



الغزارة والصفات المورفولوجية والعوائل النباتية للنحل الطنان *Bombus* spp. في المنطقة الساحلية من سورية

Abundance, Morphology and Host Plants of Bumblebees, *Bombus* spp. in the Coastal Region of Syria

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الملخص

نُفذ البحث في المنطقة الساحلية السورية (طرطوس واللاذقية) خلال عامي 2009 و 2010. جُمعت خلالها 344 عينة من النحل الطنان: 127 عينة خلال عام 2009 و 217 عينة خلال 2010 في ثمانية مواقع، صُنفت العينات اعتماداً على ست صفات مورفولوجية: عرض وطول الرأس، طول الجناح الأمامي، طول الخلية الهامشية، طول اللسان، طول سلة حبوب الطلع، كما تم تحديد العوائل النباتية من خلال الصيد المباشر، وقُسمت إلى ثلاثة مستويات اعتماداً على طول النبات.

أوضحت نتائج الدراسة وجود نوعين من النحل الطنان هما: *B. terrestris* وهو الأكثر غزارة، والنوع *B. argillaceus*. تظهر ملكات النوع الأول بدءاً من شهر شباط (فبراير)، وتدخل في طور سكون بعد نهاية تموز (يوليو)، وينشط النوع الثاني بدءاً من آذار (مارس) حتى منتصف حزيران (يونيو).

بلغ متوسط طول ملكات النوع *B. terrestris* 20.05 ± 0.003 مم، ومتوسط طول الشغالة 15.32 ± 0.23 مم، ومتوسط طول الذكر 16.18 ± 0.11 مم. تم تسجيل 23 عائلاً نباتياً للنوع *B. terrestris*، وستة عوائل نباتية للنوع *B. argillaceus* تنتمي إلى عدة فصائل على ثلاثة مستويات نباتية.

الكلمات المفتاحية: المنطقة الساحلية، النحل الطنان، العوائل النباتية، سورية.

Abstract

The study was carried out during the period between 2009 and 2010 in the coastal region of Syria, Lattakia and Tartus. A total of 344 individuals of bumblebees were collected, 127 individuals in 2009 and 217 individuals in 2010 at 8 sites. The collected samples were classified depending on six morphological characters; head width (HW), head length (HL), marginal cell length (ML) of the fore wing, wing length (WL), tongue length (TL) and pollen basket length (PBL). Host plants of the selected species were identified and divided into three levels according to their length. In this study, two species of bumblebees were identified, *Bombus terrestris* L. and *Bombus argillaceus* Scopoli. Among these species, *B. terrestris* was the most abundant. Regarding the activity of bumblebees, *B. terrestris* was active from February, where the queens were observed, until July, and then overwintered (Diapause), while *B. argillaceus* activity extended from March until July. Morphometric of the collected species *B. terrestris* were 20.05 ± 0.003 mm, 15.32 ± 0.23 mm and 16.18 ± 0.11 mm for the queen, the worker and the male, respectively. The study showed that *B. terrestris* and

B. argillaceus are hosted by 23 and 6 plant species, respectively, belonging to several plant families and on three plant levels.

Key words: Coastal region, Bumblebees, *Bombus terrestris*, *Bombus argillaceus*, Host plants, Syria.

Introduction

Pollinators visit flowers to search for pollen and nectar, and the majority of pollinators visit more than one plant species. Pollinator insects are principal key in agricultural ecosystems, especially in the production of seeds and fruits, but the bees of super family Apoidea are more important, which highlights their importance in the protection and maintenance of diversity vital to plants, particularly local ones (Payette, 1996 and 2004), as well as in protected cultivation, in orchards and gardens, therefore, from here must be commitment to maintain and protect (Pouvreau, 2005, Velterop, 2000). Some studies were conducted in Syria and the most important species of wild bees pollinating the most important fruit tree species (Almond, Apricot, Cherry, Pear and Apple) in three villages of AlKhalamoun (Hosh Arab, Esal Alward and Rankous), were surveyed and classified together with their host plants. Seven different species of wild bees were found: *Osmia* sp., *Andrena* spp., *Eucera* sp., *Xylocopa* sp., *Anthophora* sp. and *Dasypoda* sp. (Alburaki and Khaled, 2008). Furthermore, in the same villages but on herbaceous hosts, other studies showed the presence of 28 species of wild bees belonging to several genera's: *Anthidium*, *Halictus*, *Andrena*, *Megachile*, *Xylocopa*, *Anthophora* and *Eucera*.. (Soleiman-Khaled and Alburaki, 2009).

