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Systematic Studies on the Family Apidae (Hymenoptera) in Ankara Province Part I: Bombinae

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Abstract: Species from the family Apidae (Hymenoptera) in Ankara province were considered. Nine species were determined from the subfamily Bombinae. Synonymies, the plants on which the specimen were caught, the Turkish and global distributions are given along with their distribution maps. Detailed drawings of the ventral view and photographs of the dorsal view of the male genitalia are also given except for the species *Megabombus armeniacus* (Rad.), *M. pascuorum* (Scopoli), and *M. humilis* (Illiger), which had insufficient male specimens.

Key Words: Apidae, Bombinae, Systematic, Distribution, Ankara.

Ankara İli Apidae (Hymenoptera) Familyası Üzerinde Sistemik Çalışmalar Bölüm I: Bombinae

Özet: Çalışmada, Ankara ili Apidae (Hymenoptera) familyası türleri ele alınmıştır. Bombinae altfamilyasından 9 tür tespit edilmiştir. Bu türlerin dağılım haritaları ile birlikte sinonimler, örneklerin ziyaret ettiği bitki türleri, Türkiye ve Dünya'daki yayılışları da verilmiştir. Yeterli sayıda erkek bireyin bulunmadığı *Megabombus armeniacus* (Rad.), *M. pascuorum* (Scopoli), ve *M. humilis* (Illiger), dışındaki türlerde genital organ yapısı ventral yönden ayrıntılı olarak çizilerek ve dorsal yönden de fotoğraflanarak sunulmuştur.

Anahtar Sözcükler: Apidae, Bombinae, Sistemik, Yayılış, Ankara.

Introduction

The family Apidae, which is commonly known as the most important and useful insect group, has always been very close and interesting to humans since cultural evolution began (1). Various etymological and anthropological marks of this family can be found in human history (2). Because of this old relationship, there have been many studies on their systematics, taxonomy, biology, host plants, colony raising and their use in the pollination of cultivated crop plants (3-7). The family Apidae is divided into five subfamilies: Apinae (honey bees), Meliponinae (stingless bees), Euglossinae (solitary orchid bees), Bombinae (bumble bees) and Psithyrinae (cuckoo bumble bees) (8). Some authors have classified Apidae into tribes as Euglossini, Meliponini, Apini and Bombini (9), while others recognize them as genera (10). In the holarctic region the family is represented by Apinae, Bombinae and Psithyrinae (11). In the subfamily Apinae there is only one genus *Apis* L. (12). From Bombinae and Psithyrinae, 300 species have been

recorded world wide (8). The external morphology and an illustration of a part of the genitalia have been given on the subgeneric level by Richards (13). Biological and systematic studies have been carried out in England by Prys-Jones and Corbet (10), in Poland by Pawlikowski (3), in Taiwan by Starr (8), in Japan by Ito (9) and in the Balkans by Pittioni (14). Introductory morphometric studies by Medler (15) and enzyme variation by Pekkarinen (16) in Holland have been carried out. In Turkey 55 species have been recorded by different authors (4, 7, 17-21). These species are variable in body color and it is quite difficult to distinguish between them (22). In Turkey apart from faunistic studies done by Reinig (17-19) and Rasmont (4), Özbek (7, 20, 21) has illustrated the male genitalia of some species mostly found in the East Anatolian Region.

In this paper, the morphology, color variation of the bodies and the male genitalia are examined. The significance of the characters, especially the squama, sagitta, stipes, cardo, spatha and lacinia, are discussed

with the figures and photographs along with their host plants and distribution maps.

Materials and Methods

The materials were collected from Akyurt, Altındağ, Ayaş, Bala, Beynam, Beypazarı, Çankaya, Çubuk, Elmadağ, Evren, Gölbaşı, Güdül, Haymana, Kalecik, Kazan, Kızılcahamam, Nallıhan, Polatlı, Şereflikoçhisar and Yenimahalle between 1994 and 1996. For the study of male genitalia the technique and terminology follow those proposed by Prys-Jones and Corbet (10), Özbek (20) and Rasmont (4). The figures were drawn with a camera lucida and a Nikon stereoscopic microscope from the ventral view and photographs were taken with a Prior stereoscopic microscope from the dorsal view. The altitudes, the plants on which the specimens were caught and distribution maps were given with information regarding their global and Turkish distributions. Because of the diagnostic value, the measurements of the malar area, clypeus and head index were given following the method proposed by Özbek (20). The formulas below were used to determine the means after and 10 specimens of each species were examined and measurements were taken.

Head index=100x(Width of the head/Length of the head)

Clypeus index=100x(Width of the labrum/Length of the clypeus)

Malar area=100x(The apical length of the malar area/length of the malar area)

Abbreviations Used in the Figures

crd	cardo
lcn	lacinia
sgt	sagitta
spt	spatha
sqm	squama
stp	stipes

Results

Genus *Bombus* Latreille, 1802

Syn. *Leucobombus* von Dalla Torre, 1880,
Terrestribombus Vogt, 1911

Bombus terrestris L, 1758

Syn. *Bombus cullumanus* (Kirby), 1802, *Bombus audax* (Harris), 1870, *Bombus silantjewi* Morawitz, 1892, *Bombus holsaticus* Krüger, 1954

Male

Length of the body 13-17 mm; length of the head shorter than width, index 107 ± 7.4 , supra-orbital line dorsally tangential to ocelli; first flagellar segment a little longer than the second, nearly equal to the third one; clypeus, vertex and basal half of the propleuron with black hairs; clypeus index 112 ± 8.7 ; collar with dark yellow, interalar band and scutellum with black hairs; first and second terga with yellow hairs besides some black ones basally scattered on the first tergum, basal half of the third tergum with black hairs while apical part with white ones, fourth, fifth and sixth terga with white or dark yellow hairs; basal part of the third metatarsus broad and margins with short fringes; apical of the eighth sternum straight.

