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Wild bees of Lebanon: faunal revision, climatic risk, and community variation

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presented by
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Cover: *Bombus melanurus* visiting *Cousinia libanotica*. Picture by Mira Boustani.

« La vie trouve toujours sa voie comme un fleuve détourné de son lit en creuse toujours un autre »

Amin Maalouf, Les Échelles du Levant

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List of publications

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Abstract

Lebanon is a country located in the eastern Mediterranean region with converging climatic and biogeographic influences from Europe, Africa, and Asia. Lebanon's mountainous landscape includes a multitude of humid and semi-arid habitats that host a high floral and faunal diversity. Although the flora and some parts of the fauna are well known and are being monitored for conservation, the wild bee fauna of Lebanon remains largely unknown. Wild bees are the single most important pollinator group, and recent studies have reported their decline in many parts of the world. However, their distribution and population trends in the Mediterranean in general, and Lebanon in particular, remain largely unknown. The present work revolves around the wild bee fauna of Lebanon, with focus on a mountainous area in northern Lebanon. The flower-rich montane habitats are potentially the most vulnerable to climate change in Lebanon and a knowledge of the bee communities in these regions is the first step towards their conservation.

The first chapter is a state of the art knowledge of the bee fauna of Lebanon and is divided into two parts. The first part focuses on bumblebee distributions and flower records in Lebanon. We show that *Bombus terrestris* and *B. argillaceus* have a wide foraging range and are widespread in Lebanon. In contrast, *B. niveatus vorticosus* and *B. melanurus* are restricted to higher

altitudes and have narrower foraging ranges. We also investigate the subspecies of *Bombus terrestris* and suggest that it is represented in Lebanon by *B. t. calabricus* based on cephalic labial gland secretion analysis.

The second part of this chapter is dedicated to the checklist of the bees of Lebanon. We compile historic data from literature, museum collections, private collections, and recent collections. We count 573 species for Lebanon of which 289 are reported for the first time. The foraged flowers from recent collections are provided when possible along with any historic records from literature. We highlight the diversity of the local bee fauna and the knowledge gaps that remain.

The second chapter focuses on the heat stress resistance of 15 wild bee species with different sociality, distribution, and size. Females show a higher heat resistance than males in some species, and taxa show differences in heat stress resistance. We find that it is mainly large-bodied widespread taxa that show a variability of heat stress resistance in regard to dry weight, altitude, and Julian day. Our results highlight that many bee species have a low heat stress resistance.

The third chapter explores the variability of the bee community on the western slope of Mount Lebanon over the course of two years. We find decreasing bee species richness, generic richness, and bee abundance with increasing altitude. Furthermore, the variation in the wild bee community along the transect is mainly due to species turnover. Furthermore, we find that altitude and flower species richness affect bee species richness, while bee abundance is only affected by flower richness. We also see a correlation between beta diversity nestedness between both years, but not turnover. Our findings emphasize the roles of altitude and floral community on bee community varibility. We also highlight the importance of mountainous areas to preserve the overall diversity of the bee community.

The annexes present the works that fit into the larger context of the themes we tackle in this thesis, starting with the revision of the *Andrena* of Lebanon that has been carried out prior to the checklist of the bee fauna. The second annex presents a large-scale work on the heat stress resistance of bumblebees in which three species are included from Lebanon. The third annex presents a large-scale study on bumblebee pollen collection in which samples from Lebanon were included. We also present in the fourth and fifth annexes the work on the dissemination of information on the wild bees of Lebanon and a work in progress focused on producing Arabic common names for bees.

Overall, this thesis provides a first contribution to the study the bee fauna of Lebanon by combining available data sources with field surveys and studying the variability of bee communities along altitude. We also combine the taxonomic knowledge with experimental methods to measure heat stress resistance for a variety of local species. Finally, we highlight the high diversity of the Lebanese bee fauna and provide the first steps towards monitoring and assessments of the local species.

General Introduction

View of Fehta (Tannourine district, North Lebanon Governorate) from the highlands. Picture by Mira Boustani

General Introduction

1. Wild bees

1.1. Introduction to wild bees

Wild bees constitute the Anthophila clade within the Apoidea superfamily, and there are more than 20 400 species worldwide (Michener, 2007) belonging to seven families. The study of wild bees, referred to as melittology, has shown many advancements in the recent years with the description of hundreds of new species (Ascher & Pickering, 2021). Major re-structuration of the phylogeny has been made possible by genetic sequencing (Danforth *et al.*, 2013). Wild bees are morphologically diverse, ranging from less than 2 mm to almost 4 cm (Michener, 2007) in length, and display a wide range of shapes and colour patterns (Michez *et al.*, 2020). They can be eusocial such as honeybees (Seeley, 1985) and bumblebees (Goulson, 2010), semi-social such as *Ceratina* and *Xylocopa*, or solitary as is the case for most taxa (Engel *et al.*, 2020). Many genera are brood parasites, resembling wasps in shape with less body hair, and have no characteristic pollen collecting tools (Goulet & Hubert, 1993).

1.2. Bee-flower relations

The common behavioural trait of all wild bees is their dependence on pollen as a main food source (Michener, 2007; Leach & Drummond 2018) (except for three species of *Trigona* that feed on flesh (Noll, 1997)). This food choice leads to a strong bee-flower link (Woodard & Jha, 2017) resulting in a long-term co-evolution (Lunau, 2014; Pauw *et al.*, 2017). For example, zygomorphic flower shapes such as Fabaceae have evolved in adaptation to specific bee pollination methods (Cubas, 2004). Many flower species produce nectar as a main resource or a reward to attract pollinators (Parachnowitsch *et al.*, 2019). Consequently, the mutualistic relationship with flowers and their worldwide distribution and abundance makes bees important crop and wildflower pollinators.

1.3. Pollination by bees

Pollination is crucial to ensure cross-pollination and consequently plant reproductive success and fitness (Rick *et al.*, 1978; De Grandi-Hoffman & Watkins, 2000; Sapir *et al.*, 2017). Furthermore, the anatomy of bees has adapted to pollen collection through various structures. For instance, female bees from the genus *Megachile* have a ventral scopa (Fig. 1A), while female bees from the genus *Andrena* have scopae covering the hind leg (Fig. 1B) (Michener, 2007). Another example is *Hoplitis pici* that has hooked bristles on its mouthparts allowing to the more efficient removal of pollen from *Muscari* flowers (Mülller, 2006). These morphological adaptations are also complemented by specialised foraging behaviours adapted to the host plant such as buzzing, which consists of using the flight muscles to vibrate and help release the pollen (Portman *et al.*, 2019). In parallel, bees have developed several foraging strategies to maximise foraging efficacy, such as visiting larger flower clumps or higher density groupings that would offer more nectar reward (Bernhardt *et al.*, 2008) and reducing flight energy expenditures while foraging (Heinrich, 1975a). Since pollination by bees allows for a higher productivity of food crops, many studies have quantified their pollination service (Munyuli, 2014; Toni & Djossa, 2015; Tibesigwa *et al.*, 2019) and its variability between northern Europe and the Mediterranean where pollinators play a bigger economic role (Leondhart *et al.*, 2013). Furthermore, the service provided by the diversity of pollinating bees cannot be replaced by robotic bees (Potts *et al.*, 2018), and although hand pollination can be useful in specific agricultural settings (Toledo-Hernández *et al.*, 2020), it cannot replace the pollinators of wild plants in the wider environment.

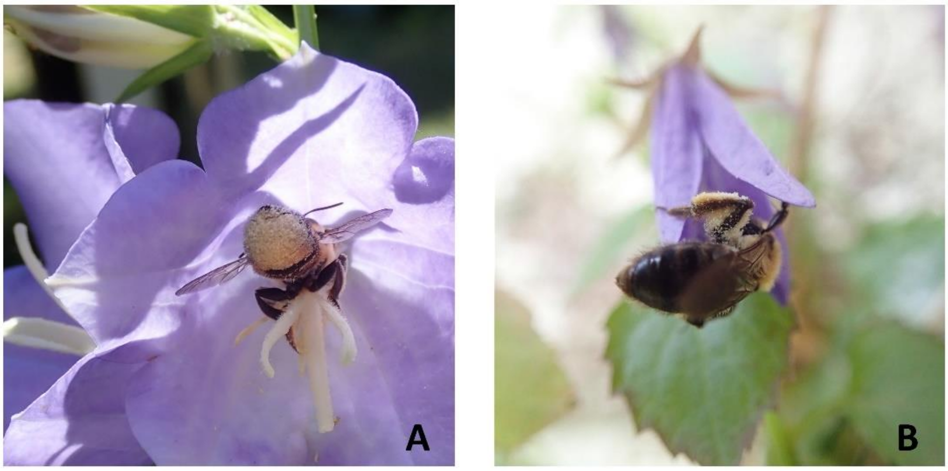

Figure 1: A) *Megachile* sp. showing the ventral scopa covered with pollen. B) *Andrena* sp. showing the hind leg scopa covered with

2. Wild bee population trends

2.1. General population trends

The Anthropocene has brought many environmental changes and new challenges to the fauna and flora of the planet. The main drivers of these challenges facing wildlife are climate change (Milligan *et al.*, 2009), the increase in extreme climatic events (Easterling *et al.*, 2000), and habitat loss and fragmentation (Hanski, 2011). In the context of this global loss of wildlife, many studies are highlighting the decline of insects, be it species loss, population declines, or reduced distributions (Wagner, 2019). Wild bees are no exception (Potts *et al.*, 2010). Because of their important role in crop and wildflower pollinators (Goulson, 2003), their loss is likely to have negative environmental and economic consequences (Leonhardt *et al.*, 2013). Although some species are expanding (Martinet *et al.*, 2015, Ghisbain *et al.*, 2021), many species show a decline (Nieto *et al.*, 2014; Rasmont *et al.*, 2015). Population trends have been best studied in Europe, where declines have mainly been observed for bumblebees, though many species lack sufficient data to be able to conduct rigorous analyses. At the European level only 43.3 % of species were assessed, and 5.2% of all species are considered to be threatened following the IUCN statuses (Nieto *et al.*, 2014). On the other hand, 56.7 % of species are data deficient and require direct monitoring, otherwise they could go extinct unnoticed (Bland *et al.*, 2015).

2.2. Species monitoring and determination

Data gaps are an obstacle to species monitoring. Although honeybees (*Apis mellifera*) have been the focus of many studies, their population trends are not a suitable proxy for the entirety of the wild bee fauna (Wood *et al.*, 2020). Therefore, monitoring programs should be put in place to gather distributional and ecological information on data deficient taxa (Fitzpatrick *et al.*, 2006). Furthermore, in order to assess a species conservation status a robust species concept and accurate taxonomy are necessary (Eardley & Kwapong, 2012; Ghisbain *et al.*, 2020). Indeed, conservation strategies should be developed for species and consider their specific needs and ecology (McPherson & Jetz, 2007). However, separating taxa can be challenging in the presence of cryptic species that may require the help of genetic sequencing (Williams *et al.*, 2012) or integrative taxonomy (Martinet *et al.*, 2019). Additionally, taxonomic biases can remain in large-scale datasets of well-studied areas due to overrepresentation of certain taxa such as bumblebees (De Palma *et al.*, 2016). Furthermore, highly diversified areas such as the Levant (Boustani *et al.*, 2021), and the Maghreb (Lhomme *et al.*, 2020) increase the difficulty of determinations as many taxonomic issues remain.

2.3. Historical data and predictions from north to south

The presence of historical collections in Europe and North America allows for an assessment of species conservation statuses with enough data, or assessments at the faunal level. For example, some European countries have produced red lists of their local bee fauna, i.e. Switzerland (Cordillot & Klaus, 2011), Belgium (Drossart *et al.*, 2019), the Czech Republic (Straka & Bogusch, 2017), and Ireland (Fitzpatrick *et al.*, 2006). When the quantitative data covers enough spatio-temporal grids, population declines or expansions can be studied over time. For instance, Van Dooren (2019) studied the decline of wild bees in the Netherlands over the last 80 years, Rasmont *et al.* (1993) reported species from the Belgian bee fauna declining over time, and Rollin *et al.* (2020) reported major population shifts of bumblebees in Belgium over recent decades.

Moving towards southern Europe, some northern Mediterranean countries have had recent checklists that are comprehensive and almost exhaustive, such as Portugal (Baldock *et al.* 2018), the Maltese Islands (Balzan *et al.*, 2016) and Cyprus (Varnava *et al.*, 2020). On the other hand, the high diversity of Mediterranean areas (Blondel & Aronson, 1999; Blondel *et al.* 2010) makes the exploitation of historical data more difficult, and revisions on the bee genera of the Mediterranean basin are necessary to construct a robust spatio-temporal image (Dorchin *et al.*, 2018; Dorchin, 2019; Wood *et al.*, 2020). While European Mediterranean countries have a starting point on the bee fauna knowledge, the MENA (Middle East and North Africa) countries remain poorly studied (Shebl *et al.*, 2021) with largely scattered studies and historical records over the last century.

3. The main challenges facing wild bees

Monitoring plans and historical data have allowed to pinpoint bee groups or taxa that displayed a decline in the last decades. Population shifts, individual bee species declines, and extinctions have been strongly linked to three main factors: habitat fragmentation and loss, food plant decline, and climate change.

3.1. Habitat fragmentation

Habitat fragmentation affects the bee fauna at a larger scale, starting from the plant-pollination relationships that affect both pollinator abundance and plant fitness (Rathcke *et* *al.*, 1993), and also affecting host–parasitoid networks (Grass *et al.*, 2018). Furthermore, the diversity patterns of bee communities fluctuate over time (Hung *et al.*, 2017). On the species level, the responses are heterogenous and seem to be best explained by ecological traits linked to diet and nesting behaviour (Cane *et al.*, 2006; Ramírez *et al.*, 2012). This heterogeneity is also dependent on several spatial factors, such as patch size, isolation, and complexity (Lázaro *et al.*, 2020). In addition, these habitat changes affect intraspecific body size in bees over different habitat fragments (Warzecha *et al.*, 2016), and over time (Gérard *et al.*, 2020).

3.2. Habitat destruction

Other events and land-use factors can also have a significant impact on habitat availability for wild bees. For instance, wildfires can change the availability of flower resources and change the structure of the bee community over the following decades (Vinson et al., 1993; Potts *et al.*, 2003). Furthermore, overgrazing in natural or semi-natural areas can dramatically re-structure the host plant availability and consequently the bee community (Mayer, 2007; Xie *et al.*, 2008; Yoshihara *et al.*, 2008). Finally, the spread of urbanization over the last decades is also a major threat to wild bee species diversity (Cardoso & Gonçalves, 2018).

3.3. Host plant decline

Suitable habitats and nesting sites notwithstanding (Harmon-Threatt, 2020), the availability of food resources is key for the presence of wild bees (Rasmont & Mersch, 1988; Bagella *et al.*, 2013; Neumüller *et al.*, 2020; Ropars *et al.*, 2020). Additionally, both bee and plant communities co-vary in response to habitat loss and impacts of land use (Papanikolaou *et al.*, 2017a). Furthermore, wild plants have been declining driven by climate change (Harisson, 2020), and are also subject to shifts in latitude and altitude (Bertin, 2008). As a result, the decline of food plants will be one of the drivers of bee declines (Roulston & Goodell, 2011;

Scheper *et al.*, 2014). On the other hand, patches with a high floristic diversity that offer a solid food supply for foraging bees can compensate for the effects of habitat loss (Hülsmann *et al.*, 2015).

3.4. *Climate change and heat waves*

Another important driver of bee species decline is climate change, which has been recently linked to population declines of pollinating insects (Rasmont & Iserbyt, 2012; Marshman *et al.* 2019) and the sixth mass extinction of wildlife (Raven & Wagner, 2021). This is driven by two major mechanisms: temperature increases (Halsch *et al.*, 2021), and an increased frequency of extreme climatic events (Filazzolla *et al.*, 2021). Bees are particularly vulnerable to climate change (Goulson *et al.*, 2015; Soroye *et al.*, 2020; Lima & Marchioro, 2021; Rasmont & Iserbyrt, 2021), and have been the focus for numerous studies on abundance modelling (Iserbyt & Rasmont, 2012; Koh *et al.*, 2015), and future projections based on different climate change scenarios (Rasmont *et al.*, 2015; Gonzales *et al.*, 2021). Additionally, taxa with restricted distributions seem to be the most vulnerable (Giannini *et al.*, 2020). Furthermore, extreme climatic events are becoming more frequent and more intense (Easterling *et al.*, 2000; Meehl & Tebaldi, 2004). These events have negative effects on wild fauna (Jiguet *el al.*, 2011) and are suspected to cause high mortality in insect populations (Abarca *et al.*, 2019). One example is heat waves, that are defined by a period of two consecutive days with the temperature exceeding 40.6 °C (Robinson, 2001). Heat waves can compromise development and fitness of insect populations (Fischer *et al.*, 2014), reducing fertility (Martinet *et al.*, 2020), and even causing extinctions (Rasmont & Iserbyt, 2012). Additionally, the high temperatures often surpass species innate heat resistance causing changes in distribution (Hamblin *et al.*, 2017) and certain behaviours (Ma & Ma, 2016).

As in the case of other decline drivers, responses of different species to climate change are also variable (Cariveau & Winfree, 2015). Indeed, bee declines caused by climate change can be buffered by semi-natural areas (Papanikolaou *et al.*, 2017b) and stabilised by bee species diversity (Rader *et al.*, 2013). Therefore, studying insect resistance to extreme temperatures is key to understand current distributions and forecast their population trends and extinction risks (Overgaard *et al.*, 2014, García-Robledo *et al.*, 2016).

4. Breakdown of resistance to heat stress

4.1. Insect thermoregulation

Resistance to temperature stress by insects is achieved by thermoregulation, this process is linked to both behaviour and physiology (Sanborn, 2018). Insects can be either ectothermic or endothermic, and endothermy is achieved by generating heat using the flight muscles as in the case of moths and bumblebees (Heinrich, 1974; Heinrich, 1979, see example in Fig. 2). In the case of wild bees, the wide range of body sizes and behaviour patterns suggests that different genera may have varying thermoregulation strategies. For instance, bumblebees thermoregulate by increasing thoracic temperature as air temperature increases (Heinrich, 1975b; Heinrich, 1979), whereas smaller-size *Apis* and *Centris* decrease metabolic rates when flying at high temperatures (Robets & Harrison, 1998). Furthermore, regulation of thoracic temperatures for bumblebees is also dependant of individual body size and gut content (Heinrich, 1975b). Finally, gene expression can also enhance cold tolerance of bumblebees (Liu et *al.*, 2020; Pimsler *et al.*, 2020).

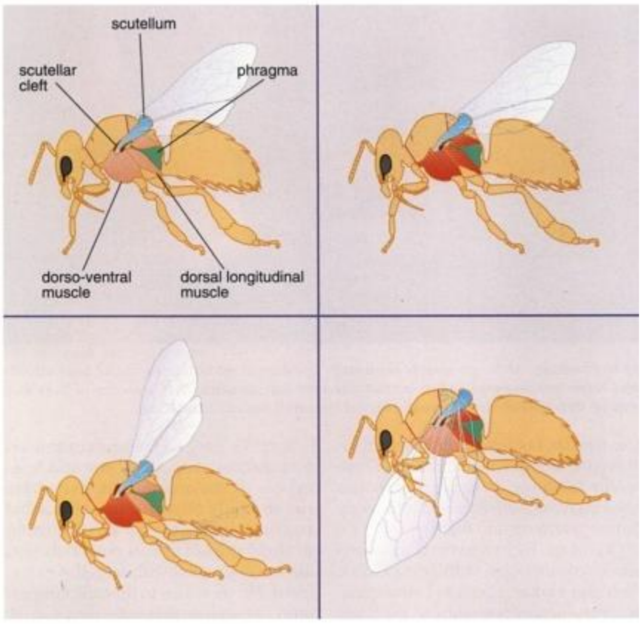

Figure 2: Illustration of the warm-up process in some bees involving the flight muscles movement, from Heinrich & Esch (1994)

4.2. *Components and variability of insect heat stress resistance*

In addition to the thermoregulation strategies of insects, several behavioural, physiological, and environmental factors are involved in managing higher temperatures (Uvarov, 1931). Behavioural adaptations include sheltering, such as the rice leaf folder (Lepidoptera) that increases the speed of leaf folding after heat exposure (Bodlah *et al.*, 2017) and heat-escaping behaviour in Aphids when foraging in high temperatures (Ma & Ma, 2012). Furthermore, social insects like honeybees and stingless bees have collective nest thermoregulation strategies such as fanning hot air out of the nests (Vollet-Neto *et al*., 2015; Pérez & Aron, 2020). On a physiological level, insects can respond to heat stress by producing heat shock proteins (Zhao & Jones, 2012; King & MacRae, 2015). These molecular chaperones protect proteins from denaturation under extreme conditions, and their production may differ under different biotypes (Mahadav *et al.*, 2009).

Heat resistance of insects has lower plasticity than cold resistance (Hoffmann *et al.*, 2012; Pimsler *et al*., 2020). However, it can still be improved by hardening (Sejerkilde *et al.*, 2003), by higher body mass (Klockmann *et al.* 2016) and higher water content (Nyamukondiwa *et al.*, 2018). In contrast poor nutrition has been shown to worsen insect response to heat stress at both individual (Iltis *et al.*, 2021) and colony levels (Vanderplanck *et al.*, 2019). Although many factors can influence the heat stress resistance variability, species seems to be one the most important. Indeed, a growing body of research concurs with interspecific variability of heat stress resistance across insect groups (Klok & Chown, 2003; Zhu *et al.*, 2017; Franken et al., 2018), and has been also observed in wild bees (Oyen *et al.*, 2016; Zambra *et al.*, 2020; Martinet *et al.*, 2021).

5. Bee community variability

Extreme climatic events have a direct impact on bee population trends, and structure bee communities and distributions. In parallel, bee communities are highly variable spatially and temporally and differ strongly between habitats or even sites of nominally the same habitat type. This variability is influenced by many factors, such as altitude, plant community, and vegetation cover.

5.1. Altitude and temperature

Altitude is one of the most influential factors on insect communities (Jacobsen *et al.* 2003, Mihoci *et al.*, 2011) and bees are no exception (Perillo *et al.*, 2017, Widhiono *et al.*, 2017). Indeed, altitude is correlated with several key environmental factors that are equally important, specifically temperature (Wang *et al.*, 2011) and vegetation cover (Naud *et al.*, 2019). One common insect population pattern observed along altitudinal transects from lower to higher altitudes is decreasing species diversity and decreasing abundance (McCain & Grytnes, 2010; Pinto *et al.*, 2019), and taxa restricted to fewer taxonomic groups (Hoiss *et al.*, 2012). Furthermore, all three trends can be observed simultaneously (Sydenham *et al.*, 2014). In parallel, temperature decrease along an altitudinal gradient has a strong correlation with the decrease of bee diversity and abundance (Osorio-Canadas *et al.*, 2021). Indeed, decreasing temperature seems to limit bee diversity at higher altitudes due to the energetic constraints of foraging as ectotherms (Classen *et al.*, 2015). Similarly, higher vegetation temperatures were correlated with higher insect diversity in agricultural landscapes (Horák, 2021). Micro-climate also affects species distributions and local abundance through oviposition site selection (Eilers *et al.*, 2013), and through influencing their thermal limits (Alford *et al.*, 2017). Therefore, predicting insect abundance more accurately requires data on microclimatic conditions (Rebaudo *et al*., 2016).

5.2. Plant community and flower preferences

High plant diversity (Zhang *et al.*, 2016), as well as denser (Sáenz-Romo, 2019), and more diverse vegetation cover (Winter *et al.*, 2018), have often been correlated with higher insect diversity. While plant diversity alone is a good predictor of insect diversity, the relationship is stronger with plant phylogenetic diversity (Procheş *et al.*, 2009). Furthermore, canopy cover as well as herbaceous layer diversity are significant factors on pollinator diversity (Scherber *et al.*, 2014). In contrast, species richness and diversity both decrease when the vegetation cover consists of non-native plants (Oliver *et al.*, 2016), and in fragmented habitats (Donaldson *et al.*, 2002). The effects of plant communities on bee communities are the manifestation of their relationship with their host-plants. Bee species can be found on a specialization spectrum between polylectic with a wide foraging range, and oligolectic with a forage range restricted to one botanical family (Proctor *et al.*, 1996; Müller, 1996), rendering this second group more dependent on host plant availability (Bogusch *et al.*, 2020). Consequently, the presence of food plants, these being within an adequate foraging distance (Gathmann & Tscharntke, 2002), is necessary for the presence of the associated pollinator taxa. Variations in foraging preferences between sexes and in different habitats have been shown (Pascarella, 2007; Ritchie *et al.*, 2016). Furthermore, variation in the pollen collected by individuals from the same colonies influenced by the geographical foraging range (Saifuddin & Jha, 2014). Additionally, when introduced to new biogeographical regions, it has been shown that bees tend to prefer flowers from their native biogeographical range but also collect pollen from other plants present in the environment (Vaudo *et al.*, 2020). This reinforces the role of the habitat in providing good quality nutrition for native and non-native bees, thus playing a role in the species fitness (Leach & Drummond, 2018).

6. Bee species conservation requirements

Conservation plans require a layered knowledge of several key points surrounding the targeted species. Indeed, species taxonomy should allow for a correct determination (Mace, 2004), backed up by the publication of verified data to feed public databases (Costello *et al.*, 2015). This requires the collaboration between taxonomists and conservation biologists (Dubois, 2003). Additionally, the ecology of the species should be studied, namely habitat and geographical range (Sanderson *et al.*, 2002; Rasmont *et al.*, 2015), food plants (Müller, 2006), hosts in the case of parasites (Gillespie, 2010) and nesting requirements (Russel *et al.*, 2005). Finally, this conservation plan should be put in context as part of a larger fauna (Batley & Hogendoorn, 2009), and as part of an ecological niche that is potentially shared by competitor species (Wojcik *et al.*, 2018). On one hand, conservation strategies and law-making should be done in close collaboration with scientists (Hipólito *et al.*, 2021). On the other hand, conservation can benefit greatly from raising awareness and encouraging citizen science as long as the resulting data is properly managed and validated (MacPhail *et al.*, 2020).

7. Studies on the Lebanese bee fauna

7.1. *Geographical context*

The Mediterranean is a geographical range with high floristic and faunistic diversity and many diversity hotspots (Heywood, 1995; Médail & Quézel, 1997; Pignatti & Pignatti, 1999; Blondel *et al.*, 2010). There are also many regions of high floral and faunal endemism (Myers, 1990; Médail & Quézel, 1999; López-Villalta, 2010). However, future climatic predictions for the Mediterranean region predict drier summers, more variability between years, and an overall increase in temperatures (Fig. 3; Giorgi & Lionello, 2008). Indeed, the Mediterranean biodiversity is threatened by climate change (Resco de Dios *et al.*, 2007; Abott & Le Maitre, 2010; Newbold *et al.*, 2020), and future research needs to encompass the numerous mechanisms behind the ecosystem changes (Doblas-Miranda *et al.*, 2014).

Within the Mediterranean basin, one important biodiversity hotspot is the Levant (Por, 1975), which is located on the Eastern Mediterranean strip. The topography and location along the coast produce a wide range of habitats (Blondel et al., 2010).

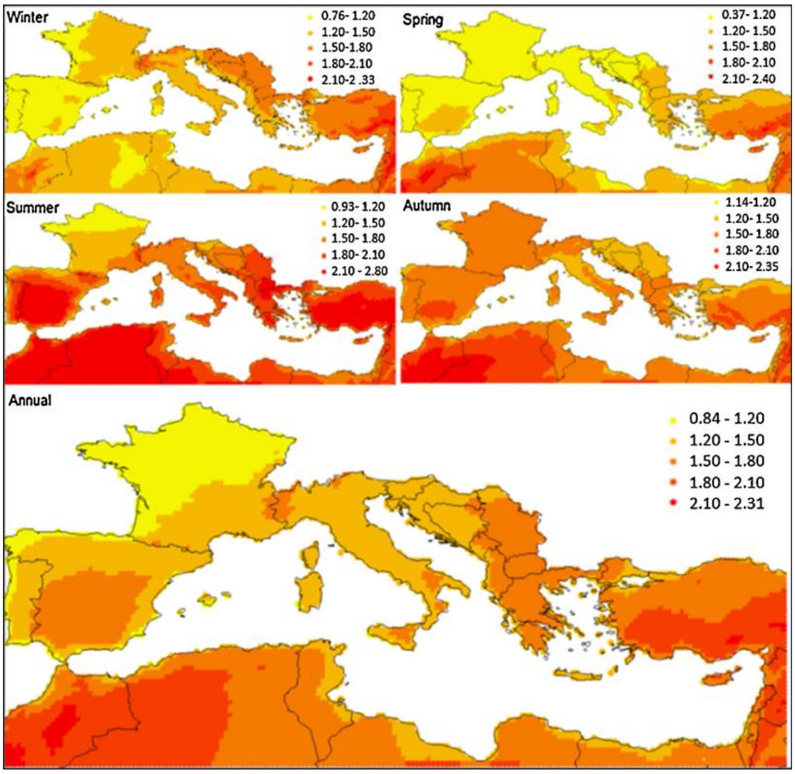

Figure 3: Spatial pattern of the mean annual and seasonal temperature difference (◦C) between 2000 and 2050 from Saadi *et al.*, 2015.

Lebanon is a relatively small country of 10,452 km² surface located in the heart of the Levant (Fig. 4). The mountainous landscape is generated by two mountain chains running north to south (Fig. 5) that generate an alternance of plains and mountains from west to east. Consequently, the landscape shifts from the humid Mediterranean along the coast, to progressively more arid mountains and plains towards the east (Abi-Saleh & Safi, 1988). This aridity transect has already been closely studied through the characterisation of the vegetation covers (Zohary, 1973). The study of plants is well established in Lebanon with more than 3,000 plant species, and the vegetation covers of altitude ranges from the coast to the Syrian border are also well-known (Mouterde 1966; 1970; 1984). This wealth of information on the flora gives us precious insight into the high diversity of Lebanon and is a key factor for the study of insects. Additionally, the vegetation map (Fig. 6) shows rapid shifts along altitudes (Abi-Saleh & Safi, 1988), making Lebanon a case study of humid and semi-arid Mediterranean habitats, including the high-altitude plateaus reaching 3,088 m for Mount Lebanon, and 2,814 m for the Anti-Lebanon chain.

Figure 4: Map of the administrative Levant countries with Lebanon represented in pink. Copyright © 2010, 2013 by Ian Macky.

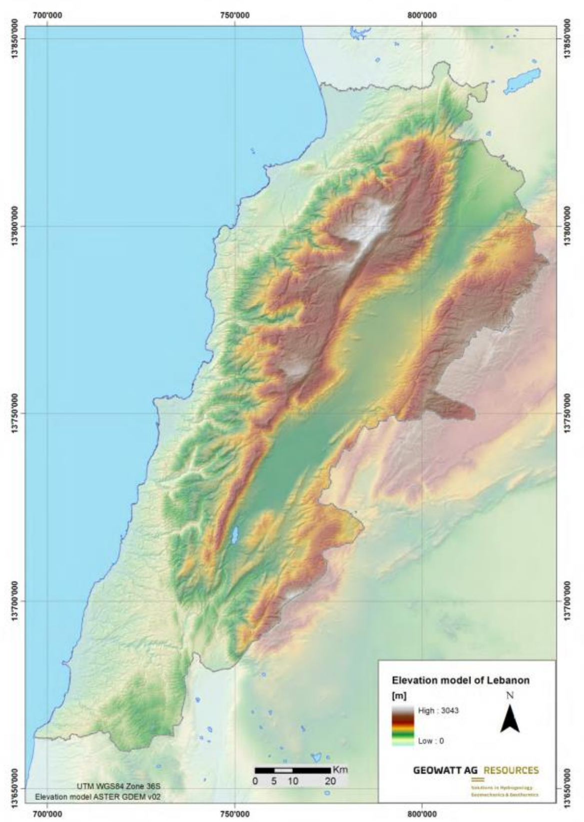

Figure 5: Elevation model of Lebanon (meters a.s.l.) from The National Geothermal Resource Assessment of Lebanon, 2014.

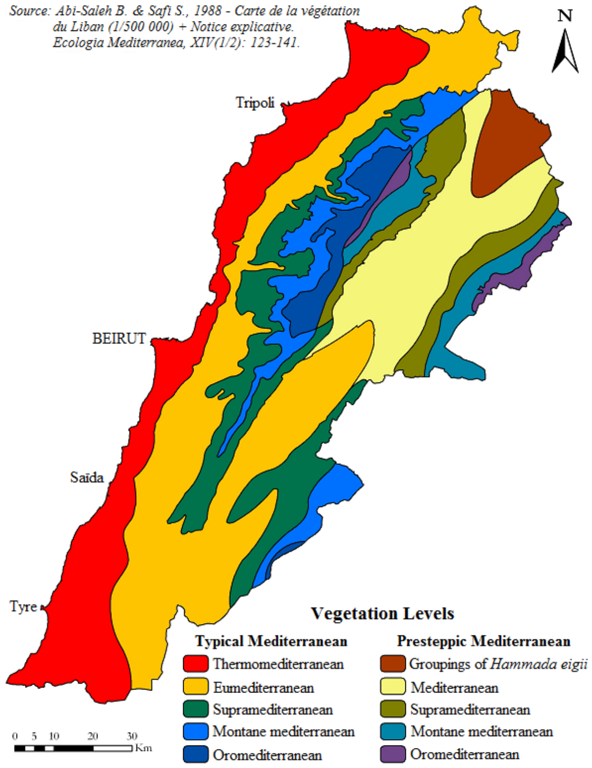

Figure 6: Vegetation map of Lebanon (Safi, 2012).

7.2. Historical instability

Lebanon has undergone many geopolitical changes in the last centuries, including drastic changes of the borders (Traboulsi, 2012). The initially smaller Lebanon under the Ottoman rule (Fig. 7) encompassed mainly what is Mount Lebanon province today until the end of World War I (Reilly, 1999), with borders shifting once again under the French Mandate, and finalising with the borders it has today after independence in 1943 (Hakim, 2019). Furthermore, as Syria has always been the largest part of the Levant, there is a historical confusion as to the use of the term as it has often been used to refer to the entire eastern Mediterranean strip. In the recent decades, Lebanon has been the stage of ongoing political turmoil (Rabinovich, 1984; Geukjian, 2014), and is currently experiencing a pronounced economic crisis (Youssef, 2020). Three main problems stem from this: i) the geographical changes outlined above make the use of historical data difficult as it is often impossible to relocate (Boustani *et al.*, 2021), ii) political instability perpetually makes study of the local fauna a low priority (Siddig, 2014; Siddig, 2019), iii) implementing monitoring plans is made more difficult by political instability and many areas along the borders become impossible to reach due to ongoing conflicts. Therefore, the political context adds a layer of complexity to the advancement of the studies on the bee fauna.

7.3. Towards a state of the art knowledge of the Lebanese bee fauna

The entomofauna of Lebanon in general is little-studied, and few groups have been the subject of recent revisions. As in most parts of the world the best studied groups remain Coleoptera (Cocquempot *et al.*, 2016; Háva & Németh, 2016, Szénasi *et al.*, 2019; Cocquempot *et al.*, 2020) and Lepidoptera (Larsen, 1974; Bálint *et al*, 2016; Zorkot, 2016). What is already known of these groups for Lebanon show a high diversity compared to the surface area of the country. The mountainous landscape of Lebanon along with the high floristic and insect diversity suggest that pollinator groups such as wild bees will have a very high diversity. Furthermore, most of the historical data on wild bees we have from Lebanon and the Levant in general is scattered in space and time (Shebl *et al.*, 2021). Therefore, the knowledge gap around the Lebanese bee fauna and the threat of climate change highlights the need for an assessment of the local bee taxa. Indeed, improving the knowledge on the local bee taxa is the first step towards their monitoring and their conservation, and the cornerstone of ecological research.

8. Background and objectives

Filling the knowledge gap on the Lebanese bee fauna is made more challenging by the economic and politic instability. However, it becomes an urgent task in the context of the rapid changes that the Lebanese territory is undergoing. Indeed, Lebanon has known and exponential rise in urbanization in the recent decades (Masri, 1999; Masri *et al*., 2002) that results in natural habitats destruction. Natural areas are also facing possible damages from overgrazing (El Hajj *et al*., 2015). In addition, Cedar forests in Lebanon risk a loss of species diversity and damages from pest outbreaks driven by climate change (Sattout & Nemer, 2011). Furthermore, drier and hotter summers in Lebanon are increasing the risk of wildfires (Salloum & Mitri, 2014), and causing further damage to the shrinking forest areas.

Therefore, we focus on natural and semi-natural habitats in the higher altitudes of Mount Lebanon in this thesis. Indeed, this range encompasses a variety of forests, including Cedar forests, as well as the highest altitude habitats in Lebanon that are potentially the most vulnerable to climate change. The focus area allows for a simultaneous sampling of bee communities across different altitudes and isolated model species that may be among the most vulnerable to extreme climatic events.

The main objective of the thesis is to produce a state of the art knowledge of the Lebanese bee fauna with focus on a mountainous transect in the humid Mediterranean climate of Mount Lebanon and to set a baseline for climatic risk assessment and biodiversity monitoring. Through focusing on the bee fauna of natural and semi-natural habitats, we aim to provide a comparison point for future studies that will target the effects of land use.

Ultimately, the thesis aims to facilitate conservation measures for the local bee fauna, and the implementation of a long-term monitoring plan. The work is divided into three main tasks:

i) Producing an annotated list of the bee fauna of Lebanon based on literature, museum collections, and recent collections; ii) Assessing the climatic risk on model wild bee species with different distributions and traits; iii) Analysing the wild bee community variability in a model mountain ecosystem that is vulnerable to climate change.

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Chapter 1

The bee fauna of Lebanon

Top left: *Andrena flavipes* ♀; top right: *Megachile manicata* ♂; bottom right: *Hylaeus sidensis* ♂; bottom left; *Eucera plumigera* ♀. All pictures taken by Pierre Rasmont (in Zootaxa).

This chapter presents the state of the art knowledge of the Lebanese bee fauna. A summary of the collected data is presented at the beginning of this chapter. The first part focuses on the four species of *Bombus* present locally, and the second part in an annotated checklist of the bee fauna with local distributions and flower preferences.

Summary of collected data:

This part presents a summary and a map of historic data and recently collected material.

Part 1:

Boustani M., Yammine W., Nemer N., Abou Fakhr Hammad E., Michez D. & Rasmont P. (2020) Distribution and flower visitation records of bumblebees in Lebanon (Hymenoptera: Apidae). *Annales de la Société entomologique de France (N.S.)*. 56(2), 115–124.

Part 2:

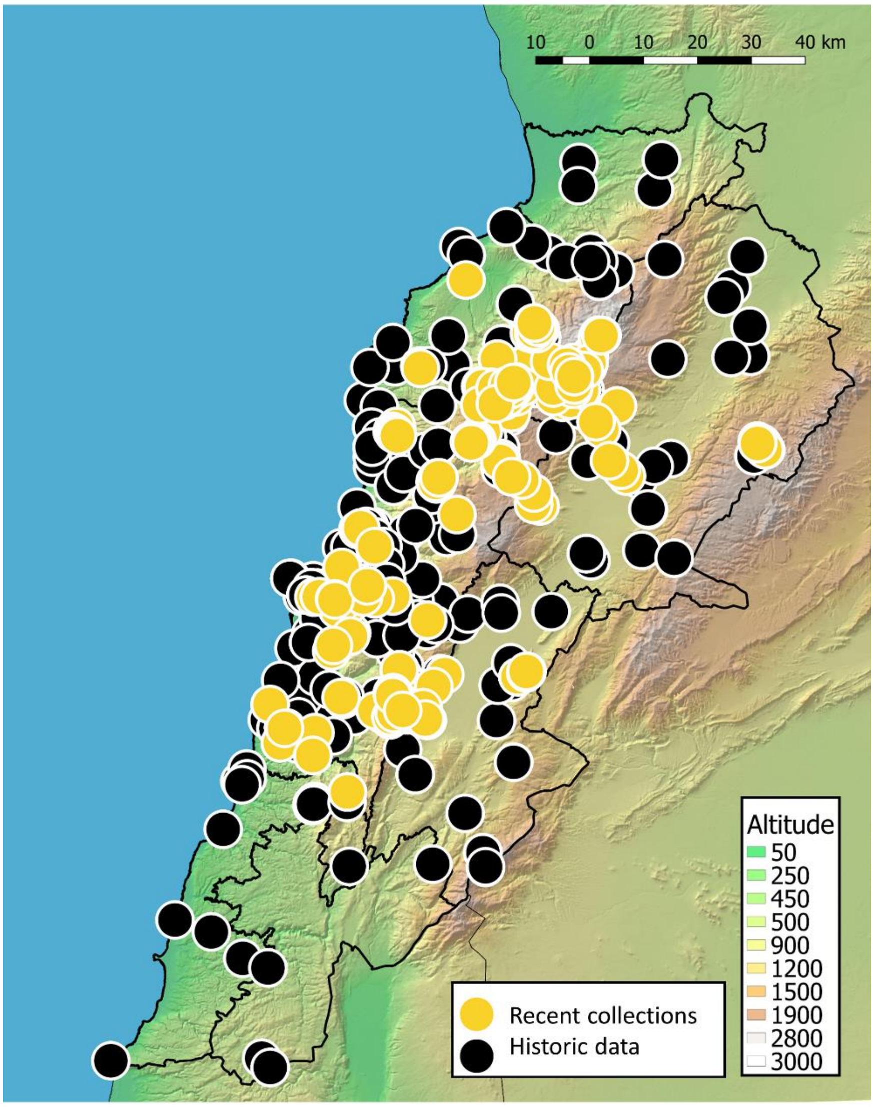
Boustani, M., Rasmont, P., Dathe, H.H., Ghisbain, G., Kasparek, M., Michez, D., Mueller, A., Pauly, A., Risch, S., Straka, J., Terzo, M., Van Achter, X., Wood, T.J. & Nemer, N. (2021) The bees of Lebanon (Hymenoptera: Apoidea: Anthophila). *Zootaxa*. 4976(1), 001–146.

Associated Annex: Annex I

Wood, T.J., **Boustani M.**, & Rasmont P. (2020). A revision of the Andrena (Hymenoptera: Andrenidae) of Lebanon with the description of six new species. *Annales de la Société entomologique de France (N.S.)*. 56(4), 279-312.

Summary of collected data

This section aims to present some key numbers on the data gathered in the context of this thesis. Approximately 10 000 biogeographic data have been compiled for this thesis from literature, private collections, and collected specimens. This number excludes all data from grey literature that could not be validated. The recent collections (starting 2015) amount to 8889 specimens and observations (7996 collected specimens). Of these recent collections 5839 specimens and observations (5339 collected specimens) were collected by Mira Boustani.



Map showing all historic data in black, and recent collections starting 2015 in yellow.

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Distribution and flower visitation records of bumblebees in Lebanon (Hymenoptera: Apidae)

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(Accepté le 27 mars 2020)

Summary. West Palearctic bumblebees are common wildflowers and crop pollinators that are well studied in their central and northern distribution ranges, but fewer information is available on their southern distribution areas. Lebanon falls on the southern limit of their distribution and no published information is available on the local bumblebees. Our study aims to produce a data baseline of the local bumblebee species. In order to do so we grouped available old records of bumblebees in Lebanon with recent author collections and produced preliminary distribution maps. We listed four species: *Bombus terrestris, B. argillaceus, B. niveatus vorticosus* and *B. melanurus*. Preliminary distribution shows that *Bombus terrestris* and *B. argillaceus* are widespread and have a large foraging range, whereas *B. niveatus vorticosus* and *B. melanurus* have a restricted distribution to altitudes above 1800 m with a smaller foraging range. The male cephalic labial gland secretions analysis of local *Bombus terrestris* specimens provides preliminary evidence that the local subspecies could be *Bombus terrestris calabricus*. Therefore, we highlight the importance of regulating foreign *Bombus terrestris* subspecies importation for agriculture purposes, as well as monitoring *B. niveatus vorticosus* and *B. melanurus* that are rendered vulnerable by their isolated populations.

Résumé. Distribution et enregistrement des visites de fleurs par les bourdons au Liban (Hymenoptera : Apidae). Les bourdons du Paléarctique occidental sont des pollinisateurs communs de fleurs sauvages et de cultures, qui sont bien étudiés dans leurs aires de répartition centrale et septentrionale, mais moins d'informations sont disponibles pour leurs aires de distribution méridionales. Le Liban se trouve à la limite sud de leur répartition et aucune information publiée n'est disponible sur les bourdons locaux. Notre étude vise à produire une base de données sur les espèces locales de bourdons. Pour ce faire, nous avons regroupé les anciens signalements disponibles de bourdons au Liban avec les collections récentes des auteurs, et produit des cartes de distribution préliminaires. Nous avons répertorié quatre espèces : *Bombus terrestris, B. argillaceus, B. niveatus vorticosus* et *B. melanurus*. La distribution préliminaire montre que *Bombus terrestris* et *B. argillaceus* sont répandus et ont une grande aire de butinage, tandis que *B. niveatus vorticosus* et *B. melanurus* ont une distribution restreinte à des altitudes supérieures à 1800 m, avec une aire de butinage plus petite. L'analyse des sécrétions des glandes labiales céphaliques mâles des spécimens locaux de *Bombus terrestris* fournit une preuve préliminaire que la sous-espèce locale pourrait être *B. terrestris calabricus*. Par conséquent, nous soulignons l'importance de réglementer l'importation de sous-espèces étrangères de *Bombus terrestris* à des fins agricoles, ainsi que de surveiller *B. niveatus vorticosus* et *B. melanurus*, rendus vulnérables par l'isolement de leurs populations.

Keywords: bio diversity; distribution; pollination; faunistics; Palaeartic; Near East

Bumblebees (*Bombus* Latreille, 1802) form a genus of wild bees that includes about 260 species worldwide (Williams 1998; Cameron & Sadd 2020). They are pollinators of many wild plants and cultivated crops (Mänd et al. 2002; Goulson 2010; Ballantyne et al. 2015). Well adapted to colder regions, they are found all over Europe and Asia to the Arctic. They are also present throughout the Americas but are absent from Africa south of the Sahara and from Oceania (Williams 1998; Hines 2008; Rasmont & Iserbyt 2010-2014), except New Zealand and Tasmania where they have been imported for pollination (Goulson & Hanley 2004). The West Palearctic distribution and status of bumblebees are relatively well documented (Rasmont et al. 2015), but less information is available on species found in the south of this region, including Lebanon. The topography of this country presents several mountainous areas that are potentially favorable to bumblebees (Özbek 2002; Rasmont & Iserbyt 2010-2014; Saini et al. 2012). However, the Lebanese wild bee fauna remains poorly documented. The main references are from Mavromoustakis (1955, 1956, 1962) that produced an inventory of wild bees belonging mainly to the tribes Anthidiini and Osminii based on his own collection trips, as well as describing several new species. His findings were included in the review compiled by Grace (2010). Aside from these

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records, to our knowledge there have been no documented findings. On the other hand, records from neighboring countries report 45 species from Turkey (Rasmont et al. 2009), two from Syria (Solaiman-Khaled et al. 2012) and Israel (Rasmont & Iserbyt 2010-2014).

In order to fill this gap of information on the presence and diversity of Lebanese bumblebees, our objectives for this paper are to present our observations from several habitats across Lebanon, and secondly to assemble unpublished records and museum collection specimens in order to produce a biogeographic data baseline.

Materials and methods

Study area

Our collections were carried out in the governorates of North Lebanon, Mount Lebanon and Beqaa. Following the vegetation levels classification of Abi-Saleh & Safi (1988), the collection areas fall into the Eumediterranean (500–1000 m), Supramediterranean (1000–1500 m), Montane Mediterranean (1500–2000 m) and Oromediterranean (>2000 m) on the western slopes of Mount Lebanon (Typical Mediterranean); and into the Mediterranean (1000–1500 m), Supramediterranean (1400–1800 m), Montane Mediterranean (1800–2400 m) and Oromediterranean (>2400 m) on the Eastern slopes (Presteppic Mediterranean). It has to be noted when validating old data that the Lebanese border has undergone changes from Ottoman Empire, the French mandate and independence (Barnett et al. 2019). In this paper, we only consider the present Lebanese borders (from 1943).

New specimen collection protocols

Collections were carried out individually by M. Boustani, W. Yammine and P. Rasmont between April 2016 and September 2017 in the following regions separately: Ammiq (973 m), Baskinta (1430 m), Beit Chabab (740 m), Dahr El Qabib (2500 m) and Qornael (1234 m). Collections were also carried on a transect between Tannourine El Tahta (900 m) and Arz Tannourine (1800 m), and between Arz Bcharré (1800 m) and Qornet El Sawda (3000 m).

All collections were made using hand nets. Bee specimens were killed using ethyl acetate or by freezing, then pinned and identified to species level, using reference specimens from the University of Mons collection. Flowers visited by bumblebees were sampled by collecting specimens for herbarium, they were then identified to species level using Mouterde (1966, 1970, 1984).

Databasing and mapping

Bombus specimens from entomological student collections of the American University of Beirut (AUB) and the Holy Spirit University of Kaslik (USEK) collections were examined, identified, and integrated into our database in addition to the new specimens collected. We also integrated the available original data from Lebanon included in the *Banque de Données Fauniques de Gembloux et Mons*.

Specimens without labels were eliminated from the counts. Specimens labeled only with country name were included in the counts but are not displayed on the map.

All data were digitized using Data Fauna Flora 5.1.2 (Barbier et al. 2000) and mapped with Quantum GIS 2.18.27.

Subspecies identification of Bombus terrestris *samples*

The diagnostic character of cephalic labial gland secretions (CLGS) is often used as a tool to delimitate bumblebee species (e.g. Lecocq et al. 2015b; Martinet et al. 2018) and has also been used to differentiate subspecies in *Bombus terrestris* (Lecocq et al. 2016). We cross-checked the morphological subspecies identifications of *B. terrestris* with a quantitative GC-FID analysis of CLGS according the protocol established by Demeulemeester et al. (2011) using five Lebanese specimens collected as follows: 1 male from Tannourine Reserve Gate Area (34°12′27.9″N 35°55′56.9″E, 1796 m) and 4 males from Tannourine Reserve Trail 4 (35°55′56.9″N 35°55′56.0″E, 1781 m). All details of the methodology are presented in supporting information (Appendix S1). We assessed CLGS differentiations of the 5 Lebanese specimens to the 9 Sicilian *Bombus terrestris calabricu*s of the same cluster using a multiple response permutation procedure (MRPP) (R-package vegan, Oksanen et al. 2011).

Results

A total of 269 specimens and field observations were assembled from the following sources: 11 from *Base de données Gembloux et Mons*, 12 from AUB, and 7 from USEK collections, 116 from the Mira Boustani collection, 83 from the Pierre Rasmont collection, and 39 from the Wael Yammine individual collections. Details of the specimens examined from the AUB and USEK collections are listed in Table 1.

Four species of *Bombus* were identified: *B. niveatus vorticosus* (Kriechbaumer, 1870) (55 specimens, Figure 1a), *B. terrestris* (Linnaeus, 1758) (164 specimens, Figure 1b), *B. argillaceus* (Scopoli, 1763) (28 specimens, Figure 1c) and *B. melanurus* (Lepeletier, 1836) (21 specimens, Figure 1d).

Bombus terrestris (Linnaeus, 1758)

Species distribution. Centered on the Mediterranean (except Egypt) stretching north to Stockholm and east to Altai (Rasmont et al. 2008, 2015; Rasmont & Iserbyt 2010-2014).

Local distribution. Figure 2b. 27♀, 90☿, 46♂, 2 sex not specified: Ehden (5♀, 37☿, 5♂), Fatri (1☿), Arsoun (2☿, 1♂), Qartaba (1☿), Arz Bcharre (5♀, 5☿, 7♂), Qannoubine (1♂), Dahr El Adib (2☿), Qornet El Sawda (1♀, 3☿), Arz Tannourine (1♀, 2☿, 12♂), Harissa (1☿), Batroun (1♀), Falougha (2☿), Aley (1♂), Maameltein (1♀), Ammiq (3☿, 1♂), Qnat (5☿), Qornayel (1♂), Jounieh (1♂), Baskinta (3☿, 1♂), Beit Chabab (4☿), Hboub (1♀), Halate (1♀), Bawarij (1☿), Sawfar (2☿), Hadath Al Jebbeh (11♀, 15☿, 16♂, 2 unknown).

Altitude range in Lebanon. From sea level (Maameltein) to 3000 m (Qornet El Sawda).

Flowers visited in Lebanon. Apiaceae: *Prangos asperula* Boiss. (1☿). Asteraceae: *Cousinia libanotica* D.C.

Table 1. Details of specimens of *Bombus* examined from American University of Beirut (AUB) and Holy Spirit University of Kaslik (USEK).

