide range of habitats from sea level to 1560 m altitude within all the major native vegetation types. Prevalence of queens, workers and males of *Bombus terrestris* differed due to altitude. More frequently observed at 0-600 m, declining above 600 m in relation to general climate requirements.

**Key words:** *Bombus terrestris*, Bombirae, Seasonal activity, Host plant, Altitude  
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### Introduction

Pollination is an ecosystem service of major economic and societal value, which is endangered by recent declines in pollinators (Daily, 1997). Role of bees in pollination is vital to both agricultural and natural ecosystems. In most temperate regions bumblebees are an important and sometimes indispensable component of the pollinator complex, especially to many crops and wild flowers (Osborne and Williams, 1996). However, the declines of managed honeybees and solitary wild bees may be compensated by generalist and mobile pollinators such as bumblebees (Corbet, 2000; Kremen *et al.*, 2002). The importance of bumblebees for greenhouse pollination is recognised because they are large, hairy and have long tongues, visit long tube plants and can work at low temperature and low light intensity conditions (Corbet, 1987).

Bumblebees, notably *Bombus terrestris* L., have been moved throughout the world in vast numbers (Goka *et al.*, 2001). This bee species is known to rob flowers. When the structure of the flower renders the nectaries inaccessible, *B. terrestris* can use their powerful mandibles to bite through the base of the corolla (Goulson, 2003). The natural range of *B. terrestris* has been centered in Europe and North Africa where several distinct populations are found. These populations show a high degree of colour variation (Chittka *et al.*, 2004).

*Bombus terrestris* have been observed throughout Turkey in a wide range of habitats from sea level to 1500 m altitude. It is found in all major native vegetation types and it exists in abundance in the coastal areas of Turkey (Aslan and Sekeroglu, 1996). For example, Mediterranean populations of *B. terrestris* have greater flexibility in their phenology, with at least two generations occurring annually compared to only one in central Europe (Rasmont, 1997).

However, the populations of this species, like other wild bees, has declined recently due to the increased land of cultivation,

intensive and irregular use of pesticides and the rapid increase in the population and urbanization in Mediterranean and Aegean regions. *B. terrestris* is now scarce in some important cultivation areas, such as Cukurova, Antalya and several parts of Anatolia (Ozbek, 1993).

In many countries, pollination is done by *B. terrestris* colonies placed in greenhouses. Elimination of hormones in pollination results in healthier and higher quality product while saving substantially from labor (Heemert *et al.*, 1990). Turkey is rich in bumblebee fauna due to favorable topographic and climatic conditions (Reinig, 1968, 1971; Ozbek, 1983). *B. terrestris* has economic importance in ability of growing on wide range of wild and cultured plants of eastern Mediterranean part of Turkey (Aslan and Sekeroglu, 1996).

This study aims to investigate the plants visited by *B. terrestris*, seasonal activities, distribution and altitudes.

### Materials and Methods

*Bombus terrestris* was collected at intervals during 2002 and 2003 from various flora and ecosystems of east Mediterranean districts of Turkey. Queen, worker and male bumblebees were caught with an insect net, and placed in a killing jar. Visited plant samples were also collected, pressed and kept in laboratory until they were identified. Visited plants, seasonal activity, altitude, habitat, and the distribution were also recorded.

### Results and Discussion

*Bombus terrestris* was collected and brought into laboratory throughout the year and long-term observations were made in nature during field surveys. *B. terrestris* requires pollen and nectar to support the colony throughout the spring-autumn period. In this study, total of 1234 *B. terrestris* were recorded on visiting flowers and distribution depended on habitats and altitudes. *B. terrestris*