Genitalia broad, nearly circular; apical of lacinia with a broad hook (Figure 1); from dorsal view sagitta flattened like a plate, distal end curved exteriorly, laterally turned through lacinia, inner margin slightly chitinized (Figure 2), from ventral view inner margin strongly chitinized and apex curved like a spoon; spatha not very broad, maximum four times longer than width of sagitta; stipes clearly convex, from dorsal view with sparse dark brown hairs at inner margin; squama pointed at apex, slightly chitinized; cardo broad, undulate at apex, margins more pigmented than inside (Figure 3).

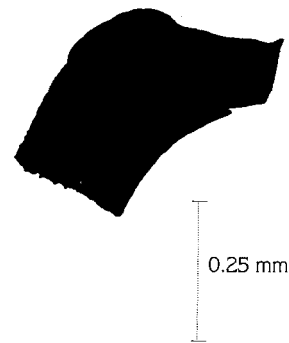


Figure 1. *Bombus terrestris* apex of the lacinia (ventral view)



Figure 2. *Bombus terrestris* male genitalia (dorsal view)

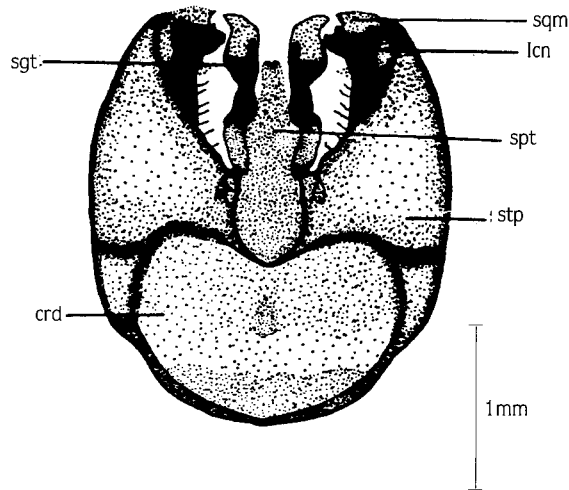


Figure 3. *Bombus terrestris* male genitalia (ventral view)

Female

Body of the queen 18-22 mm, worker 11-15 mm; length of the head about equal to the width, index 102 ± 8.3 ; with thin spotted area between lateral ocelli and compound eyes; distance between median ocellus and the lateral one short, nearly half of the diameter of median ocellus, ocelli normal size in worker; length of malar area shorter than width, index 103 ± 9.4 ; width of the clypeus broader than the length, index 112 ± 5.7 ; mandibula with distinct sulcus obliquus; collar hairs dark yellow, interalar band and scutellum with black hairs; first tergal hairs black, second one with dark yellow or brownish-yellow hairs; third tergum with black, fourth and fifth with yellow hairs, sixth tergum with black hairs medially and white ones laterally.

Material Examined: 17-VI-1995 Beynam Atatürk Forest (Bala) 10 ♀♀, 1 ♀ (ca. 800m); 24-VI-1995 Kızılcahamam 34 ♀♀ (ca. 900m); 22-VII-1995 Kızılcahamam 1 ♀ (900m); 15-VIII-1995 Beytepe (Yenimahalle) 1 ♀, 1 ♂, 1 ♀ (900 m); 8-IX-1995 Beytepe (Yenimahalle) 38 ♂♂, 3 ♀♀ (900m); 18-IX-1995 Beytepe (Yenimahalle) 9 ♀♀, 23 ♂♂, 17 ♀♀ (900m); 23-VII-1996 Yenimahalle 12 ♀♀, 2 ♂♂, 35 ♀♀ (800m). (Figure 4).

Plants Recorded: *Gaillardia* sp., *Echium italicum* L., *Echinops* sp.

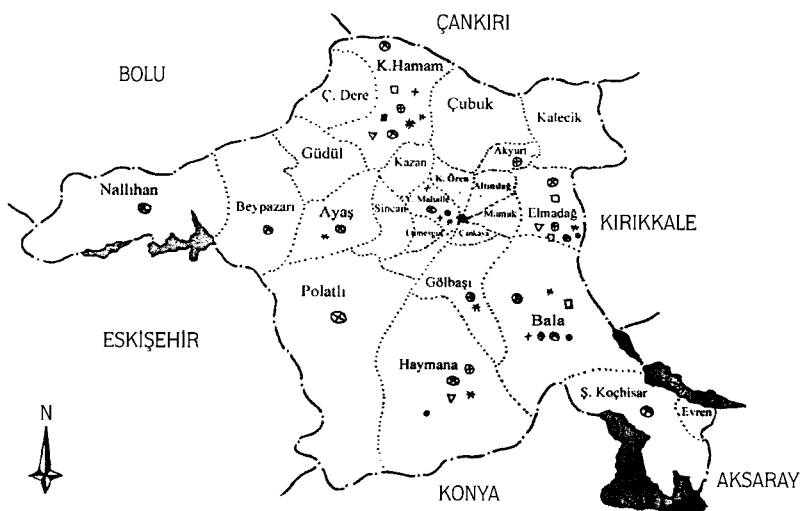


Figure 4. Distribution of the examined species

- + *Bombus terrestris*
- # *Bombus lucorum*
- ⊕ *Pyrobombus niveatus*
- *Megabombus argillaceus*
- * *Megabombus zonatus*
- *Megabombus mesomelas*
- *Megabombus armeniacus*
- *Megabombus pascuorum*
- ▽ *Megabombus humilis*