Taxon	Sex	N	Collector	Collection	Date	Locality	Governorate	Altitude
B. argillaceus	♀	1	Boustani M., Kyrk S.	USEK	2.V.2016	Arsoun	Mount Lebanon	640
B. argillaceus	♀	1	Boustani M.	USEK	20.VI.2016	Bcharre Forest	North Lebanon	1928
B. argillaceus	♀	1	Boustani M.	USEK	19.VI.2016	Ehden	North Lebanon	1567
B. argillaceus	☿	1	Usayran W.	AUB	8.VI.1985	Zahrani	South Lebanon	500
B. melanurus	♀	2	Boustani M.	USEK	24.VI.2016	Bcharre	North Lebanon	2723
B. melanurus	☿	1	Boustani M.	USEK	20.VI.2016	Bcharre	North Lebanon	2611
B. niveatus	♀	1	Yammine W.	USEK	24.VI.2016	Bcharre	North Lebanon	2723
B. niveatus	♀	1	Boustani M.	USEK	20.VI.2016	Bcharre	North Lebanon	2611
B. terrestris	☿	1		AUB	10.V.1975	Bawarij	Beqaa	1300
B. terrestris	♂	1		AUB	25.VIII.1975	Aley	Mount Lebanon	700
B. terrestris	☿	2	Nemer N.	USEK	X.2015	Arsoun	Mount Lebanon	640
B. terrestris	♂	1	Nemer N.	USEK	X.2015	Arsoun	Mount Lebanon	640
B. terrestris	☿	1	Boustani M., Kyrk S.	USEK	2.V.2016	Arsoun	Mount Lebanon	640
B. terrestris	☿	1		AUB	24.VI.1975	Falougha	Mount Lebanon	1250
B. terrestris	☿	1		AUB	24.VI.1975	Falougha	Mount Lebanon	1250
B. terrestris	☿	1	Daou R.	USEK	12.IV.2016	Fatri	Mount Lebanon	500
B. terrestris	♀	1	Kazan A., Moussa R.	USEK	3.12.2014	Halate	Mount Lebanon	100
B. terrestris	♀	1	Makdissi R.	USEK	2.XII.2013	Hboub	Mount Lebanon	375
B. terrestris	♀	1	Shwayri	AUB	21.III.1981	Jounieh	Mount Lebanon	0
B. terrestris	☿	1		AUB	21.VI.1973	Sawfar	Mount Lebanon	1320
B. terrestris	☿	1		AUB	21.VI.1973	Sawfar	Mount Lebanon	1320
B. terrestris	♀	1	Najem N., Saade C.	USEK	XI.2014	Batroun	North Lebanon	900
B. terrestris	☿	1	Boustani M.	USEK	20.VI.2016	Bcharre	North Lebanon	1928
B. terrestris	♀	1	Yammine W.	USEK	24.VI.2016	Bcharre	North Lebanon	2723
B. terrestris	♀	2	Yammine W., Kotan A.	USEK	22.VI.2016	Bcharre	North Lebanon	1926
B. terrestris	♂	2	Boustani M.	USEK	19.VI.2016	Ehden	North Lebanon	1567
B. terrestris	☿	2	Boustani M., Kyrk S.	USEK	19.VI.2016	Ehden	North Lebanon	1567
B. terrestris	♂	1	Boustani M.	USEK	22.VI.2016	Wadi Quannoubine	North Lebanon	1129

(1♀, 1☿), *Echinops* sp. (1♂, 4☿), *Echinops viscosus* D. C. (1♂, 1☿). Berberidaceae: *Berberis libanotica* Ehr. (1♀). Boraginaceae: *Cynoglossum nebrodense* Guss. (1☿), *Echium italicum* L. (1☿), *Solenanthus stamineus* (Desf.) Wettst. (1♀, 13♂). Caprifoliaceae: *Lonicera nummulariifolia* Jaub. & Spach (2♂). Dipsacaceae: *Cephalaria setosa* Boiss. & Hohen. (4♂). Fabaceae: *Colutea cilicica* Boiss. & Bal. (23☿), *Genista libanotica* Boiss. (1☿), *Ononis natrix* L. (3☿), *Trifolium* sp. (1☿), *Vicia canescens* Labill. (2☿), *Vicia tenuifolia* Roth (10♀, 13☿, 15♂), *Vicia villosa* Roth (5♀, 8☿). Lamiaceae: *Marrubium* sp. (1☿), *Marrubium libanoticum* Boiss. (2 W), *Mentha* sp. (1♂, 3☿), *Origanum ehrenbergii* Boiss. (1☿), *Phlomis* sp. (1☿). Malvaceae: *Alcea apterocarpa* (Fenzl) Boiss. (1☿). Ranunculaceae: *Ranunculus demissus* D.G. (1☿). Rosaceae: *Rubus* sp. (1♂).

Bombus argillaceus (Scopoli, 1763)

Species distribution. Eastern Mediterranean distribution, stretching North to Czech Republic (Rasmont & Iserbyt 2010-2014) East to Russia, and South to Israel (Ascher & Pickering 2018).

Local distribution. Figure 2c. 17♀, 9☿, 1♂, 1 sex not specified: Ainata Al Arz (3☿), Aintoura (1♀), Arsoun (1♀), Arz Tannourine (1♂), Baskinta (1☿), Bcharre (2♀, 1☿), Bhamdoun (1♀), Dahr El Baidar (1☿), Ehden (9♀), Hadath El Jebbe (2♀), Harissa (Tannourine) (1☿), Hlaliye (1♀), Qornael (1☿), Zahrani (1☿).

Altitude range in Lebanon. From 230 m (Aintoura) to 2332 m (Dahr el Adib).

Flowers visited in Lebanon. Asteraceae: *Echinops* sp. (1☿). Dipsacaceae: *Cephalaria setosa* Boiss. & Hohen. (1♂). Fabaceae: *Vicia tenuifolia* Roth (2♀), *Vicia villosa* Roth (5♀). Lamiceae: *Lamium* sp. (1♀), *Phlomis chrysophylla* Boiss. (1☿), *Salvia microstegia* Boiss. & Bal. (1☿), *Stachys ehrenbergii* Boiss. (2☿). Plantaginaceae: *Linaria aucheri* Boiss. (1☿). Rosaceae: *Rubus* sp. (1☿).

Bombus niveatus vorticosus (Kriechbaumer, 1870)

Species distribution. Centered on the Aegean Sea, reaching Eastern European Russia to the North, Spain to the West, Iran to the East, and Israel to the South (Rasmont et al. 2015).

Local distribution. Figure 2a. 10♀, 32☿, 10♂, 4 not specified: Ainata Al Arz (5♀, 27☿, 6♂), Arz Bcharre

Figure 1. The four *Bombus* species from Lebanon. **A**, *B. niveatus vorticosus* queen foraging on *Astragalus angustifolia*, Bcharre, 30.VI.2017 (Photo M. Boustani); **B**, *B. terrestris calabricus* male foraging on *Solenanthus stamineus*, Arz Tannourine, 6.V.2017 (Photo M. Boustani); **C**, *B. argillaceus* queen, Horch Ehden, 31.V.2017 (Photo P. Rasmont); **D**, *B. melanurus* queen foraging on *Vicia canescens*, Plateau Qornet El Sawda, 24.VI.2016 (Photo M. Boustani).

(1♀, 4☿, 2♂, 1 unknown), Duhor Barnasa (4♀), Ehden (1☿), Fehta (1♂), Mount Hermon (1♂), Qartaba (1☿).

Altitude range in Lebanon. From 1648 m (Qartaba) to 3000 m (Qornet El Sawda).

Flowers visited in Lebanon. Asteraceae: *Cousinia libanotica* D.C. (4♂). Fabaceae: *Astragalus angustifolius* D. C. (3♀, 6☿), *Vicia canescens* Lab. (1♀, 6☿, 2♂). Lamiaceae: *Marrubium libanoticum* Boiss. (6☿, 1♂), *Stachys ehrenbergii* Boiss. (13☿, 1♂).

Bombus melanurus (Lepeletier, 1836)

Species distribution. Central Asia, reaching the Caucasus and Eastern Turkey to the East (Rasmont et al. 2015).

Local distribution. Figure 2d. 5♀, 10☿, 6♂: Qadisha (1♀), Arz Bcharre (1♀, 1☿, 1♂), Ainata Al Arz (3♀, 9☿, 5♂).

Altitude range in Lebanon. From 1815 m (Bcharre Cedars) to 3000 m (Qornet El Sawda).

Flowers visited in Lebanon. Asteraceae: *Cousinia libanotica* D.C. (3♀, 2♂). Fabaceae: *Vicia canescens* Labill. (3♀, 3☿, 2♂), *Vicia tenuifolia* Roth (1☿). Lamiaceae: *Marrubium libanoticum* Boiss. (2♂), *Stachys ehrenbergii* Boiss. (3☿).

Distribution by governorate

Bumblebee species presence or absence in the Lebanese governorates is displayed in Table 2 from left to right. The governorates are shown on every map from west to

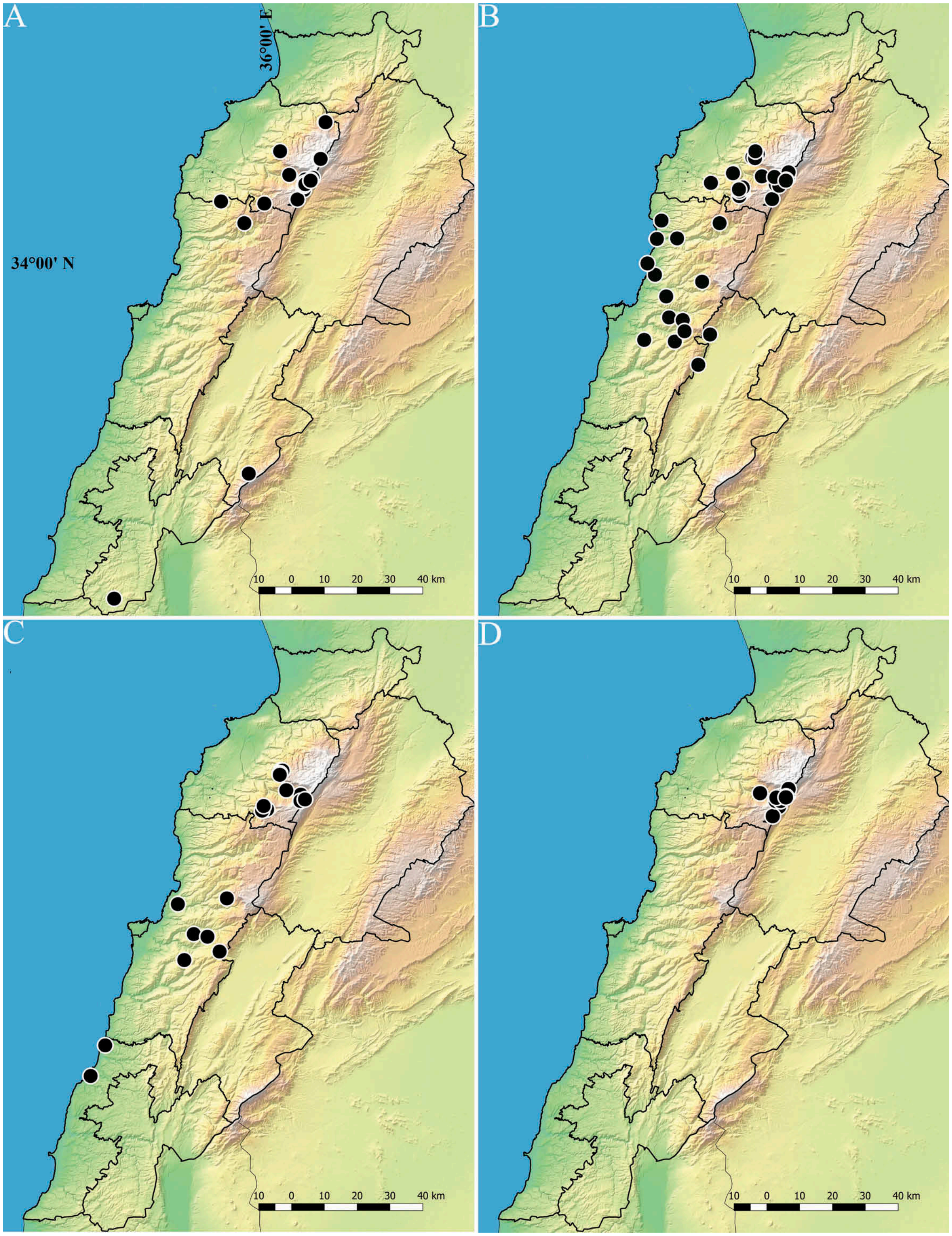

Figure 2. Distribution maps of the four *Bombus* species from Lebanon. **A**, *B. niveatus vorticosus*; **B**, *B. terrestris calabricus*; **C**, *B. argillaceus*; **D**, *B. melanurus.*

east and from north to south (Table 1) in order to highlight sampled areas and the ones that are still data deficient.

Bombus terrestris *subspecies*

The morphological criteria of the examined *Bombus terrestris* material suggest the subspecies *Bombus terrestris*

Table 2. Bumblebee species by governorate in Lebanon: recorded (+), not recorded (–).

	Beirut	Akkar	North Lebanon	Mount Lebanon	Nabatieh	Baalbek-Hermel	Beqaa	South Lebanon
Bombus argillaceus	–	–	+	+	–	–	+	+
B. melanurus	–	–	+	–	–	–	–	–
B. niveatus vorticosus	–	–	+	+	+	–	+	–
B. terrestris	–	–	+	+	–	–	+	–

calabricus Krüger, 1958 as the yellow band of the thorax extends under the tegulae in addition to the color pattern (Rasmont et al. 2008). Furthermore, the cephalic labial gland secretions analysis provides preliminary evidence that the local subspecies may be *B. t. calabricus*. Indeed, the Lebanese specimens fall in the only cluster of the individuals identified as this subspecies when compared to the database of Lecocq et al. (2016) (Figure 3), the *p*-value of the MRPP analysis being >0.05; therefore, the difference is not significant, and the chemicals profiles match the Sicilian *B. t. calabricus* specimens.

Discussion

Distribution

Bombus terrestris is newly recorded in Lebanon despite it being locally widespread. This species is one of the most common in the West Palearctic (Williams 2011), and is a common species in Mediterranean ecosystems (Potts et al. 2006). Regional data report its presence in Syria coastal area (Solaiman-Khaled et al. 2012), and in Israel and Jordan (Rasmont & Iserbyt 2010-2014). Therefore, its absence from any published records is possibly due to under-sampling of the region. We can also eliminate the possibility of its recent incursion due to introduction of colonies for agricultural use as our oldest specimens in the database date back to 1973 (Sawfar) from the AUB collection, well before any introduction of non-native *B. terrestris* in 2001 (FAO Representation in Lebanon 2011). *Bombus argillaceus* on the other hand has already been recorded from some localities; older records include Reinig (1939) and another from 1977, both collected in Bcharre (*Base de données fauniques Gembloux et Mons*). It has also been collected in a variety of different habitats locally including woodlands, pastures, grasslands and ruderal areas, with a local distribution spanning sea level to 2500 m, although Solaiman-Khaled et al. (2012) found it significantly less abundant than *B. terrestris* in Syrian coastal areas. Indeed, it can live in several habitat types and is a common forager in cultivated and natural

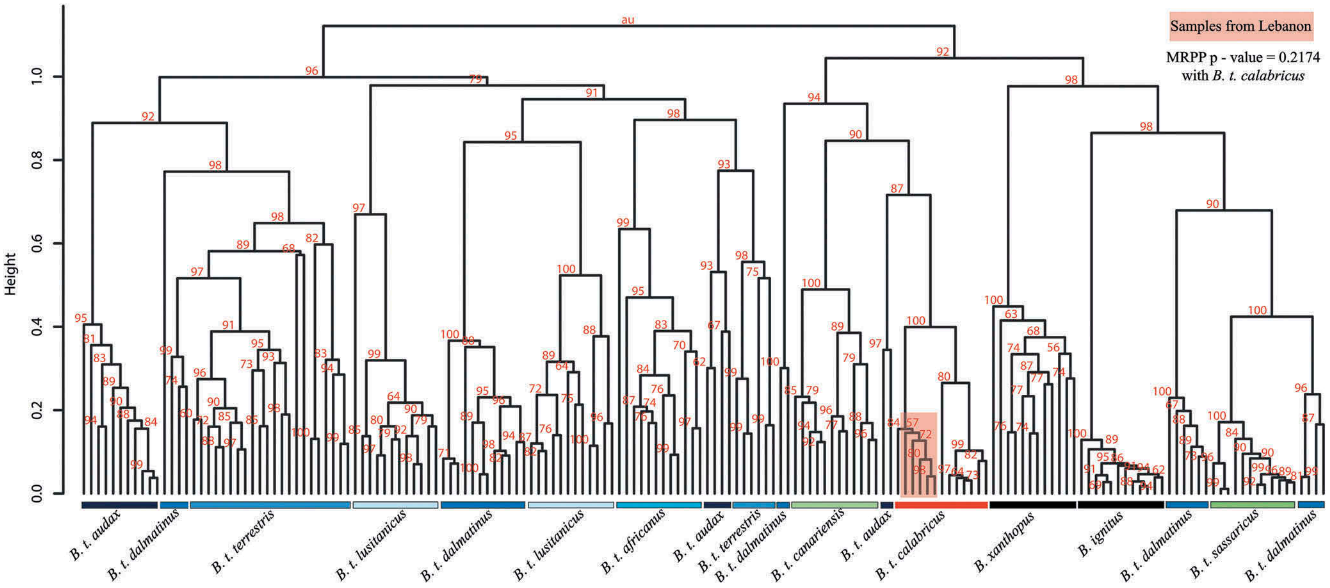

Figure 3. Unweighted pair group method with arithmetic mean (UPGMA) cluster based on a correlation matrix calculated from the cephalic labial gland secretions matrix of *Bombus terrestris* taxa, *B. ignitus* and *B. xanthopus* data from Lecocq et al. (2016). The values near nodes are multiscale bootstrap resampling (only values N90 of main groups are shown). The Lebanese specimens are highlighted in red.

landscapes on an altitudinal range reaching 3500 m in Turkey (Özbek 2002). *Bombus terrestris* and *B. argillaceus* have broader distributions in Lebanon, contrasting with *B. niveatus vorticosus* and *B. melanurus* that seem to be restricted in the higher altitudes. *Bombus niveatus vorticosus* has also been reported from several locations including Rmeich from 1870 (Rasmont, original data), Jabal Al Shaikh in 2010 (*Base de données fauniques Gembloux et Mons*), and Bcharre in 1931 collected by Zerny (GBIF 2019). Despite these records from lower altitude villages, in our collections we only found specimens from altitudes above 1800 m. *Bombus niveatus vorticosus* is indeed typical to steppe areas (Rasmont et al. 2009) as in the alpine steppe regions of Mount Lebanon chain, where most of our specimens were found. This species is also one of the most abundant species in its distribution range (Özbek 2002; Rasmont et al. 2015). *Bombus melanurus* also has some older records and has been reported through one collected specimen by Monty (2004), and two from the BMNH collection with one specimen of unknown date from Qadisha valley and the other from 1931 from Bcharre. In Lebanon it is at the southernmost point of its distribution (Rasmont et al. 2009) and is found mainly in altitudes higher than 1500 m (Aslan 2003; Rasmont et al. 2009; An et al. 2011). Its presence is somewhat unexpected as the closest known population is in the Taurus Mountains in Turkey (Rasmont et al. 2009).

The GBIF dataset (2019) reports other species: *Bombus fragrans, B. muscorum, B. sylvarum, B. maxillosus, B. subterraneus* and *B. zonatus* from Jezzine in 1905, identified by Vogt and preserved in UiT, the Arctic University of Norway. The examination of the original labels of the material (Kjærandsen J., pers. comm. 2019) showed that this is a misinterpretation of the original label "Jassian, Asia Minor" [currently Yasyan in Turkey (Konya)], and the locality is not Jezzine in Lebanon.

Bombus terrestris *subspecies*

The cephalic labial gland secretions analysis suggests that the *Bombus terrestris* subspecies found in Lebanon is *Bombus terrestris calabricus*, as suggested by the morphological criteria from Rasmont et al. (2008). The morphological criteria method for differentiating species level for *Bombus* has been criticized as insufficient, such as in the case of *Bombus lucorum* complex (Carolan et al. 2012), and in certain subspecies, e.g. the difference between *Bombus terrestris calabricus* and *B. terrestris dalmatinus* (Bertsch & Schweer, 2012). The CLGS on the other hand has allowed bumblebee species to be separated in certain cases (e.g. Lecocq et al. 2015b; Martinet et al. 2018), and has also been used to differentiate subspecies in *B. terrestris* (Lecocq et al. 2016). However, it remains difficult to rely solely on this method as individuals may present variability among age (Žáček et al. 2009), and for certain species such as *Bombus montanus* and *B. ruderarius*, for example, the differences are not conclusive (Terzo et al. 2005). Furthermore, Bertsch & Schweer (2012) add that differentiation is difficult through CLGS for the different *B. terrestris* subspecies. Therefore, it has often been used in an integrative taxonomy framework, alongside the sequencing method of the mitochondrial gene cytochrome C oxidase I (COI) region, COI (e.g. Williams et al. 2012; Lecocq et al. 2016; Williams et al. 2019), and in certain cases where the DNA evidence is not enough, it is necessary to find molecular markers in order to differentiate the subspecies (Cejas et al. 2018). On the other hand, the known distribution of the *Bombus terrestris calabricus* subspecies is Sicily and south Italy (Rasmont et al. 2008; Coppée 2010), and the identified subspecies closest to the area is *Bombus terrestris dalmatinus* from Turkey (Rasmont et al. 2008), and the records from Israel and Turkey (Rasmont & Iserbyt 2010-2014) do not provide any information on the subspecies. This suggests that the local *Bombus terrestris* subspecies may be an isolated population. Therefore, and with the current lack of information of the biogeography of *Bombus terrestris* subspecies in the East Mediterranean, the evidence in our case remains very circumstantial and a larger sampling over the whole altitudinal range in Lebanon and neighboring countries, in an integrative taxonomy framework, are necessary to confirm the subspecies identification.

Flower resources

Bombus terrestris remains the most polyphagous species, foraging on 26 flowering species based on our observations. Indeed, it is a species known to forage from a broad spectrum of flowers (Rasmont 1988; Aslan 2003; Monfared et al. 2007; Williams 2011), highlighting its importance as a wild pollinator and potential interest for agricultural rearing in Lebanon. *Bombus argillaceus* is equally polyphagous (Rasmont 1988; Rasmont & Flagothier 1996; Monfared et al. 2007; Rasmont et al. 2015), with a preference for flowers with long corolla like Fabaceae (Rasmont et al. 2015). *Bombus niveatus vorticosus* is also a forager that visits a wide range of flowers but focuses mainly on Lamiaceae and Fabaceae (Rasmont & Flagothier 1996; Monfared et al. 2007). This concurs with our results for the plant family preference, but the number of species foraged locally from our records is only five. Similarly, *Bombus melanurus* seems to have restricted preferences with five foraged plants recorded locally, this can be due to the distribution of *B. niveatus vorticosus* and *B. melanurus* above 2000 m in the Oro-Mediterranean strip where fewer seasonal foraging plants are available.

Primary climatic risk assessment and recommendations

From a conservation perspective, the four species are of interest as they visit and are potential pollinators of a wide range of wild plants, of which several are endemic such as *Vicia canescens* Labill., *Stachys ehrenbergii* Boiss. and *Cousinia libanotica* D.C. This is especially relevant for *Bombus niveatus vorticosus* and *B. melanurus* that are found in areas of high plant endemism in Lebanon (Bou Dagher-Kharrat et al. 2018). *Bombus terrestris* does not appear to be at risk due to climate change as the current conditions are causing its expansion towards the north (Martinet et al. 2015); therefore, we can expect it to preserve its current wide distribution locally. Similarly, the future distribution predictions for *Bombus argillaceus* suggest an expansion and no risk (Rasmont et al. 2015), although it is legally protected in Hungary (Kosior et al. 2007). *Bombus niveatus vorticosus* predictions also suggest that it could expand beyond its distribution range (Rasmont et al. 2015); in Lebanon, however, it seems restricted to altitudes above 1800 m from our collected specimens. Given its current local distribution, this species may yet be locally vulnerable as it is close to its southernmost distribution limit and does not seem to be expanding towards coastal areas. *Bombus melanurus* on the other hand has the most restricted local distribution mostly in the Oro-Mediterranean strip, rendering it vulnerable to extreme climatic events. This is emphasized by its total isolation from its closest known population in Turkey (Rasmont et al. 2009). The isolated local distribution of *Bombus niveatus vorticosus* and *B. melanurus* could be the result of a climatic induced shift towards higher altitudes (Biella et al. 2017), especially in the case of *B. niveatus vorticosus* for which literature records come from lower altitudes than the author's collections. All four species should be included in any conservation plan as these pollinators potentially play an important role in the local flower–pollinator network, with emphasis on *B. melanurus* that must be closely monitored through observation as it is easily recognizable. Furthermore, current *Bombus* rearing efforts for agricultural purposes should focus on local *B. terrestris* as to avoid foreign strain invasions and protect the local subspecies (Lecocq et al. 2015a; Cejas et al. 2018).

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Supplementary material

Supplemental data for this article can be accessed here.

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The bees of Lebanon (Hymenoptera: Apoidea: Anthophila)

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Abstract

The study of wild bees has markedly increased in recent years due to their importance as pollinators of crops and wild plants, and this interest has been accentuated by increasing evidence of global declines in their abundance and species richness. Though best studied in Europe and North America, knowledge on the current state of wild bees is scarce in regions where they are particularly diversified, such as the Mediterranean basin. The eastern Mediterranean country of Lebanon, located at the heart of the Levant in a biodiversity hotspot, is particularly poorly studied. The aim of this paper is to produce a first annotated checklist of the wild bees of Lebanon from new and museum collections, literature records, and verified occurrences from online databases. The present list totals **573** species for Lebanon of which **289** are reported for the first time, but the estimated diversity is likely to be closer to 700. Preliminary information on local distributions and flower records are also presented. The local species assemblages indicate affinities with montane habitats of the Mediterranean and Anatolia and the semi-arid habitats of the Levant and north Africa. This study also encourages further research on local wild bee faunas and the use of this knowledge for conservation purposes.

Key words: Anthophila, Biodiversity, Checklist, Endemism, Floral choices, Mediterranean, Wild bees

Introduction

Bees (Hymenoptera: Anthophila) constitute a species-rich group of insects with over 20,000 described species worldwide (Michener, 2007; Ascher & Pickering 2021). Over the last few decades, bees have been used as models for studies in a large array of scientific fields including biogeography (e.g. Patiny & Michez 2007), evolutionary biology (e.g. Danforth *et al.* 2019) and, most concerningly, global change biology (e.g. Duchenne *et al*. 2020). A global trend of bee decline has been identified, mainly due to a combination of anthropic stressors including climate change and habitat destruction (Potts *et al.* 2010). At the European level, 9.2% of wild bees have been assessed as threatened, although more than the half of the total number of European species could not be evaluated because of a lack of rigorous scientific information to assess their risk of extinction (Nieto *et al.* 2014). The status of one of the most studied bee groups, the bumblebees, has raised much concern in relation to their decline at multiple scales, from local (Vray *et al.* 2019; Rollin *et al.* 2020), to continental (Rasmont *et al.* 2015), and even at the global scale (Cameron & Sadd 2020). These findings have been made possible by the large quantity of available historical occurrence data that allows assessments of population shifts in well studied regions. Unfortunately, assessments of this type are not yet possible for much of western Asia and northern Africa, both areas with highly diversified bee faunas but with relatively little information on the historical context and ecology of the species present (Michez *et al.* 2019). Countries such as Morocco have recently had a checklist of the bee fauna compiled (Lhomme *et al.* 2020), but the other north African countries do not have any comprehensive studies. In such places, little to nothing is known about the current status of their bee faunas, although some species may have declining populations and may be in critical need of conservation interventions.

The Mediterranean basin is a biodiversity hotspot that encompasses many little-studied regions, such as the Maghreb to the west and the Levant in the eastern Mediterranean region (Blondel *et al*. 2010). Lebanon is a prime example of a species-rich country that remains poorly studied. The country is located in the centre of the Levant (fig. 1) and has a high floristic diversity (Mouterde 1966, 1970, 1984). The Lebanese landscape is shaped by the western Mount Lebanon (peaking at 3000 m) and eastern Anti-Lebanon (peaking at 2800 m) mountain chains, divided by the semi-arid Bekaa valley at 1000 m a.s.l. that follows the Great Rift. This peculiar topology generates a variety of vegetation levels spanning humid, arid and semi-arid habitats starting from the coastal strip, and following an eastward transect towards Mount Lebanon, Bekaa valley and Anti-Lebanon (Zohary 1973; Abi Saleh & Safi 1988). The territory also encompasses several scattered areas with high plant endemism (Bou Dagher-Kharrat *et al.* 2018).

FIGURE 1. Map of the Mediterranean basin showing Lebanon represented in yellow, within the administrative Levant represented in orange.

Lebanon is likely to have a high diversity of other insect species as well, but is little studied in this regard. A few recent studies have focused on Lepidoptera inventory and records (Zorkot 2016, Bálint *et al.* 2016), and Coleoptera diversity (Cocquempot *et al.* 2016, 2020, Háva & Németh 2016, Háva 2018). A recent revision focused on the Elateridae (Coleoptera) fauna (Németh, 2019), with 13 species newly reported from Lebanon and two new species to science. These few available studies on the entomofauna suggest a potentially high insect diversity in the country, but apart from the aforementioned papers and scattered descriptions of species from the literature, this fauna remains poorly studied.

Among the earliest documented faunal records are the specimens treated by Klug (1832, 1845) from the collections of Friedrich Wilhelm Hemprich and Christian Gottfried Ehrenberg in 1824, that covered Beirut and Tripoli on the coastal plain, and trips to Mount Sannine in Mount Lebanon and Baalbeck in the Bekaa (Baker 1997). These included a number of wild bee records, including several described as new to science.

George A. Mavromoustakis (1955, 1956, 1963) later published three papers focusing mainly on the Anthidiini of Lebanon, some other Megachilidae and a few species from other families such as Apidae. His travels in spring-summer 1953 covered some coastal localities and higher altitude villages such as Broumana, Barouk and Jezzine. In his second trip during spring-summer of 1960, he conducted extensive collections in the northern part of Mount Lebanon covering cedar forests and surrounding areas. The records from the Mavromoustakis publications remain the most well documented in this regard.

Warncke (1980) then listed some species from Lebanon that came mainly from previously collected museum material. Parts of the pre-1920 literature from Lebanon are scattered in publications reporting or describing bees from localities that were previously located in the ambiguously-delimited region of "Syria", such as Beirut, Tripoli, or the Bekaa valley. This is due to the change of the Lebanese borders from the Ottoman period (where the term "Syria" broadly encompassed the whole Levant region) and later through the French mandate when Beirut, parts of the coastal strip as well as southern and northern Lebanon were also included as part of the Syrian territory. In addition, labels with "Lebanon" before 1920 often referred broadly to the Mount Lebanon chain with no further precision. As such, precise locality details are needed to use these historical data correctly.

Grace (2010) listed several species from Lebanon, drawn partly from the records reported by Mavromoustakis and Warncke, and also adding several species. These additions however are not backed up by detailed occurrence data. More recently, the *Bombus* species of Lebanon have been listed (Boustani *et al.* 2020) and the local *Andrena* fauna has been entirely revised on basis of recent collections (Wood *et al.* 2020a). However, no comprehensive works have reviewed and listed all bee species present in the Lebanese fauna.

This paper aims to present the first annotated faunistic list of the Apoidea taxa present in Lebanon through combining available literature, open database records that could be confirmed with a level of confidence, specimens from university and private collections, unpublished data from museum material, and the authors' collections. This work also aims to set a groundwork for future research on the Lebanese bee fauna and to serve as a reference for conservation-oriented decision making through providing a baseline for local bee diversity studies.

Materials and methods

Data Sources. The data in this paper come mainly from literature and the collections of authors and collaborators. Material from collections made by students of the American University of Beirut and Université de Saint Esprit de Kaslik universities was borrowed for identification. Specimens will be deposited partly in the collection of the University of Mons and the specimens borrowed from private collections remain with their respective owners. Data were compiled from the online databases Discover Life (Ascher & Pickering 2021), and GBIF. Most of the GBIF data from Lebanon comes from the Donald Baker collection, housed at the Snow Entomological Collection Lawrence, Kansas, USA (SEMC). All data occurrences in this paper are presented on the map (fig. 2).

Recent Sampling

Collection areas. Contemporary collections predominantly focused on the Mount Lebanon mountain chain at higher altitudes between 900 m and to the highest peak at 3000 m. The sampled vegetation levels classification according to Abi Saleh & Safi (1988) are Eumediterranean (500–1000 m, e.g. fig. 3), Supramediterranean (1000–1500 m), Montane Mediterranean (1500–2000 m, e.g. fig. 4–5) and Oromediterranean (>2000 m, e.g. fig. 6). Some sampling was carried out in the Presteppic Mediterranean (e.g. fig. 7), through the Bekaa valley and up the slopes of the Anti-Lebanon mountains spanning the Mediterranean (1000–1500 m), Supramediterranean (1400–1800 m), Montane Mediterranean (1800–2400 m) and Oromediterranean (>2400 m, e.g. fig. 8). Other sampling locations fell into the Thermomediterranean (0–500 m) including coastal areas (e.g. fig. 9) and the Eumediterranean (500 – 1000 m). Samplings focused on natural habitats such as nature reserves, semi-natural areas such as the borders of forests and orchards, and grazing areas. When possible, some collections were carried out in residential and urbanised area gardens.

Collection Methods. Contemporary specimens were mostly collected by hand netting, and then killed using ethyl acetate or by freezing. Some specimens were collected using pan traps, and these are dated with the pan trap removal date. Pan trapping was conducted with three triplets of blue, yellow, and white pan traps (Westphal *et al.* 2008). They were filled to the ¾ mark with water with the addition of colourless and odourless soap, and collected 48 hours later. The pans within a triplet were 1 m apart and the triplets themselves were 10 m apart.

Visited flowers identification. Flowers that were visited by the bee specimens during sampling are identified using the Mouterde flora (Mouterde 1966, 1970, 1984). A sample was collected and dried in herbarium for reference. These plant specimens were deposited at Université de Saint Esprit de Kaslik, Kaslik, Lebanon.

Data management. All data occurrences were digitised using Data Fauna Flora 5.1.2 (Barbier *et al.* 2000) and mapped with Quantum GIS 2.18.27.

Records Listing

Order and taxa listing. The order of the families and genera follows Michener (2007) in the main listing and annexes I and II. The subgeneric classification follows Michez *et al.* (2019), exceptions to this are indicated in the beginning of the genus listing. Information on subspecies and "varieties" is systematically displayed when available for all listed data, and the material examined identified under a subspecies is listed separately under said subspecies. Synonyms are given after the priority name for the taxa for which there has been recent changes in synonymy or with an uncertain taxonomic status that requires revision.

Records listing categories. For every taxon, the general distribution is given, then the records are listed.

Distributions are very broad and aim to give geographical context to the species using the following classification: **Endemic:** Endemic to Lebanon; **Levant:** the countries highlighted in fig. 1; **East Mediterranean:** Southern Balkans (Albania, North Macedonia, Bulgaria, and Greece), Turkey, Caucasus (Armenia, Azerbaijan, and Georgia) to Iran, Egypt and Libya; **West Palaearctic:** Encompassing Europe, North Africa, Levant and northern Arabian Peninsula, and stretching east to Iran, Kazakhstan and the western part of Russia; **Palaearctic**. Distributions are given at the species level, and if they refer to the subspecies distribution, it is indicated.

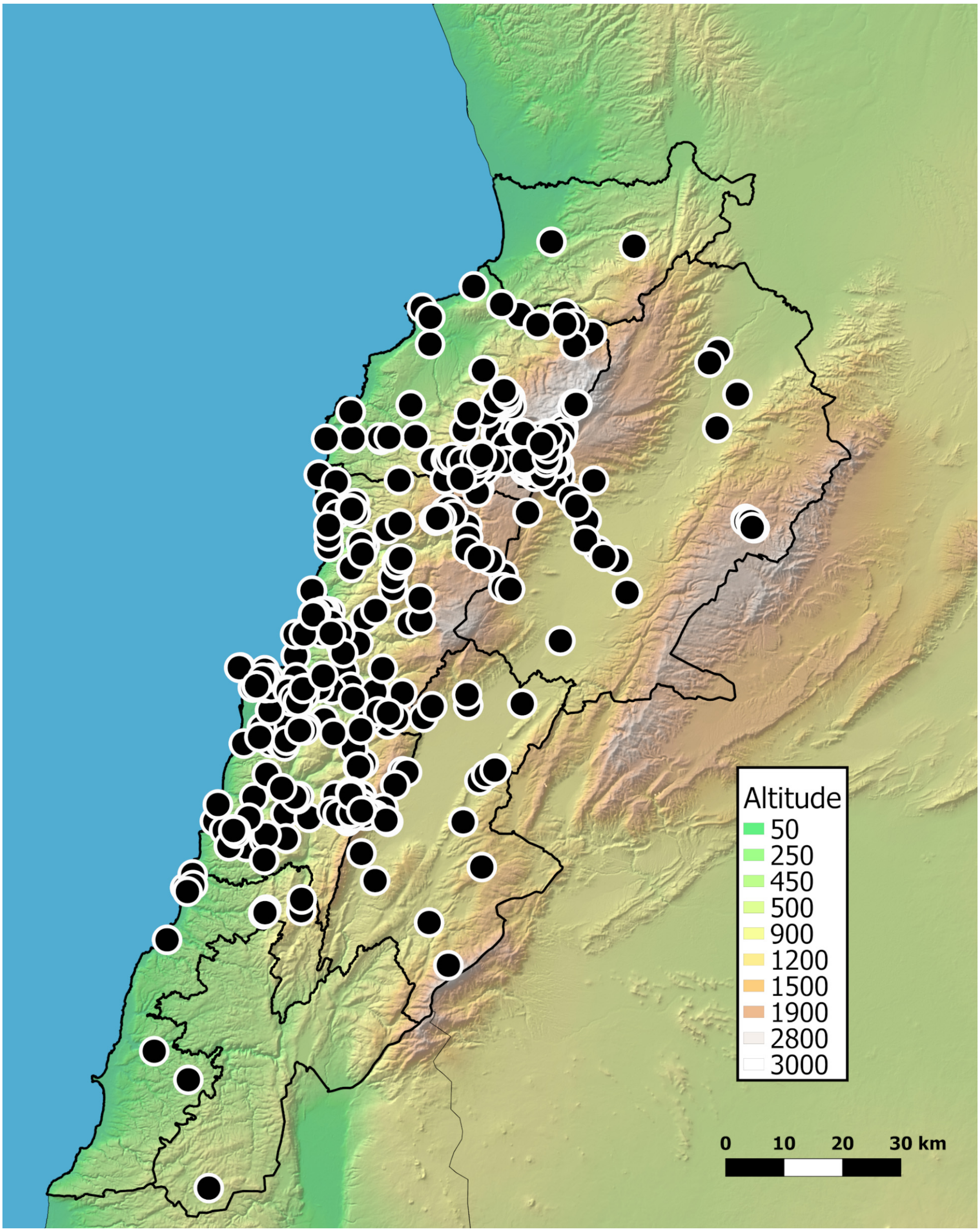

FIGURE 2. Map representing all data points of collected specimens and literature occurrences. The governorates are from north to south and from west to east: North Lebanon (Akkar and North), Mount Lebanon, Beirut, South Lebanon (Nabatieh and South), Bekaa (Baalbek-Hermel and Bekaa).

FIGURE 3. Oak forest habitat with *Spartium junceum* at the transition between Eumediterranean and Supramediterranean. Picture taken at Tannourine El Tahta (N. Lebanon), by Mira Boustani.

A record is defined as a specimen associated with one date and one locality. Records are listed by alphabetical order of governorate, and sorted by chronological order within each governorate. Records from the same date are sorted by locality alphabetically. For all species that have more than 15 records, these have been shortened to avoid long listings. In this case the earliest records are given for each governorate, and the number of specimens is then given with the range of collection dates and a list of the remaining localities. A local distribution map is provided in this case as well as for all listings with more than five scattered localities. Only the confirmed occurrences (literature and material examined) localities are presented on the maps.

The governorate division uses the older classification that divides Lebanon into five governorates: **North Lebanon** currently divided into Akkar and North; **Mount Lebanon**; **Beirut**; **South Lebanon**, currently divided to Nabatieh and South; and **Bekaa** currently divided to Baalbek-Hermel and Bekaa (fig. 2).

All the records mentioned in the list of taxa under "**Material examined**" are ones that have a physical examined specimen linked to them and were determined by contemporary specialists. This section also includes records from Banque de Données Fauniques de Gembloux et Mons (BDFGM, data available at Atlas Hymenoptera, Rasmont *et al.* 2021) that were examined by contemporary specialists.

All **literature** occurrences were listed under the currently accepted taxon name, when the taxon was reported in the literature under a synonymous name this is indicated before each relevant record.

Specimens without labels or with localities that were unreadable or erased from the original label have been added in the occurrences, however they were not used as a basis to confirm the presence of a species if the data is not backed up by other recent specimens or reliable literature occurrences.

Online occurrences from GBIF and Discover Life databases (Ascher & Pickering 2021) were listed separately under "**Unpublished records**", and are not confirmed as the records themselves were not recently confirmed by contemporary specialists, and cannot be considered valid because of changing species concepts.

FIGURE 4. Clearing in the Cedar Woods with flowering *Vicia tenuifolia*, in the Montane Mediterranean level. Picture taken at the Tannourine Cedar Forest Nature Reserve by Mira Boustani.

FIGURE 5. View of the Cedar Forest of Bcharre from the passage of Ainata Al Arz showing the transition between the Montane Mediterranean and Oromediterranean level. Picture taken by Mira Boustani.

FIGURE 6. Alpine Oromediterranean pastures with *Astragalus* sp. near the peak of the Mount Lebanon Chain (Qornet Es Sawda). Picture taken by Mira Boustani.

FIGURE 7. Pierre Rasmont collecting in Pre-steppic habitat with *Vicia tenuifolia* with a view of the Bekaa Valley. Picture taken by Mira Boustani.

FIGURE 8. Alpine steppe with *Acantholimon* sp. and *Stipa* sp. in Oromediterranean level of the Anti-Lebanon mountain chain near the highlands of Aarsal. The mountains on the horizon show the Syrian border and the progression into arid habitats. Picture taken by Mira Boustani.

FIGURE 9. View of Beirut and the coastline from 300 m a.s.l. in some of the remaining pine woods. Picture taken by Pierre Rasmont.

Furthermore, all taxa that only have online occurrences that do not report precise specimen information are listed in the supplementary material **ANNEX I.** This list also includes all taxa that were reported from "Syria" without locality details before 1920 as they could be located in the current Lebanese territory or elsewhere in the Levant.

A small number of species which have been reported from Lebanon but which we can confidently exclude are listed in **ANNEX II** and these are not included in the provided species counts.

All taxa with no published occurrences in literature or material examined are considered as probably reported for the first time and are indicated by an asterisk *.

When available, flower records from author or borrowed collections of the specimens listed in material examined are added at the bottom of every bee taxon record list and are sorted by alphabetical order of family and genera within family. These records aim to provide preliminary information on the flower preferences of individual species. When flower preferences from literature are mentioned, these are discussed in the notes at the end of the flower listing with the reference.

The full species list is in **ANNEX III**. They are listed at the species level, and the distribution is that of the species following the aforementioned categories.

Determinations. Species determination in the "Material examined" sections was conducted by specialists as listed below following family, subfamily, or genus.

A determination is mentioned in case there is more than one person that determined the material in an individual genus.

Colletini: Kuhlmann M., Germany
Hylaeinae: Dathe H., Germany
Andreninae, Panurginae: Wood T.J., Belgium
Halictidae: Pauly A., Belgium, (Sphecodes) Straka J., Czech Republic
Melittidae: Michez D., Belgium
Megachilini: Praz C., Switzerland
Coelioxys: Schwarz M., Austria
Osmiini: Müller A., Switzerland
Anthidiini: Litman J., Switzerland; Kasparek M., Germany; Fateryga A., Ukraine
Anthophorini: Rasmont P., Belgium
Eucerini: Risch S., Germany
Xylocopinae: Terzo M., Belgium
Nomadinae: Schwarz M., Austria; Straka J., Czech Republic
Ammobatini: Dufrêne E., France, Schwarz M., Austria
Bombini: Rasmont P., Belgium

List of abbreviations

USEK	Université de Saint Esprit de Kaslik, Kaslik, Lebanon
AUB	American University of Beirut, Lebanon
BBSL	Bee Biology and Systematics Laboratory, Utah, USA
BMNH	Natural History Museum (London), United Kingdom
BDFGM	Banque de Données Fauniques de Gembloux et Mons.
MBOU	Mira Boustani Collection, Mons, Belgium
MKAS	Max Kasparek Collection, Heidelberg, Germany
MNHNP	National Museum of Natural History (Muséum national d'Histoire naturelle) - Paris, France
MNHUB	Museum für Naturkunde, Berlin, Germany
MPAV	Collection Mark Pavett, Wales, UK
NMSF	Natur-Museum Senckenberg, Frankfurt, Germany
OÖLM	Oberösterreichisches Landesmusum, Linz, Austria
OUMNH	Oxford University Museum of Natural History, Oxford, England
TCFNR	Tannourine Cedar Forest Nature Reserve, Lebanon
SEMC	Snow Entomological Museum Collection, Lawrence, Kansas, USA

SOILS	Soils Permaculture Association, Saidoun, Lebanon
XVA	Xavier Van Achter Collection, Soignies, Belgium
TJW	Thomas Wood collection, Mons, Belgium
UMONS	Université de Mons, Mons, Belgium
PRAS	Pierre Rasmont Collection, Mons, Belgium
RBINS	Royal Belgian Institute of Natural Sciences, Brussels, Belgium
ZSM	Zoologische Staatssammlung München, Munich, Germany

Checklist of the wild bees of Lebanon

The present list assembles **573** total species, distributed over **49** genera. Of these **573** species, **492** are confirmed through literature records and material examined and listed below. **289** species are probably reported from Lebanon for the first time. All collected and literature localities of the specimens listed below are represented in fig. 2. Species in need of confirmation are listed in ANNEX I. Four species are unconfirmed and are most likely misidentifications and are listed in ANNEX II.

Following our classification for the species distribution, the present list comprises 18.8% (n=108) widely distributed Palaearctic taxa, 54.3% (n=311) West Palaearctic taxa, 21.7% (n=124) East Mediterranean taxa, 4.9% (n=28) restricted to the Levant, and 0.3% (n=2) endemic species. The full list of species and their respective distribution categories are listed in ANNEX III.

COLLETIDAE

COLLETINI

Genus *Colletes* Latreille, 1802

Six species.

All specimens identified by Kuhlmann M.

Floral preferences seem to be focused on Asteraceae, especially the genus *Achillea*, in line with the observations of Müller & Kuhlmann (2008).

Colletes (Colletes) cariniger Pérez, 1903 *

Distribution: EAST MEDITERRANEAN: Azerbaijan, Bulgaria, Greece, Turkey, Levant, Libya, Egypt (Kuhlmann & Proshchalykin 2016).

Material examined. Bekaa: AUB Farm [Haush Sneid], 19.IV.1966, 1♂, leg. Tanveev, coll. AUB.

N. Lebanon: Tannourine El Tahta, Wadi Ain El Raha, 900 m, 6.IV.2017, 1♂, leg. Mourad A., Mourad A., coll. MBOU.

S. Lebanon: Saidoun, 11.II.2018, 1♂, leg. Baghdadi A., coll. SOILS.

Colletes (Colletes) caskanus (Strand, 1919) *

Distribution: WEST PALAEARCTIC: South-eastern Europe and further east to Iran (Ascher & Pickering 2021), Jordan (Kuhlmann, pers. comm.).

Material examined. Bekaa: AUB Farm [Haush Sneid], 23.IV.1962, 1♂, leg. Shaikh., coll. AUB.

Colletes (Colletes) mlokossewiczi Radoszkowski, 1891 *

Distribution: PALAEARCTIC: Southern and Eastern Europe, Caucasus, and east to Russia, Turkey and further east to Tajikistan (Kuhlmann & Proshchalykin 2016).

Material examined. N. Lebanon: Arz Bcharre, 1928 m, 20.VI.2016, 1♀, 4♂, leg. Boustani M.; Fehta, Teleje, 1846 m, 14.VII.2017, 2♂, leg. Boustani M.; Arz Bcharre, 1883 m, 21.VII.2018, 4♀, leg. Boustani M.; Fehta, El Biara, 1664 m, 30.VI.2019, 1♂, leg. Boustani M.; Arz Bcharre, Reforestation Area, 1973 m, 2.VII.2019, 1♀, 3♂, leg. Boustani M.; all coll. MBOU; 1900 m, 12.VII.2019, 2♀, leg. Van Achter X.; 14.VII.2019, 12♀, leg. Van Achter X., all coll. XVA; Arz Bcharre, Forest Limit, 1900 m, 22.VII.2019, 4♀, leg. Boustani M., coll. MBOU; Arz

Bcharre, 1873 m, 22.VII.2019, 3♀, leg. Van Achter X.; Arz Bcharre, 1900 m, 24.VII.2019, 3♀, leg. Van Achter X.; 31.VII.2019, 1♀, leg. Van Achter X., all coll. XVA.
Flower records. Asteraceae: *Achillea falcata*.

***Colletes (Colletes) nasutus* Smith, 1853 ***
Distribution: WEST PALAEARCTIC: Central, Eastern and Southern Europe, Caucasus and east to Russia, Turkey, Syria (Kuhlmann & Proshchalykin 2014).
Material examined. Bekaa: Hadath, 1610 m, 7.VII.2019, 3♀, 2♂, leg. Boustani M., coll. MBOU.
Flower records. Boraginaceae: *Anchusa italica*.

***Colletes (Colletes) similis* Schenck, 1853**
Distribution: PALAEARCTIC: Europe, Caucasus, Russia, Levant, North Africa, Central Asia and China (Kuhlmann & Proshchalykin 2019).
Local distribution fig. 10.1
Literature. Mavromoustakis (1963): Mount Lebanon, Baabdate, 25.V.1953, 3♂; Mount Lebanon, Brummana, 11.V.1953, 4♂; Hammana, 16.V.1953, 1♀, all det. & leg. Mavromoustakis G.A.
Material examined. N. Lebanon: Arz Tannourine, 1762 m, 24.IV.2018, 1♂, leg. Boustani M.; Arz Bcharre, 1973, 2.VII.2019, 1♂, leg. Boustani M., coll. MBOU.
Flower records. Asteraceae: *Achillea falcata, Anthemis* sp.

***Colletes (Colletes) tuberculatus* Morawitz, 1893 ***
Distribution: PALAEARCTIC: Eastern Europe, Caucasus, Levant and further east to Kazakhstan and Pakistan (Kuhlmann & Proshchalykin 2012).
Local distribution fig. 10.2
Material examined. Bekaa: Jord Aarsal, Kechek, 2120 m, 11.VII.2019, 1♀, 1♂, leg. Boustani M., coll. MBOU.N. Lebanon: Fehta, Teleje, 1846 m, 14.VII.2017, 3♀, leg. Boustani M.; Fehta, El Biara, 1664 m, 30.VI.2019, 5♀, leg. Boustani M.; Arz Bcharre, Reforestation Area, 1973 m, 2.VII.2019, 1♂, leg. Boustani M.; Arz Bcharre, Forest Limit, 1873 m, 2.VII.2019, 1♀, leg. Boustani M.; Arz Bcharre, Reforestation Area, 1897 m, 2.VII.2019, 2♂, leg. Boustani M.; Arz Tannourine, Main Gate, 1794 m, 4.VII.2019, 1♂, leg. Boustani M., all coll. MBOU; Horch Ehden, Upper Gate, 1597 m, 5.VII.2019, 2♂, leg. Gekière A., coll. UMONS; Jord Ehden, 1983 m, 5.VII.2019, 3♀, leg. Boustani M., coll MBOU.; Bcharre, 2042 m, 14.VII.2019, 1♂, leg. Van Achter X.; Horch Ehden, 1686 m, 22.VII.2019, 2♀, 2♂, leg. Van Achter X., coll. XVA.
Flower records. Asteraceae: *Achillea falcata*; Fabaceae: *Medicago* sp.

HYLAEINAE

Genus *Hylaeus* Fabricius, 1793

23 species.

All identified by Dathe H.H. The specimens collected by Roche C.G. are deposited at the SEMC Donald Baker collection.

Flower records for some of the species below show a wide family range of floral with many specimens caught on Apiaceae.

***Hylaeus* (*Spatulariella*) *armeniacus* (Warncke, 1981) ***
Distribution: EAST MEDITERRANEAN: Turkey, Armenia, Azerbaijan, Lebanon, Jordan, Israel, Iran (Ascher & Pickering 2021, Kuhlmann *et al.* 2021).
Material examined. Bekaa: Jdeide, 1000 m, 19.V.1996, 5♂, leg. Roche C.G.; Der Mar Maroun, 26.V.1996, 1♀, leg. Roche C.G., coll. SEMC.
N. Lebanon: Arz Tannourine, Trail 4, 1762 m, 11.VII.2018, 1♂, leg. Boustani M.; Arz Tannourine, Gate, 1796 m, 3.VI.2019, 2♂, leg. Boustani M.; Arz Bcharre, 1897 m, 2.VII.2019, 1♂, leg. Boustani M., all coll. MBOU; Arz Tannourine, 1797 m, 22.VII.2019, 1♀, leg. Van Achter X., coll. XVA.
Flower records. Apiaceae: *Chaerophyllum aurantiacum*; Plantaginaceae: *Anarrhinum orientale*.

***Hylaeus* (*Paraprosopis*) *clypearis* (Schenck, 1853) ***

Distribution: WEST PALAEARCTIC (Ascher & Pickering 2021, Kuhlmann *et al.* 2021).

Material examined. N. Lebanon: Horch Ehden, 1625 m, 22.VII.2019, 2♀, leg. Van Achter X., coll. XVA.

Flower records. Apiaceae: *Hippomarathrum* sp.

***Hylaeus* (*Hylaeus*) *communis* Nylander, 1852 ***

Distribution: PALAEARCTIC (Ascher & Pickering 2021).

Material examined. Mount Lebanon: Jabal Moussa Biosphere Reserve, Peony Trail, 1465 m, 21.VIII.2018, 1♂, leg. Boustani M.; Barouk, Masyaf El Mir, 1807 m, 7.VIII.2019, 1♂, leg. Boustani M., all coll. MBOU.

N. Lebanon: Horch Ehden Nature Reserve, 1300–1600 m, 13–18.IX.2000, 2♂, leg. Pavett P.M.; Horch Ehden Nature Reserve, 1300–1600 m, 29.V.2001–3.VI.2001, 1♂, leg. Pavett P.M., all coll. MPAV; Arz Tannourine, Trail 4, 1762 m, 25.VI.2018, 1♀, leg. Boustani M.; Hadath El Jebbe, Road to Wadi Al Fouar, 1553 m, 28.VI.2018, 1♂, leg. Boustani M., Jabbour J.; Arz Tannourine, Trail 4, 1762 m, 18.VIII.2018, 1♂, leg. Boustani M., Jabbour J.; Hadath El Jebbe, Border of Cedar Forest, 1681 m, 22.VIII.2018, 1♀, leg. Boustani M., Jabbour J.; Arz Tannourine, Gate, 1796 m, 3.VI.2019, 1♂, leg. Boustani M.; Arz Tannourine, Trail 4, 1781 m, 23.VIII.2019, 2♀, 1♂, leg. Boustani M., all coll. MBOU.