Bumblebees are the primary pollinators for crop pollination, and therefore they are more important than honey bees, because bumblebees actually pollinate more flowers than honey bees, and Honey bees have short tongues in comparison with bumblebees. This means that honey bees are not so keen to visit deep flowers such as bumblebees (Goulson, 2003). No any previous studies of bumblebees in Syria, but there are worldwide studies. These studies pointed out that the species *Bombus argillaceus* Scopoli. spread on large areas of the world, it was recorded in France, Germany, Switzerland, Austria, Slovakia, Hungary, Greece, Italy, the Caucasus and the EU from Russia, Iran, Turkmenistan, Ukraine and Turkey (Kosior et al., 2007). Studies indicated that *B. argillaceus* live in the dry plains of Ukraine, and there were a lot of *B. argillaceus* in slope areas, but now it is one of the endangered species there, and some were kept in the Ukrainian Natural History NAS (SMNH). Recent field studies conducted in Ukraine in the period between 2001 and 2006 indicated the absence of this species (Konovalova, 2007 and 2008). This species was recorded in the northern part of Anatolia at an altitude of up to 2500 m (Rasmont and Flagothier, 1996). Studies indicated that this species of bumblebees exist with another species of bumblebees in Turkey, including: *B. vorticossus*, *B. niveatus*, *B. terrestris*, etc., and this species spread at an altitude of 400 - 2855 m about 80% of which are on the rise 900-1870 m (Rasmont and Flagothier, 1996). In this study, we collected bumblebees using window traps in various landscapes in an area where bumblebees are spread. It was examined the effects of habitat conditions characterized by land use and the local abundance of native bumblebees on the number and body size of trapped bumblebees using statistical models. The morphology of native bumblebees was also analyzed because morphological characters are closely related to floral resource use.

Materials and methods

-Investigated area

The study was carried out during the period between the end of 2009 and the end of 2010 in the coastal region of Syria, Lattakia governorate, (36. 44.61.84 – 36.67.43.15), (The villages of Jableh, Al- Quirdaha, Slunfeh, Kassab). and Tartus governorate (34.83.33.33 – 35.91.66.67). (Amrit, Safita, Machta Al-Helo, and Al-Qadmus) The lowland of the studied area was ranged from 0 - 900 m altitudes. This area consisted of citrus orchards (26%), apple orchards (24%), woodlands (23%), urban areas including residential and industrial areas (14%), tobacco orchards (3%) and others.

-Trapping

Every year 8 trapping sites were located in the windbreak forests surrounded by various landscapes. The bumblebees thereupon were collected by using flying insects nets. Trapping was conducted 4 times in 2009, and 9 times in 2010,

at intervals of about 2 or 3 weeks. Trapped bumblebees were transferred to a plastics container attached to a definition nameplate which recorded on them the sample number and all the necessary data such as location host plant and date of collection.

-Morphology

Trapped bumblebees were preserved in 99.5% ethanol and classified into species and sex. In the following analysis, the two-abundant species, *B. terrestris* and *B. argillaceus* were examined. As an indicator of body size, the head width (HW) of trapped bumblebees was measured using a microscope with a micrometer. The morphological characters of 10 queens of *B. terrestris* and 4 of *B. argillaceus*, and 15 workers randomly sampled from the trapped females of both abundant species were measured under a binocular microscope with a micrometer. Six characters related with foraging behavior were selected according to Nagamitsu, et al., (2006) HW, head length (HL), marginal cell length (ML) of the fore wing, wing length (WL), tongue length (TL) and pollen basket length (PBL).

-Relative abundance

The total number of bumblebees of each species collected during the study period was assumed to follow Relative abundance of each species. The relative abundance was calculated as the following

$$A = (N_1 / N_1 + N_2) \times 100$$

Where:

A=relative abundance.

N₁= number of individual of first species

N₂= number of individual of second species.

The species were abundant (exuberant) when relative abundance greater than or equal to the value (2) (Kabakibi, 1989).

Plant level have been identified through members bumblebee on plants (flowers) and depending on the length of the plant has been divided into three leves:

a- The first level: less than 1m plant height.

b- The second level : 1-2 m.

c- The third level: More than 2 m. (Kabakibi, 1989)

The data were analyzed with SPSS statistical software for (t) test.