Turkish Distribution From Literature Cited:

Kastamonu, Ilgaz Mountains, Isfendiyar Mountains, Baba Mountain (26); Bursa, Ordu, Fatsa, Ünye, Rize, Sivriköy (18); Erzurum, Olur (20); Artvin, Rize, Trabzon, Gümüşhane, Giresun, Ordu, Tokat, Amasya, Çorum, Samsun, Sinop, Kastamonu, Çankırı, Kırklareli, Kırşehir, Ankara, Eskişehir, Kütahya, Bursa, Bolu, Bilecik, Yalova, İstanbul, Tekirdağ, Balıkesir, Çanakkale, Manisa, İzmir, Aydın, Muğla, Antalya, Burdur, Isparta, Afyon, Konya, Karaman, Niğde, Nevşehir, Içel, Adana, Osmaniye, Hatay, Gaziantep, Kahramanmaraş (23).

Global Distribution From Literature Cited: Scotland, England (6); Italy, Iberian Peninsula, Turkey, Greece, North Africa, Caucasia (4); Tasmania (24); Poland (3); Denmark, Czechoslovakia, Romania (16).

Bombus lucorum L., 1761

Syn. *Bombus cryptarum* (Fabricius), 1775, *Bombus lucocryptarum* Ball., 1914, *Bombus magnus* Alford, 1975

Male

Length of the body 13-15 mm; length of the head shorter than the width, index 108 ± 6.3 , supra-orbital line dorsally reaches the ocelli; first flagellar segment nearly equal to the third, longer than the second one; clypeus, vertex and the basal half of the propleuron with yellow hairs; clypeus short, index 113 ± 9.2 ; collar with light yellow hairs reaching the ventral part, interalar band and scutellum with black hairs; first and the second terga with yellow hairs but with some black ones at the basal part of the first tergum, basal half of the third tergum with black hairs while the apical part with white ones, fourth, fifth, sixth and the seventh terga with white hairs; apical of eighth sternum with two sharp processes apically.

Genitalia broad and somewhat circular as in *B. terrestris*; lacinia with a narrow hook apically (Figure 5); from dorsal view sagitta flattened, distal end exteriorly turned and laterally curved through lacinia as in *B. terrestris*, inner margin slightly chitinised (Figure 6); other parts same as in *B. terrestris* (Figure 7).

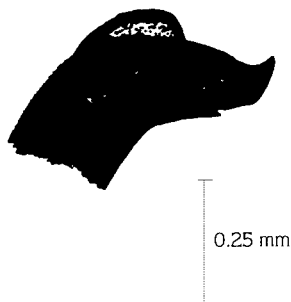


Figure 5. *Bombus lucorum* apex of the lacinia (ventral view)



Figure 6. *Bombus lucorum* male genitalia (dorsal view)

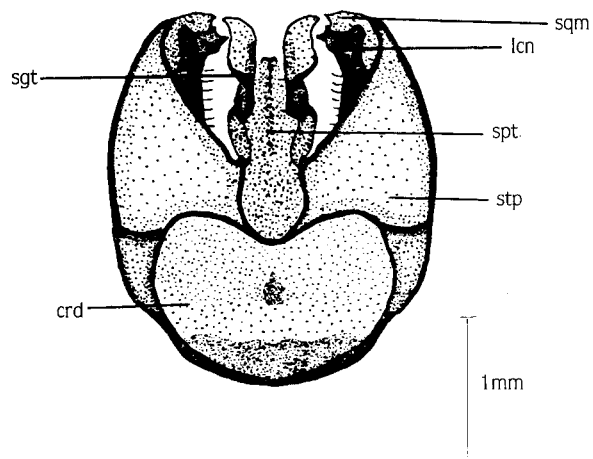


Figure 7. *Bombus lucorum* male genitalia (ventral view)

Female

Body of the queen 17-20, worker 10-14 mm; length of the head shorter than the width, index 108 ± 11.4 ; with a naked area between lateral ocelli and compound eyes; distance between median ocellus and lateral one equal to the diameter of the median ocellus, worker with smaller ocelli; length of the malar area shorter than the width, index 104 ± 8.1 ; width of the clypeus broader than the length, index 107 ± 5.4 ; mandibula with distinct incisura and sulcus obliquus, with no basal carina; collar hairs light-yellow, interalar band and scutellum with black hairs; first tergal hairs black, second tergum with light yellow hairs, third tergum with black, fourth and fifth with white hairs, sixth tergum with black hairs medially and white ones laterally as in *B. terrestris*.

Material Examined: 22-VII-1995 Kızılcahamam 2 ♀♀, 2 ♂♂ (1195 m); 29-VII-1996 Kızılcahamam 6 ♀♀, 14 ♂♂, 5 ♀♀ (1120 m) (Figure 4).

Plants Recorded: *Stachys* sp., *Astragalus* sp.