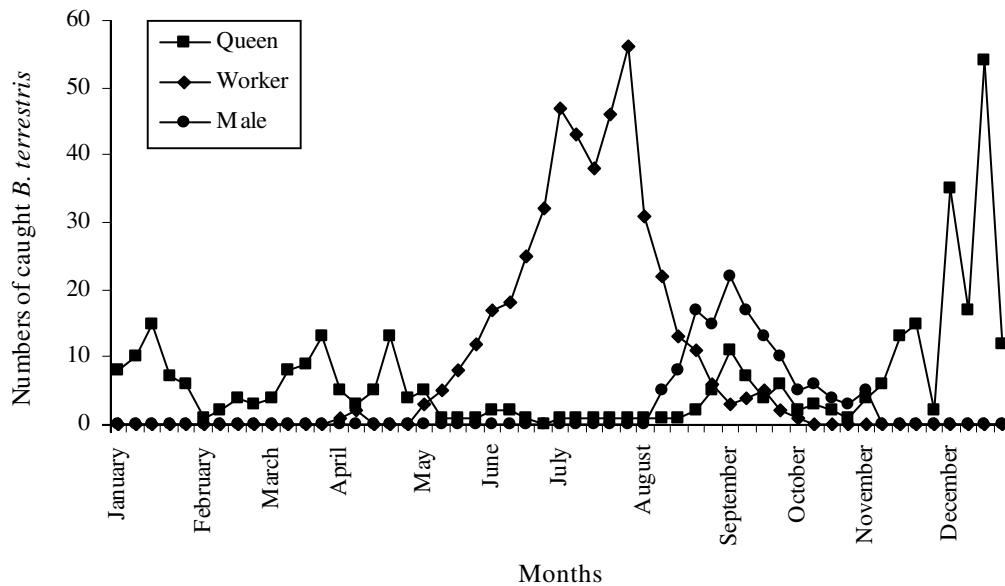


Fig. 1 : *Bombus terrestris* was collected (queen, worker and male) in east Mediterranean region, 2002-2003

was found in a wide range of altitudes from 0 to 1560 m and ranked second in 13 families with 48 host plants.

Findings of 2002-2003 surveys are summarized in Fig. 1. Queens of *B. terrestris* were collected mainly from *Eriobotria japonica*, *Abutilon hybriden* and *Vicia faba*. They were observed from January until the end of April. After this date, the number of queen bees was gradually decreased. The workers of *B. terrestris* were caught and observed towards the end of March. They were caught and observed in large numbers especially at the end of April, since the weather had been cold. The worker bees were collected mainly from plants belonging to families Asteraceae, Boraginaceae, Labiatae and Leguminaceae. This reached the maximum number in August and then the number was declined at the end of August. Starting from August, the males of *B. terrestris* were caught and observed until the end of November. After November winter surveys were started and *Bombus* queens were caught and observed during December in large numbers. *B. terrestris* was more effective during warm weather conditions than cold weather conditions in terms of movement and pollinating ability.

Prevalence of queens, workers and males of *B. terrestris* was differed by altitude and general climate requirements. *Bombus* bees were more frequently observed at 0-600 m altitude.

Unlikely that pollen foraging in generalist species, such as the bumblebee, *B. terrestris*, involves fully genetically preprogrammed, stereotyped motor skills (Raine and Chittka, 2007). Bees must adapt their collection and packing strategies depending on the floral structure and anther morphology of the flowers visited

Table - 1: Collection locations in east Mediterranean region of Turkey

Location	Altitude
Adana-Balcali	100 m
Adana-Hacihanli	120 m
Hatay-Harbiye	150 m
Adana-Hakkibeyli	160 m
Mersin-Kanlidivane	180 m
Hatay-Karaçay	200 m
Mersin-Gözne	220 m
Hatay-Teknepinari	250 m
Hatay-Iskenderun	320 m
Mersin-Doruklu	320 m
Adana-Aladag	780 m
Adana-Himmetli	900 m
Hatay-Yayladag	900 m
Adana-Karaisali	1010 m
Adana-Pozanti	1060 m
Mersin-Aydinlar	1280 m
Mersin-Kirobasi	1320 m
Adana-Demiruluk	1560 m

and the characteristics of pollen collected (Throp, 2000; Stone *et al.*, 2003; Willmer and Stone, 2004). Pollen and nectar are the most important nutrient sources for bees. So differences in their ability to collect either resource could have significant effects on potential survival and fecundity (Chittka *et al.*, 2004; Raine *et al.*, 2006 a, b).