Flower records. Amaryllidaceae: *Allium phanerantherum*; Apiaceae: *Eryngium glomeratum*; Asteraceae: *Echinops gaillardotii*; Plantaginaceae: *Anarrhinum orientale.*

H. communis seem to be a generalist in the choice of botanical families to forage as noted by Teppner *et al.* (2016)

***Hylaeus* (*Abrupta*) *cornutus* Curtis, 1831 ***

Distribution: WEST PALAEARCTIC (Ascher & Pickering 2021, Kuhlmann *et al.* 2021).

Material examined. N. Lebanon: Tanourine El Tahta, Mahbaseh, 926 m, 27.VI.2019, 1♀, leg. Van Achter X., coll. XVA.

Flower records. Apiaceae: *Daucus carota*.

***Hylaeus* (*Hylaeus*) *crispulus* Dathe, 1980 ***

Distribution: EAST MEDITERRANEAN: Turkey, Iran, Israel, Lebanon (Ascher & Pickering 2021).

Material examined. Bekaa: Ainata, 2229 m, 29.VII.2018, 1♂, leg. Boustani M., coll. MBOU.

N. Lebanon: Bcharre, Dahr El Adib, 2441 m, 8.VI.2017, 3♂, leg. Boustani M.; Bcharre, Reforestation Area, 2347 m, 27.VI.2017, 2♂, leg. Boustani M.; Bcharre, Qornet Es Sawda, 2911 m, 21.VII.2017, 3♀, 1♂, leg. Boustani M.; Arz tannourine, Trail 4, 1762 m, 5.VII.2018, 1♀, leg. Boustani M.; Bcharre, Plateau Qornet Es Sawda, 2909 m, 12.VII.2018, 1♀, 3♂, leg. Boustani M.; Bcharre, Plateau Qornet Es Sawda, 2882 m, 1.VIII.2018, 1♀, 1♂, leg. Boustani M., all coll. MBOU; Bcharre, Plateau Qornet Es Sawda, 2867 m, 1.VIII.2018, 1♀, leg. Van Achter X., coll. XVA; Bcharre, Dahr El Adib, 2572 m, 25.VIII.2018, 3♀, leg. Boustani M., Jabbour J.; Arz Tannourine, Trail 4, 1781 m, 30.VI.2019, 1♀, leg. Boustani M.; Bcharre, Dahr El Adib, 2566 m, 24.VII.2019, 1♂, leg. Boustani M.; Bcharre, Plateau Qornet Es Sawda, 2882 m, 30.VII.2019, 1♀, leg. Boustani M.; Bcharre, Qornet Es Sawda, 2909 m, 30.VII.2019, 2♀, 3♂, leg. Boustani M.; Bcharre, Dahr El Adib, 2566 m, 20.VIII.2019, 2♀, det. leg. Boustani M., all coll. MBOU.

Flower records. Wide range of floral choices. Asphodelaceae: *Asphodeline taurica*; Asteraceae: *Centaurea solstitialis*; *Cirsium lappaceum*; *Cousinia libanotica*; Euphorbiaceae: *Euphorbia macroclada*; Fabaceae: *Vicia canescens*; Lamiaceae: *Lamium striatum*; *Stachys ehrenbergii*; Plantaginaceae: *Veronica polifolia*. Rubiaceae: *Asperula taurica.*

***Hylaeus* (*Prosopis*) *damascenus* (Magretti, 1890) ***

Distribution: WEST PALAEARCTIC: Turkey, Israel, Syria, Iran, Iraq, Lebanon, eastern Europe (Ascher & Pickering 2021, Kuhlmann *et al.* 2021).

Material examined. Mount Lebanon: Mazraat Al Daher, 529 m, 19.VII.2019, 2♀, leg. Boustani M., coll. MBOU.

Flower records. Rosaceae: *Rubus sanctus*.

***Hylaeus* (*Dentigera*) *imparilis* Förster, 1871 ***

Distribution: PALAEARCTIC: Mediterranean basin, Europe, Russia (Ascher & Pickering 2021, Kuhlmann *et al.* 2021).

Local distribution fig. 10.3

Material examined. Bekaa: Jdeide, 1000 m, 19.V.1996, 1♀, 1♂, leg. Roche C.G., coll. SEMC; 9.VI.1996, 1♀, leg. Roche C.G.; Hadath, 1610 m, 07.VII.2019, 1♀, leg. Ghisbain G., coll. UMONS.

Mount Lebanon: Aley, Ain Es Sayde, 15.VIII.1994, 1♀, 3♂, leg. Roche C.G.; Mansourieh, Al Mountazah, 350 m, 25.VI.1995, 2♀, 1♂, leg. Roche C.G.; 250 m, 26.VI.1996, 1♂, leg. Roche C.G. all coll. SEMC; Souk El Ghareb, Balamand University, 839 m, 23.VII.2019, 1♀, leg. Boustani M., coll MBOU.

N. Lebanon: 20 km NE Tripoli, Nahr El Bared, 2.VI.2001, 3♂, Pavett P.M., coll. MPAV; Arz Tannourine, Trail 4, 1786 m, 13.VII.2017, 2♀, 3♂, leg. Boustani M.; Tannourine El Tahta, Wadi Ain El Raha, 1115 m, 19.VIII.2017, 1♀, leg. Boustani M.; Fehta, El Biara, 1632 m, 18.VIII.2018, 1♀, leg. Boustani M., Jabbour J.; Tannourine El Tahta, Mahbase, 936 m, 27.VI.2019, 2♂, leg. Boustani M., all coll. MBOU; Tannourine El Tahta, Mahbase, 926 m, 27.VI.2019, 2♂, leg. Van Achter X.; Hadath El Jebbe, Al Fouar, 1529 m, 25.VII.2019, 1♀, leg. Boustani M., Mouawad G.; Horch Ehden, 1686 m, 31.VII.2019, 1♂, leg. Van Achter X., all coll. XVA.

Flower records. Apiaceae: *Daucus carota*, *Eryngium creticum*, *Eryngium glomeratum*; Hypericaceae: *Hypericum triquetrifolium*, Lamiaceae: *Origanum* sp.

***Hylaeus* (*Spatulariella*) *iranicus* Dathe, 1980 ***

Distribution: EAST MEDITERRANEAN: Turkey, Iran, Lebanon (Ascher & Pickering 2021).

Material examined. N. Lebanon: Arz Bcharre, Forest Limit, 1897 m, 02.VII.2019, 1♂, leg. Boustani M.; Bcharre, Dahr El Adib, 2566 m, 24.VII.2019, 1♂, leg. Boustani M.; Harissa, Al Jawar, 1758 m, 23.VIII.2019, 1♀, leg. Boustani M., all coll. MBOU.

Flower records. Apiaceae: *Eryngium glomeratum*; Lamiaceae: *Stachys ehrenbergii*.

***Hylaeus* (*Dentigera*) *kahri* Förster, 1871 ***

Distribution: WEST PALAEARCTIC (Ascher & Pickering 2021, Kuhlmann *et al.* 2021).

Local distribution fig. 10.4

Material examined. Bekaa: Jord Aarsal, Kechek, 2120 m, 11.VII.2019, 1♀, 1♂, leg. Boustani M., coll. MBOU.

Mount Lebanon: Aley, Ain Es Sayde, 15.VIII.1994, 1♂, leg. Roche C.G., coll. SEMC.

N. Lebanon: Arz Tannourine, Trail 4, 1786 m, 13.VII.2017, 4♂, leg. Boustani M.; Arz Tannourine, Trail 1, 1798 m, 28.VII.2017, 3♀, leg. Boustani M.; Arz Tannourine, Trail 4, 1762 m, 11.VII.2018, 1♂, leg. Boustani M.; Fehta, El Biara, 1632 m, 18.VIII.2018, 1♂, leg. Boustani M., Jabbour J.; Hadath El Jebbe, Border of Cedar Forest, 1681 m, 22.VIII.2018,1♂, leg. Boustani M., Jabbour J., all coll. MBOU; Tannourine El Tahta, Mahbase, 926 m, 27.VI.2019, 1♂, leg. Van Achter X., coll. XVA; Arz Tannourine, Gate, 1796 m, 29.VI.2019, 1♀, 1♂, leg. Boustani M.; Arz Bcharre, Forest Limit, 1897 m, 02.VII.2019, 1♂, leg. Boustani M., all coll. MBOU; Arz Tannourine, 1796 m, 04.VII.2019, 1♀, leg. Ghisbain G., coll. UMONS; Arz Tannourine, Gate, 1797 m, 12.VII.2019, 1♀, leg. Van Achter X.; Arz Bcharre, 2042 m, 14.VII.2019, 1♀, leg. Van Achter X.; Arz Tannourine, 1797 m, 14.VII.2019, 2♀, leg. Van Achter X., all coll. XVA; Hadath El Jebbe, Al Fouar, 1529 m, 25.VII.2019, 1♀, leg. Boustani M., Mouawad G., coll. MBOU; Arz Tannourine, 1797 m, 29.VII.2019, 1♂, leg. Van Achter X.; Arz Tannourine, 1797 m, 31.VII.2019, 1♀, leg. Van Achter X., all coll. XVA; Arz Bcharre, Forest Limit, 1873 m, 20.VIII.2019, 1♂, leg. Boustani M.; Arz Tannourine, Gate, 1796 m, 23.VIII.2019, 1♂, leg. Boustani M.; Fehta, El Biara, 1664 m, 23.VIII.2019, 1♀, 1♂, leg. Boustani M., all coll. MBOU.

Flower records. Apiaceae: *Apium* sp., *Chaerophyllum aurantiacum*, *Eryngium billardieri*; *Eryngium glomeratum*; Brassicaceae: *Alyssum* sp.; Hypericaceae: *Hypericum triquetrifolium*; Lamiaceae: *Origanum* sp.

***Hylaeus* (*Hylaeus*) *kotschisus* (Warncke, 1981) ***

Distribution: EAST MEDITERRANEAN: Turkey, Lebanon, Israel (Ascher & Pickering 2021, Kuhlmann *et al.* 2021).

Material examined. Bekaa: Yammouneh, 1450 m, 6.VIII.1995, 1♀, 3♂, leg. Roche C.G., coll. SEMC.

N. Lebanon: Horch Ehden, 1686 m, 22.VII.2019, 1♀, leg. Van Achter X., coll. XVA.

Flower records. Asteraceae: *Achillea* sp.

***Hylaeus* (*Paraprosopis*) *lineolatus* (Schenck, 1861) ***

Distribution: WEST PALAEARCTIC (Ascher & Pickering 2021, Kuhlmann *et al.* 2021).

Local distribution fig. 10.5

Material examined. Beirut: Achrafieh, Sioufi Garden, 137 m, 21.VI.2019, 1♂, leg. Van Achter X., coll. XVA.

Mount Lebanon: Monteverde, 350 m, 22.V.1994, 1♂, leg. Roche C.G.; Monteverde, 350 m, 23.V.1994, 1♀, leg. Roche C.G., all coll. SEMC. Additional 19♀ and 32♂ from 14 records, collected between 15.VIII.1994 and 23.VII.2019, from Aley, Monteverde, Der El Haref, Choueifat, Mansourieh, Jabal Moussa Biospehre Reserve, Bentael, and Souk El Ghareb.

N. Lebanon: 20 km NE Tripoli, Nahr El Bared, 2.VI.2001, 2♂,. leg. Pavett P.M.; Horch Ehden Nature Reserve, 1300–1600 m, 13–18.IX.2000, 10♀, leg. Pavett P.M., coll. MPAV. Additional 5♀ and 12♂ from 11 records, collected between 29.V.2001 and 23.VIII.2019, from Horch Ehden Nature Reserve, Arz Tannourine, Tannourine El Tahta, and Hadath El Jebbe.

Flower records. Wide range of forage plants. Apiaceae: *Eryngium glomeratum*, *Eryngium creticum*, *Chaerophyllum aurantiacum*, *Hippomarathrum* sp.; Asteraceae: *Carlina curetum* ssp. *orientalis*; *Echinops viscosus*; Boraginaceae: *Echium glomeratum*; Caprifoliaceae: *Cephalaria setosa*; Lamiaceae: *Origanum* sp.; Plantaginaceae: *Anarrhinum orientale*, Verbenaceae: *Duranta erecta*.

***Hylaeus* (*Spatulariella*) *longimacula* (Alfken, 1936) ***

Distribution: WEST PALAEARCTIC: Morocco, Algeria, East Mediterranean, Azerbaijan (Ascher & Pickering 2021, Kuhlmann *et al.* 2021).

Local distribution fig. 10.6

Material examined. Beirut: Achrafieh, Sioufi Garden, 137 m, 21.VII.2019, 1♂, Van Achter X., coll. XVA; 137 m, 26.VII.2019, 1♂, leg. Boustani M., coll. MBOU.

Bekaa: Der Mar Youhanna Maroun, 700 m, 9.V.1996, 1♀, 1♂, leg. Roche C.G.; 19.V.1996, 1♂, leg. Roche C.G.; 700 m, 22.IX.1996, 1♂, leg. Roche C.G., all coll. SEMC.

Mount Lebanon: Monteverde, 350 m, 22.V.1994, 3♀, 1♂, leg. Roche C.G.; Monteverde, 350 m, 23.V.1994, 3♀, 3♂, leg. Roche C.G., all coll. SEMC. Additional 4♀ and 12♂ from 8 records, collected between 15.VIII.1994 and 23.VII.2019, from Aley, Mansourieh, Monteverde, Bentael, Marej Barja, Kaleet El Besten, and Souk El Ghareb.

N. Lebanon: Horch Ehden Nature Reserve, 1300–1600 m, 13–18.IX.2000, 1♀, 1♂, leg. Pavett P.M.; Baksmaya, Nahr El Jawz, 250 m, 1.VI.2001, 4♂, leg. Pavett P.M., all coll. MPAV. Additional 29♀ and 18♂ from 17 records, collected between 2.VI.2001 and 23.VIII.2019, from 20 km NE Tripoli, Hadath El Jebbe, Tannourine El Tahta, Fehta, Arz Tannourine, and Harissa.

Flower records. Wide range of forage plants. Apiaceae: *Chaerophyllum aurantiacum*, *Eryngium creticum*, *Eryngium glomeratum*, *Ferulago frigida*, *Foeniculum vulgare*; Asteraceae: *Carlina curetum* ssp. *orientalis*; Fabaceae: *Brassica* sp.; *Vicia tenuifolia*; Hypericaceae: *Hypericum triquetrifolium*; Lamiaceae: *Origanum* sp. *Lamium* sp.; Plantaginaceae: *Anarrhinum orientale*; Ranunculaceae: *Delphinium ithaburense*, Rosaceae: *Rubus sanctus*; Verbenaceae: *Duranta erecta*.

***Hylaeus* (*Prosopis*) *meridionalis* Förster, 1871 ***

Distribution: PALAEARCTIC (Ascher & Pickering 2021, Kuhlmann *et al.* 2021).

Local distribution fig. 10.7

Material examined. Bekaa: Hadath, 1610 m, 7.VII.2019, 1♂, leg. Ghisbain G., coll. UMONS.

Mount Lebanon: Laqlouq, Matoube, 1751 m, 6.VII.2019, 1♀, leg. Boustani M., coll. MBOU.

N. Lebanon: Qanat, Qornet Dammouaa, 1242 m, 5.VII.2019, 1♀, H. leg. Ghisbain G., coll. UMONS.; Horch Ehden, 1625 m, 14.VII.2019, 2♀, leg. Van Achter X., coll. XVA; Hadath El Jebbe, Cedar Forest, 1646 m, 25.VII.2019, 1♀, leg. Boustani M., coll. MBOU; Jord Tannourine, 2034 m, 27.VII.2019, 1♂, leg. Van Achter X., coll. XVA; Bcharre, Forest of the Cedars of God, 1873 m, 20.VIII.2019, 2♀, 1♂, leg. Boustani M., coll. MBOU.

Flower records. Apiaceae: *Eryngium billardieri*, *Eryngium creticum*; Lamiaceae: *Mentha aquatica*, *Teucrium orientale*.

***Hylaeus* (*Prosopis*) *pictus* (Smith, 1853) ***

Distribution: WEST PALAEARCTIC: Southern Europe, Mediterranean basin and east to Azerbaijan (Ascher & Pickering 2021, Kuhlmann *et al.* 2021).

Material examined. Mount Lebanon: Aley, Ain Es Sayde, 15.VIII.1994, 1♂, leg. Roche C.G.; Mansourieh, Al

Mountazah, 11.V.1995, 1♂, leg. Roche C.G.; Mansourieh, Al Mountazah, 250 m, 26.VI.1996, 1♀, leg. Roche C.G., all coll. SEMC.

***Hylaeus* (*Koptogaster*) *punctulatissimus* Smith, 1842 ***
Distribution: WEST PALAEARCTIC (Ascher & Pickering 2021).
Material examined. N. Lebanon: Tannourine El Tahta, Wadi Al Fouar, 1528 m, 17.VI.2016, 1♀, leg. Boustani M., coll. MBOU.

***Hylaeus* (*Dentigera*) *punctus* Förster, 1871 ***
Distribution: WEST PALAEARCTIC: North and East Mediterranean (Ascher & Pickering 2021, Kuhlmann *et al.* 2021).
Material examined. Mount Lebanon: Monteverde, 350 m, 7.VIII.1994, 1♂, leg. Roche C.G.; Aley, Ain Es Sayde, 15.VIII.1994, 1♂, leg. Roche C.G., all coll. SEMC.
N. Lebanon: Tannourine El Tahta, Wadi Al Fouar, 22.VIII.2018, 1187 m, 1♂, leg. Boustani M., Jabbour J.; Fehta, El Biara, 1664 m, 23.VIII.2019, 1♂, leg. Boustani M., all coll. MBOU.
Flower records. Apiaceae: *Foeniculum vulgare*, Asteraceae: *Echinops gaillardotii*.

***Hylaeus* (*Prosopis*) *rugicollis* Morawitz, 1873 ***
Distribution: EAST MEDITERRANEAN (Ascher & Pickering 2021, Kuhlmann *et al.* 2021).
Material examined. Bekaa: Jdeide, 1000 m, 12.V.1995, 1♀, leg. Roche C.G., coll. SEMC.

***Hylaeus* (*Hylaeus*) *sidensis* (Warncke, 1981) *** (fig. 18.1)
Distribution: EAST MEDITERRANEAN: Greece, Turkey, Syria, Israel, Lebanon (Ascher & Pickering 2021, Kuhlmann *et al.* 2021).
Material examined. Bekaa: Jdeide, 1000 m, 12.V.1995, 1♀, leg. Roche C.G., coll. SEMC.
Mount Lebanon: Monteverde, 350 m, 21.V.1994, 1♂, leg. Roche C.G.; 6.V.1995, 1♂, leg. Roche C.G.; 25.V.1995, 1♀, leg. Roche C.G., all coll. SEMC; Chammis, Wadi Cheber, 372 m, 26.IV.2019, 2♂, leg. Boustani M., Rasmont P., coll. MBOU.
N. Lebanon: Bokesmaya, Nahr El Jawz, 250 m, 1.VI.2001, 1♂, leg. Pavett P.M., coll. MPAV.
Flower records. Apiaceae: *Chaetosciadium trichospermum*.
Notes: Reported from Lebanon with no details on the specimens by Grace (2010).

***Hylaeus* (*Paraprosopis*) *soror* (Pérez, 1903) ***
Distribution: WEST PALAEARCTIC (Ascher & Pickering 2021).
Material examined. Mount Lebanon: Aley, Ain Es Sayde, 15.VIII.1994, 1♀, leg. Roche C.G.; Monteverde, 350 m, 23.V.1994, 2♂, leg. Roche C.G., leg. SEMC.
N. Lebanon: Arz Tannourine, 1800 m, 19.VII.2005, 1♂, leg. Nemer N., coll. TCFNR; Arz Tannourine, Trail 4, 1786 m, 13.VII.2017, 4♂, leg. Boustani M.; Arz Tannourine, Trail 1, 1798 m, 28.VII.2017, 3♀, leg. Boustani M.; 1748 m, 28.VII.2017, 1♀, leg. Boustani M., all coll. MBOU; Arz Tannourine, Main Gate, 1796 m, 4.VII.2019, 1♀, leg. Ghisbain G., coll. UMONS; 1762 m, 11.VII.2018, 1♂, leg. Boustani M., coll. MBOU; Horch Ehden, 1625 m, 14.VII.2019, 2♂, leg. Van Achter X.; 22.VII.2019, 1♀, leg. Van Achter X., all coll. XVA.
Flower records. Apiaceae: *Chaerophyllum aurantiacum*, *Ferulago* sp., *Hippomarathrum* sp.

***Hylaeus* (*Paraprosopis*) *styriacus* Foerster, 1871 ***
Distribution: PALAEARCTIC: Southern Europe, Russia (Ascher & Pickering 2021).
Material examined. N. Lebanon: Horch Ehden, Nature Reserve, 1300–1600 m, 29.V.2001–3.VI.2001, 1♀, 1♂, leg. Pavett P.M., coll. MPAV.

***Hylaeus* (*Dentigera*) *syriacus* (Alfken, 1936) ***
Distribution: EAST MEDITERRANEAN: Turkey, Jordan, Egypt, Lebanon (Ascher & Pickering 2021).
Local distribution fig. 10.8
Material examined. Bekaa: Hadath, 1441 m, 7.VII.2019, 1♀, leg. Ghisbain G., coll. UMONS.

Mount Lebanon: Souk El Ghareb, Balamand University, 839 m, 23.VII.2019, 1♂, leg. Van Achter X., coll. XVA.
N. Lebanon: Horch Ehden, Nature Reserve, 1300–1600 m, 13–18.IX.2000, 3♀, 5♂, leg. Pavett P.M., coll. MPAV; Tannourine El Tahta, Wadi Al Fouar, 1187 m, 22.VIII.2018, 1♂, leg. Boustani M., Jabbour J.; Arz Tannourine, 1781 m, 23.VIII.2019, 1♂, leg. Boustani M.; Arz Tannourine, 1796 m, 23.VIII.2019, 1♂, leg. Boustani M., all coll. MBOU.
Flower records. Apiaceae: *Eryngium creticum*, *Eryngium glomeratum*, *Foeniculum vulgare*.

***Hylaeus* (*Paraprosopis*) *taeniolatus* Förster, 1871 ***
Distribution: WEST PALAEARCTIC (Ascher & Pickering 2021, Kuhlmann *et al.* 2021).
Local distribution fig. 10.9
GBIF (2021) SEMC records examined by Dathe H. and included in Material examined below.
Material examined. Beirut: Achrafieh, Sioufi Garden, 137 m, 21.VII.2019, 2♂, leg. Boustani M.; 26.VII.2019, 2♂, leg. Boustani M., all coll. MBOU.
Mount Lebanon: Mansourieh, Al Mountazah, 250 m, 30.IV.1996, 3♀, 2♂, leg. Roche C.G.; 26.VI.1996, 1♂, leg. Roche C.G.; 350 m, 25.VI.1995, 1♀, 1♂, leg. Roche C.G., all coll. SEMC; Daychounieh, Nahr Beirut Climbing Site, 133 m, 27.IV.2017, 1♂, leg. Boustani M.; Bentael, 337 m, 23.IV.2019, 5♂, leg. Boustani M., all coll. MBOU.
N. Lebanon: Bokesmaya, Nahr El Jawz, 250 m, 1.VI.2001, 1♀, 1♂, leg. Pavett P.M., coll. MPAV; Hadath El Jebbe, Chemin Wadi Ain El Raha, 1575 m, 28.VII.2017, 1♀, Boustani M.; Arz Tannourine, 1762 m, 18.VIII.2018, 1♂, leg. Boustani M., Jabbour J.; Hadath El Jebbe, Cedar Forest, 1681 m, 22.VIII.2018, 1♀, 4♂, leg. Boustani M., Jabbour J.; Tannourine El Tahta, Wadi Al Fouar, 1187 m, 22.VIII.2018, 4♂, leg. Boustani M., Jabbour J., all coll. MBOU; Tannourine El Fawka, Salon de l'Eglise, 1244 m, 4.VII.2019, 1♂, leg. Ghisbain G., coll. UMONS.
Flower records. Apiaceae: *Eryngium glomeratum*, *Ferulago frigida*, *Foeniculum vulgare*; Lamiaceae: *Lamium* sp.; Rosaceae: *Rubus sanctus*; Rutaceae: *Ruta chalepensis*; Verbenaceae: *Duranta erecta*.

***Hylaeus* (*Prosopis*) *variegatus* (Fabricius, 1798) ***
Distribution: PALAEARCTIC (Ascher & Pickering 2021).
Local distribution fig. 10.10
Unpublished records. GBIF 2015: Beirut, 15 miles East, 6.VIII.1964, 2♂, det. G.C.& R.R. Snelling 1972, leg. Bohart GE.; coll. BBSL.
Material examined. Bekaa: Jdeide, 1000 m, 19.V.1996, 1♂, leg. Roche C.G., coll. SEMC.
Mount Lebanon: Mansourieh, Al Mountazah, 250 m, 20.VIII.1995, 1♂, leg. Roche C.G.; 3.IX.1995, 1♂, leg. Roche C.G.; 26.VI.1996, 1♂, leg. Roche C.G.; Monteverde, 350 m, 06.V.1994, 3♂, leg. Roche C.G.; 21.V.1994, 1♂, leg. Roche C.G.; 23.V.1994, 1♂, leg. Roche C.G.; 29.V.1994, 1♀, leg. Roche C.G.; 14.VIII.1994, 1♂, leg. Roche C.G.; 19.VIII.1994, 1♀, leg. Roche C.G.; 6.V.1995, 1♀, 1♂, leg. Roche C.G.; 4.VI.1995, 1♀, leg. Roche C.G.; 1.VII.1995, 2♀, leg. Roche C.G.; Choueifat, Der Koubel, 300 m, 2.VII.1995, 1♂, leg. Roche C.G.; Monteverde, 350 m, 8.VII.1995, 1♂, leg. Roche C.G.; Deir El Haref, 1100 m, 16.VII.1995, 2♀, leg. Roche C.G.; 23.VII.1995, 1♀, leg. Roche C.G.; 30.VII.1995, 1♀, leg. Roche C.G.; Monteverde, 350 m, 13.VIII.1995, 1♂, leg. Roche C.G.; 18.V.1996, 1♂, leg. Roche C.G.; 19.VI.1996, 1♀, leg. Roche C.G., all coll. SEMC.
N. Lebanon: Zgharta, Kahef Al Malloul, 1100 m, 09.VII.1995, 2♀, leg. Roche C.G., coll. SEMC; Nahr El Bared, 2.VI.2001, 2♀, 1♂, leg. Pavett P.M., coll. MPAV.

ANDRENIDAE

ANDRENINAE

Genus *Andrena* Fabricius, 1775
88 species.

All Material Examined determined by Wood T.J.

All *Andrena* occurrences, global distributions, and their related flower records were published in Wood *et al.* (2020a); species are listed here with only dates and regions, and without flower records to avoid redundancy. Two species that were not reported previously, *Andrena leucopsis* and *Andrena rugulosa*, have been included in the list with full record details.

Andrena (Aciandrena) abruptifovea **Wood, 2020**
Distribution: LEVANT, this species also occurs in Syria (Wood T.J., unpublished data).
Material examined. Mount Lebanon: Shouf Biosphere Reserve 1♀, 5♂; North Lebanon: Harissa, 1♀, 1♂, Tannourine Reserve, 1♀, Arz Tannourine Gate area, 1♀**,** Hadath El Jebbe, 1♀, Arz Bcharre, 1♂; between 5.V.2017 and 20.V.2019.

Andrena (Melandrena) albopunctata **(Rossi, 1792)**
Distribution: PALAEARCTIC.
Material examined. Bekaa: AUB Farm, 4♀, Baalbeck, Haush Sneid ,1♀; Mount Lebanon: Chhim, 1♂; S. Lebanon: Sidon [Saida], 1♀; between 19.IV.1962 and 25.V.1981.

Andrena (Micrandrena) alfkenella **Perkins, 1914**
Distribution: WEST PALAEARCTIC.
Material examined. Mount Lebanon: Shouf Biosphere Reserve, 1♀; N. Lebanon: Horch Ehden, 3♀, Arz Tannourine, 18♀, between 19.VI.2016 and 29.VII.2019.

Andrena (Micrandrena) alfkenelloides **Warncke, 1965**
Distribution: WEST PALAEARCTIC.
Material examined. N. Lebanon: Tannourine El Tahta, 4♀**,** 24–27.III.2017.

Andrena (Nobandrena) anatolica **Alfken, 1935**
Distribution: WEST PALAEARCTIC.
Material examined. N. Lebanon: Arz Bcharre, 4♀, 3♂, between 27.V.2018 and 5.VI.2019.

Andrena (Cryptandrena) aruana **Warncke, 1967**
Distribution: LEVANT.
Material examined. Bekaa: Quaraoun, 1♂**,** 24.III.2013.

Andrena (Nobandrena) asiatica **Friese, 1921**
Distribution: EAST MEDITERRANEAN.
Literature. Schuberth *et al.* (2001): N. Lebanon, Cedars [Arz Bcharre], 10–23.VI.1962, 1♀, 1♂, Coll. Schmiedeknecht, MNHUB.

Andrena (Euandrena) bicolor **Fabricius, 1775**
Distribution: PALAEARCTIC.
Material examined. N. Lebanon: Hadath El Jebbe, 1♀, 12.IV.2019.

Andrena (Aenandrena) bisulcata **Morawitz, 1877**
Distribution: WEST PALAEARCTIC.
Material examined. Mount Lebanon: Fidar, 1♀**;** Jubayl [Byblos], 1♂, between 5.IV.2017 and 25.IV.2017.

Andrena (Cryptandrena) brumanensis **Friese, 1899**
Distribution: WEST PALAEARCTIC
Literature. Friese (1899): Mount Lebanon, Brumana [Broummana, close to Beirut], 30.IV.1899, leg. Morice F. (Listed under Syria, but the location is in modern day Lebanon).

Andrena (Poecilandrena) bytinskii **Warncke, 1969**
Distribution: EAST MEDITERRANEAN
Material examined. N. Lebanon: Fehta, 1♂, 24.IV.2018.

Andrena (incertae sedis) cedricola **Wood, 2020**
Distribution: LEVANT.

Material examined. Mount Lebanon: Falougha, 1♀; Laqlouq, 1♀; N. Lebanon: Hadath El Jebbe, 2♀, 1♂; Harissa, 2♂, between 30.IV.2017 and 13.V.2019.

***Andrena (Pallandrena) christineae* Dubitzky, 2006**
Distribution: EAST MEDITERRANEAN
Material examined. N. Lebanon: Arz Bcharre, 1♀, 2♂, between 18.IV.2018 and 20.V.2019.

***Andrena (Brachyandrena) colletiformis* Morawitz, 1874** (fig. 18.2)
Distribution: PALAEARCTIC
Material examined. Mount Lebanon: Chammis, 1♀; N. Lebanon: Kfar Hay, 1♀, between 3.V.2017 and 26.IV.2019.

***Andrena (Suandrena) cyanomicans* Pérez, 1895 ssp. *mirna* Warncke, 1969**
Distribution: WEST PALAEARCTIC, subspecies *mirna* is found in the **EAST MEDITERRANEAN.**
Material examined. Bekaa: AUB Farm, 2♀, 1♂; Mount Lebanon: Fanar, 1♀, between 15.III.1961 and 11.III.1965.

***Andrena (Ulandrena) dauma* Warncke, 1969**
Distribution: EAST MEDITERRANEAN
Material examined. N. Lebanon: Arz Tannourine, 1♂; Arz Bcharre, 2♀, 6.V.2017 and 12.V.2017.

***Andrena (Truncandrena) doursana* Dufour, 1853 ssp. *mizorhina* Warncke, 1975**
Distribution: WEST PALAEARCTIC, subspecies *mizorhina* is found in the **EAST MEDITERRANEAN.**
Material examined. Bekaa: Kefraya, 1♂, 27.IV.2019.

***Andrena (Melandrena) elmaria* Gusenleitner, 1998** (fig. 18.3)
Distribution: EAST MEDITERRANEAN.
Material examined. N. Lebanon: Tannourine El Tahta, 3♀; Arz Tannourine, 1♂; Ehden, 1♀, between 2.IV.2018 and 5.V.2019.

***Andrena (Chlorandrena) exquisita* Warncke, 1975**
Distribution: EAST MEDITERRANEAN.
Material examined. Bekaa: Kefraya, 1♂, 3♀; Ammiq, 1♀; N. Lebanon: Tannourine El Tahta, 4♂, 9♀; Fehta, 1♀; Arz Tannourine, 1♂; Ehden, 2♀, between 27.III.2017 and 11.V.2019.

***Andrena (Zonandrena) flavipes* Panzer, 1799** (fig. 18.4)
Distribution: PALAEARCTIC.
Local distribution fig. 10.11
Literature. Mavromoustakis (1963): S. Lebanon, Djezzine [Jezzine], 2.VI.1952, 4♀; Mount Lebanon, Hammana, 16.V.1953, 1♀; Mount Lebanon, Ein el Arar, 25.VI.1953, 1♀; Kadisha river, 21.VI.1960, 1♀.
Material examined. 29♀ and 4♂, between 1975 and 2019 from across Lebanon.

***Andrena (Holandrena) forsterella* Osytchnjuk, 1978**
Distribution: WEST PALAEARCTIC.
Material examined. Bekaa: Der El Ahmar, 1♀, 3.VII.2019.

***Andrena (Poecilandrena) freidbergi* Pisanty & Scheuchl, 2018**
Distribution: LEVANT.
Material examined. N. Lebanon: Arz Bcharre, 1♀, 20.V.2019.

***Andrena (Truncandrena) fuligula* Warncke, 1965**
Distribution: EAST MEDITERRANEAN.
Material examined. Bekaa: Qaraoun Lake, 1♀, 1♂, 24.III.2013.

Andrena (Ulandrena) fulvitarsis **Brullé, 1832**
Distribution: WEST PALAEARCTIC
Material examined. N. Lebanon: Arz Bcharre, 1♀, 20.V.2019.

Andrena (Melanapis) fuscosa **Spinola, 1838**
Distribution: PALAEARCTIC.
Material examined. Beirut: AUB Campus, no date, 1♀; Bekaa: AUB Farm, 1♂, between 15.IV.1962 and 12.V.1962.

Andrena (Orandrena) gallinula **Warncke, 1975**
Distribution: EAST MEDITERRANEAN.
Material examined. N. Lebanon: Horch Ehden, 3♀, 20–22.V.2019.

Andrena (Orandrena) garrula **Warncke, 1965 ssp. *lomvia* Warncke, 1969**
Distribution: EAST MEDITERRANEAN.
Material examined: Mount Lebanon: Barja, 2♂; N. Lebanon: Tannourine El Tahta, 4♀, between 31.VI.2016 and 24.III.2017.

Andrena (Chrysandrena) hesperia **Smith, 1853**
Distribution: PALAEARCTIC.
Local distribution fig. 10.12
Material examined. Mount Lebanon: Ksaibe, 1♂, Bentael, 1♀; N. Lebanon, Tannourine El Tahta, 3♀; Fehta, 1♀, Harissa, 3♀, Horch Ehden,1♀, 1♂, Bcharre, 2♂, between 3.V.2017 and 20.V.2019.

Andrena (Taeniandrena) hova **Warncke, 1975**
Distribution: EAST MEDITERRANEAN.
Material examined. N. Lebanon: Arz Bcharre, 9♀, 2♂; Bcharre, 10♀, 8♂; Fehta, 1♀; Arz Tannourine, 3♀; Hadath El Jebbe, 1♀, between 27.VI.2017 and 6.VII.2019.

Andrena (Chlorandrena) humabilis **Warncke, 1965**
Distribution: LEVANT.
Material examined. S. Lebanon: Saidoun, 3♀, 1♂, between 26.III.2017 and 15.IV.2018.

Andrena (Chlorandrena) humilis **Imhoff, 1832**
Distribution: PALAEARCTIC.
Material examined. N. Lebanon: Fehta, 3♂; Arz Tannourine, 6♂; Arz Bcharre, 2♀., between 20.V.2012 and 5.VI.2019.

Andrena (Ulandrena) isabellina **Warncke, 1969**
Distribution: EAST MEDITERRANEAN.
Material examined. Bekaa: Kefraya, 2♀; N. Lebanon: Hadath El Jebbe, 2♀, 27.IV.2019 and 13.V.2019.

Andrena (Margandrena) krausiella **Gusenleitner, 1998**
Distribution: LEVANT.
Material examined. S. Lebanon: Saidoun, 2♀, 20.I.2018.

Andrena (Holandrena) labialis **(Kirby, 1802)**
Distribution: PALAEARCTIC.
Local distribution fig. 10.13
Material examined. Bekaa: Ainata, 5♂; Hadath, 1♀; Mount Lebanon: Horch El Barouk, 1♀; N. Lebanon: Arz Tannourine, 1♂; Arz Bcharre, 2♀, 2♂; Harissa, 1♂; Hadath El Jebbe, 4♀, 1♂; Arz Tannourine, 1♂; Bcharre, 2♀, between 30.V.2017 and 12.VII.2019.

Andrena (Poecilandrena) labiata **Fabricius, 1781 ssp.** ***regina*** **Friese, 1921**
Distribution: PALAEARCTIC, subspecies *regina* is found in the **EAST MEDITERRANEAN.**
Material examined. N. Lebanon: Arz Tannourine, 1♀; Hadath El Jebbeh, 1♀; Bcharre, 2♀, 2♂.

Andrena **(*****Taeniandrena*****)** ***leucopsis*** **Warncke, 1975 ***
Distribution: WEST PALEARCTIC.
Material examined. Arz Tannourine: Gate area, 1754 m, 7.VI.2019, 1♂, leg. Boustani M., Mouawad G., coll. MBOU.
Notes. Grace (2010) reported this species from Lebanon without locality details.
This male specimen was reported as *A. ovatula* agg by Wood *et al*. (2020a). However, barcoding (TJW & C. Praz, unpublished data) confirmed that it belongs to *A. leucopsis*. The females reported as *A. ovatula* agg barcode differently and do not correspond to any known European taxon. It is not currently possible to confidently place a name on this material because of the confused taxonomy of the group, and so it should remain in aggregate for now. The presence of *A. leucopsis* in Lebanon suggests the Warncke records from the Anti-Lebanon in southern Syria (Gusenleitner & Schwarz 2002) are likely to be correct.

Andrena (Melandrena) limata **Smith, 1853**
Distribution: PALAEARCTIC.
Material examined. Bekaa: AUB Farm, 3♀; Mount Lebanon: Falougha, 1♂, between 2.IV.1963 and 17.VII.1975.

Andrena (Micrandrena) lindbergella **Pittioni, 1950**
Distribution: EAST MEDITERRANEAN.
Material examined. N. Lebanon: Arz Bcharre, 1♂; Bcharre, 2♀, 3♂; Jord Tannourine, 1♂, between 8.VI.2017 and 20.V.2019.

Andrena (Micrandrena) magunta **Warncke, 1965**
Distribution: WEST PALAEARCTIC.
Material examined. Bekaa: Quaraoun, 1♀; Mount Lebanon: Jamhour, 1♀; N. Lebanon, Tannourine El Tahta, 1♀, 3♂, between 2.IV.1973 and 11.V.2017.

Andrena (Truncandrena) medeninensis **Pérez, 1895 ssp.** ***usura*** **Warncke, 1967**
Distribution: WEST PALAEARCTIC, subspecies *usura* is found in the **EAST MEDITERRANEAN.**
Material examined. Mount Lebanon: Shouf Biosphere Reserve, 1♂; Mazraat Al Daher, 1♀; N. Lebanon: Arz Tannourine, 3♀, between 11.V.2019 and 19.VII.2019.

Andrena (Melittoides) melittoides **Friese, 1899**
Distribution: EAST MEDITERRANEAN.
Literature. Friese (1899): under "Syria", the location is not clear and could be in current Lebanese territory.
Material examined. Mount Lebanon: Wadi Chahrour, 1♂, 22.V.2009.

Andrena (Chrysandrena) merula **Warncke, 1969**
Distribution: EAST MEDITERRANEAN
Material examined. Mount Lebanon: Barja, 1♂; N. Lebanon: Tannourine El Tahta, 1♂, between 7.III.2017 and 25.IV.2019.

Andrena (Micrandrena) minutula **(Kirby, 1802)**
Distribution: WEST PALAEARCTIC.
Material examined. N. Lebanon: Hadath El Jebbe, 1♀, 12.IV.2019.

Andrena (Micrandrena) minutuloides **Perkins, 1914**
Distribution: WEST PALAEARCTIC.
Material examined. N. Lebanon: Ehden, 1♀, 22.V.2019.

***Andrena (Cryptandrena) monacha* Warncke, 1965**
Distribution: EAST MEDITERRANEAN.
Material examined. Mount Lebanon: Khaldah [Khalde], 1♂, 18.IV.1973.

***Andrena (Melandrena) morio* Brullé, 1832**
Distribution: PALAEARCTIC.
Literature. Mavromoustakis (1963): N. Lebanon, Near Becharré [Bcharre], 19.VI.1960, 1♀; Focke, 20.VI.1960, 2♀; N. Lebanon, Kadisha river, 20.VI.1960, 1♀.

***Andrena (Melandrena) nigroaenea* (Kirby, 1802)**
Distribution: PALAEARCTIC.
Local distribution fig. 10.14
Literature. Mavromoustakis (1963): N. Lebanon, Near Becharré [Bcharre], 27.VI.1960, 1♀; N. Lebanon, Kadisha river, 21–26.VI.1960, 6♀; Grace (2010) Lebanon.
Material examined. Mount Lebanon: Hboub, 1♀; N. Lebanon: Tannourine El Tahta, 1♂, Hadath El Jebbeh, 1♀, 1♂; Bcharre, 1♀; Jairoun, 1♀, between 29.V.2012 and 14.VII.2019.

***Andrena (Micrandrena) oedicnema* Warncke, 1975**
Distribution: EAST MEDITERRANEAN.
Material examined. Mount Lebanon: Barja, 1♂; Marej Barja, 1♀; N. Lebanon: Tannourine El Tahta, 1♂, between 7.III.2017 and 26.IV.2019.

***Andrena (Truncandrena) optata* Warncke, 1975**
Distribution: WEST PALAEARCTIC.
Material examined. Mount Lebanon: Shouf Biosphere Reserve, 1♂; N. Lebanon: Tannourine El Tahta, 1♂,12.IV.2019 and 16.V.2019.

***Andrena (Chlorandrena) orientana* Warncke, 1965**
Distribution: WEST PALAEARCTIC.
Material examined. Bekaa: Kefraya, 2♀, 27.IV.2019.

***Andrena (Taeniandrena) ovatula* (Kirby, 1802) aggregate**
Distribution: WEST PALAEARCTIC.
The material for this taxon was reported as an aggregate in Wood *et al.* (2020a) because the group is undergoing substantial revision.

***Andrena (Pallandrena) pallidicincta* Brullé, 1832**
Distribution: EAST MEDITERRANEAN.
Material examined. N. Lebanon: Donnieh, 1♀; Horch Ehden, 1♀, between 23.V.2012 and 2.V.2017.

***Andrena (Chlorandrena) panurgimorpha* Mavromoustakis, 1957**
Distribution: EAST MEDITERRANEAN.
Material examined. N. Lebanon: Arz Tannourine, 1♂; Jairoun, 2♀, between 29.V.2012 and 6.V.2017.

***Andrena (Plastandrena) pilipes* Fabricius, 1781**
Distribution: PALAEARCTIC.
Material examined. Bekaa: Der El Ahmar, 1♂, 3.VII.2019.

***Andrena* (*Chlorandrena*) *pinkeunia* Warncke, 1969**
Distribution: LEVANT.
Material examined. S. Lebanon: Saidoun, 1♀, 8.V.2018.

Andrena (incertae sedis) prodigiosa **Wood, 2020**
Distribution: ENDEMIC: Known only from the *locus typicus* in eastern Lebanon.
Material examined. Bekaa: Qaraoun Lake, 1♂, 24.III.2013.

Andrena (Melandrena) pyropygia **Kriechbaumer, 1873**
Distribution: PALAEARCTIC.
Literature. Mavromoustakis (1963): Mount Lebanon, Baabdate, 24–25.V.1953, 2♂, 1♀; S. Lebanon, Djezzine [Jezzine], 20.V.1953, 1♂.
Material examined. Bekaa: AUB Farm, 1♀; Mount Lebanon: Bikfayya, 1♀, 18.IX.1962 and 12.VI.1973.

Andrena (Truncandrena) rotundilabris **Morawitz, 1877 ssp. *rila* Warncke, 1969**
Distribution: EAST MEDITERRANEAN.
Literature. Warncke (1969): N. Lebanon, Cedars near Bscharré [Bcharre], 1900 m, 12–19.VI.1931, leg. W. Zerny (paratype).

Andrena (Euandrena) rufitibialis **Friese, 1899 ssp. *limosa* Warncke, 1969**
Distribution: EAST MEDITERRANEAN.
Material examined. North Lebanon: Donnieh, 3♀; South of Jairoun, 1♀, 23.V.2012.

Andrena (Truncandrena) rufomaculata **Friese, 1921**
Distribution: EAST MEDITERRANEAN.
Local distribution fig. 10.15
Material examined. Beirut: 1♂; Bekaa: AUB Farm, 1♂; Mount Lebanon: Fanar, 1♂, Bcheftine, 1♀; Daichouniyé, 1♀, 2♂; Jbeil, 1♂; N. Lebanon: Tannourine El Tahta, 1♂; S. Lebanon: Hilaliyah, 1♂; Saidoun, 2♂, between 17.IV.1961 and 18.III.2018.

Andrena (Euandrena) rufula **Schmiedeknecht, 1883** (fig. 18.5)
Distribution: WEST PALAEARCTIC.
Material examined. N. Lebanon: Horch Ehden, 2♀; Arz Bcharre, 1♀, between 9.V.2017 and 24.IV.2019.

Andrena (Micrandrena) rugothorace **Warncke, 1965**
Distribution: WEST PALAEARCTIC.
Material examined. N. Lebanon: Tannourine El Tahta, 5♀, 1♂, between 11.IV.2017 and 5.V.2019.

Andrena **(*Micrandrena*)** ***rugulosa*** **Stoeckhert, 1935 ***
Distribution: WEST PALEARCTIC
Material examined. Mount Lebanon: Shouf Biosphere Reserve, Barouk-Maaser dirt road, 1769 m, 16.V.2019, 1♂; Shouf Biosphere Reserve, Barouk Trails crossing, 1772 m, 16.V.2019, 1♀, 1♂; Shouf Biosphere Reserve, Maaser Al Chouf Gate, 1726 m, 16.V.2019, 2♀, 1♂, all leg. Boustani M., coll. MBOU.
Notes. Specimens differ slightly from European *A. rugulosa* by the strength of the integumental puncturing, but a barcode sequence is very close to that of a Swiss *A. rugulosa* specimen (C. Praz pers. comm.), and so this name is favoured. Its presence in Lebanon represents another widespread West Palearctic *Andrena* species that reaches its southern limit in the Mount Lebanon range (Wood *et al*. 2020a).

Andrena (Poecilandrena) rusticola **Warncke, 1975**
Distribution: EAST MEDITERRANEAN.
Material examined. N. Lebanon: Horch Ehden, 1♂, 24.IV.2019.

Andrena (Opandrena) schencki **Morawitz, 1866**
Distribution: PALAEARCTIC.
Material examined. Beyrouth [Beirut]: 1♀, V.1979.

Andrena (Euandrena) scrophulariae **Wood, 2020**
Distribution: ENDEMIC: Known only from the locus typicus in northern Lebanon.
Material examined. N. Lebanon: Arz Tannourine, 4♀, 20.V.2018.

Andrena (Truncandrena) serraticornis **Warncke, 1965**
Distribution: EAST MEDITERRANEAN.
Material examined. Mount Lebanon: Chammis, 2♀, 1♂; Falougha, 3♀, 5.IV.2019 and 27.IV.2019.

Andrena (Zonandrena) sigiella **Gusenleitner, 1998**
Distribution: LEVANT.
Material examined. Bekaa: AUB farm, 3♀; Mount Lebanon: Barja, 2♀, 13.IV.1962 and 17.IV.2017.

Andrena (Taeniandrena) similis **Smith, 1849**
Distribution: WEST PALAEARCTIC.
Local distribution fig. 10.16
Material examined. Mount Lebanon: Bhamdoun, 1♀; Ksaibe, 1♂; Bentael, 1♀; N. Lebanon: South of Jairoun, 1♀; Tannourine El Tahta, 2♀, 1♂; Arz Tannourine, 1♀, 1♂; Hadath El Jebbe, 2♀; Arz Bcharre, 3♀; Jord Tannourine, 1♀; Jord Ehden, 1♀; South Lebanon: Saida, 1♀, between 14.III.1973 and 6.VII.2019.

Andrena (Micrandrena) simontornyella **Noskiewicz, 1939 ssp.** ***corpana*** **Warncke, 1965**
Distribution: WEST PALAEARCTIC.
Material examined. Bekaa: Qaraoun Lake, 1♀, 24.III.2013.

Andrena (Poecilandrena) sphecodimorpha **Hedicke 1942 ssp.** ***mediterranea*** **Scheuchl & Pisanty, 2016**
Distribution: WEST PALAEARCTIC, subspecies *mediterranea* is found in the **LEVANT.**
Material examined. N. Lebanon: South of Jairoun, 1♀; Tannourine Reserve, 1♂; Horch Ehden, 1♂, between 23.V.2012 and 13.V.2019.

Andrena (Micrandrena) spreta **Pérez, 1895 aggregate**
Distribution: WEST PALAEARCTIC.
Material examined. N. Lebanon: Tannourine El Tahta, 1♂, 11.V.2017.

Andrena (Lepidandrena) statusa **Gusenleitner, 1998**
Distribution: EAST MEDITERRANEAN.
Material examined. N. Lebanon: Tannourine El Tahta, 1♂, 11.IV.2017.

Andrena (Fuscandrena) stenofovea **Scheuchl & Pisanty, 2018**
Distribution: LEVANT.
Material examined. Bekaa: Quaraoun, 1♀; Mount Lebanon: Barja, 2♂; N. Lebanon: Tannourine El Tahta, 1♀, between 24.III.2013 and 27.III.2017.

Andrena (Simandrena) thomsoni **Ducke, 1898**
Distribution: WEST PALAEARCTIC.
Material examined. Bekaa: Kefraya, 2♂; Ammiq, 1♂; N. Lebanon: Tannourine El Tahta, 1♀; Arz Tannourine, 1♂, between 24.III.2017 and 27.IV.2019.

Andrena (Melandrena) thoracica **(Fabricius, 1775)**
Distribution: PALAEARCTIC.
Literature. Mavromoustakis (1963): (as *A. t. kotschyi* Mavromoustakis, 1953) N. Lebanon, Near Becharré [Bcharre], 19–20.VI.1960, 3♀; N. Lebanon, Kadisha river, 25.VI.1960, 1♀; N. Lebanon, Cedars [Arz Bcharre], 4.VII.1960, 1♀.
Material examined. Bekaa: AUB Farm [Haush Sneid], 2♀; Mount Lebanon: Berbara, 1♀, between 10.V.1961 and 29.III.1964.

***Andrena (Micrandrena) tiaretta* Warncke, 1974**
Distribution: WEST PALAEARCTIC.
Material examined. N. Lebanon: Tannourine El Tahta, 3♀, between 11.IV.2017 and 5.V.2019.

***Andrena (Cordandrena) torda* Warncke, 1965**
Distribution: EAST MEDITERRANEAN.
Material examined. Bekaa: Quaraoun, 1♀; N. Lebanon: South of Jairoun, 1♀, between 23.V.2012 and 24.III.2013.

***Andrena (Simandrena) transitoria* Morawitz, 1871**
Distribution: PALAEARCTIC.
Literature. Mavromoustakis (1963): Mount Lebanon, Hammana, 16.V.1953, 1♀, Mount Lebanon, Ein el Arar, 25.V.1953, 1♀.
Material examined. Beirut: AUB, 1♀, V.1980.

***Andrena (Hoplandrena) trimmerana* (Kirby, 1802)**
Distribution: WEST PALAEARCTIC.
Material examined. Bekaa: Donnieh, 1♀, no date; Ras Baalbeck, 1♂; N. Lebanon: Arz Bcharre, 1♂, between 9.V.2017 and 5.V.2018.

***Andrena (Micrandrena) tringa* Warncke, 1973**
Distribution: WEST PALAEARCTIC.
Material examined. Mount Lebanon: Shouf Biosphere Reserve, 2♀; Barouk, 1♀; N. Lebanon: Arz Tannourine, 3♀; Arz Bcharre, 6♀, 4♂; Tannourine El Tahta, 1♀; Harissa, 3♀, 1♂, between 2.IV.2018 and 2.VII.2019.

***Andrena (Truncandrena) tscheki* Morawitz, 1872 ssp. *tritica* Warncke, 1965**
Distribution (species): WEST PALAEARCTIC, subspecies *tritica* is found in the **EAST MEDITERRANEAN.**
Material examined. Bekaa: AUB Farm [Haush Sneid], 1♂; N. Lebanon: Tannourine El Tahta, 2♀; S. Lebanon: Saidoun, 4♀, 1♂, between 5.V.1961 and 15.IV.2019.

***Andrena (Notandrena) ungeri* Mavromoustakis, 1952**
Distribution: WEST PALAEARCTIC.
Material examined. Bekaa: Anjar, 1♀; Bawarij, 1♀; Mount Lebanon: Dahr El Baïdar, 1♀; Arz Al Barouk, 1♀, between 19.V.1972 and 27.IV.2016.

***Andrena (Poliandrena) unicincta* Friese, 1899**
Distribution: EAST MEDITERRANEAN (see Ghahnavieh & Monfared 2019).
Material examined. N. Lebanon: Tannourine El Tahta, 1♀; S. Lebanon: Saidoun,1♀, 1♂, between 5.III.2018 and 5.V.2019.

***Andrena (Poliandrena) unifasciata* Friese, 1899**
Distribution: LEVANT
Literature. Friese (1899): Beirut, 28.IV.1889, 1♂, 1♀, leg. Morice F.

***Andrena (Holandrena) variabilis* Smith, 1853**
Distribution: PALAEARCTIC.
Material examined. Mount Lebanon: Laqlouq, 1♀, collection 30.VI.2019.

***Andrena (Cryptandrena) ventricosa* Dours, 1873**
Distribution: WEST PALAEARCTIC.
Material examined. N. Lebanon: Jairoun, 1♀, 29.V.2012.