Turkish Distribution From Literature Cited: Bolu, Araç, Boyalı, İsfendiyar Mountains, Küre, İnebolu (26); Uludağ, Sivriköy, Hamsiköy, Zigana, Kop Mountains, Çakmak Mountains (18); Erzurum, Oltu, İspir (20); Dumlubaba, Göle, Ardahan, Palandöken (23).

Global Distribution From Literature Cited: England, Scotland (6); Europe, Iberian Peninsula, Greece, Turkey, Transcaucasia (4); Poland (3); Denmark, Norway, Sweden, Finland, Soviet Union (16); Yugoslavia (25).

Genus *Pyrobombus* von Dalla Torre, 1880

Syn. *Pyrrhobombus* von Dalla Torre, 1882, *Poecilobombus* von Dalla Torre, 1882, *Pratobombus* Vogt, 1911, *Hypnorobombus* Q. Pérez, 1927, *Lapponicobombus* Q. Pérez, 1927

Pyrobombus niveatus Kriechbaumer, 1870

Male

Length of the body 13-17 mm; length of the head equal or a little shorter than the width, index 101 ± 3.6 ; with large compound eyes and ocelli; supra-orbital line stretches out high above the ocelli; antenna with long flagellum, first segment nearly equal to the third and longer than the second; clypeus with white hairs, vertex and propleuron with black and white ones mixed; clypeus long, index 85 ± 4.6 ; collar and scutellum with white hairs, interalar band with black ones; first and second tergal hairs white, third tergum with black ones, fourth, fifth and the sixth terga with reddish-brown hairs.

Genitalia narrow, apically broader; lacinia with a small blunt ending process slightly turned inward; sagitta bird-head shaped with a long beak like distal process turned inward and a smaller one curling exteriorly through lacinia; spatha broad and densely pigmented; stipes from dorsal view convex, blackish-brown and chitinized strongly, with dense dark-brown hairs at inner margin (Figure 8), from ventral view inner margin hairy; squama ear-shaped, circular at apex, with a pointed triangular process stretching out upwardly among the hairs of stipes; cardo narrow, basal margin slightly curved (Figure 9).

Female

Body of the queen 17-22 mm, worker 11-15 mm; head long, index 96 ± 3.7 ; area between lateral ocelli and the compound eyes narrow and shiny, distance between them maximum two times longer than diameter of

median ocellus; length of the malar area shorter than width, index 102 ± 3.6 ; clypeus clearly convex, spotted dorsally and long, index 97 ± 2.8 ; mandibula with distinct sulcus obliquus, without incisura; collar and scutellum with white hairs, interalar band with black ones; first and second terga with white hairs, third tergum with black ones, fourth, fifth and sixth terga with reddish-brown hairs.



Figure 8. *Pyrobombus niveatus* male genitalia (dorsal view)

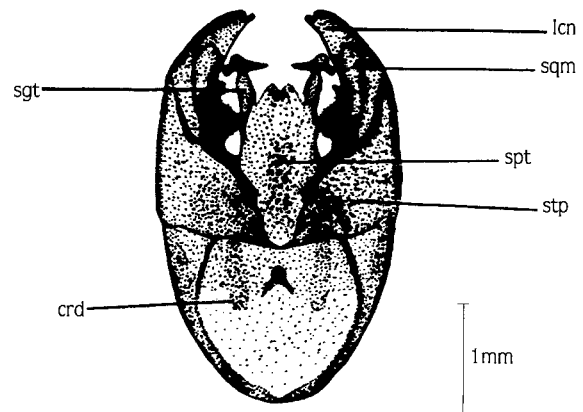


Figure 9. *Pyrobombus niveatus* male genitalia (ventral view)

Material Examined: 25-V-1995 Beytepe (Yenimahalle) 1 ♀ (900m); 4-VI-1995 Akyurt 2 ♀♀; 17-VI-1995 Beynam Atatürk Forest (Bala) 8 ♀♀, 2 ♀♀ (c a. 1200 m); 24-VI-1995 Kızılcahamam 3 ♀♀, 10 ♀♀ (ca. 1100 m); 22-VII-1995 Kızılcahamam 3 ♀♀, 1 ♂♂, 3 ♀♀ (1370m); 23-VII-1995 Hasanoğlan (Elmadağ) 6 ♀♀, 19 ♀♀ (1180m); 23-VII-1995 Karacahasan (Elmadağ) 1 ♀, 7 ♀♀ (1295m); 23-VII-1995 Süleymanlı (Elmadağ) 1 ♀ (940 m); 5-VIII-1995 Haymana 2 ♂♂ (900 m); 5-VIII-1995 Haymana 1 ♀ (1000 m); 5-VIII-

1995 Haymana 2 ♀♀ (1100 m); 8-VIII-1995 Beytepe (Yenimahalle) 1 ♀ (900 m); 12-VIII-1995 Karacahasan (Elmadağ) 1 ♀, 1 ♀ (1295 m); 12-VIII-1995 Beynam Atatürk Forest (Bala) 1 ♂ (ca. 1200 m); 4-VIII-1996 Beytepe (Yenimahalle) 14 ♂♂ (900 m); 6-VIII-1996 Ümitköy (Yenimahalle) 10 ♀♀, 14 ♂♂, 5 ♀♀ (950m); 12-IX-1996 Eymir (Gölbaşı) 4 ♀♀, 14 ♂♂, 5 ♀♀ (ca. 800m) (Figure 4).

Plants Recorded: *Cousinia* sp., *C. caesarea* Boiss. & Ball., *Ononis spinosa* L, *Anchusa leptophylla* Roemer & Schultes, *Consolida orientalis* (Gay) Schrid, *Helianthus annuus* L, *Astragalus gymnolobus* Fischer.