Results and discussion

-Abundance

344 individual of two species were collected in two years, 127 individual in 2009, and 217 individual in 2010 at 8 sites. Among the two species, *B. terrestris* was the most abundant (311 individuals; 21 Queens, 127 workers and 163 males), followed by *B. argillaceus* (33 individuals; 4 queens and 29 workers), (Table 1).

Table 1. Bumblebees numbers caught during the study.

species of bumblebee	sites		
	Tartus	Lattakia	Total
<i>B. terrestris</i>	129	182	311
<i>B. argillaceus</i>	30	4	34
Total	159	186	345

Spatial distributions of the number of bumblebees trapped in Lattakia and Tartus governorates showed different patterns among the two species. *B. terrestris* was frequently trapped in Lattakia (182 individuals) than in Tartus (129 individuals), while *B. argillaceus* was frequently trapped in Tartus (30 individuals) than in Lattakia (4 individuals). The results presented in Table (2) clearly showed that the relative abundance of *B. terrestris* was higher than the relative abundance of *B. argillaceus* in the two study sites. These results are similar to the results obtained by Rasmont et al. (2008) which has noted that the *B. argillaceus* is wide spread bumblebees in the western Palaearctic. Also in Japan, *B. argillaceus* accounting for the relative abundance 52.5% in 2003, there was 68.5% in 2004, 74.2% in 2005 (Inoue et al., 2008). The results showed that *B. terrestris* was relatively prolific species with a relative abundance 90%, while *B. argillaceus* was very rare species with a relative abundance 10%, during study in both areas .

Table 2. Relative abundance average of the species of bumblebees in the study sites

species of bumblebee \ sites	Tartus	Lattakia	Total
<i>B. terrestris</i>	81	87.8	90
<i>B. argillaceus</i>	19	2.2	10
Total	46	54	100
t=0.0003			

-Seasonal pattern

B. terrestris

The results showed that the activity of *B. terrestris* extends from the first half of February, where the queens were seen in 10/02/2010 until the end of July, and overwinters (Diapause) after this period, and this was alms similar finding (Velthuis, 2002) as recorded that *B. terrestris* was activated from March to the end of August in Mediterranean Sea area. *B. terrestris* queens were observed through February, March, June and July, Worker were observed through April, May and June, and Male were observed through April, May, June and July. As shown in figure 1 there were intensive changes at diversity of *B. terrestris* during the study, where it scored the least number of caught individuals (two individuals) in the second month (February) and third month (March), in the period of queens emergence, and then increased up to 61 individuals in the fourth month (April) and then peaked in the sixth month least 64, in the period of emergence of young queens and males as well as workers. Goulson et al., (2002) pointed that *B. terrestris* queens were observed throughout the year except in June, and workers and males were also found in all months except July and

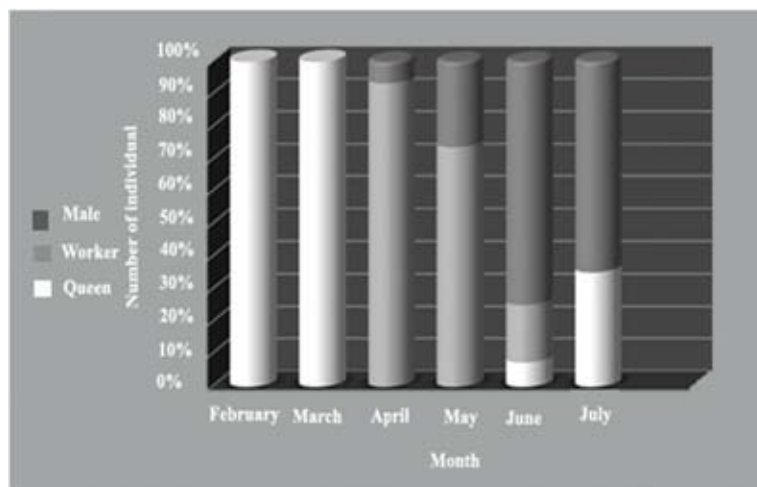


Fig 1. Seasonal changes in the number of trapped individuals of *B. terrestris* in 2010.

August. *B. terrestris* showed two peaks. The earlier one was dominated by worker, and the later one mainly consisted of male (Fig. 1).