***Andrena* (*Simandrena*) *vetula* Lepeletier, 1841**
Distribution: PALAEARCTIC.
Literature. Mavromoustakis (1963): Mount Lebanon, Ein El Arar (near Baabdate), 25.V.1953, 1♀; S. Lebanon, Djezzine [Jezzine], 2.VI.1953, 1♀.
Material examined. Mount Lebanon: Daichouniyé, 3♀, 3♂; S. Lebanon: Saidoun, 2♀, 1♂, between 27.IV.2017 and 5.V.2018.

PANURGINAE

Genus *Panurgus* Panzer, 1806
Two species.

***Panurgus (Panurgus) posticus* Warncke, 1972**
Distribution: EAST MEDITERRANEAN (Patiny 2012).
Literature. Warncke (1972): Paratype material from Beirut as *Panurgus dentipes* ssp. *posticus*.
Material examined. Mount Lebanon: Jabal Moussa, Trail Qornet El Der, 1364 m, 18.VII.2019, 1♀, det. Wood T.J., leg. Boustani M., coll. MBOU.
N. Lebanon: Hadath El Jebbe, Qornet Dammoua, 1231 m, 22.VI.2017, 1♂, det. Wood T.J., leg. Boustani M., coll. MBOU.

***Panurgus (Panurgus) pyropygus* Friese, 1901**
Distribution: EAST MEDITERRANEAN (Patiny 2012).
Literature. Friese (1901): Beirut, 23.IV.1899, 2♀, type material, leg. Morice F.

Genus *Melitturga* Latreille, 1809
One species.

***Melitturga (Melitturga) praestans* Giraud, 1861**
Distribution: WEST PALAEARCTIC: Scattered in south-eastern Europe, Caucasus and further East to Russia (Patiny 2012).
Unpublished records. GBIF 2021, SEMC: Mount Lebanon: Monteverde, nr. Mansourieh, 350 m, 28.IV.1996, 1♂, det. Baker D., leg. Roche C.G.; Deir El Harf, 1100 m, 1♂, det. Baker D., leg. Roche C.G.
Literature. Friese (1899): Listed under the description of variety *Melitturga praestans* var. *syriaca* as part of the type material.
Beirut, 21–28.IV.1899, some males and females, det. Friese H, leg. Morice F., Schmiedeknecht O.

HALICTIDAE

Specimens determined by Pauly A., except specimens from the MKAS collection determined by Ebmer A.W. and deposited at OÖLM.

Halictinae

HALICTINI

Genus *Halictus* Latreille, 1804
15 species.

Abundant species listed below have a wide range of forage plants from several families, with a focus on Asteraceae, in line with Dikmen *et al.* (2018), but also several Fabaceae genera.

***Halictus* (*Monilapis*) *aegypticola* Stand, 1909**

= *Halictus libanensis* Pérez, 1913

Distribution: EAST MEDITERRANEAN: Turkey, Lebanon, Syria, Israel, ?Egypt (Pauly *et al.* 2016).

Local distribution fig. 11.1

Literature. (Blüthgen 1955): Described as *H. libanensis* from Beit Meri listed under Syria, the locality is in current Lebanese territory; holotype♀: Mount Lebanon, Beit Meri, 12.VI.1908 (MNHNP).

Material examined. Abundant and widespread.

Bekaa: Blaika, 1325 m, 3.VII.2019, 4♀, leg. Ghisbain G.; 3♀, leg. Boustani M., all det. Pauly A.; Hadath, 1441 m, 7.VII.2019, 1♀, leg. Ghisbain G., det. Pauly A., Passage Akoura-Hadath, 1801 m, 7.VII.2019, 1♀, leg. Ghisbain G., det. Pauly A., all coll. UMONS.

Mount Lebanon: Marej Barja, Terbe, 442 m, 26.IV.2019, 1♀, leg. Boustani M., coll. MBOU; Shouf Biosphere Reserve, 1614 m, 3.VII.2019, 1♀, leg. Van Achter X., coll. XVA; Jabal Moussa, Trail Qornet El Der, 1364 m, 18.VII.2019, 1♀; Shouf Bioshpere Reserve, Maaser Al Chouf Gate, 7.VIII.2019, 1726 m, 1♀; Barouk, 1086 m, 12.VIII.2018, 1♀; 1896 m, 7.VIII.2019, 1♀, all leg. Boustani M., det. Pauly A., all coll. MBOU.

N. Lebanon: Tannourine El Tahta, Wadi Ain El Raha, 900 m, 18.IV.2017, 1♀, det. Pauly A., leg. Boustani M., coll. MBOU. Additional 60♀ collected between 18.IV.2017 and 23.VIII.2019 from Arz Tannourine, Hadath El Jebbe, Harissa, Qadisha Valley, Fehta, Horch Ehden, and Tannourine El Tahta.

S. Lebanon: Saidoun, 6.VIII.2018, 1♀; 21.VIII.2018, 1♀; all leg. Baghdadi A., det. Pauly A., coll. SOILS.

Flower records. Wide range of forage plants. Amaryllidaceae: *Allium phaneranterum*; Apiaceae: *Chaerophyllum aurantiacum*, *Eryngium creticum*, *Eryngium glomeratum*, *Foeniculum* sp.; Asteraceae: *Achillea falcata*, *Anthemis pauciloba, Anthemis* sp., *Carduus argentatus*, *Carlina curetum* ssp. *orientalis*, *Centaurea* cf *pallescens*, *Crepis reuteriana*, *Echinops viscosus*, *Picnomon acarna*, *Reichardia* sp.; Fabaceae: *Astragalus gummifer*, *Medicago* sp., *Ononis natrix*, *Trifolium resupinatum*; Brassicaceae: *Thlaspi* sp.; Caprifoliaceae: *Cephalaria joppensis*, *Cephalaria* sp., *Cephalaria stellipilis, Scabiosa argentea*; Caryophyllaceae: *Dianthus* sp.; Hypericaceae: *Hypericum triquetrifolium*; Lamiaceae: *Origanum* cf *ehrenbergii*, *Origanum* sp.; Plantaginaceae: *Anarrhinum orientale*.

***Halictus* (*Tytthalictus*) *asperulus* Pérez, 1895 ***

Distribution: WEST PALAEARCTIC: Iberia and the Maghreb to the East Mediterranean and Iran (Pauly *et al.* 2016).

Material examined. N. Lebanon: Fehta, Teleje, 2054 m, 14.VII.2017, 1♀, det. Pauly A., leg. Boustani M.; Arz Bcharre, Reforestation Area, 1960 m, 18.VIII.2017, 1♂, det. Pauly A., leg. Boustani M., all coll. MBOU.

Flower records. Asteraceae: *Echinops viscosus*, *Onopordum carduiforme*.

***Halictus* (*Hexataenites*) *berlandi* Blüthgen, 1936**

Distribution: EAST MEDITERRANEAN: Turkey, Lebanon, and Israel (Pauly *et al.* 2016).

Local distribution fig. 11.2

Literature. Blüthgen (1955): Mentioned from Syria in the distribution, from Beirut and Zahle (Bekaa governorate) that are in the current Lebanese territory.

Material examined. Mount Lebanon: Missiar, 135 m, 26.VI.2019, 2♀, det. Pauly A., leg. Boustani M., Van Achter X., coll. MBOU; Missiar, 135 m, 1.VII.2019, 1♂, det. Pauly A., leg. Van Achter X.; Jabal Moussa, 1439 m, 18.VII.2019, 1♀, det. Pauly A., leg. Van Achter X., all coll. XVA.

N. Lebanon: Tannourine El Tahta, Wadi Ain El Raha, 900 m, 24.III.2017, 3♀, det. Pauly A., leg. Boustani M.; 27.III.2017, 1♀, det. Pauly A., leg. Boustani M.; 3.V.2017, 1♀, det. Pauly A., leg. Boustani M.; Tannourine El Tahta, Al Mahbase, 893 m, 25.IV.2019, 2♀, det. Pauly A., leg. Boustani M., all coll. MBOU.; Douma, 791 m, 1.VII.2019, 2♀, det. Pauly A., leg. Ghisbain G., coll. UMONS.

S. Lebanon: Saidoun, Sahlet, 10.VIII.2019, 1♀, det. Pauly A., leg. Baghdadi A., coll. SOILS.

Flower records. Apiaceae: *Eryngium creticum*; Asteraceae: *Carduus argentatus*, *Centaurea* sp., *Echinops viscosus*; Boraginaceae: *Echium* sp.

***Halictus* (*Monilapis*) *beytueschebapensis* Warncke, 1984 ***

Distribution: EAST MEDITERRANEAN: Turkey and Iran (Pauly *et al.* 2016).

Local distribution fig. 11.3

Material examined. Bekaa: Passage Akoura-Hadath, 7.VII.2019, 6♀, det. Pauly A., leg. Boustani M., coll. MBOU, 2♀, leg. Boustani M., Gekière A., Ghisbain G., Van Achter X., coll. MBOU, UMONS, XVA; Jord Aarsal, Wadi Al Heeban, 2000 m, 11.VII.2019, 1♀, det. Pauly A., leg. Boustani M., coll. MBOU.

Mount Lebanon: Aaqoura, Mejdel Aaqoura, 1823 m, 28.VII.2018, 1♀, det. Pauly A., leg. Van Achter X., coll. XVA.

N. Lebanon: Arz Tannourine, Outskirts, 1766 m, 6.V.2017, 1♀, det. Pauly A., leg. Boustani M., coll. MBOU. 24 more records of 28♀ and 2♂ from N. Lebanon from Arz Tannourine, Horch Ehden and Arz Bcharre collected between 14.VII.2017 and 20.VIII.2019.

Flower records. Asteraceae: *Carduus argentatus*, *Centaurea eryngioides*, *Cirsium lappaceum*, *Cirsium* sp., *Centaurea pallescens*, *Cousinia libanotica*, *Echinops viscosus*, *Onopordum heteracanthum*, *Reichardia* sp.; Brassicaceae: *Medicago* sp., *Erysimum* sp.; Boraginaceae: *Solenanthus stamineus* (Desf.) Wettst.; Caprifoliaceae: *Centranthus longiflorus, Scabiosa argentea*; Caryophyllaceae: *Dianthus* cf *strictus*; Lamiaceae: *Marrubium* cf *cuneatum*; Plantaginaceae: *Anarrhinum orientale*.

***Halictus* (*Halictus*) *brunnescens* (Eversmann, 1852) ***

Distribution: PALAEARCTIC (Pauly *et al.* 2016).

Local distribution fig.11.4

Material examined. Specimen from AUB Collection without label, 1♀, det. Pauly A., coll AUB.

Bekaa: Der El Ahmar, 989 m, 3.VII.2019, 5♀, det. Pauly A., leg. Gekière A., coll. UMONS, 6♀, det. Pauly A., leg. Boustani M., coll. MBOU, 3♀, det. Pauly A., leg. Ghisbain G., coll. UMONS; Passage Akoura-Hadath, 1748 m, 7.VII.2019, 2♀, det. Pauly A., leg. Van Achter X., coll. XVA.

Mount Lebanon: Barouk, Shouf Biosphere Reserve, 1678 m, 2.VII.2019, 1♂, det. Pauly A., leg. Van Achter X.

N. Lebanon: Arz Bcharre, 1883 m, 29.VI.2018, 2♀, det. Pauly A., leg. Boustani M., Jabbour J.; 21.VII.2018, **1♀,** det. Pauly A., leg. Boustani M., Jabbour J.; Hadath El Jebbe, Border of the Cedar Forest, 1646 m, 31.V.2019, **1♀,** det. Pauly A., leg. Boustani M., all coll. MBOU; Bcharre, 1900 m, 14.VII.2019, 4♀, det. Pauly A., leg. Van Achter X., coll. XVA; Bcharre, Dahr El Adib, 2566 m, 20.VIII.2019, **1**♀, det. Pauly A., leg. Boustani M., coll. MBOU.

Flower records. Asteraceae: *Cousinia libanotica*, *Centaurea* cf *pallescens*, *Onopordum carduiforme*, *Onopordum heteracanthum*, *Serratula pusilla*.

***Halictus* (*Argalictus*) *fatsensis* Blüthgen, 1936 ***

Distribution: EAST MEDITERRANEAN: Cyprus, Turkey, Syria, Israel (Pauly *et al.* 2016).

Material examined. Bekaa: Ainata, 2229 m, 29.VII.2018, 2♂, det. Pauly A., leg. Boustani M., Van Achter X., coll. XVA.

Flower records. Astereaceae: *Centaurea solstitialis*.

***Halictus (Monilapis) galilaeus* Blüthgen, 1955 ***

Synonymised with *Halictus tetrazonius* Klug in Germar, 1817 (Ebmer 1988), considered as an unjustified emendation of *Halictus galileus* Blüthgen, 1955 with *Halictus tetrazonius* by Pesenko (2004) and will be retained here as a separate species.

Distribution of *H. tetrazonius*: PALAEARCTIC (Pauly *et al.* 2016).

Material examined. Mount Lebanon: Maaser Al Chouf, 1718 m, 6.VIII.2018, 1♂, det. Pauly A., leg. Van Achter X.; Missiar, 135 m, 1.VII.2019, 2♂, det. Pauly A., leg. Van Achter X., all coll. XVA.

North Lebanon: Horch Ehden, 1625 m, 14.VII.2019, 1♂, det. Pauly A., leg. Van Achter X.; 1686 m, 24.VII.2019, 1♂, det. Pauly A., leg. Van Achter X., all coll. XVA.

Flower records. Convolvulaceae: *Convolvulus arvensis*, Boraginaceae: *Echium* sp.

***Halictus* (*Monilapis*) *hermon* Ebmer, 1975 ***

Distribution: LEVANT: Israel (Ascher & Pickering 2021).

Material examined. Bekaa: Passage Akoura-Hadath, 1748 m, 7.VII.2019, 1♂, det. Pauly A., leg. Van Achter X., coll. XVA; 1801 m, 7.VII.2019, 1♂, det. Pauly A., leg. Ghisbain G., coll. UMONS; Jord Aarsal, Howiyit Al Borj, 2008 m, 11.VII.2019, 1♀, det. Pauly A., leg. Van Achter X., coll. XVA.

N. Lebanon: Bcharre, Reforestation Area, 1945 m, 18.VIII.2017, 1♂, det. Pauly A., leg. Boustani M.; Bcharre, Daher El Adib, 2572 m, 25.VIII.2018, 1♂, det. Pauly A., leg. Boustani M., Jabbour J., all coll. MBOU.

Flower records. Asteraceae: *Cirsium lappaceum*, *Cirsium* sp., *Echinops viscosus*, *Onopordum heteracanthum*, *Onopordum* sp.

***Halictus* (*Tythalictus*) *maculatus* Smith, 1848 ssp. *priesneri* Ebmer, 1975 ***

Distribution: The species *H. maculatus* is present throughout the **PALAEARCTIC**, the subspecies *priesneri* is present in the **EAST MEDITERRANEAN** (Pauly *et al.* 2016).

Material examined. Bekaa: Jord Aarsal, Howiyit Al Borj, 2008 m, 11.VII.2019, 1♀, det. Pauly A., leg. Boustani M., coll. MBOU.

N. Lebanon: Horch Ehden, 1567 m, 19.VII.2016, 1♀, det. Pauly A., leg. Yammine W., coll. MBOU. Additional 15 records of 20♀ and 6♂ from Horch Ehden, Arz Bcharre, Jord Tannourine, between 2.VIII.2018 and 20.VIII.2019.

Flower records. Apiaceae: *Hippomarathrum* sp.; Asteraceae: *Echinops gaillardotii*, *Centaurea* sp.; Brassicaceae: *Alyssum* sp.; Caprifoliaceae: *Scabiosa argentea*; Caryophyllaceae: *Dianthus* cf *strictus*; Euphorbiaceae: *Euphorbia* sp.; Fabaceae: *Coronilla emeroides*, *Onobrychis cornuta*; Lamiaceae: *Salvia microstegia*; Plantaginaceae: *Veronica* sp.

***Halictus* (*Acalcaripes*) *patellatus* Morawitz, 1874 ***

Distribution: WEST PALAEARCTIC: Ponto-Mediterranean (Pauly *et al.* 2016).

Local distribution fig. 11.5

Literature. Blüthgen (1955): Reported from Syria from coll. Friese (in Zoolog. Museum of Humboldt University, Berlin) which could be located in the current Lebanese territory.

Material examined. Mount Lebanon: Maaser Al Chouf, 1718 m, 6.VIII.2018, 1♀, det. Pauly A., leg. Van Acther X., coll. XVA. Six more records of 16♀ and 3♂ from Mazraat Al Daher, Jabal Moussa Biosphere Reserve, Maaser Al Chouf, and Shouf Biosphere Reserve between 21.VIII.2018 and 7.VIII.2019.

N. Lebanon: South of Jairoun, 1648 m, 23.V.2012, 1♀, det. Ebmer A.W., leg. Kasparek M., coll. OÖLM. 53 more records of 76♀ and 25♂ from Arz Tannourine, Arz Bcharre, Horch Ehden, and Fehta between 26.V.2012 and 20.VIII.2019.

Flower records. Wide range of forage plants. Amaryllidaceae: *Allium phanerantherum*, *Allium* sp.; Apiaceae: *Chaerophyllum aurantiacum*, *Eryngium billardierei*; Asteraceae: *Achillea falcata*, *Anthemis pauciloba*, *Carduus argentatus*, *Centaurea eryngioides*, *Centaurea pallescens*, *Echinops gaillardotii*, *Echinops viscosus*, *Reichardia* sp., *Senecio* cf *vernalis*; Boraginaceae: *Cynoglossum nebrodense*, *Solenanthus stamineus*; Brassicaceae: *Alyssum* sp., *Brassica* sp., *Medicago* sp., *Vicia tenuifolia*; Caprifoliaceae: *Cephalaria stellipilis*; Caryophyllaceae: *Dianthus* sp., *Dianthus strictus*; Convolvulaceae: *Convolvulus arvensis*, *Cuscuta* sp.; Fabaceae: *Astragalus emarginatus*; Lamiaceae: *Mentha aquatica*, *Phlomis* sp., *Salvia microstegia*, *Scutellaria brevibracteata*, *Sideritis* cf *pullulans*; Malvaceae: *Alcea* sp., *Alcea apterocarpa*; Plantaginaceae: *Anarrhinum orientale*; Plumbaginaceae: *Acantholimon libanoticum*; Rosaceae: *Prunus prostrata*; Rubiaceae: *Galium* sp.

***Halictus* (*Hexataenites*) *resurgens* Nurse, 1903 ***

Distribution: WEST PALAEARCTIC (Pauly *et al.* 2016).

Local distribution fig. 11.6

Material examined. Specimen from AUB collection without label, 1♀, det. Pauly A., coll. AUB.

Bekaa: West Bekaa, Aamiq, 985 m, 27.IV.2019, 1♀, det. Pauly A., leg. Boustani M., coll. MBOU.

Mount Lebanon: Fanar, 7.VIII.1969, 1♂, det. Pauly A., leg. Traboulsi R., coll. USEK; Maaser Al Chouf, 1764 m, 6.VIII.2018, 1♀, det. Pauly A., leg. Van Achter X., coll. XVA; Missiar, 135 m, 26.VI.2019, 1♀, 1♂, det. Pauly A., leg. Boustani M., Van Achter; Shouf Biosphere Reserve, Maaser Al Chouf Gate, 1726 m, 7.VIII.2019, 1♀, det. Pauly A., leg. Boustani M.; Maaser Al Chouf, Panoramic trail, 1718 m, 7.VIII.2019, 1♀, det. Pauly A., leg. Boustani M., all coll. MBOU.

N. Lebanon: Tannourine El Tahta, Wadi Ain El Raha, 900 m, 27.III.2017, 1♀, det. Pauly A., leg. Boustani M., coll. MBOU.

Flower records. Asteraceae: *Echinops* cf *viscosus*, *Onopordum heteracanthum*; Caprifoliaceae: *Scabiosa* sp.

***Halictus* (*Hexataenites*) *sexcinctus* (Fabricius, 1775) ssp. *albohispidus* Blüthgen, 1923 ***

Distribution: WEST PALAEARCTIC, subspecies *albohispidus* is found in the **EAST MEDITERRANEAN**: from Turkey to Iran and south to Israel (Pauly *et al.* 2016).

Local distribution fig. 11.7

Material examined. Mount Lebanon: Al Barouk, 18.VI.1975, 1♀, det. Pauly A.; Qornael, 7.VII.1975, 1♂, det. Pauly A.; Abay, 21.VII.1975, 1♂, det. Pauly A., all coll. AUB.

N. Lebanon: Hadath El Jebbe, Qornet Dammouaa, 1231 m, 22.VI.2017, 1♀, det. Pauly A., leg. Boustani M.; Hadath El Jebbeh, Road to Wadi Ain El Raha, 1633 m, 29.VI.2017, 1♂, det. Pauly A., leg. Boustani M.; Fehta, Teleje, 2054 m, 14.VII.2017, 1♀, 1♂, det. Pauly A., leg. Boustani M.; Qanat, Qornet Dammouaa, 1242 m, 5.VII.2019, 1♂, det. Pauly A., leg. Boustani M., all coll. MBOU.

Flower records. Apiaceae: *Eryngium creticum*; Asteraceae: *Crepis reuteriana*, *Onopordum carduiforme*; Fabaceae: *Astragalus gummifer*.

***Halictus* (*Hexataenites*) *squamosus* Lebedev, 1910**

Distribution: EAST MEDITERRANEAN: Levant, Turkey, and Iran.

Literature. Blüthgen (1955): Reported from N. Lebanon, Bcharre, 1400 m, 1–4.VII.1931, 1 specimen, coll. Natuhistor Museum Vienna, and Beirut, 1♀, coll. Blüthgen.

Material examined. N. Lebanon: Tannourine El Tahta, Wadi Ain El Raha, 1187 m, 21.VI.2017, 2♀, det. Pauly A., leg. Boustani M.; Tannourine El Tahta, Wadi Al Fouar, 1187 m, 28.VI.2018, 1♀, det. Pauly A., leg. Boustani M., Jabbour J.; Bcharre, Dahr El Adib, 2337 m, 9.VIII.2018, 1♂, det. Pauly A., leg. Boustani M., Abi Khalil N.; 2431 m, 13.VIII.2018, 1♂, det. Pauly A., leg. Boustani M., all coll. MBOU.

Flower records. Asteraceae: *Centaurea iberica*, *Cousinia libanotica*, *Echinops gaillardotii.*

***Halictus* (*Platyhalictus*) *subalfkenellus* Blüthgen, 1936**

Taxonomic status uncertain (Ebmer 1978), synonymised with *Halictus alfkenellus* Strand, 1909 (Pesenko 2004).

Distribution: EAST MEDITERANEAN: based on type material and current material from Lebanon.

Literature. Blüthgen (1955): Beirut, 1♂; Bekaa, Zahle, 1♂, coll. Blüthgen

Material examined. Bekaa: Jord Aarsal, Wadi Al Heeban, 2000 m, 11.VII.2019, 1♀, leg. Pauly A., leg. Boustani M., coll. MBOU.

N. Lebanon: Arz Tannourine, Reserve Outskirts, 1792 m, 13.VII.2017, 1♂, det. Pauly A., leg. Boustani M., coll. MBOU.

Flower records. Lamiaceae: *Marrubium* cf *cuneatum*; Plumbaginaceae: *Acantholimon libanoticum*.

***Halictus* (*Monilapis*) *tetrazonianellus* Strand, 1909**

Distribution: WEST PALAEARCTIC (Pauly *et al.* 2016).

Literature. Blüthgen (1955): Reported from Beirut.

Material examined. Bekaa: 15.VIII.1969, 1♀, det. Pauly A., leg. Shakra A., coll. AUB; Blaika, 1325 m, 3.VII.2019, 1♀, det. Pauly A., leg. Gekière A.; Der El Ahmar, 989 m, 3.VII.2019, 2♀, det. Pauly A., leg. Boustani M., Ghisbain G., all coll. UMONS; 995 m, 3.VII.2019, 1♀, det. Pauly A., leg. Boustani M., coll. MBOU.

Flower records. Asteraceae: *Centaurea* cf *pallescens*, *Onopordum heteracanthum*.

Genus *Seladonia* Robertson, 1918

Eight species.

Seladonia is considered to be a separate genus following Pesenko (2006) and Pauly (2008).

***Seladonia (Seladonia) cephalica* (Morawitz, 1873)**

Distribution: EAST MEDITERRANEAN: Greece, Asia Minor (Pauly 2016d).

Local distribution fig. 11.8

Literature. Blüthgen (1955): Listed under *Halictus cephalicus* Morawitz, 1873, reported from Beirut.

Material examined. Abundant and widespread.

BDFGM material. Beirut, 7♀, det. Pauly A., coll. MNHNP; Beirut, 1♀, det. Pauly A., coll. MNHUB; Bekaa, near Mejdel Anjar (Locality recovered from coordinates), 22.VII.1945, 1♀, det. Pauly A., coll. BMNH.

Author material. Bekaa: Blaika, 1223 m, 3.VII.2019, 3♀, leg. Boustani M., 1♀, leg. Ghisbain G., all det. Pauly A., coll. UMONS. Additional 14♀ from 3 records collected between 3.VII.2019 and 23.VII.2019 from Blaika, Der El Ahmar and Anjar.

Mount Lebanon: Jabal Moussa Biosphere Reserve, Qehmez Gate, 1401 m, 21.VIII.2018, 1♀, det. Pauly A., leg. Boustani M., coll. MBOU. Additional 2♀ and 2♂ from 3 records collected between 18.VII.2019 and 7.VIII.2019, from Jabal Moussa, Faqra and Maaser Al Chouf.

N. Lebanon: Arz Bcharre, 1914 m, 9.V.2017, 1♀, det. Pauly A., leg. Boustani M., coll. MBOU. Additional 56♀ and 5♂ from 28 records collected between 22.VI.2017 and 23.VIII.2019, from Hadath El Jebbe, Arz Tannourine, Fehta, and Qanat.

Flower records. Wide range of forage plants. Apiaceae: *Chaerophyllum aurantiacum*, *Eryngium billardieri*, *Eryngium creticum*, *Eryngium glomeratum*; Asteraceae: *Achillea falcata*, *Anthemis pauciloba*, *Carlina curetum* ssp. *orientalis*, *Carlina involucrata*, *Centaurea argentea*, *Centaurea eryngioides*, *Centaurea* cf *pallescens*, *Centaurea pallescens*, *Centaurea solstitialis*, *Centaurea* sp., *Crepis reuteriana*; Boraginaceae: *Solenanthus stamineus*; Caprifoliaceae: *Cephalaria* sp., *Cephalaria stellipilis*, *Scabiosa argentea*; Caryophyllaceae: *Dianthus* cf *strictus*; Cucurbitaceae: *Cucumis prophetarum*; Euphorbiaceae: *Euphorbia* sp.; Fabaceae: *Medicago* sp.; Hypericaceae: *Hypericum triquetrifolium*; Lamiaceae: *Origanum* cf *ehrenbergii.*

***Seladonia (Seladonia) phryganica* Pauly & Devalez, 2015 ***

Distribution: EAST MEDITERRANEAN: Northern and eastern Mediterranean and further east to Tajikistan (Pauly *et al.* 2015).

Material Examined. BDGM: Beirut, 1♀, det. Pauly A.; N. Lebanon: Tripoli, 8.VI.1944, 1♀, det. Pauly A.

***Seladonia (Vestitohalictus) pollinosa* (Sichel, 1860) ***

= *Vestitohalictus pollinosus* (Sichel, 1860)

Distribution: PALAEARCTIC: Mediterranean and Central Asia (Pauly 2016f).

Material examined. N. Lebanon: Tannourine El Tahta, Wadi Al Fouar, 1187 m, 28.VI.2018, 1♀, det. Pauly A., leg. Boustani M., Jabbour J., coll. MBOU.

Flower records. Asteraceae: *Echinops gaillardotii*.

***Seladonia (Seladonia) seladonia* (Fabricius, 1794) ***

Distribution: PALAEARCTIC: Steppes of Eurasia (Pauly 2016d).

Material examined. N. Lebanon: Arz Bcharre, 1883 m, 18.IV.2018, 2♀, det. Pauly A., leg. Boustani M.; Arz Bcharre, Reforestation Area, 1933 m, 29.VI.2018, 1♀, det. Pauly A., leg. Boustani M., Jabbour J.; 21.VII.2018, 1♀, det. Pauly A., leg. Boustani M., Jabbour J.; 25.VII.2018, 1♀, det. Pauly A., leg. Boustani M., Jabbour J.; Arz Bcharre, Reforestation Area, 1973 m, 2.VII.2019, 4♀, det. Pauly A., leg. Boustani M., all coll. MBOU; Arz Tannourine, Gate, 1797 m, 14.VII.2019, 1♀, det. Pauly A., leg. Van Achter X.; Bcharre, 1900 m, 14.VII.2019, 2♀, det. Pauly A., leg. Van Achter X.; 24.VII.2019, 1♀, det. Pauly A., leg. Van Achter X., all coll. XVA.

Flower records. Asteraceae: *Achillea falcata*, *Anthemis* sp.

***Seladonia (Seladonia) subaurata* (Rossi, 1792) ssp. *meridionalis* Morawitz, 1873**

Distribution: WEST PALAEARCTIC: *H. subauratus* occurs in the West Palaearctic, from Central Europe to Siberia and South to Spain. The subspecies *meridionalis* occurs from Turkey to Iran (Pauly 2016d).

Local distribution fig. 11.9

Unpublished records. BDFGM: Under the name *Seladonia subaurata* ssp. *syrius* Blüthgen, 1933, syn *meridionalis* MNHUB: Beirut, 1♀; MNHNP: Mount Lebanon, Beit Meri, 14.VIII.1908, 1♀.

Literature. Blüthgen (1933): Reported from N. Lebanon: Bcharre, and Beirut.

Material examined. Bekaa: Hadath, 1441 m, 7.VII.2019, 1♀ det Pauly A., leg. Ghisbain G., coll. UMONS.

Mount Lebanon: Jabal Moussa Biosphere Reserve, Peony Trail, 1420 m, 21.VIII.2018, 1♀, det. Pauly A., leg. Boustani M., coll. MBOU. Additional 6♀ from 3 records collected between 21.VIII.2018 and 23.VII.2019, from Jabal Moussa and Aley.

N. Lebanon: Horch Ehden, 16.IX.1998, 2♂, det. Pauly A., leg. Sattout E., coll. TCFNR; Tannourine El Tahta, Wadi Ain El Raha, 1371 m, 5.V.2017, 1♀, det. Pauly A., leg. Boustani M., coll. MBOU. Additional 33♀ and 8♂ from 16 records collected between 25.VIII.2018 and 29.VII.2019 from Arz Bcharre, Horch Ehden, Arz Tannourine, and Tannourine El Tahta.

Flower records. Wide range of forage plants. Apiaceae: *Cnidium* sp., *Eryngium glomeratum*; Asteraceae: *Achillea* *falcata*, *Carlina involucrata*, *Centaurea* cf *pallescens*, *Centaurea* sp., *Echinops gaillardotii*; Caprifoliaceae: *Cephalaria* cf *joppensis*, *Cephalaria* sp., *Scabiosa* sp.; Caryophyllaceae: *Dianthus* sp., *Dianthus* cf *strictus*; Fabaceae: *Medicago* sp., Hypericaceae: *Hypericum triquetrifolium*; Lamiaceae: *Origanum* sp.; Rosaceae: *Rubus sanctus*.

Seladonia (Seladonia) submediterranea **Pauly, 2015 ***
Distribution: WEST PALAEARCTIC: Central and Western Europe and further East to Iran (Pauly *et al.* 2015).
Material examined. Bekaa: Blaika, 1223 m, 3.VII.2019, 1♀, det. Pauly A., leg. Boustani M., coll. MBOU; Blaika, 1325 m, 3.VII.2019, 1♀, det. Pauly A., leg. Ghisbain G., coll. UMONS.
Mount Lebanon: Jabal Moussa Biosphere Reserve, Qehmez Gate, 1401 m, 21.VIII.2018, 1♀, leg. Boustani M.; Mansourieh, Aylout, 274 m, 26.VI.2019, 1♀, leg. Boustani M., Van Achter X.; Laqlouq, Matoube, 1751 m, 6.VII.2019, all det. Pauly A., all coll. MBOU.
N. Lebanon: Arz Bcharre, 1928 m, 20.VI.2016, 1♀, det. Pauly A., leg. Boustani M., coll. MBOU. Additional 42♀ and 10♂, from 22 records, between 5.VII.2019 and 24.VII.2019, from Arz Tanourine, Arz Bcharre, Fehta, Harissa, Horch Ehden.
S. Lebanon: Saidoun, 28.VI.2018, 1♀, det. Pauly A., leg. Baghdadi A., coll. SOILS.
Flower records. Wide range of forage plants. Apiaceae: *Eryngium billardieri*, *Eryngium glomeratum*, *Ferulago frigida*; Asteraceae: *Achillea falcata*, *Anthemis* sp., *Carlina curetum orientalis*, *Carlina involucrata*, *Centaurea* cf *pallescens*, *Centaurea pallescens*, *Centaurea* sp., *Echinops gaillardotii*, *Echinops viscosus*; Boraginaceae: *Solenanthus stamineus*; Brassicaceae: *Alyssum* sp.; Caprifoliaceae: *Scabiosa argentea*; Caryophyllaceae: *Dianthus* cf *strictus*; Fabaceae: *Medicago* sp.; Lamiaceae: *Stachys* sp.
Preferences for Asteraceae and Apiaceae in line with the observations of Pauly *et al.* (2015).

Seladonia (Vestitohalictus) tuberculata **(Blüthgen, 1924)**
= *Vestitohalictus tuberculatus* (Blüthgen, 1924)
Distribution: EAST MEDITERRANEAN (Pauly 2016f)
Local distribution fig. 11.10
Unpublished records. BDFGM: Beirut, 1♀, coll. MNHNP
Literature. Blüthgen (1955): Mentioned from Bekaa, Ksara.
Material examined. Bekaa: Der El Ahmar, 995 m, 3.VII.2019, 7♀, leg. Boustani M., coll. MBOU. 10♀, leg. Ghisbain G., coll. UMONS, all det. Pauly A.; 989 m, 3.VII.2019, 1♀, 3♂, leg. Boustani M., **1 M,** leg. Ghisbain G., coll. UMONS, all det. Pauly A.; 1011 m, 3.VII.2019, 2♂, det. Pauly A., leg. Boustani M., coll. MBOU; Passage Akoura-Hadath, 1801 m, 7.VII.2019, 2♀, leg. Boustani M., coll. MBOU, 1♀, leg. Gekière A., 3♀, leg. Ghisbain G., coll. UMONS, all det. Pauly; 1748 m, 7.VII.2019, 1♀, det. Pauly A., leg. Van Achter X., coll. XVA; Jord Aarsal, Kechek, 2120 m, 11.VII.2019, 1♀, det. Pauly A., leg. Boustani M.; Jord Aarsal, Howiyit Al Borj, 2008 m, 11.VII.2019, 1♀, det. Pauly A., leg. Boustani M., all coll. MBOU.
N. Lebanon: Harissa, Al Jawar, 1758 m, 3.VI.2019, 1♀, det. Pauly A., leg. Boustani M.; Arz Tannourine, Trail 4, 1781 m, 3.VI.2019, 1♀, det. Pauly A., leg. Boustani M.; Bcharre, Reforestation Area, 1973 m, 2.VII.2019, 3♀, 1♂, det. Pauly A., leg. Boustani M., all coll. MBOU; Bcharre, 1900 m, 14.VII.2019, 1♀, det. Pauly A., leg. Van Achter X.; 2042 m, 14.VII.2019, 2♀, det. Pauly A., leg. Van Achter X.; 22.VII.2019, 1♂, det. Pauly A., leg. Van Achter X., all coll. XVA; Bcharre, Reforestation Area, 2216 m, 25.VII.2019, 1♀, det. Pauly A., leg. Boustani M., coll. MBOU.
Flower records. Asteraceae: *Achillea falcata*, *Carthamus persicus*, *Centaurea* cf *pallescens*, *Cirsium* sp., *Cousinia hermonis*, *Cousinia libanotica*, *Cousinia* sp., *Onopordum heteracanthum*; Fabaceae: *Medicago* sp.; Plantaginaceae: *Anarrhinum orientale*.

Seladonia (Vestitohalictus) vestita **Lepeletier 1841 ssp. *tecta* (Radoszkovski, 1875)**
= *Vestitohalictus vestitus* (Lepeletier, 1841) ssp. *tectus* (Radoszkovski, 1875) *
Distribution: WEST PALAEARCTIC: Steppes of Eurasia (Pauly 2016f).
Local distribution fig. 11.11
Material examined. Bekaa: Passage Akoura-Hadath, 1801 m, 7.VII.2019, 2♀, det. Pauly A., leg. Boustani M.; 1820 m, 7.VII.2019, 6♀, det. Pauly A., leg. Boustani M., all coll. MBOU.

N. Lebanon: Bcharre, Reforestation Area, 1945 m, 18.VIII.2017, 1♂, det. Pauly A., leg. Boustani M.; Bcharre, Dahr El Adib, 2572 m, 25.VIII.2018, 1♀, det. Pauly A., leg. Boustani M., Jabbour J.; Arz Bcharre, Reforestation Area, 1933 m, 25.VIII.2018, 1♂, det. Pauly A., leg. Boustani M., Jabbour J.; Ehden, Al Bayada, 1861 m, 22.V.2019, 2♀, det. Pauly A., leg. Boustani M., all. coll. MBOU; Horch Ehden, Upper Gate, 1597 m, 5.VII.2019, 1♀, leg. Boustani M., coll. MBOU, 1♀, leg. Ghisbain G., coll. UMONS, all det. Pauly A.; Horch Ehden, 1686 m, 12.VII.2019, 1♀, det. Pauly A., leg. Van Achter X.; Bcharre, 1900 m, 12.VII.2019, 1♀, det. Pauly A., leg. Van Achter X.; Horch Ehden, 1686 m, 14.VII.2019, 5♀, 1♂, det. Pauly A., leg. Van Achter X.; Bcharre, 1900 m, 14.VII.2019, 1♀, det. Pauly A., leg. Van Achter X.; Bcharre, 2042 m, 14.VII.2019, 7♀, det. Pauly A., leg. Van Achter X.; Horch Ehden, 1686 m, 22.VII.2019, 1♀, det. Pauly A., leg. Van Achter X.; 24.VII.2019, 3♀, 2♂, det. Pauly A., leg. Van Achter X.; Bcharre, 1900 m, 31.VII.2019, 1♀, det. Pauly A., leg. Van Achter X.; Horch Ehden, 1686 m, 31.VII.2019, 1♀, det. Pauly A., leg. Van Achter X., all coll. XVA.

Flower records. Asteraceae: *Centaurea* cf *iberica*, *Centaurea* cf *pallescens*, *Cirsium lappaceum*, *Echinops viscosus*; Brassicaceae: *Alyssum* sp.; Fabaceae: *Medicago* sp.; Lamiaceae: *Teucrium orientale*; Caryophyllaceae: *Minuartia* sp.

Genus *Lasioglossum* Curtis, 1833

63 species.

Sub-generic classification of *Lasioglossum* is complex, and no global consensus has yet been reached across all regions. We therefore present the classically used Old World subgeneric concepts and also add the likely subgeneric placement based on Gibbs *et al.* (2013) and Kuhlmann *et al.* (2021).

Lasioglossum (*Evylaeus*) *adaliae* (Blüthgen, 1923) *[= *L.* (*Sphecodogastra*) *adaliae*]

Distribution: EAST MEDITERRANEAN (Pauly 2016a).

Material examined. N. Lebanon: Arz Tannourine, Reserve House, 1786 m, 14.VII.2019, 2♀, det. Pauly A., leg. Van Achter X.; Bcharre, 1900 m, 24.VII.2019, 1♀, det. Pauly A., leg. Van Achter X.; Arz Tannourine, Reserve House, 1786 m, 31.VII.2019, 1♀, det. Pauly A., leg. Van Achter X., all coll. XVA.

Lasioglossum (*Lasioglossum*) *aegyptiellum* (Strand, 1909) *

Distribution: WEST PALAEARCTIC: Northern and eastern Mediterranean basin, from Spain to Egypt (Pauly 2016b).

Material examined. Bekaa: Der El Ahmar, 989 m, 3.VII.2019, 1♀, det. Pauly A., leg. Boustani M., coll. MBOU; Der El Ahmar, 995 m, 3.VII.2019, 1♀, 1♂, det. Pauly A., leg. Ghisbain G., coll. UMONS.

N. Lebanon: Fehta, El Biara, 1632 m, 18.VII.2018, 1♀, det. Pauly A., leg. Boustani M., Jabbour J.; Hadath El Jebbe, Border of the Cedar Forest, 1646 m, 7.VI.2019, 1♀, det. Pauly A., det. Boustani M.; 1646 m, 27.VI.2019, 1♀, det. Pauly A., leg. Boustani M., all coll. MBOU; Hadath El Jebbe, 1704 m, 5.VII.2019, 1♂, det. Pauly A., leg. Ghisbain G., coll. UMONS.

Flower records. Asteraceae: *Centaurea* cf *pallescens*, *Centaurea pallescens*, *Serratula pusilla*; Lamiaceae: *Stachys cretica*.

Lasioglossum (Evylaeus) sp. aff *algericolellum* (Strand, 1909) * [= *L.* (*Sphecodogastra*) sp. aff *algericolellum*]

Distribution: WEST PALAEARCTIC (Pauly 2016a).

The specimens require further verification to assign to *L. algericolellum* with confidence. They are however morphologically close enough to said species to list here.

Material examined. Bekaa: Passage Bcharre-Ainata, 1982 m, 3.VII.2019, 1♀; Passage Akoura-Hadath, 1881 m, 7.VII.2019, 1♂, all leg. Ghisbain G., coll. Pauly A.

Mount Lebanon: Shouf Biosphere Reserve, Maaser Al Chouf Gate, 1726 m, 16.V.2019, 1♀, leg. Boustani M., coll. Pauly A.

N. Lebanon: Arz Bcharre, 1914 m, 9.V.2017, 1♀, leg. Boustani M.; 1900 m, 24.VII.2019, 1♀, leg. Van Achter X.; 1897 m, 20.V.2019, 1♀; 20.VIII.2019, 1♂, all leg. Boustani M., coll. Pauly A.

Flower records. Asteraceae: *Cirsium lappaceum*; Boraginaceae: *Solenanthus stamineus*; Caprifoliaceae: *Centranthus longiflorus*.

***Lasioglossum* (*Dialictus*) *algirum* (Blüthgen, 1923) ***

Distribution: PALAEARCTIC: Disjunct distribution in the mountains of the southern Palaearctic region (Pauly 2016c).

Material examined. N. Lebanon: Jord Tannourine, Jabal Al Mnaitra, 2455 m, 28.V.2017, 1♀, det. Pauly A., leg. Boustani M., Rasmont P.; Tannourine, Jord Tannourine, 2469 m, 28.V.2017, 4♀, det. Pauly A., leg. Boustani M.; Bcharre, Dahr El Adib, 2437 m, 8.VI.2017, 1♀, det. Pauly A., leg. Boustani M.; 2441 m, 8.VI.2017, 1♀, det. Pauly A., leg. Boustani M.; Bcharre, Reforestation Area, 2347 m, 27.VI.2017, 1♀, det. Pauly A., leg. Boustani M.; Bcharre, Qornet Es Sawda, 2863 m, 30.VI.2017, 1♂, det. Pauly A., leg. Boustani M., all coll. MBOU.

Flower records. Fabaceae: *Vicia canescens*; Lamiaceae: *Lamium striatum* var. *minus*; Plantaginaceae: *Veronica polifolia*; Ranunculaceae: *Ranunculus demissus.*

***Lasioglossum* (*Evylaeus*) *anellum* (Vachal, 1905) * [= *L.* (*Sphecodogastra*) *anellum*]**

Distribution: WEST PALAEARCTIC (Pauly 2016a).

Local distribution 11.12

Note: Bytinski-Salz & Ebmer (1974) Reported from Mt. Hermon.

Material examined. Bekaa: Blaika, 1223 m, 3.VII.2019, 2♀, det. Pauly A., leg. Boustani M., coll. MBOU. Additional 29♀ and 2♂ from 8 records between 3.VII.2019 and 11.VII.2019 in the localities Blaika, Der El Ahmar, Hadath, Passage Akoura-Hadath, Jord Aarsal and Saydit Bechwet.

Mount Lebanon: Maaser Al Chouf, Panoramic Trail, 1764 m, 6.VIII.2018, 1♀, det. Pauly A., leg. Boustani M. Additional 4♀ and 1♂ from 4 records between 30.VI.2019 and 7.VIII.2019 from the localities Akour, Bentael, Souk El Ghareb and Barouk.

N. Lebanon: Tannourine El Tahta, Wadi Ain El Raha, 900 m, 27.III.2017, 1♀, det. Pauly A., leg. Boustani M., coll. MBOU. Additional 27♀ and 2♂ from 23 records collected between 18.IV.2017 and 31.VII.2018 from localities Tannourine El Tahta, Arz Tannourine, Hadath El Jebbe, Fehta, Arz Bcharre and Ehden.

***Lasioglossum* (*Evylaeus*) *angusticeps* (Perkins, 1895) * [= *L.* (*Hemihalictus*) *angusticeps*]**

Distribution: WEST PALAEARCTIC (Pauly 2016a).

Local distribution fig. 11.13

Material examined. Bekaa: Hadath, Army Checkpoint, 1610 m, 7.VII.2019, 1♀, det. Pauly A., leg. Ghisbain G., coll. UMONS.

N. Lebanon: Fehta, El Biara, 1632 m, 23.VI.2018, 1♀, det. Pauly A., leg. Boustani M.; Jabal Moussa Biosphere Reserve, Peony Trail – Quarry, 1441 m, 21.VIII.2018, 1♂, det. Pauly A., leg. Boustani M.; Tannourine El Tahta, 1013 m, 27.VI.2019, 1♀, det. Pauly A., leg. Boustani M.; Bcharre, 2042 m, 14.VII.2019, 1♀, det. Pauly A., leg. Van Achter X.; Harissa, Al Jawar, 1758 m, 25.VII.2019, 1♀, det. Pauly A., Boustani M., all coll. MBOU.

Flower records. Apiaceae: *Eryngium creticum*, *Ferulago frigida*; Asteraceae: *Achillea falcata*; Caprifoliaceae: *Scabiosa argentea*; Plantaginaceae: *Anarrhinum orientale*.

***Lasioglossum* (*Dialictus*) *annulipes* (Morawitz, 1876) ***

Distribution: PALAEARCTIC: Bulgaria, Turkey, Armenia, Uzbekistan, Tajikistan, Iran, Afghanistan, Manchuria (Pauly 2016c).

Material examined. Bekaa: Jord Aarsal, Kechek, 2120 m, 11.VII.2019, 2♂, det. Pauly A., leg. Boustani M., coll. MBOU.

N. Lebanon: Arz Bcharre, Forest Limit, 1897 m, 5.VI.2019, 1♀, det. Pauly A., leg. Boustani M.; Arz Bcharre, Reforestation area, 2216 m, 5.VI.2019, 1♀, det. Pauly A., leg. Boustani M.; Bcharre, 1900 m, 14.VII.2019, 1♀, det. Pauly A., leg. Van Achter X.; 2042 m, 31.VII.2019, 1♀, det. Pauly A., leg. Van Achter X.; Bcharre, Dahr El Adib, 2566 m, 20.VIII.2019, 1♂, det. Pauly A., leg. Boustani M., all coll. MBOU.

Flower records. Apiaceae: *Apium* sp., *Ferulago frigida*; Brassicaceae: *Alyssum* sp., *Erysimum* sp.; Plantaginaceae: *Veronica* sp.

***Lasioglossum* (*Evylaeus*) *bluethgeni* Ebmer, 1971 * [= *L.* (*Hemihalictus*) *bluethgeni*]**

Distribution: WEST PALAEARCTIC: West Asia and Europe (Pauly 2016a).

Material examined. N. Lebanon: Horch Ehden, V.2015, 2♀, det. Pauly A., leg. Boustani M.; Arz Tannourine, Trail 4, 1706 m, 7.VI.2017, 1♀, det. Pauly A., leg. Boustani M.; Tannourine El Tahta, Wadi Ain El Raha, 1187 m, 21.VI.2017, 1♀, det. Pauly A., leg. Boustani M.; Fehta, El Biara, 1632 m, 18.VIII.2018, 1♂, det. Pauly A., leg. Boustani M., Jabbour J., all coll. MBOU; Douma, 791 m, 1.VII.2019, 1♀, det. Pauly A., leg. Ghisbain G., coll. UMONS; Arz Tannourine, Main Gate, 1796 m, 4.VII.2019, 1♀, det. Pauly A., leg. Gekière A., coll. UMONS; Horch Ehden, 1625 m, 24.VII.2019, 1♀, det. Pauly A., leg. Van Achter X., coll. XVA.

Flower records. Capparidaceae: *Capparis spinosa*; Fabaceae: *Ononis natrix*; Lamiaceae: *Phlomis* sp.; Rubiaceae: *Galium* sp.

***Lasioglossum* (*Evylaeus*) *brevicorne* (Schenck, 1869) * [= *L.* (*Hemihalictus*) *brevicorne*]**

Distribution: WEST PALAEARCTIC (Pauly 2016a).

Local distribution fig. 11.14

Material examined. Mount Lebanon: Arsoun, X.2015, 1♂, det. Pauly A., leg. Nemer N.; Jabal Moussa, Trail Qornet El Der, 1364 m, 18.VII.2019, 2♂, det. Pauly A., leg. Boustani M.

N. Lebanon: Donnieh, 1200 m, 20.VI.2011, 1♀, det. Ebmer A.W., leg. Kasparek M., coll. OÖLM; Arz Bcharre, Forest Limit, 1873 m, 20.V.2019, 2♀, det. Pauly A., leg. Boustani M.; 5.VI.2019, 1♀, det. Pauly A., leg. Boustani M.; Arz Tannourine, Gate area, 1797 m, 9.VII.2019, 1♀, det. Pauly A., leg. Van Achter X.; Bcharre, 1900 m, 14.VII.2019, 2♀, det. Pauly A., leg. Van Achter X.; Horch Ehden, 1686 m, 24.VII.2019, 1♀, det. Pauly A., leg. Van Achter X.; Tannourine El Tahta, Mar Boutrous, 1207 m, 25.VII.2019, 2♀, det. Pauly A., leg. Boustani M.; Horch Ehden, 1686 m, 31.VII.2019, 1♂, det. Pauly A., leg. Van Achter X.

Flower records. Asteraceae: *Crepis* sp.; Caprifoliaceae: *Scabiosa argentea*.

***Lasioglossum (Lasioglossum) caspicum* (Morawitz, 1873) ***

Distribution: PALAEARCTIC: Levant, Asia Minor, Armenia, Caucasus, Iran, Afghanistan (Pauly 2016b).

Material examined. Bekaa: V.1980, 1♀, det. Pauly A., leg. Bassam, coll. AUB.

Mount Lebanon: Maaser Al Chouf, 1364 m, 29.V.2019, 1♀, det. Pauly A., leg. Boustani M., coll. MBOU.

N. Lebanon: Horch Ehden, Forest Casino du Liban, 1797 m, 4.V.2017, 1♀, det. Pauly A., leg. Boustani M.; Arz Bcharre, Reforestation Area, 1975 m, 27.V.2017, **16**♀, det. Pauly A., leg. Boustani M., Rasmont P.; Fehta, El Biara, 1664 m, 3.VI.2019, 3♀, det. Pauly A., leg. Boustani M., all coll. MBOU; Bcharre, 2042 m, 14.VII.2019, 1♀, det. Pauly A., leg. Van Achter X., coll. XVA.

Flower records. Asteraceae: *Anthemis pauciloba*; Boraginaceae: *Anchusa italica*, *Cynoglossum nebrodense*; Brassicaceae: *Erysimum* sp.; Papaveraceae: *Glaucium leiocarpum*; Ranunculaceae: *Ranunculus* sp.

***Lasioglossum* (*Evylaeus*) *clypeare* (Schenck, 1863) * [= *L.* (*Hemihalictus*) *clypeare*]**

Distribution: WEST PALAEARCTIC: Warm localities in the West Palaearctic (Pauly 2016a).

Material examined. N. Lebanon: Tannourine El Tahta, Wadi Ain El Raha, 900 m, 5.V.2017, 1♀, det. Pauly A., leg. Boustani M.; Arz Tannourine, Trail 4, 1758 m, 22.VI.2017, 1♀, det. Pauly A., leg. Boustani M.; Harissa, Al Jawar, 1736 m, 25.VI.2018, 1♀, det. Pauly A., leg. Boustani M.; Hadath El Jebbe, Border of the Cedar Forest, 1632 m, 27.VI.2019, 1♀, det. Pauly A., leg. Boustani M.; Hadath El Jebbe, 1704 m, 30.VI.2019, 1♀, det. Pauly A., leg. Boustani M., Mouawad G.; Harissa, Al Jawar, 1758 m, 30.VI.2019, 1♀, det. Pauly A., leg. Boustani M.; Arz Bcharre, Reforestation area, 2216 m, 2.VII.2019, 1♀, det. Pauly A., leg. Boustani M., all coll. MBOU; Tannourine Reserve, Trail 4, 1781 m, 4.VII.2019, 1♀, det. Pauly A., leg. Ghisbain G., coll. UMONS.

Flower records. Asteraceae: *Carduus argentatus*; Lamiaceae: *Stachys cretica*, *Stachys distans*, *Stachys ehrenbergii*.

***Lasioglossum* (*Evylaeus*) *clypeiferellum* (Strand, 1909) * [= *L.* (*Hemihalictus*) *clypeiferellum*]**

Distribution: EAST MEDITERRANEAN (Pauly 2016a).

Material examined. N. Lebanon: Horch Ehden, IX.2014, 1♀, det. Pauly A., leg. Boustani M., Boustani C., coll. MBOU; Arz Tannourine, Gate Area, 1797 m, 24.VII.2019, 1♀, det. Pauly A., leg. Van Achter X., coll. XVA.

***Lasioglossum* (*Evylaeus*) *convexiusculum* (Schenck, 1853) *[= *L.* (*Hemihalictus*) *convexiusculum*]**

Distribution: WEST PALAEARCTIC (Pauly 2016a).