Turkish Distribution From Literature Cited: Sultan Mountain (17); Gerede (26); Çakmak Mountain, Murat Plain, Van, Sivrihisar, Hattuşaş, Çorum (18); Erciyas Mountain (Derinkuyu) (19); Cevizli, Konya, Mandarlı Mountains, Ulukışla (27); Erzurum, Pasinler, İspir, Hınıs, Horasan, Narman, Oltu, Olur, Tortum (20).

Global Distribution From Literature Cited: Turkey, Caucasia, Iran (4)

Genus *Megabombus* von Dalla Torre, 1880

Syn. *Hortobombus* Vogt, 1911

Megabombus argillaceus Scopoli, 1763

Syn. *Bombus sichelii* (Radoszkowski), 1859

Male

Length of the body 13-17 mm; head long, index 90 ± 5.2 ; first flagellar segment nearly equal to the third, longer than second; head with yellow and black hairs; clypeus long, index 93 ± 4.6 ; collar and scutellum with yellow hairs, interalar band with black ones; first tergum with yellow hairs, second and third terga with black hairs besides some yellow ones apically situated, fourth, fifth and sixth terga with white hairs and seventh one with black.

Genitalia broad; apical of the lacinia elongate upwardly with a process and downwardly with a shorter one, apically high-boot shaped, broader basally; from ventral view inner margin with dense and long hairs; sagitta saw-toothed at inner margin and with a little chitinized ring surrounding at median (Figure 10), from ventral view basal of sagitta sunk deeply into the cardo; spatha normal size, very transparent; stipes convex from both dorsal and ventral view, with sparse dark yellow hairs at inner margin, strongly pigmented, the two symmetrical parts fuse forming a heart-shaped hole under the spatha; squama curving distally and elongate over the stipes with

a horn-shaped process extending upwardly through the saw-toothed part of the sagitta; cardo very broad, dorsally convex and light brown (Figure 11).

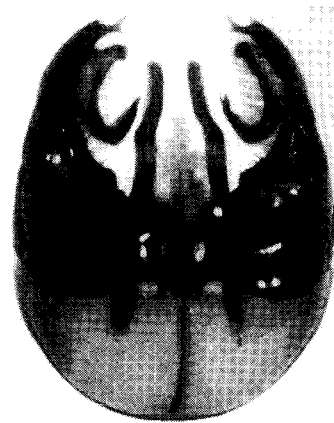


Figure 10. *Megabombus argillaceus* male genitalia (dorsal view)

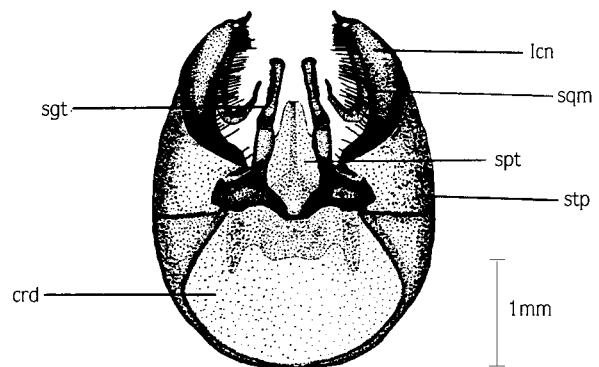


Figure 11. *Megabombus argillaceus* male genitalia (ventral view)

Female

Body of the queen 21-24 mm, worker 13-17 mm; head long, index 80 ± 2.6 ; with very long malar area, index 75 ± 3.1 ; length of the clypeus a little longer than the width, index 98 ± 1.6 ; collar and scutellum with yellow hairs, interalar band with black ones; all abdominal terga with black hairs in queens; in workers first tergum with yellow hairs, second and third tergal hairs black, fourth, fifth and the sixth ones with white hairs.

Material Examined: 20-V-1995 Soğuksu National Park (Kızılcahamam) 1 ♀ (ca. 850 m); 3-VI-1995 Bala 1 ♀ (980 m); 3-VI-1995 Oltan (Ayaş) 1 ♀; 11-VI-1995 Bepazarı 2 ♀♀; 17-VI-1995 Bala 1 ♀, 5 ♀♀ (980 m); 17-VI-1995 Beynam Atatürk Forest (Bala) 2 ♀♀ (1400m); 24-VI-1995 Kızılcahamam 2 ♀♀, 25 ♀♀

(1050 m); 24-VI-1995 Kızılcahamam 3 ♀♀ (920 m); 22-VII-1995 Kızılcahamam 1 ♂, 11 ♀♀ (1095 m); 22-VII-1995 Kızılcahamam 6 ♀♀ (1180 m); 22-VII-1995 Yukarıkese (Kızılcahamam) 1 ♂, 18 ♀♀ (1370 m); 23-VII-1995 Bala 2 ♂♂, 17 ♀♀ (1100m); 23-VII-1995 Elmadağ 2 ♀♀ (1180m); 23-VII-1995 Yukarıkese (Kızılcahamam) 3 ♀♀ (1370m); 23-VII-1995 Karacahasan (Elmadağ) 2 ♀♀ (1295m); 5-VIII-1995 Bayrak (Haymana) 1 ♀ (ca. 980m); 5-VIII-1995 Haymana 1 ♀ (1000m); 12-VIII-1995 Karacahasan (Elmadağ) 2 ♂♂, 1 ♀ (1295m); 12-VIII-1995 Deliler (Elmadağ) 2 ♀♀ (920m); 6-V-1996 Beytepe (Yenimahalle) 16 ♀♀ (900m); 8-VI-1996 Nallıhan 2 ♀♀ (900m); 9-VI-1996 Polatlı 4 ♀♀ (800m); 12-VI-1996 Şereflikoçhisar 8 ♀♀ (1000 m) (Figure 4).