Inari et al. (2005) showed that *B. terrestris* showed two peaks, the earlier one was dominated by queens, and the later one mainly consisted of workers in Hokkaido, Japan. Rasmont and Adamski, 1996 showed that *B. terrestris* start activity in late September with the start of rainfall and continued throughout the year and has two generations per year in Turkey, and is overwintered in June and July,

B. argillaceus

The results showed that the activity of this type of bumblebees extends from the second half of March until mid-July, Pawlikowski (1996) pointed that *B. argillaceus* is activated at the beginning of May, and continue the activity until September, with one generation per year. The number of trapped bumblebees of *B. argillaceus* (only Queens and Workers) was few (34 individuals), 28 individuals at Mashta-Al holo and 4 individuals at Slunfeh, this due to the presence of slopes, and the presence of large numbers of rodent holes (especially social field mouse) in Mashta-Al holo, the result consistent with (Konovalva, 2008), who pointed out that this species spread in the areas of the slopes and in areas infested with rodent in Ukraine.

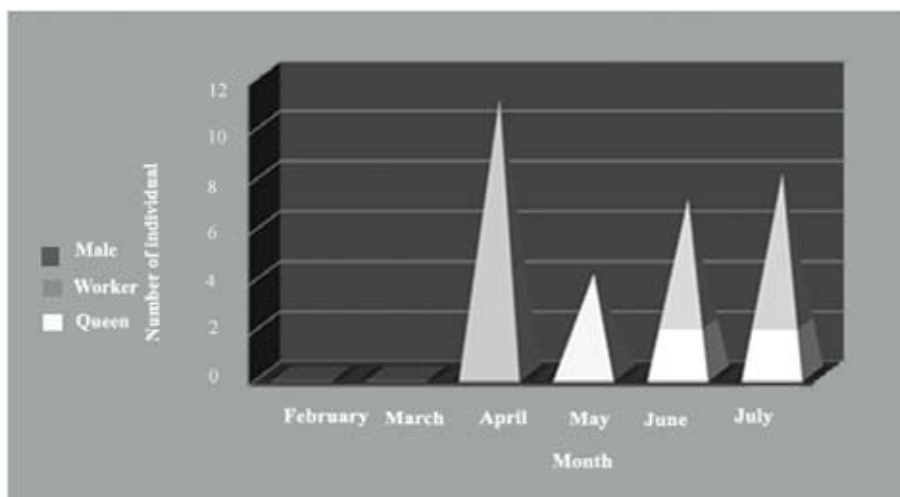


Fig 2. Seasonal changes in the number of trapped individuals of *B. argillaceus* in 2010.

-Morphology

B. terrestris

The results showed that the specie *B. terrestris* has a 12 segments antenna for the queen and the worker, 13 segments for the male, abdomen characterized by the presence of yellow color on the first thorax tergum and the second abdominal tergum, and white on fourth and fifth abdominal tergum, while the rest of segments are black. Parameters of body size of *B. terrestris* are organized in the table (3).

Table 3. Parameters of body size of *B. terrestris* (mm)

indicator of body size	body length	head width	marginal cell length	fore wing length	tongue length	pollen basket length	trunk length
Worker	15.32±0.23	4.72±0.072	3.72±0.06	13.39±0.18	5.33±0.09	4.67±0.067	4.47±0.98
Queen	20.05±0.003	5.123±0.13	4.95±0.34	18.55±0.014	6.225±0.07	6.23±0.077	6.225±0.07
Male	5.33±0.09	4.69±0.03	4.12±0.39	15.14±0.103	5.33±0.09	5	4.7±0.09

B. argillaceus:

B. argillaceus belongs to long tongue group of bumblebees. The queen marked by the presence of yellow color on the first and third thorax tergum, while the rest of segments are black. The color of the first and third thorax tergum and the first abdominal tergum is yellow, while the fourth and fifth abdominal tergum are white, and the third and sixth are black. This species of bumblebees was recorded for the first time in Syria.

-Plant hostess

B. terrestris:

The results showed that the existence of 23 plant species hosts of *B. terrestris* belonging to several plant families on three levels of plant height:

The first level (less than 1m plant height):

On this plant level, 170 individuals of *B. terrestris* were collected on 12 host plants belonging to 4 families: Asteraceae, Fabaceae, Lamiaceae and Cistaceae table (4).

table 4. The number of individuals on the first level plant and families.