Material examined. Mount Lebanon: Qartaba, Matoube, 1648 m, 23.VII.2017, 1♀, det. Pauly A., leg. Boustani M.;

Der El Kamar, 800 m, 29.V.2019, 1♀, det. Pauly A., leg. Boustani M., all coll. MBOU.
N. Lebanon: Jairoun, 1042 m, 29.V.2012, 1♀, det. Ebmer A.W., leg. Kasparek M., coll. MKAS; Harissa, Chir El Ribez, 1730 m, 11.VI.2017, 3♀, det. Pauly A., leg. Boustani M., coll. MBOU.
Flower records. Lamiaceae: *Salvia fruticosa*, *Salvia hierosolymitana*, *Salvia sclarea*.

***Lasioglossum* (*Evylaeus*) *corvinum* (Morawitz, 1878a) *[= *L.* (*Hemihalictus*) *corvinum*]**
Distribution: WEST PALAEARCTIC: Southern part of the West Palaearctic (Pauly 2016a).
Material examined. N. Lebanon: Arz Tannourine, Trail 4, 1781 m, 13.VII.2017, 1♀, det. Pauly A., leg. Boustani M.; Hadath El Jebbe, Border of the Cedar Forest, 1646 m, 25.VII.2017, 1♀, det. Pauly A., leg. Boustani M.; Arz Tannourine, Trail 1, 1798 m, 28.VII.2017, 1♀, det. Pauly A., leg. Boustani M.; Arz Tannourine, 1784 m, VII.2018, 1♀, det. Pauly A., leg. Boustani M., all coll. MBOU.
Flower records. Caprifoliaceae: *Cephalaria setosa*; *Scabiosa argentea*; Fabaceae: *Trifolium* sp.

***Lasioglossum* (*Lasioglossum*) *costulatum* (Kriechbaumer, 1873) ***
Distribution: WEST PALAEARCTIC (Pauly 2016b).
Notes: Ebmer (1988): Reported from Mt Hermon.
Material examined. Mount Lebanon: Barouk, Shouf Biosphere Reserve, 1678 m, 2.VII.2019, 2♂, det. Pauly A., leg. Van Achter X.; 1690 m, 4.VII.2019, 2♀, det. Pauly A., leg. Van Achter X., all coll. XVA.
N. Lebanon: Hadath El Jebbeh, Border of Cedar Forest, 1681 m, 22.VIII.2018, 1♀, det. Pauly A., leg. Boustani M., Jabbour J., coll. MBOU; Hadath El Jebbeh, Al Fouar, 1468 m, 27.VI.2019, 1♀, det. Pauly A., leg. Van Achter X, coll. XVA.
Flower records. Asteraceae: *Echinops viscosus*; Campanulaceae: *Campanula* sp.; Convolvulaceae: *Cuscuta* sp.

***Lasioglossum* (*Evylaeus*) *crassepunctatum* (Blüthgen, 1923) * [= *L.* (*Hemihalictus*) *crassepunctatum*]**
Distribution: WEST PALAEARCTIC: Steppe areas of Asia and the Mediterranean basin (Pauly 2016a).
Material examined. N. Lebanon: Arz Tannourine, Reserve House, 1786 m, 14.VII.2019, 5♀; Arz Tannourine, Gate Area, 1797 m, 24.VII.2019, 1♀**;** Arz Tannourine, Reserve House, 1786 m, 24.VII.2019, 1♀, all det. Pauly A., leg. Van Achter X., all coll. XVA.

***Lasioglossum (Lasioglossum) cristula* (Pérez, 1895) ssp. *donatum* (Warncke, 1975) ***
Distribution: WEST PALAEARCTIC: Western Mediterranean (Pauly 2016b).
Distribution of *L. cristula donatum*: Iran (Pauly 2016b).
Local distribution fig. 11.15
Note: Bytinski-Salz & Ebmer (1974): Reported from Mt Hermon, 1500 m.
Material examined. Mount Lebanon: Marej Barja, Daher, 350 m, 7.III.2017, 1♀, det. Pauly A., leg. Boustani M.; Daychouniyeh, Road to Pegasus, 180 m, 3.IV.2019, 1♀, det. Pauly A., leg. Boustani M., all coll. MBOU.
N. Lebanon: Tannourine El Tahta, Wadi Ain El Raha, 900 m, 24.III.2017, 3♀, det. Pauly A., leg. Boustani M.; 27.III.2017, 2♀, det. Pauly A., leg. Boustani M.; 901 m, 11.IV.2017, 1♀, det. Pauly A., leg. Boustani M.; Arz Tannourine, 1792 m, V.2017, 1♀, det. Pauly A., leg. Boustani M.; Tannourine El Tahta, Al Mahbase, 893 m, 12.IV.2019, 1♀, det. Pauly A., leg. Boustani M., all coll. MBOU; Arz Tannourine, Gate Area, 1797 m, 14.VII.2019, 1♀, det. Pauly A., leg. Van Achter X., coll. XVA.
S. Lebanon: Saidoun, 4.II.2018, 1♀, det. Pauly A., leg. Baghdadi A., coll. SOILS.
Flower records. Asteraceae: *Anthemis* sp.

***Lasioglossum* (*Evylaeus*) *damascenum* (Pérez, 1910) * [= *L.* (*Sphecodogastra*) *damascenum*]**
Distribution: WEST PALAEARCTIC: Ponto-Mediterranean (Pauly 2016a).
Material examined. Mount Lebanon: Daychouniyeh, Road to Pegasus, 180 m, 3.IV.2019, 3♀, det. Pauly A., leg. Boustani M.; Missiar, 135 m, 26.VI.2019, 6♂, det. Pauly A., leg. Boustani M., Van Achter X., all coll. MBOU.
Flower records. Asteraceae: *Anthemis* sp., *Centaurea* cf *pallescens, Chrysanthemum coronarium*, *Echinops* cf *viscosus*.

***Lasioglossum* (*Lasioglossum*) *discum* (Smith, 1853) ssp. *discum* (Smith, 1853) ***
Distribution: WEST PALAEARCTIC: Northern Mediterranean basin (Pauly 2016b).
Material examined. Bekaa: Der El Ahmar, 989 m, 3.VII.2019, 1♀, det. Pauly A., leg. Boustani M.; 995 m,

3.VII.2019, 1♀, det. Pauly A., leg. Boustani M.; 1011 m, 3.VII.2019, 2♀, det. Pauly A., leg. Boustani M., all coll. MBOU.

Flower records. Asteraceae: *Centaurea* cf *pallescens*., *Carthamus persicus*.

***Lasioglossum* (*Evylaeus*) *dolichocephalum* (Blüthgen, 1923) * [= *L.* (*Hemihalictus*) *dolichocephalum*]**

Distribution: WEST PALAEARCTIC: Scattered records in the north-eastern Mediterranean (Pauly 2016a).

Local distribution 11.16

Notes: Bytinski-Salz & Ebmer (1974): Reported from Mt Hermon, 1♂, det. Ebmer A.

***Halictus dolichocephalum* var. *hierosolymae* Blüthgen, 1931**

Material examined. Mount Lebanon: Jabal Moussa, Trail Qornet El Der, 1368 m, 18.VII.2019, 2♀, det. Pauly A., leg. Boustani M., coll. MBOU; Mazraat Al Daher, 579 m, 19.VII.2019, 1♀, det. Pauly A., leg. Van Achter X., coll. XVA.

N. Lebanon: Tannourine El Tahta, Wadi Ain El Raha, 900 m, 5.V.2017, 1♀, det. Pauly A., leg. Boustani M.; Arz Bcharre, Reforestation Area, 1993 m, 27.VI.2017, 2♀, det. Pauly A., leg. Boustani M.; Harissa, Al Jawar, 1765 m, 18.VII.2017, 3♀, det. Pauly A., leg. Boustani M.; Harissa; Al Jawar, 1736 m, 11.VII.2018, 1♀, det. Pauly A., leg. Boustani M.; Wadi Al Fouar, Tannourine El Tahta, 1504 m, 13.V.2019, 1♀, det. Pauly A., leg. Boustani M.; Hadath El Jebbe, Border of the Cedar Forest, 1646 m, 27.VI.2019, 1♀, det. Pauly A., leg. Boustani M.; Harissa, Al Jawar, 1758 m, 30.VI.2019, 7♀, det. Pauly A., leg. Boustani M.; Arz Tannourine, Main Gate, 1794 m, 4.VII.2019, 2♀, det. Pauly A., leg. Boustani M., all coll. MBOU; Horch Ehden, 1686 m, 14.VII.2019, 1♀, det. Pauly A., leg. Van Achter X., coll. XVA; Harissa, Al Jawar, 1758 m, 25.VII.2019, 4♀, det. Pauly A., leg. Boustani M., coll. MBOU.

S. Lebanon: Saidoun, 28.VI.2018, 2♀, det. Pauly A., leg. Baghdadi A., coll. SOILS.

Flower records. Apiaceae: *Foeniculum* sp.; Asteraceae: *Carduus argentatus*; Caryophyllaceae: *Dianthus strictus*; Lamiaceae: *Eremostachys laciniata*, *Lamium* sp., *Phlomis* cf *brachyodon*, *Stachys cretica*, *Stachys distans*, *Stachys ehrenbergii*, *Stachys* sp.

***Lasioglossum (Dialictus) elatum* (Warncke, 1975) ***

Distribution: EAST MEDITERRANEAN: Greece, Turkey, Armenia, Israel (Ebmer 2014).

Local distribution fig. 12.1

Material examined. Mount Lebanon: Bentaël, 11.III.2016, 1♀, det. Pauly A., leg. Boustani M., Zgheib Y., coll. MBOU.

N. Lebanon: Arz Bcharre, Reforestation Area, 1933 m, 27.V.2018, 1♀, det. Pauly A., leg. Boustani M.; Hadath El Jebbeh, Border of Cedar Forest, 1681 m, 19.VII.2018, 1♀, det. Pauly A., leg. Boustani M., Jabbour J., all coll. MBOU; Tannourine El Tahta, Al Mahbase, 926 m, 27.VI.2019, 1♂, det. Pauly A., leg. Van Achter X.; Bcharre, 2042 m, 22.VII.2019, 1♀, det. Pauly A., leg. Van Achter X.; Horch Ehden, 1686 m, 24.VII.2019, 1♀, det. Pauly A., leg. Van Achter X.; Bcharre, 1900 m, 31.VII.2019, 1♀, det. Pauly A., leg. Van Achter X., all coll. XVA.

Flower records. Asteraceae: *Crepis* sp.; Lamiaceae: *Origanum* sp.

***Lasioglossum* (*Dialictus*) *enslini* Ebmer, 1972**

Distribution: LEVANT: Lebanon, Jericho, and Mount Hermon (Pauly 2016c).

Local distribution fig. 12.2

Material examined. Bekaa: Kefrayya, Passage Maaser Al Chouf-Kefrayya, 1811 m, 6.VIII.2018, 1♀, det. Pauly A., leg. Van Achter X., coll. XVA.

N. Lebanon: Arz Bcharre, Reforestation Area, 1967 m, 12.V.2017, 1♂, det. Pauly A., leg. Boustani M.; Arz Bcharre, Reforestation Area, 1885 m, 12.V.2017, 1♀, 1♂, det. Pauly A., leg. Boustani M.; Arz Bcharre, Reforestation Area, 1993 m, 27.VI.2017, 1♀, det. Pauly A., leg. Boustani M.; Bcharre, Qornet Es Sawda, 2911 m, 21.VII.2017, 1♀, det. Pauly A., leg. Boustani M.; Arz Tannourine, Trail 4, 1781 m, 3.VI.2019, 1♀, det. Pauly A., leg. Boustani M.; Harissa, Al Jawar, 1758 m, 3.VI.2019, 2♀, det. Pauly A., leg. Boustani M.; Arz Bcharre, Forest Limit, 1897 m, 5.VI.2019, 1♀, det. Pauly A., leg. Boustani M.; Harissa, Al Jawar, 1758 m, 30.VI.2019, 1♀, det. Pauly A., leg. Boustani M.; Arz Bcharre, Forest Limit, 1897 m, 2.VII.2019, 1♀, 1♂, det. Pauly A., leg. Boustani M., all coll. MBOU; Arz Tannourine, Reserve House, 1786 m, 14.VII.2019, 1♀, 1♂, det. Pauly A., leg. Van Achter X.; Bcharre, 2042 m, 14.VII.2019, 1♀, det. Pauly A., leg. Van Achter X.; 22.VII.2019, 2♀, det. Pauly A., leg. Van Achter X.; 31.VII.2019, 2♀, det. Pauly A., leg. Van Achter X., all coll. XVA.

S. Lebanon: Saidoun, 11.II.2018, 1♀, det. Pauly A., leg. Baghdadi A., coll. SOILS.
Flower records. Asphodelaceae: *Asphodeline taurica*; Asteraceae: *Reichardia* sp.; Brassicaceae: *Alyssum* sp.; *Erysimum* sp.; Caprifoliaceae: *Centranthus longiflorus*, *Cephalaria stellipilis*; Fabaceae: *Onobrychis cornuta*; Geraniacaea: *Geranium* sp.; Lamiaceae: *Salvia microstegi*a; Rubiaceae: *Galium* sp.

***Lasioglossum* (*Evylaeus*) *epipygiale* (Blüthgen, 1924) * [= *L.* (*Sphecodogastra*) *epipygiale*]**
Distribution: WEST PALAEARCTIC: South West Asia (Pauly 2016a).
Note: Ebmer (1995) reports it from Mt Hermon, 23.IV.1993, 1♀, det. Ebmer A.W.
Material examined. Bekaa: Passage Akoura-Hadath, 1801 m, 7.VII.2019, 1♀, det. Pauly A., leg. Ghisbain G., coll. UMONS; 3♀, det. Pauly A., leg. Boustani M., coll. MBOU, 2♀, det. Pauly A., leg. Van Achter X., coll. XVA.
N. Lebanon: Tannourine, 2166 m, 6.VII.2019, 1♀, det. Pauly A., leg. Ghisbain G., coll. UMONS; Bcharre, Qornet Es Sawda, 2694 m, 27.VII.2017, 1♀, det. Pauly A., leg. Boustani M., coll. MBOU.
Flower records. Asteraceae: *Cirsium* sp., *Cousinia libanotica*, *Onopordum heteracanthum*.

***Lasioglossum* (*Evylaeus*) *filipes* Ebmer, 1972 * [= *L.* (*Hemihalictus*) *filipes*]**
Distribution: PALAEARCTIC: Turkey, Israel, Turkmenistan, Uzbekistan, Kazakhstan, Kyrgyzstan, Afghanistan (Pauly 2016a).
Material examined. Bekaa: Blaika, 1325 m, 3.VII.2019, 1♀, det. Pauly A., leg. Boustani M., coll. MBOU.
Flower records. Asteraceae: *Centaurea* cf *pallescens.*

***Lasioglossum* (*Evylaeus*) *glabriusculum* (Morawitz, 1872) * [= *L.* (*Evylaeus*) *glabriusculum*]**
Distribution: WEST PALAEARCTIC: South of the West Palaearctic (Pauly 2016a)
Material examined. Bekaa: Der El Ahmar, 995 m, 3.VII.2019, 1♀, det. Pauly A., leg. Boustani M., coll. MBOU.
Flower records. Asteraceae: *Centaurea* cf *pallescens.*

***Lasioglossum* (*Evylaeus*) *griseolum* (Morawitz, 1872) * [= *L.* (*Hemihalictus*) *griseolum*]**
Distribution: WEST PALAEARCTIC: Mediterranean and West Asian (Pauly 2016a).
Material examined. Mount Lebanon: Maaser Al Chouf, 1143 m, 29.V.2019, 1♀, det. Pauly A., leg. Boustani M., coll. MBOU.
N. Lebanon: Horch Ehden, 1625 m, 14.VII.2019, 3♂, det. Pauly A., leg. Van Achter X.; 24.VII.2019, 1♂, det. Pauly A., leg. Van Achter X.; 1686 m, 24.VII.2019, 1♀, det. Pauly A., leg. Van Achter X., coll. XVA.
Flower records. Asteraceae: *Anthemis pauciloba*.

***Lasioglossum (Dialictus) hethiticum* Ebmer, 1970 ***
Distribution: WEST PALAEARCTIC: Asia Minor (Pauly 2016c).
Material examined. N. Lebanon: Horch Ehden, Nabeh Jouit, 1405 m, 13.IV.2019, 1♀, det. Pauly A., leg. Boustani M., coll. MBOU; 1625 m, 14.VII.2019, 2♀, det. Pauly A., leg. Van Achter X.; 1686 m, 24.VII.2019, 3♀, det. Pauly A., leg. Van Achter X.; 31.VII.2019, 3♀, det. Pauly A., leg. Van Achter X., all coll. XVA.

***Lasioglossum* (*Evylaeus*) *interruptum* (Panzer, 1798) * [= *L.* (*Sphecodogastra*) *interruptum*]**
Distribution: WEST PALAEARCTIC (Pauly 2016a).
Local distribution fig. 12.3
Material examined. Mount Lebanon: Jabal Moussa, Trail Qornet El Der, 1439 m, 18.VII.2019, 1♀, det. Pauly A., leg. Van Achter X., coll. XVA.
N. Lebanon: Tannourine El Tahta, Wadi Ain El Raha, 900 m, 24.III.2017, 1♀, det. Pauly A., leg. Boustani M.; Tannourine El Tahta, Wadi Ain El Raha, 900 m, 27.III.2017, 1♀, det. Pauly A., leg. Boustani M.; Hadath El Jebbe, Qornet Dammoua, 1231 m, 22.VI.2017, 1♀, det. Pauly A., leg. Boustani M., all coll. MBOU; Douma, 791 m, 1.VII.2019, 3♀, det. Pauly A., leg. Ghisbain G.; 1♀, det. Pauly A., leg. Gekière A., all coll. UMONS; Horch Ehden, 1686 m, 14.VII.2019, 1♀, det. Pauly A., leg. Van Achter X., coll. XVA.
Flower records. Asteraceae: *Crepis reuteriana*, *Centaurea* sp.; Capparidaceae: *Capparis spinosa*.

***Lasioglossum (Evylaeus) iranicum* Ebmer, 1975 ***
Distribution: EAST MEDITERRANEAN: Iran (Ebmer 1975).
Material examined. N. Lebanon: Bcharre, Dahr El Adib, 2611 m, 20.VI.2016, 1♀, det. Pauly A., leg. Boustani

M.; Bcharre, Jord, 2723 m, 24.VI.2016, 1♀, det. Pauly A., leg. Boustani M.; Bcharre, Dahr El Adib, 2572 m, 25.VIII.2018, 1♂, det. Pauly A., leg. Boustani M., Jabbour J.; Bcharre, Reforestation area, 2216 m, 5.VI.2019, 1♀, det. Pauly A., leg. Boustani M.; Bcharre, Qornet Es Sawda, 2909 m, 17.VIII.2019, 1♀, det. Pauly A., leg. Boustani M., all coll. MBOU.

Flower records. Asteraceae: *Cirsium lappaceum*; Boraginaceae: *Solenanthus stamineus*; Brassicaceae: *Alyssum* sp.

***Lasioglossum* (*Evylaeus*) *israelense* Ebmer, 1974 * [= *L.* (*Sphecodogastra*) *israelense*]**

Distribution: EAST MEDITERRANEAN: Turkey, Israel (Pauly 2016a).

Note: Ebmer, 1995: Reported from Mt Hermon, 23.IV.1973, 1♀, det. Ebmer A.W.

Material examined. Mount Lebanon: Marej Barja, Terbe, 326 m, 17.IV.2017, 1♀, det. Pauly A., leg. Boustani M.; Marej Barja, Kaleet El Besten, 358 m, 26.IV.2019, 1♀, det. Pauly A., leg. Boustani M.; Chammis, Wadi Cheber, 373 m, 26.IV.2019, 1♀, det. Pauly A., leg. Boustani M., all coll. MBOU.

***Lasioglossum (Lasioglossum) kussariense* (Blüthgen 1925) ***

Distribution: WEST PALAEARCTIC: Ponto Mediterranean (Pauly 2016b)

Material examined. N. Lebanon: South of Jairoun, 1648 m, 23.V.2012, 1♀, det. Ebmer A.W., leg. Kasparek M., coll. OÖLM.

***Lasioglossum* (*Evylaeus*) *laeve* (Kirby, 1802) * [= *L.* (*Sphecodogastra*) *laeve*]**

Distribution: WEST PALAEARCTIC (Pauly 2016a).

Local distribution fig. 12.4

Material examined. Mount Lebanon: Barouk, Shouf Biosphere Reserve, 1690 m, 4.VII.2019, 1♂, det. Pauly A., leg. Van Achter X., coll. XVA.

N. Lebanon: Tannourine El Tahta, Wadi Ain El Raha, 900 m, 24.III.2017, 1♀, det. Pauly A., leg. Boustani M.; 900 m, 27.III.2017, 1♀, det. Pauly A., leg. Boustani M.; 3.V.2017, 5♀, det. Pauly A., leg. Boustani M.; Hadath El Jebbe, Qornet Dammoua, 1231 m, 22.VI.2017, 2♂, det. Pauly A., leg. Boustani M.; Arz Tannourine, Trail 4, 1762 m, 25.VI.2018, 1♂, det. Pauly A., leg. Boustani M.; Hadath El Jebbe, Al Fouar, 1529 m, 31.V.2019, 5♂, det. Pauly A., leg. Boustani M.; Tannourine Reserve, Trail 4, 1781 m, 3.VI.2019, 2♀, det. Pauly A., leg. Boustani M., all coll. MBOU; Tannourine, Jord, 2296 m, 30.VI.2019, 1♂, det. Pauly A., leg. Gekière A.; Arz Tannourine, Main gate, 1796 m, 4.VII.2019, 1♂, det. Pauly A., leg. Ghisbain G., all coll. UMONS; Horch Ehden, 1686 m, 14.VII.2019, 1♂, det. Pauly A., leg. Van Achter X.; Bcharre, 1900 m, 14.VII.2019, 4♂, det. Pauly A., leg. Van Achter X., all coll. XVA.

Flower records. Apiaceae: *Chaerophyllum aurantiacum*; Asteraceae: *Anthemis pauciloba*; *Crepis reuteriana*, *Reichardia* sp.; Euphorbiaceae: *Euphorbia macroclada*; Fabaceae: *Vicia tenuifolia*, *Onobrychis cornuta*.

***Lasioglossum* (*Evylaeus*) *laevidorsum* ssp. *laevidorsum* (Blüthgen, 1923) * [= *L.* (*Hemihalictus*) *laevidorsum* ssp. *laevidorsum*]**

Distribution: WEST PALAEARCTIC: Scattered in the Northern Mediterranean basin (Pauly 2016a).

Material examined. N. Lebanon: Tannourine El Tahta, Wadi Ain El Raha, 900 m, 27.III.2017, 1♀, det. Pauly A., leg. Boustani M., coll. MBOU; Bcharre, 1900 m, 14.VII.2019, 2♀, det. Pauly A., leg. Van Achter X.; Arz Tannourine, Reserve House, 1786 m, 24.VII.2019, 1♀, det. Pauly A., leg. Van Achter X.; Bcharre, 2042 m, 31.VII.2019, 1♀, det. Pauly A., leg. Van Achter X., all coll. XVA.

***Lasioglossum* (*Evylaeus*) *laevinode* (Morawitz, 1876) * [= *L.* (*Hemihalictus*) *laevinode*]**

Distribution: WEST PALAEARCTIC: Mountains of Central Asia (Pauly 2016a).

Material examined. Mount Lebanon: Shouf Biosphere Reserve, Maaser Al Chouf Gate, 1726 m, 16.V.2019, 1♀, det. Pauly A., leg. Boustani M., coll. MBOU.

N. Lebanon: Harissa, Chir El Ribez, 1730 m, 18.VI.2017, 2♀, det. Pauly A., leg. Boustani M.; Harissa, Al Biara, 1741 m, 28.VI.2017, 1♀, det. Pauly A., leg. Boustani M.; Hadath El Jebbeh, Border of the Cedar Forest, 1681 m, 28.VI.2018, 1♀, det. Pauly A., leg. Boustani M., all coll. MBOU; Arz Tannourine, Reserve House, 1786 m, 14.VII.2019, 1♀, det. Pauly A., leg. Van Achter X., coll. XVA; Harissa, Al Jawar, 1736 m, 18.VII.2018, 1♀, det. Pauly A., leg. Boustani M., Jabbour J., coll. MBOU; Horch Ehden, 1686 m, 24.VII.2019, 1♀, det. Pauly A., leg.

Van Achter X., coll. XVA.

Flower records. Asteraceae: *Jurinea* sp.; Lamiaceae: *Salvia fruticosa*, *Salvia hierosolymitana*; Scrophulariaceae: *Scrophularia libanotica*.

***Lasioglossum* (*Evylaeus*) *laticeps* (Schenck, 1869) ssp. *hellenicum* (Blüthgen, 1937) * [= *L.* (*Sphecodogastra*) *laticeps* ssp. *hellenicum*]**

Distribution: WEST PALAEARCTIC (Pauly 2016a).

Local distribution fig. 12.5

Material examined. Bekaa: Blaika, 1223 m, 3.VII.2019, 1♂, det. Pauly A., leg. Boustani M. Additional 2♀ and 7♂ from Passage Akoura-Hadath on 7.VII.2019.

Mount Lebanon: Antelias, Bach Musical Institute, 24.IV.2017, 1♀, det. Pauly A., leg. Boustani M. Additional 7♀ from 3 records, collected between 30.IV.2017 and 7.VII.2019, from Matoube and Shouf Biosphere Reserve.

N. Lebanon: Horch Ehden, V.2015, **1 F,** det. Pauly A., leg. Boustani M., coll. MBOU. Additional 20♀ and 3♂ from 12 records, collected between 24.III.2017 and 31.VII.2019, from Tannourine El Tahta, Arz Bcharre, Arz Bcharre, Harissa, Ehden and Bcharre.

Flower records. Apiaceae: *Ferulago frigida*; Asteraceae: *Anthemis* sp., *Chrysanthemum* sp., *Echinops gaillardotii*; Brassicaceae: *Alyssum* sp.; Caprifoliaceae: *Centranthus longiflorus, Scabiosa argentea*; Campanulaceae: *Asyneuma rigidum*; Lamiaceae: *Phlomis syriaca*, *Teucrium orientale*; Scrophulariaceae: *Scrophularia* sp.

***Lasioglossum* (*Lasioglossum*) *leucozonium* (Schrank, 1781) * [= *L.* (*Leuchalictus*) *leucozonium*]**

Several subspecies have been described under this species, the specimens from Lebanon are potentially referable to the taxon *L. tadschicum* which may be a subspecies of *L. leucozonium*. This issue requires revision work of the Eastern taxa.

Distribution: PALAEARCTIC: Holarctic (Pauly 2016b).

Material examined. N. Lebanon: Tannourine El Tahta, Wadi Ain El Raha, 900 m, 27.III.2017, 3♀, det. Pauly A., leg. Boustani M., coll. MBOU.

***Lasioglossum* (*Evylaeus*) *limbelloides* (Blüthgen, 1931) [= *L.* (*Sphecodogastra*) *limbelloides*]**

Distribution: EAST MEDITERRANEAN: Greece, Turkey, Lebanon, Iran (Pauly 2016a).

Literature. Ebmer 1995: Mount Lebanon, Ain Zhalta, 1300 m, coll. Pauly A.

Material examined. N. Lebanon: Tannourine El Tahta, Wadi Ain El Raha, 1187 m, 21.VI.2017, 1♀, det. Pauly A., leg. Boustani M.; Hadath El Jebbe, Chemin Wadi Ain El Raha, 1519 m, 18.VII.2017, 1♀, det. Pauly A., leg. Boustani M., all coll. MBOU.

Flower records. Asteraceae: *Echinops gaillardotii*; Caprifoliaceae: *Scabiosa argentea*.

***Lasioglossum* (*Evylaeus*) *lineare* (Schenck, 1868) * [= *L.* (*Sphecodogastra*) *lineare*]**

Distribution: WEST PALAEARCTIC (Pauly 2016a).

Local distribution fig. 12.6

Material examined. Abundant and widespread in Lebanon.

Bekaa: Kefraya, 1009 m, 27.IV.2019, 1♀, det. Pauly A., leg. Boustani M., coll. MBOU; Passage Akoura-Hadath, 1748 m, 7.VII.2019, 2♀, det. Pauly A., leg. Van Achter X., coll. XVA.

Mount Lebanon: Maaser Al Chouf, 1718 m, 6.VIII.2018, 1♂, det. Pauly A., leg. Van Achter X., coll. XVA; Additional 7♀ from 4 records collected between 3.IV.2019 and 30.VI.2019, from Daychouniyeh, Mansourieh, Falougha, and Akoura.

N. Lebanon: Arz Bcharre, 1928 m, 20.VI.2016, 2♀, det. Pauly A., leg. Boustani M., coll. MBOU. Additional 33♀ and 8♂ from 28 records collected between 9.V.2017 and 31.VII.2019, from Arz Bcharre, Tannourine El Tahta, Horch Ehden, Harissa, Qanat, Jord Tannourine, Horch Ehden and Bcharre.

S. Lebanon: Saidoun, 21.IV.2018, 1♀, det. Pauly A., leg. Baghdadi A., coll. SOILS.

Flower records. Apiaceae: *Eryngium creticum*; Asteraceae: *Achillea falcata*, *Chrysanthemum coronarium*, *Cirsium* sp., *Echinops gaillardotii*; Brassicaceae: *Alyssum* sp., *Myagrum perfoliatum*; Caprifoliaceae: *Scabiosa argentea*; Caryophyllaceae: *Dianthus* sp.; Convolvulaceae: *Convolvulus arvensis*; Fabaceae: *Medicago* sp., *Ononis natrix*, *Vicia tenuifolia*; Geraniaceae: *Geranium molle*, *Geranium* sp.; Lamiaceae: *Mentha aquatica Salvia microstegia*, *Stachys ehrenbergii*; Plantaginaceae: *Anarrhinum orientale*, *Veronica polifolia*; Rosaceae: *Cotoneaster* sp.; Scrophulariaceae: *Scrophularia* sp.

***Lasioglossum* (*Evylaeus*) *longirostre* (Morawitz, 1876) * [= *L.* (*Hemihalictus*) *longirostre*]**
Distribution: EAST MEDITERRANEAN: Levant, Turkey, Iran, and reported from Mount Lebanon (Pauly 2016a).
Local distribution fig. 12.7
Note: Reported from Mount Hermon from a specimen collected by Dorchin A, determined by Ebmer A.W. (Pauly 2016a).
Material examined. Bekaa: Blaika, 1223 m, 3.VII.2019, 1♀, det. Pauly A., leg. Boustani M.; 1♀, det. Pauly A., leg. Ghisbain G.; Blaika, 1325 m, 3.VII.2019, 2♀, det. Pauly A., leg. Ghisbain G., all coll. UMONS.
Mount Lebanon: Barouk, Shouf Biosphere Reserve, 1686 m, 2.VII.2019, 1♀, det. Pauly A., leg. Van Achter X., coll. XVA; Laqlouq, 1594 m, 6.VII.2019, 1♀, det. Pauly A., leg. Boustani M., coll. MBOU.
N. Lebanon: Tannourine El Tahta, Wadi Ain El Raha, 900 m, 18.IV.2017, 1♀, det. Pauly A., leg. Boustani M.; Fehta, Al Biara, 1741 m, 28.VI.2017, 1♀, det. Pauly A., leg. Boustani M.; Harissa, Al Jawar, 1765 m, 18.VII.2017, 1♀, det. Pauly A., leg. Boustani M.; Tannourine El Tahta, 1013 m, 27.VI.2019, 2♀, det. Pauly A., leg. Boustani M., all coll. MBOU; Tannourine El Tahta, 995 m, 27.VI.2019, 1♀, det. Pauly A., leg. Van Achter X., coll. XVA; Arz Tannourine, Main Gate, 1794 m, 4.VII.2019, 4♀, det. Pauly A., leg. Boustani M., coll. MBOU; Horch Ehden, 1625 m, 14.VII.2019, 1♀, det. Pauly A., leg. Van Achter X., coll. XVA.
Flower records. Asteraceae: *Centaurea* cf *pallescens*; Lamiaceae: *Phlomis* cf *brachyodon*, *Phlomis syriaca*, *Stachys cretica*, *Stachys distans*, *Salvia hierosolymitana*, *Salvia microstegia*, *Salvia sclarea*.

***Lasioglossum* (*Evylaeus*) *lucidulum* (Schenck, 1861) * [*L.* (*Hemihalictus*) *lucidulum*]**
Distribution: PALAEARCTIC: Euro-Siberian (Pauly 2016a).
Material examined. Mount Lebanon: Mazraat Al Daher, 529 m, 19.VII.2019, 2♀, det. Pauly A., leg. Boustani M., coll. MBOU.
N. Lebanon: Horch Ehden, V.2015, 1♀, det. Pauly A., leg. Boustani M.; Hadath El Jebbe, Al Fouar, 1529 m, 31.V.2019, 1♀, det. Pauly A., leg. Boustani M.; Jord Ehden, 1983 m, 5.VII.2019, 1♀, det. Pauly A., leg. Boustani M., all coll. MBOU; Horch Ehden, 1625 m, 14.VII.2019, 3♀, det. Pauly A., leg. Van Achter X.; Horch Ehden, 1686 m, 14.VII.2019, 1♀, det. Pauly A., leg. Van Achter X., all coll. XVA; Bcharre, Dahr El Adib, 2566 m, 24.VII.2019, **1**♀, det. Pauly A., leg. Boustani M., coll. MBOU.

***Lasioglossum* (*Evylaeus*) *malachurum* (Kirby, 1802) * [= *L.* (*Sphecodogastra*) *malachurum*]**
Distribution: WEST PALAEARCTIC (Pauly 2016a).
Local distribution fig. 12.8
Material examined. Specimen without label from AUB collection, 1♀, det. Pauly A., coll. AUB.
Beirut: AUB Campus, 1.VI.1984, 1♀, det. Pauly A., leg. Nahla B, coll. AUB.
Bekaa: Der El Ahmar, 995 m, 3.VII.2019, 1♀, 1♂, det. Pauly A., leg. Boustani M.; 1011 m, 3.VII.2019, 1♀, det. Pauly A., leg. Boustani M., all coll. MBOU.
Mount Lebanon: Barouk, Gîte des oiseaux, 1064 m, 3.VII.2019, 4♀, 1♂, det. Pauly A., leg. Van Achter X., coll. XVA; Mazraat Al Daher, 529 m, 19.VII.2019, 1♂, det. Pauly A., leg. Boustani M.; Aley, 852 m, 23.VII.2019, 1♀, det. Pauly A., leg. Boustani M., all coll. MBOU.
N. Lebanon: Qanat, Qornet Dammoua, 1231 m, 22.VI.2017, 2♀, det. Pauly A., leg. Boustani M., coll. MBOU. Additional 5♀ and 2♂ between 21.VII.2018 and 24.VII.2019 from Arz Bcharre, Hamat and Bcharre.
S. Lebanon: Saida, 25.II.1965, 1♀, det. Pauly A., coll. AUB.
Flower records. Asteraceae: *Achillea falcata*, *Carthamus persicus*, *Centaurea* cf *pallescens*, *Crepis reuteriana*, Caprifoliaceae: *Cephalaria* cf *joppensis*, *Cephalaria* sp.; Convolvulaceae: *Convolvulus* sp.; Lamiaceae: *Origanum* sp.; Plantaginaceae: *Anarrhinum orientale*; Scrophulariaceae: *Verbascum* sp.
Asteraceae genera are the most commonly visited, in line with the observations of Polidori *et al.* (2009).

***Lasioglossum* (*Evylaeus*) *marginatum* (Brullé, 1832) * [= *L.* (*Evylaeus*) *marginatum*]**
Distribution: PALAEARCTIC: South-western and Central Palaearctic (Pauly 2016a).
Local distribution fig. 12.9
Material examined. Abundant and widespread in Lebanon.

Bekaa: AUB Farm [Haush Sneid], 23.IV.1954, 1♀, det. Pauly A.; 5.V.1964, 1♀, det. Pauly A., all coll. AUB. Additional 10♀ and 1♂ from 5 records collected between 24.III.2013 and 27.IV.2019, from Quaraoun and Kefraya.

Mount Lebanon: Beit Meri, 19.IV.1981, 2♀, det. Pauly A., leg. Manassah R., coll. AUB; Bchaftine [Bcheftine], 6.V.1995, 1♀, det. Pauly A., leg. Fayad A., coll. AUB. Additional 28♀ from 13 records, collected between 17.IV.2016 and 16.V.2019, from Sahel Alma, Marej Barja, Mansourieh, Qortada, Bentael, Falougha, and Shouf Biosphere Reserve.

N. Lebanon: South of Jairoun, 1648 m, 23.V.2012, 2♀, det. Ebmer A.W., leg. Kasparek M., coll. OÖLM.

Additional 277♀ and 5♂ from 42 records, collected between 26.V.2012 and 3.VI.2019, from Donnieh, Jairoun, Horch Ehden, Tannourine El Tahta, Hadath El Jebbe, Arz Tannourine, Arz Bcharre, Harissa, Fehta and Ehden.

S. Lebanon: Saidoun, Sahlet, 12.V.2019, 1♀, det. Pauly A., leg. Baghdadi A., coll. SOILS.

Flower records. Wide range of forage plants. Asphodelaceae: *Asphodelus macrocarpus*; Asteraceae: *Anthemis* sp., *Chrysanthemum coronarium*, *Crepis sancta*, *Crepis* sp., *Reichardia* sp., *Rhagadiolus* cf *edulis*, *Sonchus oleraceus*, *Senecio* cf *vernalis*, *Senecio* sp., *Taraxacum* sp.; Brassicaceae: *Alyssum* sp., *Brassica* sp., *Capsella* sp., *Myagrum perfoliatum*, *Peltaria angustifolia*, *Thlaspi microstylum*, *Thlaspi* sp.; Boraginaceae: *Anchusa italica*, *Cynoglossum nebrodense*, *Solenanthus stamineus*; Fabaceae: *Trifolium resupinatum*, *Trifolium tomentosum*; Geraniaceae: *Geranium* sp.; Primulaceae: *Anagallis arvensis*; Rubiaceae: *Asperula arvensis*; Rutaceae: *Ruta chalepensis*; Ranunculacea: *Ranunculus scandicinus*, *Ranunculus* sp.; Rosaceae: *Cotoneaster* sp., *Crataegus monogyna*; Valerianaceae: *Valeriana dioscoridis*.

Notes: This species is one of the most abundant in Mediterranean ecosystems (Potts *et al.* 2003). In our collection sites, females were very abundant. Males in material examined were mainly collected in late fall at high altitude, caught visiting *Colchicum* sp. and *Crocus* sp. that flower before the first snow.

***Lasioglossum* (*Evylaeus*) *mesosclerum* (Pérez, 1903) * [= *L.* (*Hemihalictus*) *mesosclerum*]**

Distribution: WEST PALAEARCTIC: Steppic areas in the Mediterranean and Eastern Asia (Pauly 2016a).

Material examined. N. Lebanon: Hadath El Jebbeh, Border of the Cedar Forest, 1681 m, 22.VIII.2018, 1♀, det. Pauly A., leg. Boustani M., Jabbour J., coll. MBOU.

Flower records. Apiaceae: *Eryngium glomeratum*.

***Lasioglossum* (*Dialictus*) *montifringillum* Warncke, 1984 ssp. *cannabinum* (Warncke, 1984) ***

Distribution: EAST MEDITERRANEAN (Kuhlmann *et al.* 2021).

Distribution of *L. montifringillum cannabinum*: Described from Sinai (Warncke 1984).

Material examined. Bekaa: Jord Aarsal, Kechek, 2120 m, 11.VII.2019, 2♂, det. Pauly A., leg. Boustani M.

N. Lebanon: Arz Bcharre, Forest Limit, 1897 m, 2.VII.2019, 1♀, det. Pauly A., leg. Boustani M.; Bcharre, 2042 m, 22.VII.2019, 1♀, det. Pauly A., leg. Van Achter X.; Arz Tannourine, Reserve House, 1786 m, 31.VII.2019, 1♀, det. Pauly A., leg. Van Achter X.

Flower records. Brassicaceae: *Alyssum* sp.; Plumbaginaceae: *Acantholimon libanoticum*.

***Lasioglossum* (*Dialictus*) *morio* (Fabricius, 1793) ***

Distribution: WEST PALAEARCTIC (Pauly 2016c).

Local distribution fig. 12.10

Material examined. Bekaa: Anjar, Water Trail, 951 m, 23.VII.2019, 1♀, det. Pauly A., leg. Boustani M.

Mount Lebanon: Jabal Moussa Biosphere Reserve, Peony Trail, 1491 m, 21.VIII.2018, 1♀, det. Pauly A., leg. Boustani M., all coll. MBOU.

N. Lebanon: Hadath El Jebbe, Al Fouar, 1529 m, 31.V.2019, 1♀, det. Pauly A., leg. Boustani M., coll. MBOU; Horch Ehden, 1686 m, 14.VII.2019, 4♀, det. Pauly A., leg. Van Achter X.; 1625 m, 14.VII.2019, 2♀, det. Pauly A., leg. Van Achter X.; 1625 m, 24.VII.2019, 1♀, det. Pauly A., leg. Van Achter X.; 1686 m, 24.VII.2019, 6♀, det. Pauly A., leg. Van Achter X.; 31.VII.2019, 3♀, det. Pauly A., leg. Van Achter X.; Bcharre, 2042 m, 31.VII.2019, 1♀, 1♂, det. Pauly A., Van Achter X.; Horch Ehden, 1625 m, 31.VII.2019, 2♀, det. Pauly A., leg. Van Achter X., coll. XVA.

Flower records. Asteraceae: *Centaurea* sp.; Fabaceae: *Hymenocarpos circinnatus*, *Vicia tenuifolia*.

***Lasioglossum* (*Evylaeus*) *nigripes* (Lepeletier, 1841) ssp. *pharaonis* Strand, 1909 * [= *L.* (*Sphecodogastra*) *nigripes* ssp. *pharaonis*]**

Distribution: WEST PALAEARCTIC (Pauly 2016a).

Distribution of *L. nigripes pharaonis*: EAST MEDITERRANEAN: Syria, Israel, Jordan, Egypt (Pauly 2016a).

Local distribution fig. 12.11

All of the material below is reported under *ssp. pharaonis* as it is the subspecies present in the area.

Material examined. Beirut: AUB Campus, 11.VI.2008, 1♀, det. Pauly A., leg. Salem R., coll. AUB; Achrafieh, 27.IX.2017, 2♀, det. Pauly A., leg. Baghdadi A., coll. SOILS.

Mount Lebanon: Ehmej, 25.III.2018, 1♀, det. Pauly A., leg. Bou Zeid M., coll. USEK; Jabal Moussa, 1439 m, 18.VII.2019, 1♀, det. Pauly A., leg. Van Achter X.; Jabal Moussa, Trail Qornet El Der, 1364 m, 18.VII.2019, 1♀, det. Pauly A., leg. Van Achter X., coll. XVA.

N. Lebanon: Donnieh, Nemrud-See, 245 m, 28.V.2012, 1♀, det. Ebmer A.W., leg. Kasparek M., coll. OÖLM; Donnieh, Wadi Cehennem, 924 m, 30.V.2012, 1♀, det. Ebmer A.W., leg. Kasparek M., coll. OÖLM; Tannourine El Tahta, Wadi Ain El Raha, 900 m, 3.V.2017, 2♀, det. Pauly A., leg. Boustani M.; Arz Tannourine, Trail 4, 1762 m, 21.V.2018, 1♀, det. Pauly A., leg. Boustani M., all coll. MBOU; Arz Tannourine, Gate Area, 1797 m, 14.VII.2019, 2♀, det. Pauly A., leg. Van Achter X.; Arz Tannourine, Reserve House, 1786 m, 14.VII.2019, 4♀, det. Pauly A. leg. Van Achter X.; 1797 m, 24.VII.2019, 2♀, det. Pauly A., leg. Van Achter X.; Arz Tannourine, Reserve House, 1786 m, 24.VII.2019, 1♀, det. Pauly A., leg. Van Achter X.; Horch Ehden, 1625 m, 29.VII.2019, 1♂, det. Pauly A., leg. Van Achter X.; Arz Tannourine, Reserve House, 1786 m, 31.VII.2019, 2♀, det. Pauly A., leg. Van Achter X., all coll. XVA.

S. Lebanon: Saidoun, 21.VI.2018, 1♂, det. Pauly A., leg. Baghdadi A.; 24.VI.2018, 1♂, det. Pauly A., leg. Baghdadi A.; 21.VIII.2018, 1♀, det. Pauly A., leg. Baghdadi A., all coll. SOILS.

Flower records. Apiaceae: *Foeniculum* sp., *Scorzonera* sp.; Asteraceae: *Centaurea* sp.; Caprifoliaceae: *Scabiosa* sp.; Lamiaceae: *Mentha* sp., *Stachys* sp.

***Lasioglossum* (*Evylaeus*) *nitidiusculum* (Kirby, 1802) * [= *L.* (*Hemihalictus*) *nitidiusculum*]**

Distribution: WEST PALAEARCTIC (Pauly 2016a).

Material examined. N. Lebanon: Horch Ehden, V.2015, 1♀, det. Pauly A., leg. Boustani M., coll. MBOU.

***Lasioglossum* (*Lasioglossum*) *pallens* (Brullé, 1832) ***

Distribution: WEST PALAEARCTIC: Warm localities of the West Palaearctic (Pauly 2016b)

Material examined. Mount Lebanon: Falougha, 1478 m, 27.IV.2019, 1♂, det. Pauly A., leg. Rasmont P., coll. PRAS.

N. Lebanon: Tannourine El Tahta, Wadi Ain Al Raha, 936 m, 11.IV.2017, 1♀, det. Pauly A., leg. Boustani M.; Arz Tannourine, Gate area, 1754 m, 2.IV.2018, 1♂, det. Pauly A., leg. Boustani M.; Hadath El Jebbe, Al Fouar, 1529 m, 12.IV.2019, 1♀, det. Pauly A., leg. Boustani M., all coll. MBOU.

Flower records. Asteraceae: *Senecio* sp.; Ranunculaceae: *Ranunculus* sp.

***Lasioglossum* (*Evylaeus*) *politum* (Schenck, 1853) * [= *L.* (*Evylaeus*) *politum*]**

Distribution: PALAEARCTIC: Trans-Palaearctic (Pauly 2016a).

Local distribution fig. 12.12

Material examined. Mount Lebanon: Mansourieh, Pleine Nature, 264 m, 3.IV.2019, 1♀, det. Pauly A., leg. Boustani M., coll. MBOU; Barouk, Gîte des oiseaux, 1064 m, 3.VII.2019, 1♀, det. Pauly A., leg. Van Achter X., coll. XVA; Mazraat Al Daher, 529 m, 19.VII.2019, 2♀, det. Pauly A., leg. Boustani M., coll. MBOU.

N. Lebanon: Bcharre, Dahr El Adib, 2437 m, 8.VI.2017, 2♀, det. Pauly A., leg. Boustani M.; Bcharre, Dahr El Adib, 2441 m, 8.VI.2017, 1♀, det. Pauly A., leg. Boustani M., all coll. MBOU; Horch Ehden, 1686 m, 14.VII.2019, 1♀, det. Pauly A., leg. Van Achter X., coll. XVA.

Flower records. Asteraceae: *Chrysanthemum coronarium*; Ranunculaceae: *Ranunculus demissus*; Rosaceae: *Rubus sanctus*; Lamiaceae: *Lamium striatum*.

***Lasioglossum* (*Dialictus*) *pseudolittorale* (Blüthgen, 1923)**

Distribution: EAST MEDITERRANEAN: Levant, Turkey (Pauly 2016a).

Literature. Blüthgen 1923, described as *Halictus pseudolittolaris*
2♂ from Lebanon without precise locality, type material, leg. Schmiedeknecht O., coll. MNHUB.
See also Ebmer (1976) and Bytinski-Salz & Ebmer (1974).

***Lasioglossum* (*Evylaeus*) *pseudosphecodimorphum* (Blüthgen, 1923) * [= *L.* (*Sphecodogastra*) *pseudosphecodimorphum*]**
Distribution: EAST MEDITERRANEAN: Turkey, Syria, Israel, Jordan (Pauly 2016a).
Local distribution fig. 12.13
Material examined. Bekaa: Blaika, 1325 m, 3.VII.2019, 1♀, det. Pauly A., leg. Ghisbain G., coll. UMONS.
Mount Lebanon: Bentael, 378 m, 23.IV.2019, 1♀, det. Pauly A., leg. Boustani M., Rasmont P., Nemer N., coll. MBOU. Additional 9♀ from 5 records collected between 26.IV.2019 and 23.VII.2019, from Chammis, Akoura, Bentael, Souk El Ghareb.
N. Lebanon: Qadisha, Lebanon Mountain Trail, 936 m, 9.V.2017, 1♀, det. Pauly A., leg. Boustani M., coll. MBOU. Additional 18♀ from 13 records collected between 29.VI.2017 and 31.VII.2019, from Hadath El Jebbe, Arz Tannourine, Douma, and Ehden.
Flower records. Apiaceae: *Eryngium glomeratum*; Asteraceae: *Centaurea* cf *pallescens*; Boraginaceae: *Echium glomeratum*; Capparidaceae: *Capparis spinosa*; Fabaceae: *Ononis natrix*; Hypericaceae: *Hypericum scabrum*; Lamiaceae: *Nepeta* sp.; Rubiaceae: *Galium* sp.

***Lasioglossum* (*Evylaeus*) *punctatissimum* (Schenck, 1853) * [*L.* (*Hemihalictus*) *punctatissimum*]**
Distribution: WEST PALAEARCTIC (Pauly 2016a).
Local distribution fig. 12.14
Material examined. Bekaa: Anjar, Water Trail, 951 m, 23.VII.2019, 1♀, det. Pauly A., leg. Van Achter X., coll. XVA.
Mount Lebanon: Mansourieh, Aylout, 274 m, 26.VI.2019, 1♀, det. Pauly A., leg. Boustani M., Van Achter X., coll. XVA.
N. Lebanon: Tannourine, Wadi Al Fouar, 1528 m, 17.VI.2016, 1♀, det. Pauly A., leg. Boustani M.; Tannourine El Tahta, Wadi Ain El Raha, 1371 m, 5.V.2017, 1♀, det. Pauly A., leg. Boustani M.; Hadath El Jebbe, Chemin Wadi Ain El Raha, 1519 m, 29.VI.2017, 3♀, det. Pauly A., leg. Boustani M.; 1547 m, 29.VI.2017, 1♀, det. Pauly A., leg. Boustani M.; 1575 m, 28.VII.2017, 1♀, det. Pauly A., leg. Boustani M.; Hadath El Jebbeh, Road to Wadi Al Fouar, 1553 m, 19.VII.2018, 1♀, det. Pauly A., leg. Boustani M., Jabbour J., all coll. MBOU; Horch Ehden, 1625 m, 14.VII.2019, 8♀, det. Pauly A., leg. Van Achter X.; 1686 m, 14.VII.2019, 6♀, 1♂, det. Pauly A., leg. Van Achter X.; 1625 m, 24.VII.2019, 1♀, det. Pauly A., leg. Van Achter X.; 1686 m, 24.VII.2019, 1♀, det. Pauly A., leg. Van Achter X.; 1625 m, 31.VII.2019, 1♀, det. Pauly A., leg. Van Achter X., all coll. XVA.
Flower records. Asteraceae: *Echinops viscosus*; Fabaceae: *Ononis natrix*, *Lotus* sp.; Caprifoliaceae: *Scabiosa argentea*; Caryophyllaceae: *Minuartia* cf *mesogitana*; Rutaceae: *Ruta chalepensis*.

***Lasioglossum* (*Evylaeus*) *puncticolle* (Morawitz, 1872) * [= *L.* (*Hemihalictus*) *puncticolle*]**
Distribution: WEST PALAEARCTIC (Pauly 2016a).
Material examined. N. Lebanon: Tannourine Reserve, Trail 4, 1781 m, 30.VI.2019, 1♀, det. Pauly A., leg. Boustani M., coll. MBOU; Tannourine Reserve, Gate Area, 1797 m, 24.VII.2019, 1♀, det. Pauly A., leg. Van Achter X., coll. XVA.

***Lasioglossum* (*Evylaeus*) *pygmaeum* (Schenck, 1853) * [= *L.* (*Hemihalictus*) *pygmaeum*]**
Distribution: WEST PALAEARCTIC: Warm localities of the West Palaearctic (Pauly 2016a).
Material examined. Mount Lebanon: Bentael, 337 m, 23.IV.2019, 1♀, det. Pauly A., leg. Boustani M., Rasmont P., Nemer N.; 385 m, 23.IV.2019, 1♀, det. Pauly A., leg. Boustani M., Rasmont P., Nemer N.
N. Lebanon: Hadath El Jebbe, Chemin Wadi Ain El Raha, 1519 m, 29.VI.2017, 1♀, det. Pauly A., leg. Boustani M.; Tannourine El Tahta, Wadi Ain Al Raha, 1187 m, 21.VI.2017, 1♀, det. Pauly A., leg. Boustani M.; Arz Tannourine, Trail 4, 1762 m, 11.VII.2018, 2♀, det. Pauly A., leg. Boustani M., all coll. MBOU; Arz Tannourine, Gate Area, 1797 m, 9.VII.2019, 3♀, det. Pauly A., leg. Van Achter X.; Horch Ehden, 1686 m, 14.VII.2019, 1♀, det. Pauly A., leg. Van Achter X., all coll. XVA.

Flower records. Fabaceae: *Ononis natrix*; Caryophyllaceae: *Minuartia* cf *mesogitana*; Rutaceae: *Ruta chalepensis*.

Lasioglossum (Dialictus) semiaeneum **Brullé, 1832 ***
Distribution: PALAEARCTIC: Euro-Siberian (Pauly 2016c).
Local distribution fig. 12.15
Unpublished Records. BDFGM: MNHNP: Bekaa, Ksarah, 1913, 1♂**.**
Material examined. Bekaa: Jord Aarsal, Kechek, 2120 m, 11.VII.2019, 1♂, det. Pauly A., leg. Boustani M., coll. MBOU.
Mount Lebanon: Maaser Al Chouf, 1143 m, 29.V.2019, 1♀, det. Pauly A., leg. Boustani M., coll. MBOU.
N. Lebanon: Arz Bcharre, 1913 m, 9.V.2017, 1♀, det. Pauly A., leg. Boustani M., coll. MBOU. 46 additional specimens (31♀ and 15♂) from 30 records, collected between 28.V.2017 and 20.VIII.2019.
Flower records. Apiaceae: *Chaerophyllum aurantiacum*, *Eryngium billardieri*, *Eryngium glomeratum*; Asteraceae: *Achillea falcata*, *Anthemis pauciloba*, *Centaurea eryngioides*; Caryophyllaceae: *Dianthus* cf *strictus*, *Dianthus strictus*; Fabaceae: *Onobrychis cornuta*, *Trifolium purpureum*, *Vicia tenuifolia*; Lamiaceae: *Stachys cretica*; Plumbaginaceae: *Acantholimon libanoticum*; Ranunculaceae: *Ranunculus demissus*; Rosaceae: *Prunus prostrata*, *Cotoneaster* sp.