Plants Recorded: *Cousinia* sp., *C. caesarea* Boiss. & Ball., *Anchusa leptophylla* Roemer & Schultes, *Consolida repalis*, *C. orientalis* (Gay) Schrid., *Ballota nigra* L., *Echium italicum* L., *Helianthus annuus* L., *Centaurea solstitialis* L., *Salvia virgata* Jacq., *S. cyanescens* Boiss. & Ball., *S. brakteata* Banks. & Sol., *Ononis spinosa* L.

Turkish Distribution From Literature Cited: Emir Mountain, Sultan Mountain, Baba Mountain (17); Karabük, Kastamonu, Çankırı (26); Bursa, Van, Hattuşaş (18); Kayseri (19); Tavas, Kazıklı, Isparta, Ağlasun, Cevizli, Beyşehir, Ulukışla (27); Erzurum (20).

Global Distribution From Literature Cited: France, Italy, Austria, Turkey, Hungary, Soviet Union, Iran, Spain, Caucasia (4); Poland (3).

Megabombus pascuorum (Scopoli), 1763

Syn. *Bombus agrorum* (Fabricius), 1787

Female

Body of the queen 16-18 mm, worker 9-13 mm; length of the head little longer than width, index 94 ± 9.3 ; head with gray hairs including some long black and shorter yellow ones also; with very long malar area, index 68 ± 8.6 ; clypeus with spotted areas, length a little longer than width, index 97 ± 9.6 ; with no distinct interalar band, all thorax with reddish-brown hairs; metatarsi with large sharp spine; abdominal terga with black hairs sometimes gray or white ones apically located, fifth and sixth terga with reddish-brown or orange hairs; sixth tergum with shiny surface.

Material Examined: 24-VI-1995 Kızılcahamam 3 ♀♀ (ca. 1100m); 22-VII-1995 Kızılcahamam 2 ♀♀, 5 ♀♀ (1095 m) (Figure 4).

Plants Recorded: *Anchusa leptophylla* Roemer & Schultes.

Turkish Distribution From Literature Cited: İstanbul, Çanakkale, Balıkesir, Manisa, Bursa, Adapazarı, Düzce, Akçakoca, Bolu, Zonguldak, Kastamonu, Konya, Sinop, Tokat, Ordu, Giresun, Trabzon, Rize, Artvin (28); Erzurum (20).

Global Distribution From Literature Cited: England (6); Italy, France, Switzerland, Sardinia, Belgium, Turkey, Greece, Caucasia, Bulgaria, Iran (4).

Megabombus zonatus (Smith), 1854

Male

Length of the body 12-16 mm; head nearly equal to the width, index 99 ± 8.7 ; first flagellar segment a little shorter than the third, second flagellar segment nearly half the length of the first one; head with yellow hairs; length of the clypeus a little longer than the width, index 96 ± 6.7 ; collar and scutellum with yellow, interalar band with black hairs; first to fifth terga with yellow hairs, sixth and seventh with black ones.

Genitalia not very broad; lacinia narrow, apex distinctly sharp, with dense brown hairs at inner margin; sagitta without tooth at inner margin, apex with a small process curving exteriorly; spatha not very broad, circular, not very dense; from dorsal view stipes convex, with round ending and more pigmented apex, inner margin with sparse hairs, with a round process through cardo ventrally (Figure 12), from ventral view sharply ending stipes rolling over lacinia forming a sheath; squama with an ear-shaped inner process, innermost margin with dense brown hairs; cardo light brown, convex dorsally (Figure 13).



Figure 12. *Megabombus zonatus* male genitalia (dorsal view)

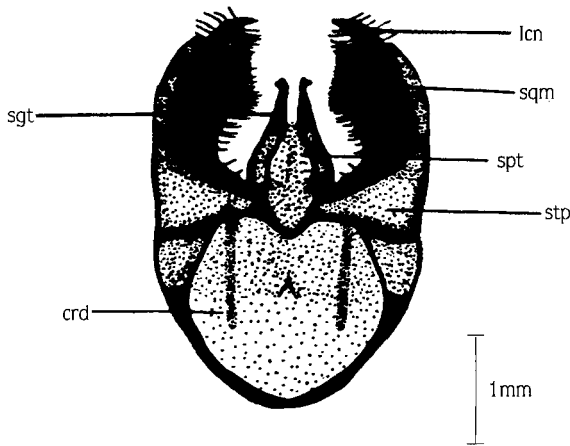


Figure 13. *Megabombus zonatus* male genitalia (ventral view)

Female

Body of the queen 16-19 mm, worker 10-14 mm; head nearly equal to the width, index 99 ± 5.7 ; labrum with a narrow hole, sparsely spotted; length of the malar area a little longer than the width, index 98 ± 4.9 ; clypeus long, index 95 ± 4.2 ; collar and scutellum with yellow hairs, interalar band narrow, with black hairs; first to fourth terga with yellow hairs, fifth and sixth ones with black hairs.