In general, when they were compared according to visited plants, it was found that *B. terrestris* preferred plants belonging to Asteraceae, Labiatae and Leguminaceae in east Mediterranean region. Number of *B. terrestris* collected and observed on these

**Table - 2:** Plant species on which *Bombus terrestris* was caught

<b>Asteraceae</b>	<b>Liliaceae</b>
<i>Carduus macrocephalus</i>	<i>Ashodeline cilicica</i>
<i>Centaurea solstitialis</i>	
<i>Echinops</i> sp	<b>Rosaceae</b>
<i>Echinops orientalis</i>	<i>Eriobotria japonica</i>
<i>Echinops viscosus</i> sub sp <i>bithynicus</i>	<i>Malus sylvestris</i>
<i>Gaillardia lanceolata</i>	<i>Rubus</i> sp
<i>Helianthus annuus</i>	
<i>Onopordum acanthium</i>	<b>Verbenaceae</b>
	<i>Lantana</i> sp
	<i>Vitex pseudonegundo</i>
<b>Boraginaceae</b>	<b>Malvaceae</b>
<i>Anchusa leptophylla</i>	<i>Abutilon hybriden</i>
<i>Anchusa officinalis</i>	<i>Alcea pallida</i>
<i>Anchusa undulata</i>	<i>Gossypium</i> sp
<i>Echium italicum</i>	<i>Hibiscus esculentis</i>
<i>Onosma gigantea</i>	
	<b>Punicaceae</b>
<b>Labiatae</b>	<i>Punica granatum</i>
<i>Ballota nigra</i> sub sp <i>anatolica</i>	
<i>Phlomis armeniaca</i>	<b>Nyctaginaceae</b>
<i>Prunella vulgaris</i>	<i>Bougainvillea glabra</i>
<i>Salvia candidissima</i> sub sp <i>occidentalis</i>	
<i>Salvia verticillata</i> sub sp <i>amasiaca</i>	<b>Rubiaceae</b>
<i>Stachys</i> sp	<i>Gerbera</i> sp
<i>Stachys cretica</i> sub sp <i>grana</i>	
<i>Teucrium chamaedrys</i>	<b>Solanaceae</b>
	<i>Capsicum annum</i>
<b>Leguminaceae</b>	<i>Lycopersicon esculentum</i>
<i>Acacia</i> sp	<i>Solanum melongena</i>
<i>Cercis siliquastrum</i>	
<i>Calycotome villosa</i>	<b>Cucurbitaceae</b>
<i>Ononis repens</i>	<i>Cucumis sativus</i>
<i>Phaseolus vulgaris</i>	<i>Cucurbita pepo</i>
<i>Vicia cracca</i> sub sp <i>stenophylla</i>	
<i>Vicia noeana</i>	
<i>Vicia villosa</i>	
<i>Vicia faba</i>	

plants was especially higher than that of others due to natural habitat of these plants. Plants were mainly at the altitude of 0-100 m.

Examined hosts of *B. terrestris* were weeds, industrial crops, vegetables and fruits (Table 2). However, it was concluded that uncontrolled use of pesticides reduced the population of *Bombus* bee species as pesticide applications directly harm the host of bee.

It was observed that *B. terrestris* is a very important pollinator in all weather conditions. It was noticed in this study that *B. terrestris* has an important effect on the pollination of *Eriobotria japonica* and *Vicia faba* especially in winter months. During flowering season of these plants, it was observed that only the queen bees were effective in pollination. Some researchers reported that Bombusbees are important pollinators of *Vicia faba* (Stoddard and Bond, 1987; Fussel and Corbet, 1991). It was observed that Bombusbees prefer plants especially having flowers with long tubes. More importantly, forager

body size in *B. terrestris* populations appears to be a crucial factor determining their foraging performance and potential competitive abilities (Ings *et al.*, 2005).

There is evidence that perennial plant species are more valuable to *B. terrestris* than those of annuals since perennial plants, such as *Eriobotria japonica* and *Abutilon hybriden* provide pollen and nectar that are nutritiously important to the colonies started by these queens. Parrish and Bazzaz (1979) reported that annual plants were visited by syrphids and halictids, while perennial plants are frequently visited by Apis and megachilids. Their ability to store the products of photosynthesis enables perennials to produce the large quantities of nectar per flower required by Bombusbees (Fussel and Corbet, 1992). It can be concluded from this study that *B. terrestris* is an important pollinator of both annual and perennial flora for sustaining their existence.

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