Lasioglossum **(*Dialictus*)** ***soror*** **(Saunders, 1901) ***
Distribution: WEST PALAEARCTIC: Mediterranean basin (Pauly 2016c).
Material examined. N. Lebanon: Arz Tannourine, Gate Area, 1797 m, 31.VII.2019, 1♀, det. Pauly A., leg. Van Achter X., coll. XVA.

Lasioglossum **(*Evylaeus*)** ***subaenescens*** **(Pérez, 1895) ssp.** ***asiaticum*** **(Dalla Torre 1896) * [=** ***L.*** **(*Hemihalictus*)** ***subaenescens*** **ssp.** ***asiaticum*****]**
Distribution: **WEST PALAEARCTIC** (Pauly 2016a)
Notes: Ebmer 1997: Reported from Mt. Hermon.
Material examined. N. Lebanon: Bcharre, 1900 m, 31.VII.2019, 1♀, det. Pauly A., leg. Van Achter X., coll. XVA.

Lasioglossum **(*Lasioglossum*)** ***subfasciatum*** **(Imhoff, 1832) ***
Distribution: WEST PALAEARCTIC: Warm localities of the West Palaearctic (Pauly 2016b).
Material examined. N. Lebanon: Bcharre, Jord, 2723 m, 24.VI.2016, 1♂, det. Pauly A., leg. Boustani M.; Arz Bcharre, 1914 m, 9.V.2017, 3♀, det. Pauly A., leg. Boustani M.; Bcharre, Dahr El Adib, 2407 m, 8.VI.2017, 1♀, det. Pauly A., leg. Boustani M.; Bcharre, Plateau Qornet Es Sawda, 2882 m, 1.VIII.2018, 1♂, det. Pauly A., leg. Boustani M.; Arz Tannourine, Trail 4, 1781 m, 13.V.2019, 1♀, det. Pauly A., leg. Boustani M., all coll. MBOU; Bcharre, 2042 m, 29.VII.2019, 1♂, det. Pauly A., leg. Van Achter X., coll. XVA.
Flower records. Asteraceae: *Cirsium lappaceum*; Boraginaceae: *Solenanthus stamineus*; Fabaceae: *Vicia canescens*.

Lasioglossum **(*Lasioglossum*)** ***tadschicum*** **(Blüthgen, 1929) ***
Distribution: PALAEARCTIC: Levant and east to Afghanistan (Pauly 2016b).
Local distribution fig. 12.16
Material examined. Mount Lebanon: Fanar, 10.III.1965, 1♀, det. Pauly A., coll. USEK; Beit Meri, 22.V.1981, 1♂, det. Pauly A., leg. Samin R; 1♂, det. Pauly A., all coll. AUB; Maaser Al Chouf, 1143 m, 29.V.2019, 1♂, det. Pauly A., leg. Boustani M., coll. MBOU.
N. Lebanon: Arz Tannourine, Reserve House, 1786 m, 14.VII.2019, 3♀, det. Pauly A., leg. Van Achter X.; Bcharre, 2042 m, 14.VII.2019, 1♀, det. Pauly A., leg. Van Achter X.; 22.VII.2019, 1♀, det. Pauly A., leg. Van Achter X., coll. XVA.

Lasioglossum **(*Evylaeus*)** ***transitorium*** **(Schenck, 1868) * [=** ***L.*** **(*Hemihalictus*)** ***transitorium*****]**
Distribution: WEST PALAEARCTIC (Pauly 2016a).

Material examined. Mount Lebanon: Antelias, Bach Musical Institute, 24.IV.2017, 1♀, det. Pauly A., leg. Boustani M., coll. MBOU.
Flower record. Asteraceae: *Chrysanthemum* sp.

***Lasioglossum* (*Evylaeus*) *truncaticolle* (Morawitz, 1878) * [= *L.* (*Hemihalictus*) *truncaticolle*]**
Distribution: WEST PALAEARCTIC: Southern part of the West Palaearctic (Pauly 2016a).
Local distribution fig. 13.1
Material examined. Bekaa: Der El Ahmar, 995 m, 3.VII.2019, 1♀, det. Pauly A., leg. Boustani M., coll. MBOU; 4♀, det. Pauly A., leg. Ghisbain G., coll. UMONS; Jord Aarsal, Howiyit Al Borj, 2008 m, 11.VII.2019, 1♀, det. Pauly A., leg. Van Achter X., coll. XVA.
N. Lebanon: Tannourine El Tahta, Wadi Ain El Raha, 900 m, 3.V.2017, 1♀, det. Pauly A., leg. Boustani M.; Hadath El Jebbeh, Border of Cedar Forest, 1681 m, 19.VII.2018, 1♀, det. Pauly A., leg. Boustani M., Jabbour J.; Arz Tannourine, Gate area, 1754 m, 16.VIII.2018, 1♀, det. Pauly A., leg. Boustani M., all coll. MBOU; Arz Tannourine, Trail 4, 1762 m, 27.VII.2018, 1♀, det. Pauly A., leg. Van Achter X., coll. XVA.
Flower records. Asteraceae: *Centaurea* cf *pallescens*, *Centaurea pallescens*, *Onopordum* sp.

***Lasioglossum* (*Evylaeus*) *villosulum* (Kirby, 1802) * [= *L.* (*Hemihalictus*) *villosulum*]**
Distribution: PALAEARCTIC (Pauly *et al.* 2019).
Local distribution fig. 13.2
Material examined. Mount Lebanon: Aley, 852 m, 23.VII.2019, 1♀, det. Pauly A., leg. Boustani M.; Keyfoun, 847 m, 23.VII.2019, 1♀, det. Pauly A., leg. Boustani M., all coll. MBOU.
N. Lebanon: Horch Ehden, 1625 m, 14.VII.2019, 3♀, det. Pauly A., leg. Van Achter X.; Arz Tannourine, Reserve House, 1786 m, 14.VII.2019, 3♀, det. Pauly A., leg. Van Achter X., all coll. XVA; Arz Bcharre, Forest Limit, 1873 m, 20.VIII.2019, 1♂, det. Pauly A., leg. Boustani M., coll. MBOU.
Flower records. Some records on unidentified Asteraceae.

***Lasioglossum* (*Lasioglossum*) *xanthopus* (Kirby, 1802) ***
Distribution: WEST PALAEARCTIC: Warm localities of the West Palaearctic (Pauly 2016b).
Material examined. N. Lebanon: Jairoun, 1042 m, 23.V.2012, 1♀, det. Ebmer A.W., leg. Kasparek M., coll. MKAS.; Horch Ehden, X.2014, 1♂, det. Pauly A., leg. Boustani M., Boustani C.; Bcharre, Reforestation Area, 1993 m, 27.VI.2017, 1♀, det. Pauly A., leg. Boustani M., all coll. MBOU; Bcharre, Reforestation Area, 1973 m, 2.VII.2019, 2♀, det. Pauly A., leg. Ghisbain G., coll. UMONS.
Flower records. Fabaceae: *Vicia tenuifolia*.

Genus *Thrincohalictus* (Pérez, 1912)
One species.

***Thrincohalictus (Thrincohalictus) prognathus* (Pérez, 1912)**
Distribution: EAST MEDITERRANEAN (Pauly 2016e).
Literature. Blüthgen (1955): Bekaa, Baalbek, 1♀, locus typicus of the described female.
Material examined. Mount Lebanon: Chammis, Wadi Cheber, 373 m, 26.IV.2019, 1♀, det. Pauly A., leg. Boustani M., coll. MBOU.
N. Lebanon: Tannourine El Tahta, Wadi Ain El Raha, 900 m, 5.V.2017, 1♀, det. Pauly A., leg. Boustani M., coll. MBOU.
Flower record. Papaveraceae: *Papaver* sp.

Genus *Sphecodes* Latreille, 1804
Seven species.

***Sphecodes (Sphecodes) barbatus* Blüthgen, 1923 ***
Distribution: EAST MEDITERRANEAN (Ascher & Pickering 2021).
Material examined. N. Lebanon: Tannourine, 29.IV.2016, 1♂, det. Straka J., leg. Boustani M., coll. MBOU.

Sphecodes (Sphecodes) dusmeti **Blüthgen, 1925 ***
Distribution: PALAEARCTIC (Ascher & Pickering 2021).
Material examined. N. Lebanon: Hadath El Jebbe, Chemin Wadi Ain El Raha, 1519 m, 29.VI.2017, 1♂, det. Straka J., leg. Boustani M., coll. MBOU.
Flower record. Fabaceae: *Ononis natrix*.

Sphecodes (Sphecodes) gibbus **(L., 1758) ***
Distribution: PALAEARCTIC (Ascher & Pickering 2021).
Material examined. Mount Lebanon: Barouk, Masyaf El Mir, 1807 m, 7.VIII.2019, 1♂, det. Straka J., leg. Boustani M., coll. MBOU.
N. Lebanon: Hadath El Jebbe, Al Fouar, 1529 m, 27.VI.2019, 1♀, det. Straka J., leg. Boustani M., Mouawad G., coll. MBOU; Tannourine, Road to Eco Dalida, 1796 m, 6.VII.2019, 2♂, det. Straka J., leg. Gekière A., coll. UMONS.
Flower records. Lamiaceae: *Mentha aquatica*; Plantaginaceae: *Anarrhinum orientale*.

Sphecodes (Sphecodes) monilicornis **(Kirby, 1802) ***
Distribution: PALAEARCTIC (Ascher & Pickering 2021).
Material examined. N. Lebanon: Arz Tannourine, Trail 1, 1748 m, 28.VII.2017, 1♂, det. Straka J., leg. Boustani M.; Arz Tannourine, Trail 4, 1762 m, 18.VIII.2018, 1♂, det. Straka J., leg. Boustani M., Jabbour J.; Arz Bcharre, Forest Limit, 1897 m, 2.VII.2019, 1♀, det. Straka J., leg. Boustani M., all coll. MBOU.
Flower records. Apiaceae: *Ferulago frigida*; Brassicaceae: *Alyssum* sp.

Sphecodes (Sphecodes) pellucidus **Smith, 1845 ***
Distribution: PALAEARCTIC (Ascher & Pickering 2021).
Material examined. N. Lebanon: Bcharre, Dahr El Adib, 2572 m, 25.VIII.2018, 1♂, det. Straka J., leg. Boustani M., Jabbour J., coll. MBOU.
Flower record. Asteraceae: *Cirsium lappaceum*.

Sphecodes (Sphecodes) puncticeps **Thomson, 1870 ***
Distribution: PALAEARCTIC (Ascher & Pickering 2021).
Material examined. N. Lebanon: Hadath El Jebbeh, Border of the Cedar Forest, 1681 m, 22.VIII.2018, 1♂, det. Straka J., leg. Boustani M., Jabbour J.; Horch Ehden, Ain El Naasa, 1560 m, 22.V.2019, 1♀, det. Straka J., leg. Boustani M., all coll. MBOU.
Flower records. Apiaceae: *Eryngium glomeratum*; Fabaceae: *Coronilla emeroides*.

Sphecodes (Sphecodes) spinulosus **Hagens, 1875 ***
Distribution: PALAEARCTIC (Ascher & Pickering 2021).
Material examined. N. Lebanon: Horch Ehden, Ain El Naasa Gate, 1598 m, 22.V.2019, 1♂, det. Straka J., leg. Boustani M., coll. MBOU.

NOMIINAE

Genus *Nomiapis* Cockerell, 1919

Two species.

Nomiapis (Nomiapis) diversipes **(Latreille, 1806) ***
Distribution: PALAEARCTIC (Pauly 2015).
Material examined.
BDFGM material. Mount Lebanon: Beit Meri, 1 F, det. Pauly A., coll. MNHNP.
Author material. Specimen without label from AUB collection, 1♂, det. Pauly A., coll. AUB.
Bekaa: Blaika, 1325 m, 3.VII.2019, 1♀, det. Pauly A., leg. Gekière A., coll. UMONS; Hadath, Near Army Checkpoint, 1610 m, 7.VIII.2019, 1♀, det. Pauly A., leg. Boustani M., coll. MBOU.

N. Lebanon: Tannourine El Tahta, Wadi Ain El Raha, 1187 m, 2.VII.2017, 1♀, det. Pauly A., leg. Boustani M.; Hadath El Jebbeh, Border of the Cedar Forest, 1681 m, 22.VIII.2018, 1♀, det. Pauly A., leg. Boustani M., Jabbour J.; Hadath El Jebbe, Al Fouar, 1529 m, 23.VIII.2019, 1♀, det. Pauly A., leg. Boustani M., Mouawad G.; Tannourine El Tahta, Mar Boutrous, 1207 m, 25.VII.2019, 1♀, det. Pauly A., leg. Boustani M., all coll. MBOU.

***Nomiapis (Nomiapis) equestris* (Gerstaecker, 1872)**
Distribution: EAST MEDITERRANEAN (Pauly 2015).
Literature (Baker 2002): N Bekaa, Deir Mar Maroun, ca 700 m, 26.V.1996, 1♂, 2.VI.1996, 1♂, 1♀, 9.VI.1996, 2♀; N. Bekaa, Jdeide, ca 1000 m, 2.VI.1996, 1♀ (all C.G. Roche) [CGRC, DBB]
Material examined. Bekaa: Anjar, Army Barracks, 967 m, 23.VII.2019, 1♂, det. Pauly A., leg. Boustani M., coll. MBOU.
Flower record. Lamiaceae: *Mentha aquatica*.

Genus *Pseudapis* Kirby, 1900

One species

***Pseudapis (Pseudapis) nilotica* (Smith, 1875)**
Distribution: WEST PALAEARCTIC: From Morocco and Mauritania east to western Pakistan (Pauly 2019).
Literature. Warncke (1976): Listed from Lebanon under *Nomia armata* Olivier, 1811, with which he synonymised *N. nilotica*, see also Baker (2002).

NOMIOIDINI

Genus *Nomioides* Schenck 1867

One species.

***Nomioides (Nomioides) minutissimus* (Rossi, 1790) ***
Distribution: PALAEARCTIC: Southern Europe, south-western Asia, and steppes and deserts of central Asia to Mongolia and northern China to the East (Pauly 2011).
Material examined. N. Lebanon: Hadath El Jebbeh, Chemin Wadi Ain El Raha, 1495 m, 28.VII.2017, 1♂, det. Pauly A., leg. Boustani M.; Tannourine El Tahta, Wadi Ain El Raha, 1036 m, 2.VIII.2017, 1♂, det. Pauly A., leg. Boustani M.; Tannourine El Tahta, Malaa Al Nahrein, 958 m, 2.VIII.2017, 1♀, det. Pauly A., leg. Boustani M.; Tannourine El Tahta, Wadi Ain El Raha, 1115 m, 19.VIII.2017, 2♂, det. Pauly A., leg. Boustani M.; 1008 m, 19.VIII.2017, 3♀, det. Pauly A., leg. Boustani M.; 1115 m, 19.VIII.2017, 1♂, det. Pauly A., leg. Boustani M.; Tannourine El Tahta, Wadi Al Fouar, 1187 m, 19.VII.2018, 1♀, det. Pauly A., leg. Boustani M., Jabbour J.; 22.VIII.2018, 2♂, det. Pauly A. leg. Boustani M., Jabbour J.; Hadath El Jebbe, Al Fouar, 1529 m, 31.V.2019, 1♀, det. Pauly A., leg. Boustani M.; Tannourine El Tahta, Mar Boutrous, 1207 m, 31.V.2019, 1♀, det. Pauly A., leg. Boustani M.; Tannourine El Tahta, Mar Boutrous, 1207 m, 27.VI.2019, 2♂, det. Pauly A., leg. Boustani M.; Tannourine El Tahta, 995 m, 27.VI.2019, 2♀, 2♂, det. Pauly A., leg. Van Achter X.; Tannourine El Tahta, Mar Boutrous, 1155 m, 27.VI.2019, 1♀, det. Pauly A., leg. Van Achter X.; Tannourine El Tahta, 1013 m, 27.VI.2019, 2♀, 3♂, det. Pauly A., leg. Boustani M., all coll. MBOU.

MELITTIDAE

DASYPODAINAE

Genus *Dasypoda* Latereille, 1802

One species.

***Dasypoda* (*Megadasypoda*) *spinigera* Kohl, 1905 *** (fig. 28.6)
Distribution: WEST PALAEARCTIC: Around the Black Sea and scattered records in Hungary (Michez *et al.* 2004).
Material examined. Mount Lebanon: Jabal Moussa, Peony Trail, 1348 m, 18.VII.2019, 1♀, 1♂, leg. Boustani M.; Jabal Moussa, Trail Qornet El Der, 1499 m, 18.VII.2019, 1♀, 1♂, leg. Boustani M., all coll. MBOU; Jabal Moussa, 1439 m, 18.VII.2019, 2♀, 1♂, leg. Van Achter X.; Jabal Moussa, 1364 m, 18.VII.2019, 1♂, leg. Van Achter X., all coll. XVA.
N. Lebanon: Tannourine El Tahta, Wadi ain Al Raha, 1187 m, 21.VI.2017, 2♂, leg. Boustani M.; 29.VI.2017, 1♂, leg. Boustani M., all coll. Boustani M.; Tannourine El Tahta, Mar Boutrous, 1207 m, 27.VI.2019, 1♂, leg. Boustani M., 1♂, leg. Van Achter X., coll. XVA, all det. Michez D.
Flower records. Apiaceae: *Ferulago* sp.; Caprifoliaceae: *Scabiosa argentea*, *Scabiosa* sp.
Preference for Dipsacaceae (species listed above now placed in Caprifoliaceae) flowers in line with Michez *et al.* (2008).
Notes: This species is very localised and was found in sites with bare sandy soil suitable for nesting (Celary 2002, Howe *et al.* 2010), it is abundant when present.

MEGACHILIDAE

LITHURGINI

Genus *Lithurgus* Berhtold, 1827
One species.

***Lithurgus* (*Lithurgus*) *chrysurus* Fonscolombe, 1834**
Distribution: WEST PALAEARCTIC (Ascher & Pickering 2021, Kuhlmann *et al.* 2021).
Literature. Mavromoustakis (1963): Near Becharre [Bcharre], 2.VII.1960, 1♀, 3♂; 1.VII.1960, 2♂; Kadisha river, 24.VI.1960, 1♂, all det. & leg. Mavromoustakis G.A.

OSMIINI

All Material Examined determined by Müller A.

Genus *Chelostoma* Latreille, 1809
10 species.

Bees of this genus were found to have floral preferences restricted to one family or genus, especially Brassicaceae, Campanulaceae and Ranunculaceae (Sedivy *et al.* 2008). Very few flower records are available in our listed records below, but there seems to be a preference for Campanulaceae and Asteraceae.

***Chelostoma (Gyrodromella) aegaeicum* Müller, 2012 ***
Distribution: EAST MEDITERRANEAN: Crete, Lesvos and the western half of Turkey (Müller 2021).
Material examined. N. Lebanon: Tannourine El Tahta, Wadi Al Fouar, 1187 m, 19.IV.2018, 1♂, leg. Boustani M., coll. MBOU.
Flower records. Asteraceae: *Carduus argentatus*.

***Chelostoma* (*Foveosmia*) *bytinskii* (Mavromoustakis, 1948)**
Distribution: LEVANT (Müller 2021).
Material examined. Beirut: 19.III.1909, 1♂, leg. Schmiedeknecht, coll. NMSF.
N. Lebanon: Tannourine El Tahta, Wadi Ain El Raha, 934 m, 11.V.2017, 1♀, leg. Boustani M.

***Chelostoma* (*Chelostoma*) *diodon* Schletterer, 1889 ***
Distribution: EAST MEDITERRANEAN: North-eastern Mediterranean, Iran (Müller 2021).

Material examined. N. Lebanon: South of Jairoun, 1648 m, 23.V.2012, 1♂, leg. Kasparek M., coll. MKAS; Tannourine El Tahta, Wadi Ain El Raha, 900 m, 1♂, 18.IV.2017, leg. Boustani M.; Arz Tannourine, 1706 m, 7.VI.2017, 1♀, leg. Boustani M.; Tannourine El Tahta, Wadi Al Fouar, 1187 m, 22.V.2018, 1♀, leg. Boustani M.; Tannourine El Tahta, Mar Boutrous, 1207 m, 5.V.2019, 1♂, leg. Boustani M.; Arz Tannourine Gate, 1796 m, 11.V.2019, 1♂, leg. Boustani M., all coll. MBOU.
Flower records. Asteraceae: *Carduus argentatus*.

***Chelostoma* (*Chelostoma*) *comosum* Müller, 2012**
Distribution: EAST MEDITERRANEAN: Levant and Cyprus (Müller 2021).
Literature. Referred to as *Chelostoma* (*Chelostoma*) *lucens* Benoist, 1928 by Mavromoustakis (1963) and the record has been also mentioned under *C. lucens* by Grace (2010). However, it has been wrongly assigned to this species (Müller 2012).
Mavromoustakis (1963): S. Lebanon: Djezzine [Jezzine], 21.V.1953, 4♀, det. & leg. Mavromoustakis G.A.
Material examined. Beirut: 14.III.1909, 1♀, leg. Weis A., coll. NMSF.

***Chelostoma* (*Foveosmia*) *foveolatum* (Morawitz, 1868) ***
Distribution: WEST PALAEARCTIC (Müller 2021).
Material examined. N. Lebanon: Horch Ehden, 1567 m, 19.VI.2016, 1♂, leg. Boustani M., Kotan A., Yammine W.; Jord Ehden, 1983 m, 5.VII.2019, 1♂, leg. Boustani M., all coll. MBOU.
Flower records. Campanulaceae: *Asyneuma rigidum*.

***Chelostoma* (*Chelostoma*) *lucens* (Benoist, 1928) ***
Distribution: EAST MEDITERRANEAN (Müller 2021)
Material examined. Mount Lebanon: Maaser Al Chouf, 1364 m, 29.V.2019, leg. Boustani M., coll. MBOU.
N. Lebanon: Donnieh, bei Quemmamine, 1600 m, 23.V.2012, 1♂, leg. Kasparek M., coll. MKAS.

***Chelostoma* (*Foveosmia*) *maidli* Benoist, 1935 ***
Distribution: EAST MEDITERRANEAN: Turkey, Syria, Israel (Müller 2021).
Material examined. N. Lebanon: Arz Tannourine, 1714 m, 7.VI.2017**,** 1♀, 1♂, leg. Boustani M., coll. MBOU.
Flower records. Campanulaceae: *Campanula stricta*.

***Chelostoma* (*Chelostoma*) *mocsaryi* Schletterer, 1889 ***
Distribution: PALAEARCTIC: Europe, Russia, Caucasus, southwestern Asia (Müller 2021).
Material examined. Beirut: 1♀, leg. Schmiedeknecht, coll. NMSF.
N. Lebanon: Qadisha, 950 m, 5.V.2017, 1♂, leg. Nemeth T.; Qadisha, 910 m, 9.V.2017, 1♀, leg. Boustani M.; Tannourine El Tahta, Wadi Ain El Raha, 1371 m, 5.V.2017, 1♂, leg. Boustani M., all coll. MBOU.
Flower records. Asparagaceae: *Ornithogalum* sp.

***Chelostoma (Foveosmia) schlettereri* (Friese, 1899)**
Distribution: EAST MEDITERRANEAN (Müller 2021).
Literature. Mavromoustakis, 1955: Listed as *Chelostoma pici* Benoist, 1935
Mount Lebanon, Nahr el Kelb [Nahr El Kalb], 12.V.1953, 1♀; 13.V.1953, 1♂, det. & leg. Mavromoustakis G.A.

***Chelostoma* (*Foveosmia*) *ventrale* Schletterer, 1889 ***
Distribution: WEST PALAEARCTIC: South-eastern Europe, eastern Mediterranean (Müller 2021).
Material examined. N. Lebanon: Horch Ehden, 1567 m, 19.VI.2016, 1♀, leg. Yammine W., coll. MBOU.

Genus *Heriades* Spinola, 1808
Four species.

***Heriades* (*Rhopaloheriades*) *clavicornis* Morawitz, 1875**
Distribution: PALAEARCTIC: Northern and eastern Mediterranean and further east to Tajikistan (Müller 2021).

Unpublished records. GBIF 2021, SEMC: N. Bekaa, Der Mar Maroun, 700 m, 26.V.1996, 1♀; 2.VI.1996, 1♂, all det. Baker D., leg. Roche C.G.

Literature. Mavromoustakis (1963): Ein El Arar, 1♂, 24.V.1953. Grotto del Kadisha, 1♀, 1♂, 23.VI.1960. Kadisha river, 1♂, 24.VI.1960, det. & leg. Mavromoustakis G.A.

***Heriades* (*Michenerella*) *punctulifera* Schletterer, 1889**

Distribution: WEST PALAEARCTIC: Northern and eastern Mediterranean and South-eastern Europe (Müller 2021).

Müller (2021) states that *Heriades* (*Michenerella*) *dalmatica* Maidl, 1922 is a junior synonym of *Heriades* (*Michenerella*) *punctulifera* Schletterer, 1889, new synonymy based on the type material.

Literature. Mavromoustakis (1963): Listed under *Heriades dalmatica* Maidl, 1922:

N. Lebanon, Cedars, 6.VII.1960, 2♀, 3♂, det. & leg. Mavromoustakis G.A.

Material examined. N. Lebanon: Arz Tannourine, Reserve Outskirts, 1792 m, 13.VII.2017, 1♀, 1♂, leg. Boustani M., coll. MBOU.

Flower record. Plumbaginaceae: *Acantholimon libanoticum*.

***Heriades* (*Heriades*) *rubicola* Pérez, 1890 ***

Distribution: WEST PALAEARCTIC: Southern Europe, eastern Mediterranean and scattered in North Africa (Müller 2021).

Unpublished records. GBIF 2021, SEMC:

Labeled as *Heriades rubicolus*:

Mount Lebanon, Al Montazah, 200 m, 11.IX.1994, 1♀, det. Baker D., leg. Roche C.G.; Mount Lebanon, Al Montazah nr. Mansourieh, 100 m, 11.V.1995, 1♀; 250 m, 20.VIII.1995, 1♂, all det. Baker D., leg. Roche C.G.; Bekaa, N. Bekaa, Deir Mar Maroun, 700 m, 19.V.1996, 1♂; 9.VI.1996, 1♀, all det. Baker D., leg. Roche C.G.

Material examined. Mount Lebanon: Aley, 852 m, 23.VII.2019, 2♀, leg. Boustani M., coll. MBOU.

***Heriades* (*Heriades*) *truncorum* L., 1758 ***

Distribution: PALAEARCTIC (Müller 2021).

Local distribution fig. 13.3

Unpublished records. GBIF 2021, SEMC: Mount Lebanon, Monteverde, 350 m, 21.V.1994, 2♂; 23.V.1994, 1♀, det. Baker D.; 28.V.1994, 1♀; 7.VIII.1994, 1♂, det. Baker D., all leg. Roche C.G.

Material examined. Mount Lebanon: Nahr El Kaleb, 28.IV.1973, 1♂; Arsoun, X.2015, 7♀, 1♂, leg. Nemer N., coll. TCFNR. Additional 6♀ and 2♂ from 6 records, collected between 18.VII.2019 and 12.VIII.2019, from Jabal Moussa, Laqlouq and Barouk.

N. Lebanon: Donnieh, Nemrud-See, 245 m, 28.V.2012, 3♀, leg. Kasparek M., coll. MKAS; Horch Ehden, 1567 m, 19.VI.2016, 2♀, leg. Yammine W., coll. MBOU. Additional 4♀ and 10♂ from 10 records, collected between 5.VIII.2018 and 29.VII.2019, from Tannourine El Tahta, Arz Tannourine, Horch Ehden and Bcharre.

Flower records. Apiaceae: *Chaerophyllum aurantiacum*, *Eryngium* sp.; Asteraceae: *Achillea falcata*, *Anthemis pauciloba*, *Achillea* sp., *Centaurea iberica*, *Helichrysum pallasii*; Caprifoliaceae: *Cephalaria* cf *joppensis*, *Cephalaria* sp.; Convolvulaceae: *Convolvulus arvensis*; Plantaginaceae: *Anarrhinum orientale*.

Preference for Asteraceae in line with past observations (Amiet *et al.* 2004, Müller 2021).

Genus *Stenoheriades* Tkalcu, 1984

One species.

***Stenoheriades (Stenoheriades) levantica* Müller, 2014**

Distribution: LEVANT (Müller 2021).

Literature. Male reported from Lebanon by Mavromoustakis (1955) was assigned to *Chelostoma coelostomum* Benoist, 1935. However, these records have been reassigned to *Stenoheriades levantica* (Müller & Trunz 2014): S. Lebanon, Djezzine [Jezzine], 2.VI.1953, 6♂, 5♀, det. & leg. Mavromoustakis G.A.

Material examined. Mount Lebanon: Maaser Al Chouf, 1143 m, 29.V.2019, 1♂, leg. Boustani M.

N. Lebanon: Hadath El Jebbe, Al Fouar, 1529 m, 31.V.2019, 1♂, leg. Boustani M., all coll. MBOU.

Flower record. Asteraceae: *Anthemis pauciloba*.

Genus *Hoplitis* Klug, 1807

16 species.

Most species seem to have preferences for Fabaceae and Boraginaceae as observed by Sedivy *et al*. 2013, but there are also a few records from Asteraceae and Campanulaceae.

***Hoplitis* (*Alcidamea*) *acuticornis* (Dufour and Perris, 1840) ***
Distribution: PALAEARCTIC (Müller 2021).
Material examined. Bekaa: Ainata, 1556 m, 30.V.2017, 1♀, leg. Boustani M., Rasmont P., coll. MBOU.
N. Lebanon: Bcharre, Reforestation Area, 2347 m, 27.VI.2017, 1♂, leg. Boustani M.; Hadath El Jebbeh, Road to Wadi Al Fouar, 1553 m, 6.VI.2018, 1♀, leg. Boustani M.; Hadath El Jebbe, Al Fouar, 1529 m, 31.V.2019, 4♀, 2♂, leg. Boustani M.; Hadath El Jebbe, Al Fouar, 1529 m, 7.VI.2019, 1♀, leg. Boustani M., all coll. MBOU; Hadath El Jebbe, Al Fouar, 1468 m, 27.VI.2019, leg. Van Achter X., coll. XVA.
Flower records. Fabaceae: *Lotus gebelia libanoticus*, *Vicia canescens*, *Vicia tenuifolia*.

***Hoplitis* (*Hoplitis*) *annulata* Latreille, 1811**
Distribution: WEST PALAEARCTIC: Southern Europe, Mediterranean basin except Egypt, Libya and Tunisia, Turkey to Azerbaijan East (Müller 2021).
Literature. Mavromoustakis (1956) listed as the subspecies *Hoplitis* (*Hoplitis*) *annulata* (Latreille, 1811) *crenulata* (Morawitz, 1871) as *Osmia* (*Anthocopa*) *crenulata* Morawitz, 1871.
Mount Lebanon, Gounnie [Jounieh], 14.V.1953, 2♀, 1♂; Beirut, 4.VI.1954, 1♀ all det. & leg. Mavromoustakis G.A.
Material examined. Mount Lebanon: Barouk, 1086 m, 12.VIII.2019, 1♀, leg. Boustani M., coll. MBOU.
N. Lebanon: Donnieh, Nemrud-See, 245 m, 28.V.2012, 4♀, leg. Kasparek M., coll. MKAS; Qanat, Qornet Dammouaa, 1231 m, 22.VI.2017, 2♀, leg. Boustani M.; 31.V.2017, 1♂, leg. Boustani M., all coll. MBOU.
Flower records. Boraginaceae: *Echium glomeratum*, *Echium italicum*.

***Hoplitis* (*Anthocopa*) *bisulca* (Gerstaecker, 1869) ***
Distribution: WEST PALAEARCTIC (Müller 2021)
Material examined. N. Lebanon: Horch Ehden, 1625 m, 12.VII.2019, 1♂; 24.VII.2019, 1♀; 31.VII.2019, 1♀; 29.VII.2019, 1♀; 1686 m, 24.VII.2019, 1♀, all leg. Van Achter X., all coll. XVA.
Flower records. Fabaceae: *Medicago* sp.

***Hoplitis* (*Alcidamea*) *campanularis* Morawitz, 1877 ***
Distribution: WEST PALAEARCTIC: Western, Eastern and Northern Mediterranean basin (Müller 2021).
Material examined. N. Lebanon: Donnieh, Wadi Cehennem oberth. Quemmamine, 1393 m, 23.V.2012, 1♀, leg. Kasparek M., coll. MKAS; Arz Tannourine, Trail 4, 1714 m, 7.VI.2017, 2♀, leg. Boustani M.; 1767 m, 7.VI.2017, 1♀, leg. Boustani M., coll. MBOU.
Flower records. Campanulaceae: *Campanula stricta*.

***Hoplitis* (*Alcidamea*) *ciliaris* (Pérez, 1902) ***
Distribution: WEST PALAEARCTIC: Northern and eastern Mediterranean (Müller 2021).
Material examined. Mount Lebanon: Maaser Al Chouf, 1364 m, 29.V.2019, 1♀, leg. Boustani M.
N. Lebanon: Hadath El Jebbe, Chemin Wadi Ain El Raha, 1519 m, 29.VI.2017, 1♂, leg. Boustani M., all coll. MBOU.
Flower records. Fabaceae: *Medicago* sp.; Lamiaceae: *Stachys cretica*.

***Hoplitis* (*Anthocopa*) *daniana* (Mavromoustakis, 1949) ***
Distribution: EAST MEDITERRANEAN (Müller 2021).
Material examined. Mount Lebanon: Chammis, Wadi Cheber, 373 m, 26.IV.2019, 1♀, leg. Boustani M.; Shouf Biosphere Reserve, Barouk-Maaser dirt road, 1769 m, 16.V.2019, 1♀, leg. Boustani M., all coll. MBOU.
Flower records. Boraginaceae: *Cynoglossum nebrodense*.

***Hoplitis* (*Anthocopa*) *duckeana* (Kohl, 1905) ***

Distribution: WEST PALAEARCTIC (Müller 2021).

Material examined. Mount Lebanon: Jabal Moussa Biosphere Reserve, Qehmez Gate, 1401 m, 21.VIII.2018, 1♀, leg. Boustani M., Nemer N.; Laqlouq, 1660 m, 6.VII.2019, 1♂, leg. Van Achter X.; Jabal Moussa, Trail Qornet El Der, 1364 m, 18.VII.2019, 1♂, leg. Boustani M. all coll. MBOU.

N. Lebanon: Horch Ehden, 1625 m, 24.VII.2019, 1♀, leg. Van Achter X.; Bcharre, 1900 m, 29.VII.2019, 1♂, leg. Van Achter X., all coll. XVA.

Flower records. Caprifoliaceae: *Cephalaria* sp., *Scabiosa* sp., *Scabiosa argentea*; Fabaceae: *Ononis natrix*.

***Hoplitis* (*Hoplitis*) *libanensis* (Morice, 1901)**

Distribution: LEVANT (Müller 2021).

Literature. Morice, 1901: Syria (Brumana) [Lebanon], 1899, 2♀, 2♂, type material, coll. Oxford University Museum of Natural History, coll. OUMNH.

***Hoplitis* (*Chlidoplitis*) *lysholmi* (Friese, 1899)**

Distribution: LEVANT (Müller 2021).

Literature. Friese (1899): Mount Lebanon, 1.V.1899, males and females, type material (along with material from Mersina, Cyprus), det. Friese H., leg. Morice F.

***Hoplitis* (*Anthocopa*) *obtusa* (Friese, 1899)**

Distribution: WEST PALAEARCTIC: Northern and eastern Mediterranean and eastern Europe (Müller 2021).

Literature. Mavromoustakis, 1956: Under the name *Osmia obtusa* Friese,1899: Mount Lebanon, Hammana, 16.V.1953, 1♂, det. & leg. Mavromoustakis G.A.

Material examined. N. Lebanon: Tannourine El Tahta, Wadi Ain El Raha, 900 m, 28.IV.2017, 1♂, leg. Boustani M., coll. MBOU.

S. Lebanon: Saidoun, El Mrouj, 7.V.2017, 1♀, leg. Baghdadi A., coll. SOILS.

***Hoplitis* (*Hoplitis*) *pallicornis* (Friese, 1895) *** (fig. 18.6)

Distribution: WEST PALAEARCTIC: Northern and eastern Mediterranean (Müller 2021).

Local distribution fig. 13.4

Unpublished records. GBIF 2021, SEMC: Mount Lebanon, Monteverde nr. Mansourieh, 350 m, 24.IV.1995, 1♂, det. Baker D., leg. Roche C.G.

Material examined. Bekaa: Ainata, 1824 m, 30.V.2017, 1♂, det. Müller A. leg. Boustani M., Rasmont P., coll. MBOU; 1556, 30.V.2017, 1♂, leg. Rasmont P., coll. PRAS.

Mount Lebanon: Bentael, 378 m, 23.IV.2019, 2♀, 1♂, leg. Boustani M., Nemer N., Rasmont P., coll. MBOU.

N. Lebanon: Hadath El Jebbe, Border of the Cedar Forest, 1639 m, 29.V.2017, 1♀, leg. Boustani M.; Hadath El Jebbeh, Road to Wadi Al Fouar, 1553 m, 6.VI.2018, 1♂, leg. Boustani M.; 1529 m, 31.V.2019, 1♂, leg. Boustani M.; Tannourine El Tahta, Al Mahbase, 893 m, 25.IV.2019, 1♂; 31.V.2019, 2♀, 1♂, leg. Boustani M., all coll. MBOU.

Flower records. Fabaceae: *Vicia tenuifolia*, *Lotus gebelia libanoticus*, *Trifolium purpureum*.

Preference for Fabaceae also noted by (Sedivy *et al.* 2013) along with Campanulaceae and Boraginaceae.

***Hoplitis* (*Hoplitis*) *pici* (Friese, 1899)**

Distribution: WEST PALAEARCTIC: Eastern Europe, northern and eastern Mediterranean (Müller 2021).

Literature. Friese (1899): Mount Lebanon, Brumana, 29.IV.1899, males and females, type material (other types from "Brussa" and "Alexandrette", Turkey).

Material examined. Mount Lebanon: Shouf Biosphere Reserve, Barouk-Maaser dirt road, 1769 m, 16.V.2019, 1♂, leg. Boustani M., coll. MBOU.

N. Lebanon: Tannourine El Tahta, Wadi Ain El Raha, 1371 m, 5.V.2017, 1♂, leg. Boustani M., coll. MBOU.

***Hoplitis* (*Alcidamea*) *praestans* (Morawitz, 1894) ***

Distribution: WEST PALAEARCTIC (Müller 2021).

Material examined. N. Lebanon: Tannourine El Tahta, Wadi Ain el Raha, 900 m, 5.V.2017, 1♀, leg. Boustani M., coll. MBOU.

Flower records. Asteraceae: *Carduus argentatus*.

***Hoplitis* (*Micreriades*) *lebanotica* (Mavromoustakis, 1955)**
Distribution: EAST MEDITERRANEAN (Müller 2021).
Literature. Mavromoustakis, 1955: Under the name *Chelostoma lebanoticum* Mavromoustakis, 1955:
Mount Lebanon, Nahr el Kelb [Nahr el Kaleb], 13.V.1953, 3♀, 1♂; S. Lebanon: Djezzine [Jezzine], 20.V.1953, 1♂, all det. & leg. Mavromoustakis G.A.

***Hoplitis* (*Anthocopa*) *unispina* (Alfken, 1935) ***
Distribution: EAST MEDITERRANEAN (Müller 2021).
The literature records listed below of the taxon referred to as *Osmia* (*Anthocopa*) *villosa* by Mavromoustakis (1956) below are probably referring to *Hoplitis* (*Anthocopa*) *unispina* (Alfken, 1935) (Müller, pers. comm.), indeed *H. villosa* distribution does not include the south-eastern Mediterranean region (Müller 2019).
Literature. Mavromoustakis, 1956: Listed under *Osmia* (*Anthocopa*) *villosa* Schenck, 1853
Mount Lebanon, Hammana, 16.V.1953, 1♂, det. & leg. Mavromoustakis G.A.
Material examined. N. Lebanon: Arz Tannourine, Gate, 1796 m, 3.VI.2019, 1♀, leg. Boustani M., coll. MBOU.

***Hoplitis* (*Anthocopa*) *yermasoyiae* (Mavromoustakis, 1938)**
Distribution: WEST PALAEARCTIC: Northern and eastern Mediterranean (Müller 2021).
Literature. Mavromoustakis (1956): Listed under *Osmia* (*Anthocopa*) *yermasoyiae* Mavromoustakis, 1938.
Mount Lebanon, Brumana, ll.V.1953, 3♂, 2♀, det. & leg. Mavromoustakis G.A.

Genus *Osmia* Panzer, 1806
40 species.

Floral preferences seem to be strongly centred on Asteraceae genera, as well as Fabaceae and Lamiaceae (Müller 2021). Our recorded flower visits do seem to follow this trend but include several records form other families within individual species visits such as Dipsacaceae and Boraginaceae.

***Osmia* (*Pyrosmia*) *amathusica* Mavromoustakis, 1937 ***
Distribution: WEST PALAEARCTIC: Northern and eastern Mediterranean (Müller 2021).
Material examined. Mount Lebanon: Chammis, Wadi Cheber, 373 m, 26.IV.2019, 1♀, leg. Boustani M.
N. Lebanon: Fehta, 1715 m, 5.V.2017, 1♀, leg. Boustani M., coll. MBOU.

***Osmia* (*Erythrosmia*) *andrenoides* Spinola, 1808 *** (fig. 19.1)
Distribution: WEST PALAEARCTIC: Europe, Turkey, and the Near East (Müller 2021).
Material examined. Mount Lebanon: Bentael, 340 m, 23.IV.2019, 5♀, 1♂, leg. Boustani M., Nemer N., Rasmont P., coll. MBOU.
N. Lebanon: Tannourine El Tahta, Wadi Ain el Raha, 900 m, 18.IV.2017, 1♂, leg. Boustani M.; Tannourine El Tahta, Al Mahbase, 893 m, 25.IV.2019, 1♂, leg. Boustani M.; Tannourine El Tahta, Mar Boutrous, 1207 m, 27.VI.2019, 1♀, leg. Boustani M., all coll. MBOU.
Flower records. Asteraceae: *Carduus argentatus*; Lamiaceae: *Lamium* sp., *Stachys distans*.

***Osmia* (*Helicosmia*) *aquila* Warncke, 1988 ***
Distribution: EAST MEDITERRANEAN: Turkey, Jordan, Israel (Müller 2021).
Material examined. N. Lebanon: Harissa, Chir El Ribez, 1730 m, 11.VI.2017, 1♀, leg. Boustani M., coll. MBOU.
Flower records. *Salvia fruticosa*.

***Osmia* (*Helicosmia*) *aurulenta* (Panzer, 1799)**
Distribution: WEST PALAEARCTIC (Müller 2021).
Local distribution fig. 13.5
Literature. Mavromoustakis (1963): N. Lebanon, Cedars, 30.VI.1960, 3♀, 1♂, det. & leg. Mavromoustakis G.A.

Material examined. N. Lebanon: Bcharre, Forest of the Cedars of God, 9.V.2017, 2♂, leg. Boustani M.; Arz Tannourine, Tannourine Reserve Trail 4, 1714 m, 7.VI.2017, 1♀, leg. Boustani M.; Hadath El Jebbe, Al Fouar, 1529 m, 31.V.2019, 4♀, 1♂, leg. Boustani M.; Hadath El Jebbe, Border of the Cedar Forest, 1646 m, 31.V.2019, 1♀, leg. Boustani M.; Arz Bcharre, Forest Limit, 1873 m, 5.VI.2019, 1♀, leg. Boustani M.; Arz Bcharre, Forest Limit, 1897 m, 5.VI.2019, 1♀, leg. Boustani M.; Hadath El Jebbe, Al Fouar, 1529 m, 7.VI.2019, 3♀, leg. Boustani M., Mouawad G., all coll. MBOU; Hadath El Jebbe, Al Fouar, 1468 m, 27.VI.2019, 1♂, leg. Van Achter X., coll. XVA; Hadath El Jebbe, Border of the Cedar Forest, 1646 m, 27.VI.2019, 1♀, leg. Boustani M., coll. MBOU; Arz Tannourine, Gate area, 1754 m, 29.VI.2019, leg. Ghisbain G.; Arz Bcharre Reforestation area, 1973 m, 20190702. VII.2019, 3♀, leg. Ghisbain G.; 1♀, leg. Gekière A.; Arz Tannourine, Main gate, 1796 m, 4.VII.2019, 2♀, leg. Ghisbain G., all coll. UMONS; Hadath El Jebbe, Border of the Cedar Forest, 1632 m, 5.VII.2019, 3♀, leg. Boustani M., coll. MBOU; 2♀, leg. Ghisbain G., coll. UMONS; Jord Ehden, 1983 m, 5.VII.2019, 1♀, leg. Boustani M., coll. MBOU, 2♀ leg. Gekière A., 5♀, leg. Ghisbain G.; 1912 m, 5.VII.2019, 1♀, leg. Van Achter X., coll. XVA; Arz Tannourine, Gate area, 1754 m, 6.VII.2019, 1♀, leg. Ghisbain G., all coll. UMONS; Bcharre, 1900 m, 14.VII.2019, 1♀, leg. Van Achter X.; Bcharre, 1900 m, 22.VII.2019, 1♀, leg. Van Achter X., all coll. XVA; Bcharre, Qornet Es Sawda, 2909 m, 30.VII.2019, 1♂, leg. Boustani M., coll. MBOU.

Flower records. Apiaceae: *Chaerophyllum aurantiacum*; Boraginaceae: *Solenanthus stamineus*; Fabaceae: *Medicago* sp*., Onobrychis cornuta, Vicia tenuifolia*; Lamiaceae: *Marrubium libanoticum*, *Nepeta curviflora*, *Scutellaria* sp., *Stachys cretica*, *Stachys distans*.

Preference for Fabaceae and Lamiaceae observed by Müller 1996.

***Osmia* (*Tergosmia*) *avosetta* Warncke, 1988**

Distribution: EAST MEDITERRANEAN: North-eastern Mediterranean to Iran (Müller 2020).

Literature. Records from North Lebanon, Bcharre, Dahr El Adib, 2017, in Müller (2020) listed with Material Examined below.

Material examined. N. Lebanon: Bcharre, Dahr El Adib, 2441 m, 8.VI.2017, 1♂, leg. Boustani M.; Bcharre, Dahr El Adib, 2437 m, 8.VI.2017, 2♂, leg. Boustani M.; Bcharre, Plateau Qornet Es Sawda, 2909 m, 12.VII.2018, 1♀, leg. Boustani M., Jabbour J., all coll. MBOU; Jord Tannourine, 2296 m, 30.VI.2019, 3♀, 1♂, leg. Ghisbain G.; Jord Tannourine, 2166 m, 6. VII.2019, 1♀, leg. Ghisbain G., all coll. UMONS.

Flower records. Fabaceae: *Astragalus cruentiflorus*, *Onobrychis cornuta*.

***Osmia* (*Osmia*) *bicornis* (L., 1758) ***

Distribution: WEST PALAEARCTIC (Müller 2021).

Local distribution fig. 13.6

Unpublished records. GBIF 2021, SEMC:

Listed as *Osmia rufa cornigera* (Rossi, 1790): Mount Lebanon, Monteverde, nr. Mansourieh, 350 m, 18.II.1996, 1♂, det. Baker D., leg. Roche C.G.

Material examined. N. Lebanon: Tannourine El Tahta, Wadi Ain El Raha, 900 m, 27.III.2017, 1♂, leg. Boustani M.; 1490 m, 5.V.2017, 1♂, leg. Boustani M.; Horch Ehden, Nabeh Jouit, 1336 m, 24.IV.2019, 2♂, leg. Boustani M., Rasmont P.; Hadath El Jebbe, Al Fouar, 1529 m, 13.V.2019, 1♂, leg. Boustani M.; Ehden, Ain El Nassa, 1560 m, 22.V.2019, 1♀, leg. Boustani M., all coll. MBOU.

S. Lebanon: Saidoun, 8.II.2019, 1♂, leg. Baghdadi A., coll. SOILS.

Flower records. Asphodelaceae: *Asphodelus microcarpus*; Boraginaceae: *Anchusa hybrida*; Fabaceae: *Coronilla emeroides*; Salicaceae: *Salix libani*.

***Osmia* (*Hoplosmia*) *bidentata* Morawitz, 1876 ***

Distribution: WEST PALAEARCTIC (Müller 2021).

Material examined. Bekaa: Ainata, 2229 m, 29.VII.2018, 1♀, leg. Boustani M.; Jord Aarsal, Wadi Al Heeban, 2000 m, 11.VII.2019, 1♂, leg. Boustani M.; Jord Aarsal, Kechek, 2120 m, 11.VII.2019, 1♂, leg. Boustani M.; Jord Aarsal, Howiyit Al Borj, 2008 m, 1♀, 1♂, leg. Boustani M., all coll. MBOU; 1♂, leg. Van Achter X., coll. XVA.

Flower records. Asteraceae: *Cousinia hermonis*, *Onopordum* sp.

***Osmia* (*Helicosmia*) *breviata* Warncke, 1988** *

Distribution: EAST MEDITERRANEAN: Greece, Turkey, Israel (Ascher & Pickering 2021, Kuhlmann *et al.* 2021, Müller 2021).

Material examined. N. Lebanon: Jord Tannourine, Jabal Al Mnaitra, 2455 m, 28.V.2017, 1♂, leg. Boustani M., Rasmont P.; Bcharre, Qornet Es Sawda, 2857 m, 30.VI.2017, 1♂, leg. Boustani M., all coll. MBOU.

Flower records. Fabaceae: *Onobrychis cornuta*.

***Osmia* (*Helicosmia*) *caerulescens* (L., 1758)** *

Distribution: WEST PALAEARCTIC: (Ascher & Pickering 2021, Kuhlmann *et al.* 2021, Müller 2021).

Local distribution fig. 13.7

Material examined. No locality, 18.VI.1971, 1♀, coll. AUB.

Mount Lebanon: Qartaba, Matoube, 1648 m, 23.VII.2017, 1♀, leg. Boustani M.; Laqlouq, Matoube, 1751 m, 6.VII.2019, 1♀, leg. Boustani M., all coll. MBOU.

N. Lebanon: Bcharre, Forest of the Cedars of God, 1914 m, 9.V.2017, 1♂, leg. Boustani M.; Arz Tannourine, Trail 4, 1714 m, 7.VI.2017, 1♀, leg. Boustani M.; 1762 m, 5.VII.2018, 2♀, leg. Boustani M.; 18.VII.2018, 1♀, leg. Boustani M., Jabbour J.; Tannourine El Tahta, Al Mahbase, 893 m, 5.V.2019, 1♀, leg. Boustani M., all coll. MBOU; Arz Tannourine, Gate, 1797 m, 24.VII.2019, 1♀, leg. Van Achter X., coll. XVA.

Flower records. Boraginaceae: *Solenanthus stamineus*; Fabaceae: *Coronilla varia*, *Trifolium purpureum*; Lamiaceae: *Salvia hierosolymitana*, *Stachys cretica*.

Preferences for Fabaceae and Lamiaceae also observed by Müller (1996).

***Osmia* (*Pyrosmia*) *cephalotes* Morawitz, 1870** *

Distribution: WEST PALAEARCTIC (Müller 2021).

Material examined. N. Lebanon: Arz Tannourine, Tannourine Reserve Trail 4, 1800 m, 6.V.2017, 1♂,; Arz Bcharre, 1917 m, 9.V.2017, 2♂; 1914 m, 9.V.2017, 1♀, 1♂**;** Arz Bcharre, 1883 m, 27.V.2018, 2♀; Horch Ehden, Ain El Naasa, 1560 m, 22.V.2019, 1♀; Hadath El Jebbe, Al Fouar, 1529 m, 31.V.2019, 1♀; Arz Tannourine, Trail 4, 1781 m, 3.VI.2019, 5♀; all leg. Boustani M., coll. MBOU.

Flower records. Asteraceae: *Reichardia* sp., *Scorzonera* sp.; Boraginaceae: *Solenanthus stamineus*; Fabaceae: *Vicia sericocarpa*, *Vicia tenuifolia*.

Preference for Fabaceae and Lamiaceae also noted by Müller 2021.

***Osmia* (*Helicosmia*) *clypearis* Morawitz, 1871 ssp. *acuta* Warncke, 1988** *

Distribution: EAST MEDITERRANEAN: Turkey, Syria, Jordan, Israel (Müller 2021).

Material examined. N. Lebanon: Arz Bcharre, Reforestation Area, 1967 m, 12.V.2017, 1♂, leg. Boustani M., coll. MBOU.

***Osmia* (*Osmia*) *cornuta* (Latreille, 1805) ssp. *quasirufa* Peters, 1978** *

Distribution: WEST PALAEARCTIC (Müller 2021).

Material examined. Mount Lebanon: Blat (Byblos district), 16.IV.2018, 1♀, coll. USEK.

N. Lebanon: Hadath El Jebbe, Al Fouar, 1529 m, 12.IV.2019, 1♀; leg. Boustani M.; Horch Ehden, Nabeh Jouit, 1411 m, 24.IV.2019, 1♀, leg. Boustani M., Rasmont P., all coll. MBOU.

Flower records. Rosaceae: *Prunus dulcis*.

***Osmia* (*Hemiosmia*) *difficilis* Morawitz, 1875** (fig. 19.2)

Distribution: PALAEARCTIC: Northern and eastern Mediterranean and eastwards to Kyrgyzstan, Russia (Müller 2020).

Local distribution fig. 13.8

Literature. in Müller (2020) Records from North Lebanon, Bcharre, Dahr El Adib, from 2017, listed with Material Examined below.