Material Examined: 3-VI-1995 Ayaş 1 ♀ (ca. 1000 m); 17-VI-1995 Bala 18 ♀♀ (980 m); 2-VII-1995 Beytepe (Yenimahalle) 2 ♀♀ (900 m); 22-VII-1995 Kızılcahamam 1 ♀ (1370 m); 23-VII-1995 Karacahasan (Elmadağ) 3 ♀♀ (1295 m); 23-VII-1995 Bala 3 ♀♀ (1100 m); 5-VIII-1995 Haymana 6 ♀♀, 3 ♂♂, 49 ♀♀ (ca. 1000 m); 8-VIII-1995 Beytepe (Yenimahalle) 1 ♀ (900 m); 12-VIII-1995 Karacahasan (Elmadağ) 7 ♀♀ (1295m); 12-VIII-1995 Taburlar (Elmadağ) 5 ♀♀ (1000m); 12-VIII-1995 Deliiler (Elmadağ) 2 ♀♀ (920m); 23-VII-1996 Eymir (Gölbaşı) 6 ♀♀, 4 ♂♂, 10 ♀♀ (ca. 1000 m) (Figure 4).

Plants Recorded: *Anchusa leptophylla* Roemer & Schultes, *Cousinia caesarea* Boiss. & Ball., *Ononis spinosa* L., *Cousinia* sp., *Centaureae iberica* Trev. & Sprengel, *Centaureae solstitialis* L., *Helianthus annuus* L., *Poa* sp., *Echium italicum* L., *Consolida orientalis* (Gay) Schrid., *Cirsium alatum* (Gmelin) Bobrov.

Turkish Distribution From Literature Cited: Bursa (17); Kastamonu, Sultan Mountain, Baba Mountain (26); Van, Çorum, Akşehir, Afyon (18); Kayseri (19); Isparta, Beyşehir, Konya (27); Erzurum, Sarıkamış, Hınıs, İspir, Oltu, Tortum, Tercan (20).

Global Distribution From Literature Cited: Bulgaria,

Romania, Hungary, Greece, Turkey, Soviet Union, Iran, Caucasia (4).

Megabombus humilis (Illiger), 1806

Syn. *Bombus solstitialis* Jurine, 1807, *Bombus helferanus* Seidl, 1837, *Bombus variabilis* Schmiedeknecht, 1878

Female

Body of the queen 18-21 mm, worker 16-19 mm; length of the head a little longer than the width, index 96 ± 8.3 ; head with yellow hairs also with some black ones between compound eyes; malar area very long, index 79 ± 8.0 ; clypeus with sparse and little spots, length a little longer than the width, index 96 ± 9.4 ; collar and scutellum with yellow hairs, interalar band with black hairs mixed with the other segments; first to fifth terga with yellow hairs, sixth tergum with black ones; ventral of the abdomen and the tibia with yellow hairs.

Material Examined: 22-VII-1995 Kızılcahamam 1 ♀, 1 ♀ (1370m); 23-VII-1995 Karacahasan (Elmadağ) 2 ♀♀ (1295m); 23-VII-1995 Süleymanlı (Elmadağ) 2 ♀♀ (940m); 5-VIII-1995 Haymana 3 ♀♀ (1000m); 12-VIII-1995 Karacahasan (Elmadağ) 2 ♀♀ (1250m); 12-VIII-1995 Taburlar (Elmadağ) 1 ♀ (1000m) (Figure 4).

Plants Recorded: *Anchusa leptophylla* Roemer & Schultes, *Helianthus annuus* L., *Centaureae solstitialis* L., *Cousinia* sp., *Echium italicum* L., *Ononis spinosa* L.

Turkish Distribution From Literature Cited: Ilgaz Mountains, Isfendiyar Mountains, Çankırı (26); Bursa, Eleşkirt (18); Ardahan (19); Erzurum, Muş, Tortum, Oltu, İspir (20).

Global Distribution From Literature Cited: England, Ireland, Scotland (6); Central Europe, France, Turkey, Caucasia (4); Poland (3).

Megabombus armeniacus (Radoszkowski), 1877

Syn. *Fervidobombus scythes* (Skorikov), 1925

Female

Queen 16-20 mm, worker 10-15 mm; head long, index 88 ± 8.6 ; area between lateral ocelli and the compound eyes very broad; head with black hairs; malar area very long, index 67 ± 9.2 ; clypeus distinctly convex, with sparse holes, width shorter than the length, index 87 ± 9.9 ; collar and scutellum with yellow hairs, interalar band narrow, with black hairs; first to fifth terga with yellow hairs, sixth tergum with black hairs.

Material Examined: 22-VII-1995 Yukarıkese (Kızılcahamam) 2 ♀♀ (1370m); 23-VII-1995 Elmadağ 1 ♀ (1180m); 23-VII-1995 Karacahasan (Elmadağ) 2 ♀♀, 24 ♀♀ (1295m); 23-VII-1995 Süleymanlı (Elmadağ) 5 ♀♀ (940m); 23-VII-1995 Bala 1 ♀ (1100 m); 12-VIII-1995 Yeşildere (Elmadağ) 4 ♀♀ (ca. 1300 m) (Figure 4).

Plants Recorded: *Morrubium anisodan* C. Koch, *Ononis spinosa* L., *Cousinia* sp., *Salvia virgata* Jacq., *Consolida repalis* S. F. Gray.

Turkish Distribution From Literature Cited: Rize, Kop, Hamur, Van, Hattuşaş, Afyon (18); Ürgüp, Kayseri (19); Konya (27); Erzurum, Pasinler, Tercan, Palandöken, Olur, Tortum (20).