	Plant hostess		Number of individuals	Family
	English Name	Scientific Name		
The first level	Red star thistle	<i>Centaurea pallescens</i>	4	Asteraceae
	Cretan rockrose	<i>Cistus creticus</i>	16	Cistaceae
	Sage leaf rockrose	<i>Cistus salvifolius</i>	2	Cistaceae
	Italian thistle	<i>Cardus australis</i>	7	Asteraceae
	Birds foot trefoil	<i>Lotus conimbricensis</i>	61	Fabaceae
	shrubby Jerusalem Syrian	<i>Phlomis syriaca</i>	3	Fabaceae
	Clover	<i>Trifolium clypeatum</i>	7	Fabaceae
	Common vetch	<i>Vicia villosa</i>	5	Fabaceae
	Binard sage	<i>Salvia penardi</i>	18	Lamiaceae
	Sage	<i>Salvia sp.1</i>	11	Lamiaceae
	Sage	<i>Salvia sp.2</i>	2	Lamiaceae
	Broad bean	<i>Vicia faba</i>	1	Fabaceae

The second level (12- m):

On this plant level 142 individuals of *B. terrestris* were collected on 7 hosts plant belonging to 5 plant: Malvaceae, Boraginaceae, Asteraceae and Rosaceae) table(5).

Table 5. The number of individuals on the second level plant and families.

	English Name	Scientific Name	Number of Individuals	Family
The second level	Hollyhock of Damascus	<i>Althaea damascena</i>	13	Malvaceae
	Alkanet	<i>Anchusa strigosa</i>	16	Boraginaceae
	Globe thistle	<i>Echinops Polyceras</i>	61	Asteraceae
	Italian bugloss	<i>Echium italicum,</i>	35	Boraginaceae
	Sunflower	<i>Helianthus annuus</i>	1	Composita
	Scotch Syriacom	<i>Onopordom syriacom</i>	11	Asteraceae
	Loganberry	<i>Rubus sanguineus</i>	5	Rosaceae

The third level (More than 2 m):

On this plant level one individual of *B. terrestris* was collected on host plant belonging to family Caesalpiniaceae. A study in Japan, Inoue *et al.*, 2008, pointed that there are 22 host plants belonging to 20 families for *B. terrestris* they are: Apiaceae, Actinidiaceae, Asclepiadaceae, Asteraceae, Balseminaceae, Boraginaceae, Brassicaceae, Convolvulaceae, Geraniaceae, Hydrangeaceae, Fabaceae, Iridaceae, Lamiaceae, Oleaceae, Onagraceae, Papaveraceae, Ranunculaceae, Rosaceae, Polygonaceae, Ruscaceae, Staphyleaceae. A study in Turkey, Gürel *et al.*, 2008, pointed that there are 47 plant hosts belonging to 20 families for *B. terrestris*, they are: *Althaea cannabina*, *Astragalus tmoleus*, *Carduus nutans*, *Cephalaria dipsacoides*, *Clematis cirrhosa*, *Centaurea solstitialis*, *Clematis flammula*, *Convolvulus scammonia*, *Coronilla emerus*, *Coronilla varia*, *Delphinium peregrinum*, *Echinops ritro*, *Fumaria officinalis*, *Hypericum scabrum*, *Jasminium fruticans*, *Lotus corniculatus*, *Medicago sativa*, *Malva sylvestris*, *Melissa officinalis*, *Opopanax hispidus*, *Gonocytisus angulatus*, *Pterocephalus plumosus*, *Ptilostemon chamaepeuce*, *Potentilla recta*, *Quercus* spp, *Rosa canina*, *Rhus coriaria*, *Rubus sanctus*, *Salvia fruticosa*, *Salvia virgata*, *Salvia tomentosa*, *Sideritis pisdica*, *Styrax officinalis*, *Umbilicus erectus*, *Vitex agnus-castus*, and *Vicia sativa*.

B. argillaceus:

The results showed the existence of 6 hosts plant species of *B. argillaceus* they are: Binard sage (*Salvia penardi*), Hollyhock of Damascus (*Althaea damascena*), Italian thistle (*Cardus australis*), Birds. foot trefoil (*Lotus conimbricensis*), Sage (*Salvia* sp.2), and Globe thistle (*Echinops polyceras*). The study pointed that *B. argillaceus* has visited medium to deep flowers, and usually specialized in a narrow range of bilaterally symmetrical long-corolla flowers and may even form narrowly oligolectic (Loken, 1973)

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