Material examined. N. Lebanon: Arz Tannourine, Bifurcation trails 3 and 4, 1798 m, 25.V.2017, 1♂, leg. Boustani M.; Jord Tannourine, Jabal Al Mnaitra, 2455 m, 28.V.2017, 6♂, leg. Boustani M., Rasmont P.; Jord Tannourine, Jabal Al Mnaitra, 2471 m, 28.V.2017, 4♂, leg. Boustani M.; Arz Tannourine, Trail 4, 1765 m, 22.VI.2017, 1♀, leg. Sader H., Arz Bcharre, Reforestation Area, 2347 m, 27.VI.2017, 1♂, leg. Boustani M.; Bcharre, Dahr El Adib,

2407 m, 8.VI.2017, 4♀, 5♂, leg. Boustani M.; 2441 m, 8.VI.2017, 2♂, leg. Boustani M.; Fehta, El Biara, 1662 m, 28.VI.2017, 1♀, leg. Boustani M.; Bcharre, Plateau Qornet Es Sawda, 2909 m, 12.VII.2018, 2♀, leg. Boustani M., Jabbour J.; 1.VIII.2018, 2♀, leg. Boustani M.; Arz Tannourine, Trail 4, 1781 m, 1♂, leg. Boustani M.; Bcharre, Plateau Qornet Es Sawda, 2909 m, 30.VII.2019, 1♀, 2♂, leg. Boustani M., all coll. MBOU; Bcharre, Plateau Qornet Es Sawda, 2679 m, 2.VII.2019, 1♂, leg. Gekière A.; Jord Tannourine, 2296 m, 30.VI.2019, 1♀, 2♂, leg. Gekière A., all coll. UMONS; 1♂, leg. Van Achter X.; Bcharre, 1900 m, 24.VII.2019, 1♀, leg. Van Achter X., all coll. XVA.
Flower records. Boraginaceae: *Onosma sericea*; Fabaceae: *Astragalus angustifolius*, *Astragalus emarginatus*, *Astragalus coluteoides*, *Astragalus cruentiflorus*, *Astragalus gummifer*, *Onobrychis cornuta*, *Vicia canescens*, *Vicia tenuifolia*; Lamiaceae: *Lamium striatum*.
Preference for Fabaceae and especially *Astragalus* flowers also observed by Müller (2020).

***Osmia* (*Pyrosmia*) *dilaticornis* Morawitz, 1875 *** (fig. 19.3)
Distribution: WEST PALAEARCTIC (Müller 2021).
Material examined. Bekaa: Ainata Al Arz, Ainata, 1556 m, 30.V.2017, 1♀, leg. Rasmont P., coll. PRAS.

***Osmia* (*Helicosmia*) *dimidiata* Morawitz, 1870**
Distribution **WEST PALAEARCTIC** (Müller 2021).
Local distribution fig. 13.9
Literature. Mavromoustakis (1956):
Listed under *Osmia* (*Chalcosmia*) *dimidiata* Morawitz, 1870
Mount Lebanon, Djezzine [Jezzine], 20.V.1953, 2♀, 2♂; 21.V.1953, 1♀, 1♂; Hezine in Bekaa valley (14 klm., from Baalbeck), 31.V.1953, 4♀; Mount Lebanon, Baabdate, 25.V.1953, 2♀, all det. & leg. Mavromoustakis G.A.
Material examined. N. Lebanon: Tannourine El Tahta, Al Mahbase, 893 m, 5.V.2019, 1♂, leg. Boustani M.; Arz Tannourine, Gate, 1796 m, 3.VI.2019, 1♀, leg. Boustani M., all coll. MBOU; Tannourine Reserve, Trail 4, 1781 m, 4.VII.2019, 1♀, leg. Ghisbain G., coll. UMONS.
Flower records. Asteraceae: *Carduus argentatus*; *Centaurea eryngioides*, *Onopordum carduiforme*.

***Osmia* (*Hoplosmia*) *distinguenda* (Tkalcu, 1974) ***
Distribution: WEST PALAEARCTIC: Northern and eastern Mediterranean and east to Azerbaijan (Müller 2021).
Local distribution fig. 13.10
Material examined. Bekaa: Ainata, 2229 m, 29.VII.2018, 1♂, leg. Boustani M., coll. MBOU. Additional 1♀ from Der El Ahmar, 3.VII.2019, and 2♀, 4♂ from Jord Aarsal, 11.VII.2019.
Mount Lebanon: Barouk, Shouf Biosphere Reserve, 1678 m, 2.VII.2019, 1♂, leg. Van Achter X., coll. XVA; Laqlouq, 1700 m, 2♀, 6.VII.2019, leg. Boustani M., coll. MBOU.
N. Lebanon: Arz Tannourine, Tannourine Reserve Trail 4, 1758 m, 22.VI.2017, 1♂, leg. Boustani M., coll. MBOU. Additional 20♀ and 4♂ from 18 records collected between 28.VI.2017 and 25.VII.2019, from Arz Tannourine, Fehta, Harissa, Hadath El Jebbe, and Tannourine El Tahta.
Flower records. Asteraceae: *Centaurea argentea*, *Centaurea* cf *pallescens*, *Centaurea eryngioides*, *Centaurea iberica*, *Centaurea pallescens*, *Onopordum* sp., *Onopordum carduiforme*, *Picnomon acarna*; Caprifoliaceae: *Cephalaria setosa*; Fabaceae: *Medicago* sp.; Plumbaginaceae: *Acantholimon libanoticum*.
Müller (2018) observes a strong preference for Asteraceae such as *Centaurea* that we also find, however flower visitations also include Dipsacaceae (species above now placed in Caprifoliaceae) and Plumbaginaceae flowers.

***Osmia* (*Pyrosmia*) *forticornis* Zanden, 1989 ***
Distribution: WEST PALAEARCTIC: Greece, Turkey, Armenia, and Azerbaijan (Müller 2021).
Material examined. Bekaa: Ainata, 1556 m, 30.V.2017, 1♀, leg. Boustani M., coll. MBOU.

***Osmia* (*Helicosmia*) *gutturalis* Warncke, 1988 ***
Distribution: EAST MEDITERRANEAN (Müller 2021).
Material examined. Bekaa: Hadath, near Army Checkpoint, 1610 m, 7.VII.2019, 1♂, leg. Gekière A., coll. UMONS.

N. Lebanon: Hadath El Jebbe, 1704 m, 7.VI.2019, 1♀, leg. Boustani M., coll. MBOU.
Flower records. Lamiaceae: *Molucella laevis*, *Stachys cretica*.

Osmia* (*Helicosmia*) *kuznetzovi* Cockerell, 1930
Distribution: WEST PALAEARCTIC: Eastern Mediterranean to Uzbekistan (Müller 2021).
Material examined. N. Lebanon: Bcharre, Qornet Es Sawda, 2694 m, 27.VII.2017, 1♀, leg. Boustani M., coll. MBOU; Bcharre, Dahr El Adib, 2572 m, 29.VII.2018, 2♀, leg. Boustani M., coll. MBOU; 1♂, leg. Van Achter X., coll. XVA; Bcharre, Plateau Qornet Es Sawda, 2882 m, 1.VIII.2018, 1♂, leg. Boustani M., coll. MBOU; Bcharre, Qornet Es Sawda, 2909 m, 30.VII.2019, 2♂, leg. Boustani M., coll. MBOU; Bcharre, 2042 m, 31.VII.2019, 1♀, leg. Van Achter X., coll. XVA; Bcharre, Dahr El Adib, 2566 m, 20.VIII.2019, 1♀, leg. Boustani M., coll. MBOU.
Flower records. Asteraceae: *Cirsium lappaceum*, *Cousinia libanotica*; Lamiaceae: *Marrubium libanoticum*

Osmia* (*Helicosmia*) *labialis* Pérez, 1879
Distribution: WEST PALAEARCTIC (Müller 2021).
Material examined. N. Lebanon: Tannourine El Tahta, Wadi Ain El Raha, 900 m, 11.V.2017, 2♀; Arz Tannourine, Trail 4, 1762 m, 21.V.2018, 1♀; Tannourine El Tahta, Al Mahbase, 893 m, 5.V.2019, 1♀; Tannourine El Tahta, Mar Boutrous, 1207 m, 31.V.2019, 1♀; all leg. Boustani M, coll. MBOU.
Flower records. Asteraceae: *Carduus argentatus*, *Centaurea triumfetti.*

***Osmia* (*Helicosmia*) *melanogaster* Spinola, 1808 ***
Distribution: WEST PALAEARCTIC: Mainly Northern Mediterranean basin, Eastern Europe and Eastern Turkey to Azerbaijan (Müller 2021).
Local distribution fig. 13.11
Unpublished records. GBIF 2021, SEMC: S. Lebanon, Sour s.l., 28.V.1995, 1♀, det. Baker D., leg. Roche C.G.
Material examined. Bekaa: Donnieh, Wadi Cehennem, 924 m, 30.V.2012, 1♀, leg. Kasparek M., coll. MKAS.
N. Lebanon: Tannourine el Tahta, Wadi ain Al Raha, 900 m, 11.V.2017, 5♀, leg. Boustani M.; Arz Lubnan, Bcharre Reforestation Area, 1993 m, 27.VI.2017, 1♀, leg. Boustani M.; Tannourine El Tahta, Wadi Ain Al Raha, 1187 m, 21.VI.2017, 1♀, leg. Boustani M.; Arz Tannourine, Ras Al Wadi, 1754 m, 8.VI.2018, 1♀, leg. Abi Khalil N, Boustani M., Fakhry M.; Tannourine El Tahta, Al Mahbase, 893 m, 31.V.2019, 4♀, leg. Boustani M.; Arz Tannourine, Gate, 1796 m, 3.VI.2019, 2♀, leg. Boustani M.; Fehta, El Biara, 1664 m, 3.VI.2019, 1♀, leg. Boustani M., all coll. MBOU; Bcharre, 1900 m, 12.VII.2019, 1♀, leg. Van Achter X.; 29.VII.2019, 2♀, leg. Van Achter X., coll. XVA.
Flower records. Asteraceae: *Centaurea eryngioides*, *Centaurea iberica*; Caprifoliaceae: *Scabiosa* sp.; Lamiaceae: *Stachys ehrenbergii*.
Müller (2021) states that the species is oligolectic on Asteraceae. As with other species in the genus listed here, there are flower visitation records from other families such as Dipscaceae (species listed above now in Caprifoliaceae) and Lamiaceae.

***Osmia* (*Helicosmia*) *mirhiji* Mavromoustakis, 1957**
Distribution: EAST MEDITERRANEAN (Müller 2021).
Literature. Mavromoustakis (1956): Mount Lebanon, Hammana, 15.V.1953, 1♀, 1♂, det. & leg. Mavromoustakis G.A.

***Osmia* (*Pyrosmia*) *moreensis* Zanden, 1984 ***
Distribution: WEST PALAEARCTIC: Northern and eastern Mediterranean (Müller 2021).
Material examined. N. Lebanon: Arz Tannourine, Tannourine Reserve Trail 4, 1747 m, 7.VI.2017, 1♀; Arz Bcharre, Reforestation Area, 1933 m, 18.IV.2018, 1♂; 1883 m, 27.V.2018, 1♀; Arz Bcharre, Forest Limit, 1873 m, 20.V.2019, 1♂, all leg. Boustani M., all coll. MBOU.
Flower record. Fabaceae: *Vicia tenuifolia*.

***Osmia* (*Osmia*) *mustelina* Gerstaecker, 1869**
Distribution: WEST PALAEARCTIC: especially southern Europe to Turkey (Müller 2021).
Local distribution fig. 13.12

Unpublished records. GBIF 2021, SEMC:
N. Lebanon, Cedern b. Becharré [Bcharre], 1900 m, 3–6.VI.1931, 1♀, det. Zanden G, leg. Zerny.
Literature. Mavromoustakis (1963): Listed under *Osmia* (*Osmia*) *emarginata* Lepeletier, 1841.
Osmia emarginata does not occur in the south-eastern Mediterranean region (Müller 2021), and these records are re-assigned to *O. mustelina.* This issue was addressed by Ungricht *el al.* (2008), and indeed, the taxon is often confused with *O. emarginata* (Tkalcu, 1971).
N. Lebanon, Cedars, 30.VI.1960, 3♀, det. & leg. Mavromoustakis G.A.
Material examined. N. Lebanon: Arz Bcharre, 1914 m, 9.V.2017, 4♂, leg. Boustani M., coll. MBOU. Additional 21♀ and 3♂ from 16 records between 12.V.2017 and 12.VII.2019 from Bcharre, Jord Tannourine, Hadath El Jebbeh, and Arz Tannourine.
Flower records. Boraginaceae: *Anchusa hybrida*, *Solenanthus stamineus*; Fabaceae: *Onobrychis cornuta*, *Vicia canescens*, *Vicia tenuifolia*; Geraniaceae: *Geranium tuberosum*; Rubiaceae: *Galium* sp.; Lamiaceae: *Lamium striatum*.
This species' floral preferences as observed by Haider *et al.* (2013) include Fabaceae and Boraginaceae that are also observed here.

***Osmia* (*Pyrosmia*) *nana* Morawitz, 1874**
Distribution: WEST PALAEARCTIC: Southern Europe, Caucasus, Levant, Turkestan, possibly Algeria (Müller 2021).
Unpublished records. GBIF 2021, SEMC:
Mount Lebanon, Monteverde nr Mansourieh, 350 m, 4.IV.1994, 1♂, determiner unspecified, leg. Roche C.G.; 5.IV.1996, 1♀, det. Baker D., leg. Roche C.G.
Literature. Benoist (1934): Under the name *Osmia tetrodonta* Benoist, 1934
The paper provides the description of the species that has later been synonymised with *O. nana* (Zanden, 1985). Locality mentioned as "Asie Mineure, Betmeri" [Mount Lebanon, Beit Meri], 1♂, leg. Pérez J.
Material examined. N. Lebanon: Horch Ehden, Nabeh Jouit, 1346 m, 24.IV.2019, 1♂, leg. Boustani M.; Tannourine El Tahta, Mar Boutrous, 1207 m, 5.V.2019, 1♂, leg. Boustani M., Rasmont P., all coll. MBOU.

***Osmia* (*Osmia*) *nigrohirta* Friese, 1899 ***
Distribution: WEST PALAEARCTIC: Northern and eastern Mediterranean and east to Azerbaijan (Müller 2021).
Material examined. Bekaa: Ainata Al Arz, 2472 m, 29.VI.2019, 1♀, leg. Gekière A., coll. UMONS.
N. Lebanon: Bcharre, Dahr El Adib, 2437 m, 8.VI.2017, 2♀, 1♂, leg. Boustani M.; 2407 m, 8.VI.2017, 2♀, leg. Boustani M.; Arz Bcharre, Reforestation Area, 2347 m, 27.VI.2017, 1♀, leg. Boustani M.; Arz Bcharre, Reforestation Area, 2345 m, 4.VII.2018, 1♀, leg. Fakhry M., all coll. MBOU; Jord Tannourine, 2296 m, 30.VI.2019, 1♀, leg. Van Achter X., coll. XVA.
Flower records. Fabaceae: *Astragalus angustifolius*, *Genista libanotica*, *Onobrychis cornuta*, *Vicia canescens*.
This species is polylectic with records from several families including Fabaceae for which we have flower records, but also Asteraceae, Lamiaceae, Boraginaceae ect. (Haider *et al.* 2013).

***Osmia* (*Helicosmia*) *niveata* (Fabricius, 1804)**
Distribution: WEST PALAEARCTIC (Müller 2021).
Local distribution fig. 13.13
Literature. Mavromoustakis (1956): Listed under *Osmia* (*Chalcosmia*) *fulviventris albiscopa* Alfken, 1914.
Mount Lebanon, Ain el Arar, 24.V.1953, 1♀, 1♂; Beirut, 9.V.1953, 1♀, all det. & leg. Mavromoustakis G.A.
Material examined. Mount Lebanon: Chammis, Wadi Cheber, 373 m, 26.IV.2019, 1♀, 1♂, leg. Boustani M., coll. MBOU.
N. Lebanon: Tannourine El Tahta, Wadi Ain El Raha, 900 m, 5.V.2017, 4♀, 1♂**;** Tannourine El Tahta, Wadi Ain El Raha, 900 m, 11.V.2017, 5♀; Tannourine El Tahta, Al Mahbase, 893 m, 5.V.2019, 1♀, 1♂, all leg. Boustani M., all coll. MBOU.
S. Lebanon: Saidoun, 25.III.2018, 1♀; 27.IV.2019, 1♀, all leg. Baghdadi A., coll. SOILS.
Flower records. Asteraceae: *Carduus argentatus*.

***Osmia* (*Pyrosmia*) *oramara* Warncke, 1992 ***

Distribution: WEST PALAEARCTIC: Turkey, Iran, Israel (Müller 2021)

Material examined. N. Lebanon: Hadath El Jebbe, Chemin Wadi Ain El Raha, 1633 m, 29.VI.2017, 1♀; Harissa, Al Jawar, 5.VII.2018, 1♀, leg. Boustani M., coll. MBOU.

Flower records. Asteraceae: *Astragalus gummifer*; Lamiaceae: *Stachys distans*.

***Osmia* (*Tergosmia*) *rhodoensis* (Zanden, 1983)**

Distribution: WEST PALAEARCTIC: Northern and eastern Mediterranean (Müller 2020).

Literature. Records from North Lebanon, Hadath El Jebbe, in Müller (2020) listed with Material examined below.

Material examined. N. Lebanon: South of Jairoun, 23.V.2012, 1♀, leg. Kasparek M., coll. MKAS; Hadath El Jebbe, Border of the Cedar Forest, 1639 m, 5.V.2017, 1♂, leg. Boustani M.; Hadath El Jebbeh, Border of Cedar Forest, 1681 m, 19.IV.2018, 1♀, leg. Boustani M.; Hadath El Jebbe, Al Fouar, 1529 m, 1♀, leg. Boustani M., Mouawad G., all coll. MBOU.

Flower records. Fabaceae: *Trifolium tomentosum*, *Vicia tenuifolia*.

***Osmia* (*Allosmia*) *rufohirta* Latreille, 1811 ***

Distribution: WEST PALAEARCTIC (Müller 2021).

Material examined. Mount Lebanon: Marej Barja, Kaleet El Besten, 358 m, 26.IV.2019, 1♀, leg. Boustani M., coll. MBOU.

Flower record. *Trifolium resupinatum*.

***Osmia* (*Pyrosmia*) *saxicola* Ducke, 1899**

Distribution: PALAEARCTIC: Northern and eastern Mediterranean basin and east to Tajikistan (Müller 2021).

Literature. Mavromoustakis (1956): Listed under *Osmia* (*Chalcosmia*) *posti* Mavromoustakis, 1956.

Mount Lebanon, Jebel El Knaisse [Jabal Al Knaisse], 1700 m, 18.V.1953, 1♀, 1♂, det. & leg. Mavromoustakis G.A.

Material examined. N. Lebanon: Arz Bcharre, Reforestation Area, 1885 m, 12.V.2017, 1♀**;** 2296 m, 27.VI.2017, 1♀, 1♂, leg. Boustani M.; Arz Tannourine, Gate area, 1754 m, 19.IV.2018, 1♂, all leg Boustani M., all coll. MBOU.

Flower records. Asteraceae: *Scorzonera mollis*; Fabaceae: *Onobrychis cornuta*.

***Osmia* (*Hoplosmia*) *scutellaris* Morawitz, 1868 ***

Distribution: WEST PALAEARCTIC: Eastern Europe, Mediterranean basin, and east to Iran (Müller 2021).

Local distribution fig. 13.14

Unpublished records. GBIF 2021, SEMC:

Unknown location, label indicates Libanon [Lebanon], 1900, 1♂, det. Zanden G, leg. Schmiedeknecht O.

Mount Lebanon, Monteverde, 350 m, 21.V.1994, sex unspecified, determiner unspecified, leg. Roche C.G.

Material examined. Mount Lebanon: Maaser Al Chouf, 1143 m, 29.V.2019, 2♀, 2♂, leg. Boustani M.; 1364 m, 29.V.2019, 1♂, leg. Boustani M., all coll. MBOU.

N. Lebanon: Ehden, Ehden Forest, 1567 m, 19.VI.2016, 1♀, leg. Yammine W.; Qadisha Valley, 950, 5.V.2017, 1♀, 1♂, leg. Nemeth T.; Tannourine El Tahta, Wadi Ain El Raha, 900 m, 3.V.2017, 2♂, leg. Boustani M.; 5.V.2017, 1♀, 1♂, leg. Boustani M.; 11.V.2017, 2♀, 4♂, leg. Boustani M.; Tannourine El Tahta, Al Mahbase, 893 m, 5.V.2019, 1♂, leg. Boustani M.; Hadath El Jebbe, Al Fouar, 1529 m, 31.V.2019, 6♂, leg. Boustani M.; Arz Tannourine, Trail 4, 1781 m, 3.VI.2019, 1♀, leg. Boustani M., all coll. MBOU.

Flower records. Asteraceae: *Anthemis pauciloba*, *Asteriscus* sp., *Carduus argentatus*; Fabaceae: *Vicia tenuifolia*; Lamiaceae: *Stachys cretica*.

Recorded floral preferences are from Asteraceae, mainly Chichorioidea (Müller 2018). We do have mostly Asteraceae genera in the records above, but also Fabaceae and Lamiaceae flowers.

***Osmia* (*Helicosmia*) *signata* Erichson, 1835 ***

Distribution: WEST PALAEARCTIC (Müller 2021).

Material examined. Bekaa: Der El Ahmar, 989 m, 3.VII.2019, 1♀, leg. Boustani M., 1♀, leg. Ghisbain G., coll.

UMONS.
Flower records. Asteraceae : *Centaurea* cf *pallescens.*

***Osmia* (*Hoplosmia*) *spinigera* Latreille, 1811**
Distribution: WEST PALAEARCTIC: Northern and eastern Mediterranean and south to Egypt (Müller 2021).
Literature. Mavromoustakis (1956): Mount Lebanon, Nahr el Kelb [Nahr El Kalb], 13.V.1953, 1♂, det. & leg. Mavromoustakis G.A.

***Osmia* (*Helicosmia*) *subcornuta* Morawitz, 1875 ***
Distribution: PALAEARCTIC: Northern and eastern Mediterranean to Tajikistan (Müller 2021).
Material examined. Bekaa: Ainata, 1556 m, 30.V.2017, 1♀, leg. Boustani M., Rasmont P., coll. MBOU.
N. Lebanon: South of Jairoun, 1648 m, 23.V.2012, 1♀, leg. Kasparek M., coll. MKAS; Tannourine El Tahta, Al Mahbase, 893 m, 25.IV.2019, 1♀, leg. Boustani M.; Tannourine El Tahta, Mar Boutrous, 1207 m, 5.V.2019, 1♀, 1♂, leg. Boustani M., Hadath El Jebbe, Al Fouar, 1529 m, 31.V.2019, 1♀, leg. Boustani M., all coll. MBOU.
Flower records. Fabaceae: *Hymenocarpos circinnatus*, *Vicia tenuifolia*.

***Osmia* (*Pyrosmia*) *submicans* Morawitz, 1870**
Distribution: WEST PALAEARCTIC (Müller 2021).
Local distribution fig. 13.15
Unpublished records. GBIF 2021, SEMC: Listed as *Osmia submicans* ssp. *hebraea* Benoist, 1934.
Beirut, Garden of St. Joseph University, 15.III.1949, 1♂, determiner unspecified, leg. Kullenberg B.
Literature. Mavromoustakis (1956): Mount Lebanon, Brumana, 11.V.1953, 1♀, 1♂; 26.V.1953, 1♀; Harissa, 15.V.1953, 1♀, all det. & leg. Mavromoustakis G.A.
Material examined. N. Lebanon: Arz Tannourine, Tannourine Reserve Trail 4, 1800 m, 1♀, 6.V.2017; Tannourine El Tahta, Mar Boutrous, 1207 m, 12.IV.2019, 1♂; Horch Ehden, Nabeh Jouit, 1405 m, 13.IV.2019, 1♂; Tannourine El Tahta, Mar Boutrous, 1207 m, 25.IV.2019, 1♂; 5.V.2019, 1♀, all leg. Boustani M., all coll. MBOU.

***Osmia* (*Allosmia*) *sybarita* Smith, 1853 ***
Distribution: WEST PALAEARCTIC (Müller 2021).
Material examined. Mount Lebanon: Batloun, 25.IV.1981, 1♂, leg. Othob, coll. AUB.

***Osmia* (*Pyrosmia*) *teunisseni* Zanden, 1981 ***
Distribution: WEST PALAEARCTIC: Northern and eastern Mediterranean (Müller 2021).
Material examined. Mount Lebanon: Barja, Terbe, 326 m, 17.IV.2017, 1♀, 1♂, leg. Boustani M., coll. MBOU.
N. Lebanon: Horch Ehden, Nabeh Jouit, 1346 m, 24.IV.2019, 1♂, leg. Boustani M., coll. MBOU.

***Osmia* (*Melanosmia*) *thoracica* Radoszkowski, 1874 ***
Distribution: WEST PALAEARCTIC: Turkey and Armenia (Müller 2021).
Material examined. N. Lebanon: Bcharre, Bcharre Jord, 2723 m, 24.VI.2016, 2♀, leg. Boustani M.; Bcharre, Qornet Es Sawda, 2863 m, 30.VI.2017, 3♀, leg. Boustani M.; Bcharre, Qornet Es Sawda, 2949 m, 21.VII.2017, 1♀, leg. Boustani M.; Bcharre, Plateau Qornet Es Sawda, 2882 m, 12.VII.2018, 2♀, leg. Abi Khalil N., Boustani M., Jabbour J., Fakhry M., all coll. MBOU; 2867 m, 1.VIII.2018, leg. Van Achter X., coll. XVA.
Flower records. Fabaceae: *Astragalus angustifolius*, *Vicia canescens*.

***Osmia* (*Pyrosmia*) *versicolor* Latreille, 1811** (fig. 19.4)
Distribution: WEST PALAEARCTIC (Müller 2021).
Unpublished records. GBIF 2021, SEMC: Listed as *Osmia versicolor viricephalica* Warncke, 1992.
Mount Lebanon, Monteverde, nr Mansourieh, 350 m, 27.III.1994, sex not specified, determiner not specified.
Material examined. N. Lebanon: Arz Tannourine, Tannourine Reserve Greenhouse, 1700 m, 1.V.2017, 1♂, leg. Nemeth T., coll. MBOU; Tannourine El Tahta, 942 m, 25.IV.2019, 1♂, leg. Rasmont P., coll PRAS.
Notes: Subspecies *O. v. viricephalica* Warncke, 1992 mentioned from Lebanon (Grace 2010).

Genus *Protosmia* Ducke, 1900
Five species.

***Protosmia* (*Protosmia*) *glutinosa* (Giraud, 1871) ***
Distribution: WEST PALAEARCTIC: Southern Europe, especially Mediterranean basin, and Caucasus (Müller 2021).
Material examined. N. Lebanon: Hadath El Jebbeh, Chemin Wadi Ain El Raha, 1547 m, 29.VI.2017, 1♀, leg. Boustani M., coll. MBOU.

***Protosmia* (*Chelostomopsis*) *longiceps* (Friese, 1899)**
Distribution: EAST MEDITERRANEAN (Müller 2021).
Local distribution 13.16
Unpublished records. GBIF 2020, SEMC:
Mount Lebanon, Monteverde nr Mansourieh, 350 m, 24.IV.1995, 1♀; 5.IV.1996, 1♂, all det. Baker D. leg. Roche C.G.
Literature. Friese (1899): 2 females from Lebanon (no locality details), type material, Berlin.
Listed under *Chelostoma longiceps* Friese, 1899
Mavromoustakis (1955): S. Lebanon: Djezzine [Jezzine], 20.V.1953, 3♀, 8♂ (type material), det. & leg. Mavromoustakis G.A.
Material examined. Beirut: 19.III.1909, 2♀, leg. Schmiedeknecht, coll. NMSF.
Bekaa: Kefraya, Horch El Kaser, 992 m, 9.IV.2019, 1♂, leg. Boustani M., coll. MBOU.
Mount Lebanon: Arsoun, VII.2015, 3♀, leg. Nemer N.; coll. TCFNR.
N. Lebanon: Donnieh, Wadi Cehennem, 924 m, 30.V.2012, 1♀, leg. Kasparek M., coll. MKAS; Horch Ehden, 1567 m, 19.VI.2016, 1♀, leg. Yammine W., coll. MBOU. Additional 12♀ and 13♂ from 14 records, collected between 6.IV.2017 and 7.VI.2019, from Tannourine El Tahta, Horch Ehden, Qadisha Valley, Bcharre, Horch Ehden, and Hadath El Jebbe.
Flower records. Asteraceae: *Centaurea eryngioides*, *Reichardia* sp., *Serratula pusilla*; Boraginaceae: *Solenanthus stamineus*; Fabaceae: *Coronilla emeroides*; Geraniaceae: *Geranium* sp.
This species is polylectic (Müller 2017) on several families including Fabaceae, Asteraceae, Lamiaceae, and Caryophyllaceae. A preference for Fabaceae and Asteraceae is also observed in the records above.

***Protosmia* (*Protosmia*) *monstrosa* (Pérez, 1895)**
Distribution: WEST PALAEARCTIC: Northern and eastern Mediterranean, Algeria (Müller 2021).
Local distribution fig. 14.1
Literature. Friese (1899): Listed under the taxon *Osmia mirabilis* Friese, 1899 that should be synonymised with *P. monstrosa* based on type material examination (A. Müller, unpublished).
Mount Lebanon, Brumana, 1–3.V.1899, males and females, type material, det. Friese H., leg. Morice F, coll. Oxford / MNHUB.
Material examined. Mount Lebanon: Barja, Terbe, 326 m, 17.IV.2017, 1♀**;** Daychounieh, Nahr Beirut Climbing Site, 133 m, 27.IV.2017, 1♀, all leg. Boustani M. all coll. MBOU.
N. Lebanon: Tannourine El Tahta, Wadi Ain El Raha, 900 m, 5.V.2017, 1♀**;** Harissa, El Biara, 1741 m, 28.VI.2017, 1♀, all leg. Boustani M. all coll. MBOU.
Flower records. Astereaceae: *Carduus argentatus*; Lamiaceae: *Salvia microstegia*.

***Protosmia* (*Protosmia*) *paradoxa* (Friese, 1899)**
Distribution: EAST MEDITERANNEAN (Müller 2021).
Literature. Friese (1899): Mount Lebanon, Brumana (Lebanon), 30.IV.1899, some males and females, type material, det. Friese H., leg. Morice F., Schmiedeknecht O.

***Protosmia* (*Protosmia*) *tiflensis* (Morawitz, 1876) ***
Distribution: WEST PALAEARCTIC: South-eastern Europe and eastern Mediterranean (Müller 2021).
Material examined. N. Lebanon: Hadath El Jebbeh, Chemin Wadi Ain El Raha, 1547 m, 29.VI.2017, 1♀**;** Tannourine

El Tahta, Wadi Ain El Raha, 900 m, 11.V.2017, 1♀**;** Tannourine El Tahta, Al Mahbase, 893 m, 25.IV.2019, 1♂; Ehden, Ain El Naasa, 1560 m, 22.V.2019, 1♂; all leg. Boustani M., coll. MBOU; Horch Ehden, 1625 m, 12.VII.2019; 1686 m, 14.VII.2019, 1♂; leg. Van Achter X., coll. XVA.
Flower records. Fabaceae: *Coronilla emeroides*, *Lotus gebelia libanoticus*, *Medicago* sp.; Lamiaceae: *Salvia sclarea*.

ANTHIDIINI

Bees of this tribe have been well studied by Mavromoustakis (1955, 1956, 1963) in Lebanon compared to other bee groups, and several new species and subspecies were described in those papers. Below we list the literature and occurrences from material examined with the priority name as many of these taxa have undergone status changes. The vast majority of the species collected in Bcharre and other high altitude stations were found in our collections, however several species reported in literature from lower altitudes of Mount Lebanon could not be found in our recent collections, and this probably due to a lack of sampling.

Flower preferences vary within the genera, but general preference trends are consistent with the observations of Müller (1996) and Mavromoustakis (1955, 1956, 1963) from his Lebanon field data.

Genus *Afranthidium* Michener, 1948

Two species.

Afranthidium (*Mesanthidium*) *lebanense* Mavromoustakis, 1955

= *Anthidium lebanense* Mavroumoustakis 1955.
Distribution: EAST MEDITERRANEAN: Levant and Turkey (Ascher & Pickering 2021).
Literature. Mavromoustakis (1955): Mount Lebanon, Nahr el Kelb [Nahr Al Kaleb], 12.V.1953, 1♀ (holotype), 1♂ (paratype), det. & leg. Mavromoustakis G.A.

Afranthidium (*Mesanthidium*) *pusillum* (Morawitz, 1895)

Distribution: PALAEARCTIC: Eastern Mediterranean from Egypt to Syria and further east to Iran and Central Asia (Ascher & Pickering 2021).
Unpublished records.
NMSF:
N. Lebanon, Kadisha [Qadisha], 26.VI.1960, 1♂, det. Warncke K.
Mount Lebanon, Brumana, 26.V.1953, 1♂, det. Warncke K.
Literature. Mavromoustakis (1968):
N. Lebanon, near Becharre [Bcharre], 3.VII.1960, 2♀; 27.VI.1960, 1♀; Kadisha River, 21.VI.1960, 2♀, 1♂; 24.VI.1960, 3♀, 2♂, det. & leg. Mavromoustakis G.A.
Material examined. N. Lebanon: Arz Tannourine, Tannourine Forest Reserve Outskirts, 1739 m, 7.VI.2017, 2♀, det. Fateryga A, leg. Boustani M.; Arz Tannourine, Trail 4, 1781 m, 30.VI.2019, 1♀, det. Kasparek M., leg. Boustani M., all coll. MBOU.
Flower record. Asteraceae: *Anthemis* sp.

Genus *Anthidiellum* Cockerell, 1904

Two species

Anthidiellum (Anthidiellum) troodicum (Mavromoustakis, 1949)

= *Anthidiellum breviusculum* ssp. *troodicum* Mavromoustakis, 1949.
Distribution: WEST PALAEARCTIC: Northern and eastern Mediterranean to Iran (Ascher & Pickering 2021).
Literature. Mavromoustakis (1955): Listed under *Anthidiellum breviusculum troodicum* Mavromoustakis, 1949.
Mount Lebanon, Brumana [Broumana], 26.V.1953, 1♂, det. & leg. Mavromoustakis G.A.

Material examined. N. Lebanon: Tannourine El Tahta, Al Mahbase, 926 m, 27.VI.2019, 1♀, det. Kasparek M., leg. Van Achter X., coll. XVA.
Flower records. Lamiaceae: *Origanum* sp.

***Anthidiellum* (*Anthidiellum*) *strigatum* (Panzer, 1805) s.l.**
Distribution: WEST PALAEARCTIC (Ascher & Pickering 2021).
Local distribution fig. 14.2
GBIF 2020, SEMC: Labelled as "*Anthidiellum strigatum* subps."
Mount Lebanon: Monteverde, near Mansourieh, 350 m, 15.VII.1995, 1 specimen, sex not mentioned, leg. Roche C.G.; Der El Harf, 1100 m, 15.VIII.1995, 1♂, det. Baker D., leg. Roche C.G.; Monteverde, near Mansourieh, 350 m, 16.VI.1996, 1♀, 1♂, det. Baker D., leg. Roche C.G.
Literature. Alfken, 1936: Listed under *Anthidiellum strigatum humerale*
The taxonomic situation of this subspecies needs to be clarified. Additionally, *Anthidium strigatum crassepunctatum* Popov, 1935 has been synonymised with *A. strigatum* by Warncke (1980). Synonymy criticised by Schwarz & Gusenleitner (2003). Whether *humerale* and *strigatum* should be regarded as valid taxa still needs to be clarified.
Mavromoustakis (1955): Mount Lebanon, Ein el Arar (near Baabdate), 25.V.1953, 1♂, det. & leg. Mavromoustakis G.A.
Material examined. Bekaa: Anjar, Water Trail, 951 m, 23.VII.2019, 1♂, det. Kasparek M., leg. Boustani M., coll. MBOU.
Mount Lebanon: Bentael, Main gate (Green Shell), 565 m, 20.VII.2019, 3♂, det. Kasparek M., leg. Van Achter X., coll. XVA.
N. Lebanon: Donnieh, Wadi Cehennem above Quemmamine, 1393 m, 23.05.2012, leg. Kasparek M., coll. MKAS; Hatah El Jebbe, Road to Wadi Ain El Raha, 1519 m, 28.VII.2017, 1♂, det. Litman J., leg. Boustani M.; Tannourine El Tahta, Wadi Ain el Raha, 1036 m, 2.VIII.2017, 2♂, det. Litman J., leg. Boustani M.; Tannourine El Tahta, Wadi Al Fouar, 1187 m, 19.VII.2018, 1♂, det. Litman J., leg. Boustani M., Jabbour J., all coll. MBOU.
Flower records. Caprifoliaceae: *Scabiosa argentea*; Fabaceae: *Ononis natrix*, *Hymenocarpos circinnatus*.
Note: Grace (2010): Listed from Lebanon under *Anthidiellum strigatum* (Panzer, 1805) *crassepunctatum* (Popov, 1935).

Genus *Anthidium* Fabricius, 1804
15 species.

***Anthidium* (*Anthidium*) *christianseni* Mavromoustakis, 1956**
Distribution: EAST MEDITERRANEAN: Levant and Iran (Ascher & Pickering 2021).
Local distribution fig. 14.3
Literature. Mavromoustakis (1956): Locus typicus.
Mount Lebanon, Barouk Cedars, 1600 m, 14–16.VI.1953, 1♀, det. Mavromoustakis G.A., leg. Christiansen K; N. Lebanon, Cedars near Bcharre, 1900 m, 3–6.VI.1931, 2♀, det. Mavromoustakis G.A., leg. Zerny H.
Mavromoustakis (1963): N. Lebanon, Near Becharre [Bcharre], 20.VI.1960, 1♀; 27.VI.1960, 1♀; 3.VII.1960, 3♀; Kadisha river, 21.VI.1960, 1♂; 26.VI.1960, 2♂; Cedars, 4.VII.1960, 2♂; 30.VI.1960, 2♀, 4♂; 6.VII.1960, 1♀; 29.VI.1960, 2♂, leg. & det. Mavromoustakis G.A.
Records mentioned again in Mavromoustakis (1968) and listing occurrences in Iran.
Material examined. Bekaa: Passage Akoura-Hadath, 1820 m, 7.VII.2019, 1♀, det. Kasparek M., leg. Ghisbain G., coll. UMONS.
N. Lebanon: Harissa, Al Jawar, 1765 m, 28.VI.2017, 2♂, det. Litman J., leg. Boustani M.; 1738 m, 18.VII.2017, 1♀, det. Litman J. leg. Boustani M.; 1765 m, 18.VII.2017, 2♂, det. Litman J., leg. Boustani M.; Hadath El Jebbeh, Road to Wadi Al Fouar, 1553, 28.VI.2018, 1♀, det. Litman J., leg. Boustani M.; Harissa, Al Jawar, 1736 m, 5.VII.2018, 1♀, 2♂, det. Litman J., leg. Boustani M.; Bcharre, Forest of the Cedars of God, 1933 m, 21.VII.2018, 1♂, det. Litman J., leg. Boustani M., Jabbour J.; Harissa, Al Jawar, 1736 m, 18.VIII.2018, 1♂, det. Litman J., leg. Boustani M., Jabbour J.; Arz Tannourine, Trail 1, 1762 m, 29.VI.2019, 1♂, det. Kasparek M., leg. Boustani M.; Harissa, Al Jawar, 1758 m, 30.VI.2019, 1♂, det. Kasparek M., leg. Boustani M.; Arz Bcharre, Reforestation area, 2216, 2.VII.2019, 1♂, det. Kasparek M., leg. Boustani M.; Arz Tannourine, Main Gate, 1794 m, 4.VII.2019, 1♂, det. Kasparek M., leg.

Boustani M., all coll. MBOU; Bcharre, 1758 m, 24.VII.2019, 1♂, det. Kasparek M., leg. Van Achter X., coll. XVA; Harissa, Al Jawar, 1758 m, 25.VII.2019, 1♂, det. Kasparek M., leg. Boustani M., coll. MBOU.

Flower records. Asteraceae: *Echinops viscosus*; Fabaceae: *Lotus* sp., *Ononis spinosa*; Lamiaceae: *Phlomis* cf *brachyodon*, *Salvia microstegia*, *Stachys cretica*, *Stachys distans*, *Stachys ehrenbergii*.

Mavromoustakis (1963) recorded specimens from Lebanon on Lamiaceae as well, visiting *Teucrium divaricatum* var. *graecum*.

***Anthidium (Anthidium) syriacum* Pérez, 1912**

Distribution: LEVANT (Warncke 1980).

Described as *Anthidium syriacum* by Pérez (1912), accepted as subspecies of *A. dalmaticum* (as *A. dalmaticum syriacum*) by Mavromoustakis (1939) and Warncke (1980) and re-elevated to species rank by Pasteels (1981).

Literature.

Subspecies *A. dalmaticum syriacum* described by Pérez (1911), from Mount Lebanon, Broumana, 16.VI.1908, 1♂, leg. Gadeau de Kerveille H. (type locality).

Mavroumoustakis (1955): Listed under *Anthidium (Anthidium) dalmaticum* Mocsáry, 1884 *syriacum* Pérez, 1911: Mount Lebanon, Brumana [Broumana], 23.V.1953, 4♀, 1♂; Ein el Arar (near Baabdate), 23.V.1953, 3♀, 1♂; 24.V.1953, 4♀, 2♂; Nahr el Kelb, 12.V.1953 1♀, 1 M; 27.V.1953, 1♀; all det. & leg. Mavromoustakis G.A.

Material examined. Bekaa: Passage Akoura-Hadath, 1820 m, 7.VII.2019, 1♀, det. Kasparek M., leg. Ghisbain G., coll. UMONS.

Flower records. Lamiaceae: *Teucrium orientale*.

***Anthidium* (*Anthidium*) *diadema* Latreille, 1809 ***

Distribution: WEST PALAEARCTIC: Mediterranean basin, mainly North Western Mediterranean and stretching East to Kyrgyzstan (Ascher & Pickering 2021).

Material examined. Mount Lebanon: Akoura, Mejdel Akoura, 1823 m, 28.VII.2018, 1♂, det. Litman J., leg. Boustani M., coll. MBOU.

N. Lebanon: Hadath El Jebbe, 1704 m, 30.VI.2019, 1♂, det. Kasparek M., leg. Boustani M., coll. MBOU.

Flower records. Asteraceae: *Centaurea pallescens*; Lamiaceae: *Stachys cretica*.

***Anthidium* (*Anthidium*) *florentinum* (Fabricius, 1775)**

Distribution: WEST PALAEARCTIC (Ascher & Pickering 2021).

Literature. Klug (1832): Listed under *Anthidium subspinosum* from "Syria", June. This material collected by Ehrenberg and Hemprich is in current Lebanese territory (Baker 1997).

Mavromoustakis (1963): Listed under *Anthidium florentinum subspinosum* Klug, 1832

Reported as common near Bcharre and Kadisha River, no details given on date.

Material examined. Bekaa: Anjar, Guest house, 973 m, 23.VII.2019, 1♂, det. Kasparek M., leg. Boustani M., coll. MBOU.

N. Lebanon: Tannourine El Fawka, Salon de l'église, 1244 m, 4.VII.2019, 2♀, leg. Boustani M., coll. MBOU; 1♀, 1♂, leg. Gekière A.; 1♂, leg. Ghisbain G., all coll. UMONS.

Flower records. Lamiaceae: *Lavandula* x *intermedia*, *Salvia* cf *hierosolymitana*; Rosaceae: *Rubus sanctus*.

Recorded flower visit from Lebanon by Mavromoustakis (1963) on *Rubus ulmifolius anatolicus*, and seems to have this preference for *Rubus* in Cyprus (Mavromoustakis 1952) as well.

***Anthidium* (*Anthidium*) *gussakovskiji* Mavromoustakis, 1939 ***

Distribution: WEST PALAEARCTIC (Ascher & Pickering 2021).

Material examined. Bekaa: Blaika, 1223 m, 3.VII.2019, 1♀, 1♂, det. Kasparek M., leg. Boustani M., coll; MBOU; Blaika, 1325 m, 3.VII.2019, 1♀, det. Kasparek M., leg. Gekière A., coll. UMONS.

Flower record. Asteraceae: *Centaurea* cf *pallescens.*

***Anthidium* (*Anthidium*) *loti* Perris, 1852**

Distribution: WEST PALAEARCTIC: Southern and Eastern Europe, and further east to Kazakhstan, Syria, Israel (Ascher & Pickering 2021).

Local distribution fig. 14.4

Literature. Mavromoustakis (1955): Listed under *Anthidium variegatum* var *meridionale* Giraud, 1863.

Mount Lebanon, Brumana [Broumana], 26.V.1953, 1♀, det. & leg. Mavromoustakis G.A.

Material examined. Bekaa: Anjar, Army Barracks, 967 m, 23.VII.2019, 1♂, det. Kasparek M., leg. Van Achter X., coll. XVA.

Mount Lebanon: Maaser Al Chouf, Panoramic Trail, 1764 m, 6.VIII.2018, 1♀, det. Litman J., leg. Boustani M., coll. MBOU; Maaser Al Chouf, Al Shouf Cedar Reserve, 1764 m, 6.VIII.2018, 1♀, det. Kasparek M., leg. Van Achter X., coll. XVA.

N. Lebanon: Arz Tannourine, 1784 m, 18.VI.2016, 1♀, det. Litman J., leg. Boustani M.; Fehta, El Biara, 1632 m, 18.VII.2018, 1♀, det. Litman J., leg. Boustani M.; Arz Bcharre, Forest Limit, 1873 m, 2.VII.2019, 1♀, det. Kasparek M., leg. Boustani M., all coll. MBOU; Hadath El Jebbe, Border of the Cedar Forest, 1632 m, 6.VII.2019, 1♀, det. Kasparek M., leg. Van Achter X., coll. XVA.

Flower records. Lamiaceae: *Sideritis libanotica linearis*, *Sideritis perfoliata*, *Stachys cretica*.

***Anthidium* (*Anthidium*) *manicatum* L.1758** (fig 19.5–6)

Distribution: PALAEARCTIC (Ascher & Pickering 2021).

Local distribution fig. 14.5

Literature. Mavromoustakis (1956): Mount Lebanon, Brumana [Broumana], 26.V.1953, 1♀, det. & leg. Mavromoustakis G.A.

Material examined. Common and probably widespread, abundant when present.

Mount Lebanon: Jabal Moussa Biosphere Reserve, Qehmez Gate, 1401 m, 21.VIII.2018, 1♂, det. Litman J., leg. Boustani M., Nemer N., coll. MBOU. Additional 3♀ and 8♂ from 8 records, collected between 21.VIII.2018 and 6.VII.2019, Jabal Moussa, Laqlouq, Akoura and Maaser Al Chouf.

N. Lebanon: Qanat, Qornet Dammouaa, 1231 m, 31.V.2017, 1♀, 1♂, det. Litman J., leg. Rasmont P. Additional 51♀ and 47♂ collected between 21.VI.2017 and 23.VIII.2019, from Tannourine El Tahta, Arz Tannourine, Harissa, Hadath El Jebbe, Fehta, and Bcharre.

Flower records. Apiaceae: *Eryngium glomeratum*; Asteraceae: *Carlina curetum orientalis*; Fabaceae: *Ononis natrix*, *O. spinosa*; Lamiaceae: *Marrubium libanoticum*, *Phlomis rigida*, *Salvia microstegia*, *Scutellaria brevibracteata*, *Sideritis libanotica* ssp. *linearis*, *Sideritis perfoliata*, *Stachys cretica*, *S. distans*.

Reported to be polylectic with a preference for Fabaceae, Lamiaceae and Scrophulariaceae by Müller (1996), the preference first two being also apparent in our observations. Mavromoustakis (1956) also reports observations on *Phlomis viscosa* from Lebanon.

***Anthidium* (*Proanthidium*) *venustum* Morawitz, 1877**

= *Anthidium morawitzi* Dalla Torre, 1896

Distribution: WEST PALAEARCTIC: Scattered records, Egypt, Azerbaijan, Iran (Ascher & Pickering 2021)

Literature. Pérez (1911): Mount Lebanon, Broumana, 11.VI.1908,♀, det. Pérez J, leg. Gadeau de Kerveille H.

***Anthidium* (*Gulanthidium*) *rotundum* (Warncke, 1980)**

Distribution: EAST MEDITERRANEAN: Turkey, Iran, Syria, Lebanon (Ascher & Pickering 2021).

Species described by Warncke (1980) from Iran, with paratypes from the Mavromoustakis material collected in Lebanon. According to Warncke the taxon is incorrectly assigned to *A. anguliventre* by Mavromoustakis and Pasteels.

Literature. Mavromoustakis (1963): The records listed under *Anthidium anguliventre* Morawitz, 1888 refer to this species (see under Warncke 1980).

Warncke (1980): N. Lebanon, Bcharre, 1.VII.1960, 1♀, 1♂; 27.VI.1960, 1♀; 2.VII.1960, 4♀; 3.VII.1960, 3♂; Kadisha, 21.VI.1960, 1♀; 27.VI.1960, 1♂; 22.VI.1960, 1♀; leg. Mavromoustakis G.A., det. Warncke K.

Material examined. Mount Lebanon: Barouk, Shouf Biosphere Reserve, 1692 m, 2.VII.2019, 1♂, det. Kasparek M., leg. Van Achter X.; 1382 m, 3.VII.2019, 1♀, 1♂, det. Kasparek M., leg. Van Achter X.; 1716 m, 4.VII.2019, 2♀, det. Kasparek M., leg. Van Achter X.; Laqlouq, 1660 m, 6.VIII.2019, 1♀, det. Kasparek M., leg. Van Achter X., all coll. XVA.

Flower record. Asteraceae: *Centaurea* sp.

***Anthidium* (*Anthidium*) *spiniventre* Friese, 1899 ***

Distribution: PALAEARCTIC: Scattered between Greece and Turkmenistan, Levant (Ascher & Pickering 2021).

Notes. Mentioned by Warncke (1980) and Grace (2010) from Lebanon with no date or locality.

Material examined. N. Lebanon: Arz Tannourine, Tannourine Forest Reserve Outskirts, 1792 m, 13.VII.2017, 1♀, det. Litman J., leg. Boustani M., coll. MBOU.

***Anthidium* (*Anthidium*) *taeniatum* Latreille, 1809 ***

Distribution: WEST PALAEARCTIC: Scattered between Morocco and Turkmenistan, Levant (Ascher & Pickering 2021).

Material examined. Mount Lebanon: Barouk, Shouf Biosphere Reserve, 1690 m, 4.VII.2019, 1♂, det. Kasparek M., leg. Van Achter X.; Laqlouq, Matoube LMT trail, 1699 m, 6.VII.2019, 1♀, det. Kasparek M., leg. Van Achter X., all coll. XVA; Laqlouq, Matoube, 1751 m, 6.VII.2019, 1♂, det; Kasparek M., leg. Boustani M., coll. MBOU.

N. Lebanon: Hadath El Jebbe, 1704 m, 5.VII.2019, 1♂, det. Kasparek M., leg. Ghisbain G.; Arz Tannourine, Gate area, 1754 m, 6.VII.2019, 2♂, det. Kasparek M., leg. Gekière A., all coll. UMONS.

Flower records. Fabaceae: *Medicago* sp.; Lamiaceae: *Stachys cretica*.

***Anthidium* (*Proanthidium*) *trispinosum* Friese, 1917 *** (fig. 20.1)

Distribution: WEST PALAEARCTIC: Scattered records in Turkey, Azerbaijan and Iran (Ascher & Pickering 2021).

Material examined. Bekaa: Ainata, 1556 m, 30.V.2017, 4♂, det. Litman J., leg. Rasmont P., coll. PRAS.

Flower record. Fabaceae: *Astragalus cruentiflorus*.

***Anthidium* (*Proanthidium*) *undulatiforme* Friese, 1917 ***

Distribution: WEST PALAEARCTIC: Scattered records around the Mediterranean (Ascher & Pickering 2021)

Material examined. Mount Lebanon: Laqlouq, 1752 m, 30.VI.2019, 3♀, 1♂, leg. Boustani M., coll. MBOU; 2♀, 2♂, leg. Ghisbain G., coll. UMONS; 2♀, 3♂, all det. Kasparek M.

N. Lebanon: Jord Tannourine, 2166 m, 30.VI.2019, 1♀, det. Kasparek M., leg. Gekière A.

Flower records. Lamiaceae: *Phlomis rigida*.

***Anthidium* (*Proanthidium*) *undulatum* Dours, 1873**

Distribution: WEST PALAEARCTIC: Northern and eastern Mediterranean and east to Iran, Algeria (Ascher & Pickering 2021).

Local distribution fig. 14.6

Literature. Pérez (1911): Mount Lebanon, Beit Meri, 14.VI.1908, det. Pérez J., leg. Gadeau de Kerveille H.

Warncke (1980) assigned the material from Lebanon to the subspecies *holozonicum* (Mavromoustakis, 1939).

Material examined. Bekaa: Hadath, 1441 m, 7.VII.2019, 1♂, det. Kasparek M., leg. Boustani M.; Jord Aarsal, 1975 m, 11.VII.2019, 1♀, det. Kasparek M., leg. Boustani M.; Anjar, Guest house, 973 m, 23.VII.2019, 1♀, 1♂, det. Kasparek M., leg. Boustani M., all coll. MBOU; 1♀, det. Kasparek M., leg. Van Achter X., coll. XVA.

N. Lebanon: Arz Tannourine, 1800 m, 25.VI.2006, 1♂, det. Litman J., leg. Nemer N., coll. TCFNR; Tannourine El Tahta, Wadi Ain Al Raha, 1187 m, 29.VI.2017, 1♂, det. Litman J., leg. Boustani M.; Harissa, Al Jawar, 1765 m, 28.VI.2017, 1♀, 1♂, det. Litman J., leg. Boustani M.; Harissa, Al Jawar, 1765 m, 18.VII.2017, 1♀, 3♂, det. Litman J., leg. Boustani M.; Harissa, Al Jawar, 1736 m, 11.VII.2018, 3♂, det. Litman J., leg. Boustani M.; Harissa, Al Jawar, 1736 m, 18.VII.2018, 1♂, det. Litman J., leg. Boustani M., Jabbour J.; Hadath El Jebbeh, Road to Wadi Al Fouar, 1553 m, 22.VIII.2018, 1♂, det. Litman J., leg. Boustani M., Jabbour J.; Arz Tannourine, Trail 4, 1781 m, 27.VII.2019, 1♂, det. Kasparek M, leg. Boustani M.; Tannourine El Tahta, Mar Boutrous, 1207 m, 27.VI.2019, 1♂, det. Kasparek M., leg. Boustani M., all coll. MBOU; 1♂, det. Kasparek M., leg. Van Achter X., coll. XVA.