Global Distribution From Literature Cited: Balkans, Turkey, Caucasia, Iran, Soviet Union (4); Poland (3).

Megabombus mesomelas (Gerstaecker), 1869

Syn. *Bombus elegans* (Seidl), 1837

Male

14-16 mm; head long, index 86 ± 8.8 , with white and black hairs; area between compound eyes and the lateral ocellus shiny; first flagellar segment nearly equal to the third, both longer than the second; clypeus long, index 92 ± 9.8 ; collar and scutellum with white hairs, interalar band with indistinct margins and with black hairs; first, second and the third terga with white hairs, fourth, fifth and the sixth terga with light yellow hairs; seventh tergum laterally with long and light yellow hairs but medially with short black ones.

Genitalia normal, not very broad; apex of the lacinia with a process like a curled leaf interiorly; apex of the sagitta flattened, curved exteriorly as in *M. zonatus* but broader, median part with an inwardly extending process, all sagitta pigmented strongly except the apex (Figure 14); spatha not very broad, innermost part denser; stipes clearly convex with a round process through cardo basally, with dense brown hairs at inner margin extending through the sagitta; squama ear-shaped from dorsal view, apex thinner than the basal part, with no hairs at inner margin, nearly fused with the lacinia from ventral view; cardo broad and light brown (Figure 15).

Material Examined: 5-VIII-1995 Haymana 1 ♂ (1000m); 12-VIII-1995 Karacahasan (Elmadağ) 1 ♂ (1295m); 12-VIII-1995 Yeşildere (Elmadağ) 1 ♂ (ca. 1300m); 12-VIII-1995 Beynam Atatürk Forest (Bala) 1 ♂ (ca. 1200m) (Figure 4).



Figure 14. *Megabombus mesomelas* male genitalia (dorsal view)

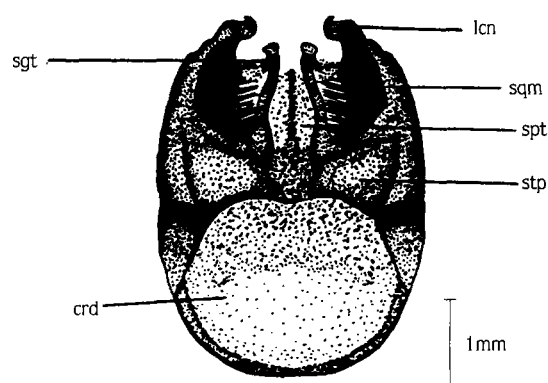


Figure 15. *Megabombus mesomelas* male genitalia (ventral view)

Plants Recorded: *Anchusa leptophylla* Roemer & Schultes, *Consolida orientalis* (Gay) Schrid., *Morrubium anisodan* C. Koch.

Turkish Distribution From Literature Cited: Rize, Kop, Eleşkirt, Van, Trabzon (18); Bolkar Mountains (27); Ardahan, Yalnızçam Mountains (19); Erzurum, Pasinler, Tercan, Palandöken (20).

Global Distribution From Literature Cited: Balkans, Turkey, Caucasia, Iran (4); Poland (3).

Discussion

The family Apidae is distinguished from the other families by the presence of a well developed malar area in males and tibial corbicula in females. Because of being sexually dimorphic it is sometimes quite difficult to determine the species. Mayr (22) pointed out that there may sometimes be more than 100 different body color variations in one species. This difficulty may be solved by using male genitalia in the determination. The subfamily Apinae includes one genus *Apis* L. which is distinguished by the presence of hairy compound eyes and highly eusocial lifestyle.

The subfamily Bombinae is distinguished from the other subfamilies by the lack of hairs on the compound eyes and primitive eusocial lifestyle. In the genus *Bombus* Latreille, the basic structural taxonomic characters of the male genitalia are as follows: Sagitta flattened like a plate, distal edge curves exteriorly, lacinia with a hooklike process apically and in females the presence of a lateral incisura on the mandible. These data are consistent with those of Alford (6). The structure of the sagitta is shown in more detail in this study from the ventral view. *B. terrestris* and *B. lucorum* are morphologically very similar and also have a similar genital structure, however *B. terrestris* is distinguished by a broader process at the apical of the lacinia and that it exists in lowlands, below 1000 m and in open habitats. These species need to be studied in much more detail especially their vertical differentiation and clines. In *Pyrobombus* von Dalla Torre the basic structural taxonomic characters of the male genitalia are: Rounded sagitta that has an internally or externally curved hook and also presence of large compound eyes, in females ocelli located below the supra-orbital line. *P. niveatus* is distinguished by white hairs on the clypeus. These data are consistent with those of Richards (13) and Özbek (20, 23). The genus

Megabombus von Dalla Torre has the following taxonomic characters: In the male genitalia squama extending through the stipes forming a lammella, antenna long and curved and in females there is a distinct sulcus obliquus on the mandible. *M. argillaceus* is distinguished by the presence of long squama and high-boot shaped lacinia. The genital organ structure of *M. argillaceus* is similar to those of *M. hortorum* and *M. portschinskyi* but from the ventral view it is shown that in *M. argillaceus* the apical of the squama is sharper and the broader sagitta has a basal portion extending in through the stipes. More detailed information on the biology of this subfamily is needed. Therefore, more biological data and especially studies on biochemical taxonomy are needed necessary.

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