S. Lebanon: Saidoun, El Mrouj, 15.VI.2017, 1♀, det. Litman J., leg. Baghdadi A., coll. SOILS.

Flower records. Fabaceae: *Ononis natrix*, *O. spinosa*; Lamiaceae: *Lavandula* x intermedia, *Stachys distans*. Müller (1996) reports a strong preference for Leguminosae for this polylectic species that we also observe here.

***Anthidium* (*Anthidium*) *wuestneii* Mocsáry, 1887**

Distribution: WEST PALAEARCTIC: Lebanon (listed as Syria, locality in current Lebanese territory), Greece, Armenia, China (Warncke 1980).

Local distribution fig. 14.7

Literature. Mentioned from Lebanon, Bcharre, by Warncke (1980).

Material examined. All the specimens came from the AUB collection and mostly have no collector name.

Labels unreadable, 3♂, 1♀, det. Litman J.

Bekaa: AUB Farm [Haush Sneid], 2.VI.1962, 1♂, det. Litman J., leg. Rafi Z

Mount Lebanon: Salima, 21.VI.1973, 1♂**;** Sawfar, 21.VI.1973, 3♂, 4♀**;** Arz El Barouk, 18.VI.1975, 4♂**;** Baalchmay, 3.VII.1975, 1♀, 2♂; Qornael, 7.VII.1975, 1♂, all det. Litman J.

S. Lebanon: Darhouna, 17.VI.1975, 3♂, det. Litman J.

Genus *Eoanthidium* Popov, 1950

Three species.

***Eoanthidium (Eoanthidium) hoplostomum* (Mavromoustakis, 1945)**

= *Dianthidium hoplostomum* Mavromoustakis, 1945

= *Anthidium clypeare* ssp. *hoplostomum* (Mavromoustakis, 1945)

= *Eoanthidium* (*Eoanthidiellum*) *hoplostumum* (Mavromoustakis, 1945)

Distribution: EAST MEDITERRANEAN: Levant and southern and south-eastern Turkey (Kasparek 2020).

Literature. Kasparek (2020): Mount Lebanon: Der El Harf, 1100 m, 16.VII.1995, 1♂, det. Kasparek M., leg. Roche C.G.

***Eoanthidium* (*Eoanthidium*) *insulare* Morawitz, 1873**

Syn.: *Eoanthidium (Eoanthidium) insulare persicolum* (Mavromoustakis, 1937)

Distribution: WEST PALAEARCTIC: Scattered records in Cyprus, Greece, Turkey, Levant, and east to Uzbekistan and Tajikistan (Ascher & Pickering 2021, Kasparek unpublished).

Material from the SEMC and OOLL collections below re-examined by Kasparek M.

Material Examined. Mount Lebanon: Ain El Azar [Ain El Arar], 25.V.1953, 1♀, det. Warncke K., leg. Mavromoustakis G.A., coll. OOLL; Monteverde nr. Mansourieh, 350 m, 21.V.1995, 1♂; 25.VI.1995, 1♀; 16.VI.1996, 1♂, all det. Baker D., leg. Roche C.G., coll. SEMC; Souk El Ghareb, Balamand University, 839 m, 23.VII.2019, 1♂, det. Kasparek M., leg. Van Achter X., coll. XVA.

N. Lebanon: Tannourine Al Tahta, Wadi Ain El Raha, 1036 m, 2.VIII.2017, 1♀, det. Litman J., leg. Boustani M., coll. MBOU.

Flower record. Caprifoliaceae: *Scabiosa argentea*.

***Eoanthidium* (*Eoanthidium*) *judaeense* (Mavromoustakis, 1945)**

= *Dianthidium elongatum* ssp. *judaeense* Mavromoustakis, 1945

= *Eoanthidium* (*Eoanthidiellum*) *judaeense* (Mavromoustakis, 1945)

= *Anthidium* (*Anthidiellum*) *judaeense* (Mavromoustakis, 1945)

Distribution: EAST MEDITERRANEAN: South-east Turkey and Levant (Kasparek 2020).

Local distribution fig. 14.8

Literature. Mavromoustakis (1955) and Kasparek (2020):

Nahel Kelb [Naher El Kaleb], 1♀, 1♂, 13.V.1953, Mavromoustakis G.A., leg. (OLL782, RBINS126); ibid., 27.V.1953 (OLL783); Nahel Kelb [Naher El Kaleb], 13.V.1953, 1♀, Mavromoustakis G.A. leg. (OLL775); ibid., 27.V.1953 (OLL777); Chouf, El Barak [Al Barouk], c. 1100m, 1♂, 12.VI.1995, C. G. Roche leg. (L 653 /D. & M. Baker collection KUNHM 2004-en-004 / SEMC0975119) (SEMC23);

Mount Lebanon: Baabdate, 24.V.1953, 1♀, Mavromoustakis G.A. leg. (OLL778)

Material Examined. Mount Lebanon: Barouk, Shouf Biosphere Reserve, 1571 m, 3.VII.2019, 1♀, 1♂, det. Kasparek M., leg. Van Achter X., coll. XVA.

Genus *Icteranthidium* Michener, 1948

Three species.

***Icteranthidium (Icteranthidium) cimbiciforme* Smith, 1854 ***

Distribution: WEST PALAEARCTIC: Northern and eastern Mediterranean and further east to Iran (Ascher & Pickering 2021).

Unpublished records. GBIF 2021, SEMC: Beirut, IV.1882, 1♀, det. Zanden G.

Literature. Warncke (1980) mentioned from Lebanon without date or locality details.

Material examined. 2 female specimens, one from the AUB and one of the TCFNR collection, both without labels.

***Icteranthidium (Icteranthidium) fedtschenkoi* (Morawitz, 1875)**

Distribution: WEST PALAEARCTIC: Levant, extending east to Iran (Ascher & Pickering 2021).

Literature. Mavromoustakis (1963): N. Lebanon, near Becharre, 27.VI.1960, 1♀, det. & leg. Mavromoustakis G.A.

***Icteranthidium (Icteranthidium) grohmanni* (Spinola, 1838)**

Distribution: WEST PALAEARCTIC: Scattered records around the Mediterranean, mainly South Eastern Europe, Levant, Turkey and east to Russia (Ascher & Pickering 2021).

Local distribution fig. 14.9

Unpublished records. GBIF 2021, SEMC: Mount Lebanon, Der El Harf, 1100 m, 15.VIII.1995, 1♂, det. Baker D., leg. Roche C.G.

Material examined. N. Lebanon: Tannourine El Tahta, Wadi Ain El Raha, 1115 m, 19.VIII.2017, 1♀, det. Fateryga A., leg. Boustani M.; Harissa, Al Jawar, 1736 m, 18.VIII.2018, 2♀, det. Fateryga A., leg. Boustani M., Jabbour J., coll. MBOU; Tannourine El Tahta, 995 m, 27.VI.2019, 1♂, det. Kapsarek M., leg. Van Achter X., coll. XVA; Tannourine El Tahta, Mar Boutrous, 1207 m, 25.VII.2019, 1♀, det. Kasparek M., leg. Boustani M.; Arz Tanourine, Forest Limit, 1873 m, 20.VIII.2019, 1♂, det. Kasparek M., leg. Boustani M.; 1897 m, 20.VIII.2019, 1♀, 1♂, det. Kasparek M., leg. Boustani M.; Tannourine El Tahta, Mar Boutrous, 1207 m, 23.VIII.2019, 1♀, det. Kasparek M., leg. Boustani M.; Arz Tannourine, Gate, 1796 m, 23.VIII.2019, 2♂, det. Kasparek M., leg. Boustani M.; Harissa, Al Jawar, 1758 m, 23.VIII.2019, 1♀, det. Kasparek M., leg. Boustani M., all coll. MBOU.

Flower records. Apiaceae: *Eryngium billardierei*, *E. glomeratum*, Asteraceae: *Carlina curetum* ssp. *orientalis*; Caprifoliaceae: *Scabiosa argentea*.

Müller (1996) reports a strong preference for Apiaceae, specifically *Eryngium* sp. flowers that we also observe in the records above.

Genus *Pseudoanthidium* Friese, 1898

Four species.

***Pseudoanthidium* (*Pseudoanthidium*) aff. *cribratum* (Morawitz, 1875)**

Pérez (1911) gave the record of a *Anthidium lituratum* Latr., which is actually a junior synonym of *Pseudoanthidium scapulare* Latreille, 1809 (Schwarz *et al.* 1996). While Warncke (1980) summarised various closely related taxa under the name *Anthidium lituratum* and distinguished four subspecies, it has been understood in the meantime that it is actually a complex of species (Aguib *et al.* 2010). From the description of Pérez (1911), it can be concluded that his material can likely be assigned to *P. cribratum*, based on the coarse punctuation of the terga, possibly to "*palestinicum* Mavromoustakis, 1938" which was described as subspecies of *cribratum*.

A comprehensive taxonomic revision of the complex is still required and as long as it is not available, we regard it as premature to take a final taxonomic decision. Recent material of the species collected in Lebanon was therefore not assigned to one of the species of the complex.

Literature. Pérez (1911): Mount Lebanon, Broumana, 17.VI.1908, det. Pérez J., leg. Gadeau de Kerveille H.

***Pseudoanthidium* (*Royanthidium*) *melanurum* (Klug, 1832)**

Distribution: WEST PALAEARCTIC: Mediterranean basin, Eastern Europe and Caucasus to Russia East (Ascher & Pickering 2021).

Literature. Klug (1832): Listed under *Anthidium melanurum* from "Syria", June. This material collected by Ehrenberg and Hemprich is in current Lebanese territory (Baker 1997).

***Pseudoanthidium* (*Royanthidium*) *reticulatum* (Mocsáry, 1884)**

Distribution: WEST PALAEARCTIC: Southern Europe, Morocco, Algeria, eastern Mediterranean to Iran (Ascher & Pickering 2021).

Literature. Mentioned by Warncke (1980) from Bcharre.

Material examined. N. Lebanon: Arz Tannourine, Trail 4, 1771 m, 22.VI.2017, 2♂, det. Litman J., leg. Boustani M., coll. MBOU.

Flower record. Asteraceae: *Onopordum carduiforme*.

***Pseudoanthidium* (*Pseudoanthidium*) *stigmaticorne* Dours, 1873 ***

Distribution: WEST PALAEARCTIC: Maghreb (Ascher & Pickering 2021).

Material examined. N. Lebanon: Fehta, El Biara, 1632 m, 18.VII.2018, 1♀, det. Litman J., leg. Boustani M., coll. MBOU.

Flower record. Asteraceae: *Centaurea pallescens*.

Genus *Rhodanthidium* Isensee, 1927

Four species.

***Rhodanthidium* (*Asianthidium*) *aculeatum* (Klug, 1832).**

Distribution: EAST MEDITERRANEAN: Turkey, Lebanon, Iran, Syria (Kasparek 2019, Ascher & Pickering 2021).

Literature. Klug (1832): Listed under *Anthidium aculeatum* from "Syria", June and July. This material collected by Ehrenberg and Hemprich is in the current Lebanese territory (Baker 1997).

Mavromoustakis (1963): Listed under *Meganthidium* (*Oxyanthidium*) *aculeatum* (Klug, 1832).

N. Lebanon: Cedars [Bcharre], 29.VI.1960, 8♀, 50♂; 4.VII.1960, 3♀, 24♂; Kadisha river, 24.VI.1960, 1♀.

Material examined. N. Lebanon: Arz Bcharre, Reforestation Area, 1993 m, 27.VI.2017, 2♀, det. Litman J., leg. Boustani M.; 29.VI.2018, 1♀, det. Litman J., leg. Boustani M.; 4.VII.2018, 1♂, det. Litman J., leg. Boustani M.; Arz Bcharre, 1867 m, 10.VII.2018, 1♀, 2♂, det. Litman J., leg. Boustani M.; Arz Tannourine, Forest Limit, 1873 m, 2.VII.2019, 1♂, det. Kasparek M, leg. Boustani M.; 1897 m, 2.VII.2019, 1♀, det. Kasparek M., leg. Boustani M.; Arz Tannourine, Main Gate, 1794 m, 4.VII.2019, 1♂, det. Kasparek M., leg. Boustani M., all coll. MBOU; Arz Bcharre, Reforestation area, 1973 m, 2.VII.2019, 1♀, 2♂, det. Kasparek M, leg. Gekière A.; 3♀, det Kasparek M., leg. Ghisbain G.; Arz Tannourine, Main Gate, 1794 m, 4.VII.2019, 2♂, det. Kasparek M., leg. Ghisbain G., all coll. UMONS; Bcharre, 1900 m, 12.VII.2019, 1♀, 3♂, det. Kasparek M., leg. Van Achter X.; 22.VII.2019, 2♂, det. Kasparek M., leg. Van Achter X.; Arz Bcharre, Forest Limit, 1897 m, 1♂, det. Kasparek M., leg. Van Achter X., all coll. XVA.

Flower records. Fabaceae: *Vicia tenuifolia*; Lamiaceae: *Salvia microstegia*.

Notes: Friese 1898: Mentioned from Syria and "Asia Minor", could be located in current Lebanese territory.

***Rhodanthidium* (*Asianthidium*) *caturigense* (Giraud, 1863)** (fig. 20.2)

= *Anthidium moreense* ssp. *jerusalemicum* Mavromoustakis, 1938

Distribution: WEST PALAEARCTIC: Northern Mediterranean basin from Spain to the west and east to Iran (Kasparek 2019, Ascher & Pickering 2021).

Local distribution fig. 14.10

Literature.

Listed under: *A. moreense jerusalemicum*

Mavromoustakis, 1955: S. Lebanon, Djezzine [Jezzine], 3.VI.1953, 1♂, det. & leg. Mavromoustakis G.A.

Mavromoustakis (1963): N. Lebanon: Near Becharre [Bcharre], 5.VII.1960, 1♂, det. & leg. Mavromoustakis G.A.
Material examined. Mount Lebanon: Maaser Al Chouf, Panoramic Trail, 1764 m, 6.VIII.2018, 1♂, det. Litman J., leg. Boustani M., coll. MBOU.
N. Lebanon: Arz Tannourine, 1800 m, 20.VI.2002, 1♂, det. Litman J., leg. Nemer N., coll. TCFNR; Qanat, Qornet Dammouaa, 1231 m, 31.V.2017, 1♀, det. Litman J., leg. Rasmont P.; Arz Tannourine, Tannourine Forest Reserve Outskirts, 1792 m, 13.VII.2017, 1♂, det. Litman J., leg. Boustani M.; Tannourine El Tahta, Wadi Al Fouar, 1187 m, 28.VI.2018, 2♀, 1♂, det. Litman J., leg. Boustani M., Jabbour J.; Hadath El Jebbe, Al Fouar, 1529 m, 25.VII.2019, 1♀, det. Kasparek M., leg. Boustani M., Mouawad G., all coll. MBOU; Horch Ehden, Upper Gate, 1597 m, 5.VII.2019, 1♂, det. Kasparek M., leg. Ghisbain G., coll. UMONS.
Flower records. Fabaceae: *Ononis natrix*; Lamiaceae: *Marrubium libanoticum*, *Sideritis libanotica* ssp. *linearis*; Plumbaginaceae: *Acantholimon libanoticum*.
Müller (1996) reports that this species is polylectic with a preference for Fabaceae, most of our records above come from Lamiaceae but we also have one Fabaceae species: *Ononis natrix*, which is also recorded by Mavromoustakis (1963) from Lebanon.

***Rhodanthidium* (*Rhodanthidium*) *exsectum* (Pasteels, 1969)**
Distribution: WEST PALAEARCTIC: Turkey, Lebanon, Iran (Kasparek 2019).
Literature. N. Lebanon, Becharre [Bcharre], 1400 m, 1–4.VII.1931, 1♂, (Warncke 1980). This record was erroneously attributed to *A. moreense* ssp. *jerusalemicum* MAVR. by Mavroumoustakis (Warncke 1980).

***Rhodanthidium* (*Rhodanthidium*) *septemdentatum* (Latreille, 1809)** (fig. 20.3)
Syn.: *Rhodanthidium (Rhodanthidium) septemdentatum* ssp. *faciale* Friese, 1917
Distribution: WEST PALAEARCTIC: Central and Southern Europe, stretching from Spain West to Iran East (Kasparek 2019).
Local distribution fig. 14.11
Unpublished records. GBIF 2021, SEMC:
Mount Lebanon: Monteverde, near Mansourieh, 350 m, 22.V.1994, 1♀, det. Baker D., leg. Roche C.G.; Monteverde, near Mansourieh, 350 m, 4.VI.1995, 1♂, det. Baker D., leg. Roche C.G.
Bekaa: Jdeide N. Bekaa, 1000 m, 2.VI.1996, 1♂, det. Baker D., leg. Roche C.G.
Literature. Mavromoustakis (1955):
Mount Lebanon, Brumana [Broumana], 26.V.1953, 1 F, 7♂; 23.V.1953, 1♀; Nahr el Kelb [Nahr Al Kalb], 27.V.1953, 1♀; Ein el Arar (near Baabdate), 25.V.1953, 2♀, 9♂.
S. Lebanon, Djezzine [Jezzine], 20.V.1953, 1♂; 21.V.1953, 2♂; 3.VI.1953, 3♀, 2♂.
Material examined. Mount Lebanon: Nahr Al Hammam, 455 m, 25.V.2019, 1♂, det. Kasparek M., leg. Boustani M.; Maaser Al Chouf, 1364 m, 29.V.2019, det. Kasparek M., leg. Boustani M., all coll. MBOU.
N. Lebanon: Arz Tannourine, Tannourine Reserve Trail 4, 1714 m, 7.VI.2017, 3♂, det. Litman J., leg. Boustani M., coll. MBOU. Additional 3♀ and 20♂ from 18 records collected between 27.VI.2017 and 12.VII.2019, from Arz Tannourine, Qanat, Tannourine El Tahta, Hadath El Jebbe, Arz Bcharre, Bcharre, and Harissa.
S. Lebanon: Saidoun, Joura, 15.IV.2018, 1♀, det. Kasparek M., leg. Baghdadi A., coll. SOILS.
Flower records. Campanulaceae: *Michauxia campanuloides*; Fabaceae: *Medicago* sp., *Lotus* sp., *Ononis natrix*, *Vicia tenuifolia*; Lamiaceae: *Marrubium libanoticum*, *Phlomis chrysophylla*, *Stachys cretica*, *Stachys distans*; Rubiaceae: *Galium* sp.
Reported as highly polylectic by Müller (1996), Mavromoustakis (1955) also reported visits from Lebanon on *Calycotome* sp. (Fabaceae), *Lavandula stoechas* (Lamiaceae), and *Cirsium syriacum* (Asteraceae).

Genus *Stelis* Panzer, 1806

Five species.

***Stelis* (*Pseudostelis*) *denticulata* Friese, 1899 ***
Distribution: LEVANT: Scattered records from the Levant (Kasparek 2015).
Material examined. N. Lebanon: Arz Tannourine, Reserve Outskirts, 1792 m, 1♀, 2♂, 13.VI.2017, det. Kasparek

M., leg. Boustani M., coll. MBOU.
Flower record. Plumbaginaceae: *Acantholimon libanoticum*.

***Stelis* (*Pseudostelis*) *minuta* Lepeletier & Audinet-Serville, 1825**
Distribution: WEST PALAEARCTIC: Central Europe (Ascher & Pickering 2021)
Literature. Kasparek (2015) distribution includes Lebanon.
Reported by Grace (2010) from Lebanon, Hezine. This locality name is probably a misspelling of Jezzine (S. Lebanon).

***Stelis* (*Stelidomorpha*) *nasuta* Latreille, 1809**
Distribution: WEST PALAEARCTIC: (Kasparek 2015, Ascher & Pickering 2021).
Literature. Mavromoustakis (1963): N. Lebanon: Near Becharre [Bcharre], 5.VII.1960, 1♀, 1♂; Kadisha river, 26.VI.1960, 1♀, 1♂; South Lebanon, Djezzine [Jezzine], 2.VI.1960, 2♀, all leg. & det. Mavromoustakis G.A.

***Stelis* (*Heterostelis*) *ruficornis* Morawitz, 1872**
Distribution: EAST MEDITERRANEAN: Greece, Turkey, Lebanon, Israel (Kasparek 2015, Ascher & Pickering 2021)
Literature. Reported from Lebanon by Kasparek (2015)
Under the synonym *Stelis ruficornis lebanensis* Mavromoustakis, 1962
South Lebanon, Djezzine [Jezzine], 2.VI.1953, 3♀, leg. & det. Mavromoustakis G.A.
Material examined. N. Libanon: Donnieh nr. Qemmemine (34°24'N 36°09'E) at 1600 m asl, 24.V.2012, 1♂, leg. & det. Kasparek M.

***Stelis* (*Protostelis*) *signata* Latreille, 1809**
Distribution: WEST PALAEARCTIC (Kasparek 2015, Ascher & Pickering 2021).
Literature. Under the synonym *Stelis signata* ssp. *eremica* Alfken, 1938. Reported from Lebanon by Kasparek (2015).

Genus *Trachusa* Panzer, 1804
One species.

***Trachusa* (*Archianthidium*) *verhoeffi* (Morawitz, 1872)**
Anthidium pubescens verhoeffi Mavromoustakis, 1954 (elevated to species rank by Kasparek 2018).
Distribution: EAST MEDITERRANEAN: Jordan, Palestine, Israel, Lebanon, Syria, South Turkey (Kasparek 2018).
Literature. Mavromoustakis (1954): Mount Lebanon: Baabdate, 24.V.1953, 1♂; S. Lebanon, Djezine [Jezzin], 3.VI.1953, 2♂; all det. & leg. Mavromoustakis G.A.
Reported from Lebanon by Kasparek (2018): N. Lebanon, Donnieh: Sfiri, 808 m, 27.V.2012, det. & leg. Kasparek M.

MEGACHILINI

Genus *Coelioxys* Latreille, 1809
One species.
***Coelioxys* (*Mesocoelioxys*) *argenteus* Lepeletier, 1841 ***
Distribution: WEST PALAEARCTIC: Southern Europe, Centred around the Mediterranean except Egypt and Libya (Ascher & Pickering 2021).
Material examined. Mount Lebanon: Arz Al Barouk, 18.VI.1975, 1♂, det. Schwarz M., coll. AUB.
Notes: Friese (1895) reports the species from Syria, which could be located in current Lebanese territory.

Genus *Megachile* Latreille, 1802

23 species.

All Examined Material determined by Praz C.

Floral preferences of the subgenera listed below seem to be focused on Fabaceae, Lamiaceae and Asteraceae (Praz 2017), a trend that we observe as well with the flower records listed below.

***Megachile* (*Creightonella*) *albisecta* Klug, 1817 ***

Distribution: WEST PALAEARCTIC (Ascher & Pickering 2021)

Material examined. Mount Lebanon: Falougha, 17.VII.1975, 1♀., coll. AUB.

N. Lebanon: Hadath El Jebbe, Wadi Ain El Raha, 1633 m, 29.VI.2017, 1♂, leg. Boustani M.; Tannourine El Tahta, Wadi Ain El Raha, 1008 m, 19.VIII.2017, 1♂, leg. Boustani M., all coll. MBOU.

Flower records. Asteraceae: *Carlina curetum* ssp. *orientalis*; Fabaceae: *Astragalus gummifer*.

Notes: Friese (1898) reports the species from Syria, could be located in current Lebanese territory.

***Megachile* (*Chalicodoma*) *albonotata* Radoszkowski, 1886 ***

Distribution: PALAEARCTIC: North Mediterranean, Turkmenistan, Iran (Ascher & Pickering 2021).

Material examined. N. Lebanon: Hadath El Jebbe, Cedar Forest, 1639 m, 24.V.2017, 1♂, leg. Boustani M., coll. MBOU; Qanat, Qornet Dammouaa, 1231 m, 31.V.2017, 1♀, leg. Rasmont P., coll. PRAS; Fehta, El Biara, 1662 m, 28.VI.2017, 1♀, leg. Boustani M.; Harissa, El Jawar, 1738 m, 28.VI.2017, 1♀, leg. Boustani M.; Hadath El Jebbe, Wadi Al Fouar, 1553 m, 21.V.2018, 3♀, 2♂, leg. Boustani M.; Tannourine El Tahta, Wadi Al Fouar, 1187 m, 21.V.2018, 1♂, leg. Boustani M.; 1553 m, 22.V.2018, 1♀, leg. Boustani M.; 1♀, 22.V.2018, leg. Boustani M.; Fehta, El Biara, 1632 m, 23.VI.2018, 1♀, leg. Boustani M.; Bcharre, Forest of the Cedars of God, 1883 m, 4.VII.2018, 1♀, leg. Boustani M., all coll. MBOU.

Flower records. Boraginaceae: *Echium italicum*; Fabaceae: *Lotus gebelia libanoticus*, *Vicia tenuifolia*.

***Megachile* (*Eutricharaea*) *apicalis* Spinola, 1808 ***

Distribution: WEST PALAEARCTIC (Ascher & Pickering 2021).

Local distribution fig. 14. 12

Unpublished records. GBIF 2021, SEMC: Mount Lebanon, Monteverde, nr. Mansourieh, 350 m, 4.VI.1995, 1♀**;** 25.VI.1995, 1♂, det. Baker D., leg. Roche C.G.

Material examined. N. Lebanon: Arz Tannourine, 1747 m, 7.VI.2017, 1♂, leg. Boustani M., coll. MBOU. Additional 7♀ and 11♂ from 15 records collected between 21.VI.2017 and 19.VII.2018, from Tannourine El Tahta, Arz Tannourine, Harissa, Arz Bcharre, Fehta, and Hadath El Jebbe.

Flower records. Apiaceae: *Eryngium glomeratum*; Asteraceae: *Centaurea iberica*; *Echinops viscosus*, *Onopordum carduiforme*, *Picnomon acarna*; Caprifoliaceae: *Cephalaria setosa*, *Scabiosa argentea*; Fabaceae: *Medicago* sp.; Lamiaceae: *Stachys cretica*; Plumbaginaceae: *Acantholimon antilibanoticum*, *Acantholimon libanoticum*.

This species is reported to be polyectic with a preference for Carduae (Asteraceae) flowers (Müller & Bansac 2004) that we observe in the records above as well.

***Megachile* (*Eutricharaea*) *burdigalensis* Benoist, 1940 ***

Distribution: WEST PALAEARCTIC: France, Slovenia, Croatia, Bosnia & Herzegovina, Armenia, Kazakhstan, Russia, Georgia (Ascher & Pickering 2021).

Material examined. N. Lebanon: Arz Tannourine, 1765 m, 22.VI.2017, 1♂, leg. Boustani M., coll. MBOU.

***Megachile* (*Eutricharaea*) *inexspectata* Rebmann, 1968 ***

Distribution: WEST PALAEARCTIC: Eastern Mediterranean, Algeria (Ascher & Pickering 2021).

Unpublished records. GBIF 2021, SEMC: Mount Lebanon, Al Montazah, 11.IX.1994, 200 m, 1♂, det. Baker D., leg. Roche C.G.

Material examined. N. Lebanon: Fehta, El Biara, 1632 m, 18.VIII.2018, 1♀, leg. Boustani M., Jabbour J.

***Megachile* (*Creightonella*) *doriae* Magretti, 1890** (fig. 28.5)
Distribution: EAST MEDITERRANEAN (Ascher & Pickering 2021).
Local distribution fig. 14 .13
Literature. Magretti, 1890: Locus typicus, Mount Lebanon, Alei [Aley], 800 m, 4♀, 5♂.
Material examined. Mount Lebanon: Jabal Moussa Biosphere Reserve, 1404 m, 21.VIII.2018, 1♀, leg. Boustani M.; 1420 m, 21.VIII.2018, 1♀, 1♂, leg. Boustani M., Nemer N.; 1440 m, 21.VIII.2018, 1♀, leg. Boustani M.; 1441 m, 21.VIII.2018, 3♂, leg. Boustani M., all coll. MBOU.
N. Lebanon: Tannourine El Tahta, Wadi Ain El Raha, 1187 m, 29.VI.2017, 1♂, leg. Boustani M.; Hadath El Jebbe, Wadi Ain El Raha, 1519 m, 28.VII.2017, 1♂, leg. Boustani M.; Tannourine El Tahta, Wadi Ain El Raha, 1187 m, 2.VIII.2017, 2♂, leg. Boustani M., all coll. MBOU.
Flower records. Asteraceae: *Echinops gaillardotii*, *Echinops viscosus*.

***Megachile* (*Pseudomegachile*) *ericetorum* Lepeletier, 1841**
Distribution: WEST PALAEARCTIC (Ascher & Pickering 2021).
Unpublished Records. GBIF 2021: based on Dorchin & Praz (2018): N. Lebanon, Becharre [Bcharre], 4.VII.1931, 1 specimen, sex unknown, leg. Zerny H.
Literature. Mavromoustakis (1963): Species mentioned in the listing of specimens collected in Bcharre Cedar Forest, summer of 1960.
Material examined. N Lebanon: Arz Bcharre, 1815 m, 22.VI.2017, 1♂, leg. Boustani M.; Bcharre, Reforestation Area, 1993 m, 27.VI.2017, 1♀, 1♂, leg. Boustani M.; Hadath El Jebbe, Wadi Ain El Raha, 1547 m, 29.VI.2017, 1♂, leg. Boustani M., Jabbour J.; Bcharre, Plateau Qornet Es Sawda, 2882 m, 12.VII.2018, 1♀, leg. Abi Khalil N, Boustani M., Jabbour J., Fakhry M.; Hadath El Jebbe, Wadi Al Fouar, 1553 m, 21.V.2018, 1♂, leg. Boustani M.; 1553 m, 28.VI.2018, 1♂, leg. Boustani M., Jabbour J.; Bcharre, Forest of the Cedars of God, 1883 m, 29.VI.2018, 1♂, leg. Boustani M., Jabbour J.; Hadath El Jebbe, Wadi Al Fouar, 1553 m, 19.VII.2018, 1♀, leg. Boustani M., Jabbour J., all coll. MBOU.
Flower records. Fabaceae: *Lotus gebelia* var *libanoticus*, *Ononis spinosa*.
Notes: Friese 1898: Mentioned from Syria, could be located in current Lebanese territory.

***Megachile* (*Eutricharaea*) *flabellipes* Pérez, 1895 ***
Distribution: WEST PALAEARCTIC: Southern Europe, Iran (Ascher & Pickering 2021).
Material examined. N. Lebanon: Arz Tannourine, 1792 m, 13.VII.2017, 1♂, leg. Boustani M.; 1781 m, 13.VII.2017, 1♀, leg. Boustani M., all coll. MBOU.
Flower records. Dipsacaceae: *Cephalaria setosa*; Plumbaginaceae: *Acantholimon libanoticum*.

***Megachile* (*Pseudomegachile*) *foersteri* Gerstäcker, 1869**
= *Megachile marqueti* Pérez, 1897
Distribution: WEST PALAEARCTIC: Northern and eastern Mediterranean (Ascher & Pickering 2021).
Literature. This taxon was described based on 2 specimens from Lebanon, Beirut, and one specimen labelled from Syria that could have been in current Lebanese territory (Pérez 1897).
Material examined. No Label, specimen from AUB collection, 1♀.

***Megachile* (*Eutricharaea*) *giraudi* Gerstäcker, 1869 ***
Distribution: PALAEARCTIC: Southern Europe, Near East, Uzbekistan (Ascher & Pickering 2021).
Material examined. N. Lebanon: Tannourine El Tahta, Wadi Ain El Raha, 900 m, 11.V.2017, 1♂, leg. Boustani M.; Arz Tannourine, 1714 m, 7.VI.2017, 1♂, leg. Boustani M.; Arz Bcharre, Reforestation Area, 1993 m, 27.VI.2017, 1♀, leg. Boustani M.; Arz Tannourine, 1754 m, 20.V.2018, 1♂, leg. Boustani M.; 8.VI.2018, 1♂, leg. Boustani M., all coll. MBOU.
Flower records. Asteraceae: *Carduus argentatus*, *Centaurea eryngioides*; Fabaceae: *Lotus gebelia* var *libanoticus*.

***Megachile* (*Chalicodoma*) *hirsuta* Morawitz, 1893 ***
Distribution: PALAEARCTIC: Turkey, Israel, Uzbekistan, Tajikistan, Kyrgyzstan (Ascher & Pickering 2021).
Material examined. N. Lebanon: Arz Bcharre, Reforestation Area, 1936 m, 12.V.2017, 1♀,1♂, leg. Boustani M.;

1967 m, 12.V.2017, 1♀, leg. Boustani M.; 1885 m, 12.V.2017, 4♀, leg. Boustani M.; Bcharre, Daher El Adib, 2441 m, 8.VI.2017, 2♀, 1♂, leg. Boustani M.; Bcharre, Reforestation Area, 2296 m, 27.VI.2017, 2♀, leg. Boustani M.; Bcharre, Plateau Qornet Es Sawda, 2882 m, 12.VII.2018, 2♀, 1♂, leg. Abi Khalil N, Boustani M., Jabbour J., Fakhry M.; Arz Bcharre, Reforestation Area, 1933 m, 18.IV.2018, 3♂, leg. Boustani M., all coll. MBOU.
Flower records. Fabaceae: *Astragalus cruentiflorus*, *Onobrychis cornuta*.

***Megachile* (*Chalicodoma*) *hungarica* Mocsáry, 1877 ***
Distribution: EAST MEDITEARRANNEAN (Praz, pers. comm.).
Material examined. Beirut: AUB, 5.V.1984, 1♀, leg. Alice R., coll. AUB.
N. Lebanon: Fehta, Teleje, 2026 m, 14.VII.2017, 1♀, leg. Boustani M.; 2050 m, 14.VII.2017, 1♀, 1♂, leg. Boustani M. coll. MBOU.
S. Lebanon: Saidoun, El Mrouj, 24.VII.2017, 1♀, leg. Boustani M. coll. MBOU.
Flower record. Lamiaceae: *Phlomis brachyodon*.

***Megachile* (*Xanthosarus*) *lagopoda* (L., 1761)**
Distribution: PALAEARCTIC (Ascher & Pickering 2021).
Literature. Listed in Mavromoustakis (1956) as *Megachile lagopoda fulvohirta* Alfken, 1935, which can possibly be a distinct subspecies. Verification of type material is necessary in this case.
Mount Lebanon, Baabdate, 2♀, 1♂, 24.V.1953, det. & leg. Mavroumoustakis G.A.

***Megachile* (*Chalicodoma*) *monstrifica* Morawitz, 1877**
Distribution: WEST PALAEARCTIC (Ascher & Pickering 2021).
Possibly conspecific with *M. manicata* (Praz, unpublished).
Mavromoustakis (1956): Listed under M. *monstrfica* var. *lebanotica* Mavromoustakis, 1956
Bekaa: North of Ainata, 2200 m., 1♀, 1.VII.1953, det. Mavroumoustakis G.A., leg. Christiansen K.

***Megachile* (*Eutricharaea*) *leucomalla* Gerstäcker, 1869 ***
Distribution: WEST PALAEARCTIC (Ascher & Pickering 2021).
Material examined. N. Lebanon: Tannourine El Tahta, Wadi Ain El Raha, 1187 m, 29.VI.2017, 1♂, leg. Boustani M., coll. MBOU.
Flower record. Astereaceae: *Echinops gaillardotii*.

***Megachile* (*Chalicodoma*) *manicata* Giraud, 1861** (fig. 20.4–5)
Distribution: WEST PALAEARCTIC: Northern and eastern Mediterranean (Ascher & Pickering 2021).
Local distribution fig. 14.14
Literature. Listed under *Megachile manicata* var. *hammanensis* Mavromoustakis, 1956
Mavromoustakis (1956) describes this variety from Lebanon with smaller size than *Megachile manicata*. He also reports that *M. manicata* "has the punctuation on anterior tergites somewhat finer than in my Lebanon females."
Mount Lebanon: Hammana, 17.V.1953, 1♀; 16.V.1953, 1♀; Mount Lebanon, Jebel el Knaisse, 1♂, 18.V.1953; Mount Lebanon, Brumanna, 11.V.1953, 2♂.
Material examined. Bekaa: Ainata, 1824 m, 30.V.2017, 1♀, leg. Boustani M., Rasmont P., coll. MBOU.
N. Lebanon: Arz Tannourine, 1800 m, 25.III.2002, 1♂, leg. Nemer N., coll. TCFNR; Horch Ehden, 1797 m, 4.V.2017, 1♀, leg. Boustani M., coll. MBOU. Additional 22♀ and 18♂ from 14 records, collected between 5.V.2017 and 9.VIII.2018 from Fehta, Hadath El Jebbe, Jord Tannourine, Bcharre, and Arz Tannourine.
Flower records. Fabaceae: *Astragalus angustifolius*, *Astragalus coluteoides*, *Astragalus cruentiflorus*, *Lotus gebelia libanoticus*, *Onobrychis cornuta*, *Vicia canescens*, *Vicia tenuifolia*; Lamiaceae: *Stachys ehrenbergii*.
Reported as having a preference for Fabaceae (Gogala 2014) that we also observe in the records above.

***Megachile* (*Chalicodoma*) *montenegrensis* Dours, 1873 ***
Distribution: PALAEARCTIC: Northern and eastern Mediterranean, Armenia, Azerbaijan, Iran, Afghanistan, Uzbekistan, Tajikistan, Algeria (Ascher & Pickering 2021).
Local distribution fig. 14.15
Material examined. N. Lebanon: Tannourine El Tahta, Wadi Ain El Raha, 900 m, 11.V.2017, 7♀, leg. Boustani M.,

coll. MBOU. Additional 30♀ and 10♂ from 17 records collected between 26.V.2017 and 23.VI.2018, from Fehta, Arz Tannourine, Tannourine El Tahta, Arz Bcharre, Harissa, and Hadath El Jebbe.
Flower records. Asteraceae: *Carduus argentatus*; Fabaceae: *Colutea cilicica*, *Lotus gebelia* var *libanoticus*, *Ononis natrix*, *Vicia tenuifolia*; Campanulaceae: *Michauxia campanuloides*; Lamiaceae: *Stachys distans*.
Reported as having a preference for Fabaceae (Praz 2017), as observed in the records above.

***Megachile* (*Chalicodoma*) *parietana* Geoffroy, 1785** (fig. 20.6, fig. 28.3)
Distribution: WEST PALAEARCTIC (Ascher & Pickering 2021).
Local distribution fig. 14.16
Literature. Mavroumoustakis (1956): Listed as *Megachile parietina nestorea Brullé, 1832*, as a form of *M. parietana* with an entirely black scopa.
Mount Lebanon, Hammana, 15.V.1953, 1♀, 1♂; 17.V.1953, 5♀, 4♂; Bekaa, Baalbeck, 25.V.1953, 1♀, 1♂, all det. & leg. Mavroumoustakis G.A.
Material examined. N. Lebanon: Bcharre, Daher El Adib, 2611 m, 20.VI.2016, 4♀, leg. Boustani M., coll. MBOU. Additional 25♀ and 3♂ from 16 records, collected between 4.V.2017 and 29.VII.2018, from Horch Ehden, Arz Bcharre, and Qanat.
S. Lebanon: Hlaliyeh, 29.V.1975, 1♀; Chhim, Khallat Chhim, 24.IV.1981, 1♂., all coll. AUB.
Flower records. Boraginaceae: *Echium italicum*; Fabaceae: *Astragalus angustifolius*, *Lotus gebelia* var *libanoticus*, *Onobrychis cornuta*; Lamiaceae: *Stachys ehrenbergii*; *Salvia multicaulis*.
Reported to visit mainly Fabaceae and Lamiaceae by Gogala (2014), both observed in our records as well.

***Megachile* (*Megachile*) *pilicrus* Morawitz, 1877 ***
Distribution: WEST PALAEARCTIC: Southern Europe and east to China (Ascher & Pickering 2021).
Material examined. N. Lebanon: Tannourine El Tahta, Wadi Ain El Raha, 21.VI.2017, 1♂, leg. Boustani M.; Ehden, Ain Naasa, 1528 m, 2.VIII.2018, 1♂, leg. Boustani M.; Arz Tannourine, 1754 m, 16.VIII.2018, 1♀, leg. Boustani M., all coll. MBOU.
Flower records. Asteraceae: *Centaurea pallescens*, *Centaurea* sp.

***Megachile* (*Eutricharaea*) *pilidens* Alfken, 1924 ***
Distribution: WEST PALAEARCTIC (Ascher & Pickering 2021).
Material examined. Mount Lebanon: Jabal Moussa Biosphere Reserve, 1440 m, 21.VIII.2018, 1♂, leg. Boustani M., coll. MBOU.
N. Lebanon: Hadath El Jebbe, Wadi Ain El Raha, 1547 m, 29.VI.2017, 1♀, leg. Boustani M.; Arz Tannourine, 1798 m, 18.VII.2017, 1♀, leg. Boustani M.; Hadath El Jebbe, Wadi Ain El Raha, 1495 m, 28.VII.2017, 1♀, leg. Boustani M.; Tannourine El Tahta, Wadi Ain El Raha, 1200 m, 19.VIII.2017, 1♂, leg. Boustani M.; 1187 m, 21.V.2018, 1♀, leg. Boustani M.; Fehta, El Biara, 1632 m, 18.VII.2018, 1♀, leg. Boustani M., Jabbour J.; Hadath El Jebbe, Wadi Al Fouar, 1553 m, 19.VII.2018, 2♀, leg. Boustani M., Jabbour J.; Arz Tannourine, 1754 m, 18.VIII.2018, 1♀, leg. Boustani M., Jabbour J.; 1762 m, 18.VIII.2018, 1♀, 1♂, leg. Boustani M., Jabbour J.; Hadath El Jebbe, Cedar Forest, 1681 m, 22.VIII.2018, 1♂, leg. Boustani M., Jabbour J., all coll. MBOU.
Flower records. Apiaceae: *Eryngium glomeratum*; Asteraceae: *Echinops viscosus*; Caprifoliaceae: *Scabiosa argentea*; Fabaceae: *Ononis natrix*, *Ononis spinosa*.

***Megachile* (*Chalicodoma*) *pyrenaica* Lepeletier, 1841 ***
Distribution: PALAEARCTIC: Southern Europe, Turkey, west of the Caspian Sea, Tajikistan, Kazakhstan, Algeria, Israel (Ascher & Pickering 2021).
Material examined. N. Lebanon: Arz Bcharre, Reforestation Area, 1885 m, 12.V.2017, 1♂, leg. Boustani M.; Bcharre, Daher El Adib, 2437 m, 8.VI.2017, 1♂, leg. Boustani M.; Arz Bcharre, Reforestation Area, 2296 m, 27.VI.2017, 2♀, leg. Boustani M.; Bcharre, Plateau Qornet Es Sawda, 2882 m, 12.VII.2018, 4♀, 1♂, leg. Boustani M.; 2661 m, 9.VIII.2018, 1♀, leg. Boustani M., all coll. MBOU.
Flower records. Fabaceae: *Onobrychis cornuta*; Lamiaceae: *Stachys ehrenbergii*.

***Megachile* (*Pseudomegachile*) *sanguinipes* Morawitz, 1875 ***
Distribution: WEST PALAEARCTIC: Northern and eastern Mediterranean, Iran to Kyrgyzstan (Ascher & Pickering 2021).
Material examined. N. Lebanon: Hadath El Jebbe, Wadi Al Fouar, 1553 m, 19.VII.2018, 1♀, leg. Boustani M., Jabbour J., coll. MBOU.
Flower record. Fabaceae: *Ononis spinosa*.

***Megachile* (*Chalicodoma*) *sicula* Rossi, 1792 ***
Distribution: WEST PALAEARCTIC: Mediterranean basin (Ascher & Pickering 2021).
Material examined. S. Lebanon: Saidoun, El Mrouj, 30.IV.2017, 1♀; Saidoun, Joura, 18.III.2018, 1♂; Saidoun, Beehives, 25.III.2018, 1♂; all leg. Baghdadi A., coll. SOILS.

APIDAE

All Material Examined determined by Terzo M.

Flower preferences have been little studied for *Xylocopa* and *Ceratina*, therefore few comparisons can be made with our observations.

XYLOCOPINI

Genus *Xylocopa* Latreille, 1802
Eight species

***Xylocopa* (*Copoxyla*) *iris* (Christ, 1791)** (fig. 21.1)
= *Xylocopa cyanescens* Brullé, 1832
Distribution: PALAEARCTIC: Mediterranean basin and Southern Europe, and further east to Tajikistan (Terzo & Rasmont 2014, Ascher & Pickering 2021).
Local distribution fig. 15.1
Literature. Maidl (1912): Listed under *Xylocopa cyanescens*
Beirut (labelled as Syria at time of the record), leg. Leuthner V, det. Maidl F.
Material examined. Bekaa: AUB Farm [Haush Sneid], IV.1979, 1♀, leg. Boghos D., coll. AUB.
Mount Lebanon: Bhamdoun, 1.V.1975, 1♂, coll. AUB; Jabal Moussa Biosphere Reserve, Peony Trail, 1440 m, 21.VIII.2018, 1♀, leg. Nemer N.; Marej Barja, Kaleet El Besten, 358 m, 26.IV.2019, 1♀, leg. Boustani M., all coll. MBOU; Al Barouk, Shouf Biosphere Reserve, 1690 m, 4.VII.2019, 1♂, leg. Van Achter X., coll. XVA.
N. Lebanon: Tannourine El Tahta, Wadi ain Al Raha, 1187 m, 2.VIII.2017, 1♀, leg. Boustani M.; Hadath El Jebbeh, Road to Wadi Al Fouar, 1553 m, 19.VII.2018, 1♂, leg. Boustani M., Jabbour J.; Hadath El Jebbeh, Al Fouar, 1529 m, 7.VI.2019, 1♂, leg. Boustani M., Mouawad G.; Tannourine El Tahta, Mar Boutros, 1207 m, 25.IV.2019, 1♀, leg. Boustani M.; 1182 m, 25.IV.2019, 1♀, leg. Rasmont P.; 1207 m, 5.V.2019, 2♂, 1♀, leg. Boustani M., all coll. MBOU.
Flower records. Asteraceae: *Echinops gaillardotii*; Boraginaceae: *Anchusa hybrida*; Fabaceae: *Vicia tenuifolia*; Iridaceae: *Gladiolus segetum*; Lamiaceae: *Stachys distans*.
Terzo (2021) reports flower preferences for Asteraceae, Fabaceae and Lamiaceae, all three of which are found in our observations, he also reports a strong preference for *Eryngium campestre* (Apiaceae).

***Xylocopa* (*Proxylocopa*) *olivieri* Lepeletier, 1841 *** (fig. 21.2)
= *Xylocopa hellenica* Spinola, 1843
Distribution: WEST PALAEARCTIC: Northern and eastern Mediterranean to the western Caspian Sea, indicating two records from Lebanon detailed below (Terzo & Rasmont 2014).
Local distribution fig. 15.2
Unpublished records. GBIF 2021, SEMC:
listed under *Xylocopa hellenica* Spinola, 1843

S. Lebanon, Jezzine; 1♂, unknown collector and determiner.

Material Examined.

BDFGM material. ZSM: Beirut, No date, 1♂; N. Lebanon Becharre [Bcharre], V.1931, 1♂, leg. K/ZR.

Author material. Specimens with no labels or unreadable labels from AUB collection, 3♀, 1♂, coll. AUB. Specimen labelled « J.E.B. » from AUB collection, 26.III.1981, 1♂**.**

Mount Lebanon: Bikfaya, 9.VI.1975, 1♀, coll. AUB; Jounieh, 12.VI.1984, 1♀, leg. Nahla B, coll. AUB.

N. Lebanon: Tannourine, Wadi Al Fouar, 1528 m, 17.VI.2016, 1♀, leg. Boustani M.; Tannourine Forest, 1784 m, 18.VI.2016, 1♂, leg. Kotan A.; Tannourine Forest, 1800 m, 5.VIII.2016, 1♀, leg. Kyrk S.; Hadath El Jebbe, Al Fouar, 1535 m, 30.V.2017, 3♂, leg. Boustani M., Rasmont P.; Hadath El Jebbe, Road to Wadi Al Fouar, 1553 m, 22.V.2018, 1♂, leg. Boustani M.; 1553 m, 6.VI.2018, 2♂, leg. Boustani M., all coll. MBOU.

Flower records. Fabaceae: *Vicia tenuifolia*; Malvaceae: *Alcea apterocarpa*.

Xylocopa (Ancylocopa) parviceps **Morawitz, 1895 *** (fig. 21.3)

Males of the material examined for this species have both a white clypeus and clypeus without colouration. In his key, Warncke (1982) assigned both these forms to *X. parviceps*. In our case the specimens collected on the 28.V.2017 from the same locality had both forms flying at the same time. Further investigations are necessary to see if these two forms diverge in a significant manner.

Distribution: PALAEARCTIC: Iran, Afghanistan, Turkey (Terzo & Rasmont 2014) and further east to China (Ascher & Pickering 2021).

Local distribution fig. 15.3

Material examined. N. Lebanon: Donnieh, 1200 m, 20.VI.2011, 1♂, leg. Kasparek M.; Bcharre, Dahr El Adib, 2611 m, 20.VI.2016, 1♀, leg. Boustani M.; Bcharre, Reforestation Area, 2174 m, 27.VI.2016, 1♀, leg. Boustani M.; Jord Tannourine, Jabal al Mnaitra, 2471 m, 28.V.2017, **23**♂, leg. Boustani M., Rasmont P. ; Bcharre, Qornet Es Sawda, 2863 m, 30.VI.2017, 2♂, leg. Boustani M.; Bcharre, Qornet Es Sawda, 2911 m, 21.VII.2017, 1♀, leg. Dayoub Y., all coll. MBOU.; Jord Tannourine, 2498 m, 26.VII.2018, 1♀, leg. Van Achter X.; Jord Tannourine, 2371 m, 9.VII.2019, 1♀, leg. Van Achter X., all coll. XVA.

Flower records. Asphodelaceae: *Asphodeline taurica*; Fabaceae: *Astragalus coluteoides*, *Onobrychis cornuta*, *Vicia canescens*; Lamiaceae: *Lamium striatum*.

Xylocopa **(*Koptortosoma*)** ***pubescens*** **Spinola, 1838 ***

Distribution: WEST PALAEARCTIC: North Africa, north-eastern Mediterranean and east to Iran (Terzo & Rasmont 2014).

Local distribution fig. 15.4

Material Examined.

BDFGM material. Pauly 2013: One specimen from Beyrouth [Beirut], det. Pauly A., no date or collector details.

Author material. Specimens from USEK collection with no labels, 2♀.

Beirut: AUB Campus, 19.III.1960, 1♂, leg. Ibrahim, coll. AUB. Additional 26♀ and 18♂, from 13 records, collected between 7.VI.1978 and 26.VII.2019, from AUB Campus and Achrafieh.

Bekaa: AUB Farm [Hauch Sneid], 15.VI.1962, 1♂, leg. Yeganiantz L., coll. AUB. Additional 3♀ and 3♂ from 4 records collected between 1970 and 4.XI.2018, from AUB Farm and Anjar.

Mount Lebanon: Fanar, 9.IX.1969, 2♀, coll. USEK; Deirkoubel [Deir Qoubel], 10.XII.2004, coll. AUB, 1♂, leg. Ezzedine S., Merhbi K., coll. AUB; Jounieh, Kaslik, 28.IV.2017, 1♂, leg. Mhanna K., coll. USEK. Additional 4♀ and 13♂ from 5 records, collected between 26.VI.2019 and 5.VIII.2019, from Mansourieh, Sin El Fil and Kaslik (Jounieh).

Flower records. Asteraceae: *Echinops viscosus*; Fabaceae: *Parkinsonia aculeata*; Verbenaceae: *Duranta erecta*.

This species is found in coastal areas and the drier habitats in the Bekaa. It has been found mainly foraging on non-native decorative plants on the coastal area, in the few remaining urban gardens.

Xylocopa **(*Proxylocopa*)** ***rufa*** **Friese, 1901 ***

Distribution: WEST PALAEARCTIC: Eastern Mediterranean to China (Terzo & Rasmont 2014, Ascher & Pickering 2021).

Local distribution fig. 15.5

Unpublished records. GBIF 2021, SEMC: Mount Lebanon: Monteverde, nr. Mansourieh, 350 m, 18.II.1996, 1♂, det. Baker, leg. Roche C.G.

Material examined. N. Lebanon: Bcharre, Wadi Quannoubine, 1129 m, 22.VI.2016, 1♀, leg. Boustani M.; Hadath El Jebbe, Chemin Wadi Ain El Raha, 1519 m, 28.VI.2017, 2♂, leg. Boustani M., all coll. MBOU; Tannourine El Tahta, Ain El Raha, Mar Yaacoub, 900 m, 27.VII.2018, 1♂, leg. Van Achter X., coll. XVA; Douma, 791 m, 1.VII.2019, 4♀, Gekière A., Ghisbain G., coll. UMONS.

S. Lebanon: Saidoun, El Mrouj, 13.V.2017, 2♂, leg. Baghdadi A., coll. SOILS.

Flower records. Asteraceae: *Echinops gaillardotii*; Fabaceae: *Ononis natrix*; Capparaceae: *Capparis spinosa*.

***Xylocopa* (*Xylocopa*) *valga* Gerstaecker, 1872 *** (fig. 21.4, fig. 28.4)

Distribution: WEST PALAEARCTIC: Widespread in Europe and East of the Mediterranean basin to China, scattered records in N. Africa (Terzo & Rasmont 2014, Ascher & Pickering 2021).

Local distribution fig. 15.6

Material examined. Common and widespread.

Beirut: AUB Campus, 19.II.1989, 1♀, leg. Dolly - Shafik, 1♀, leg. Yeganiantz L., coll. AUB.

Bekaa: AUB Farm [Haush Sneid], 28.IV.1962, 1♀, leg. Bedirian K.; 27.V.1962, 1♀, leg. Khan A.R.; 28.V.1964, 1♀, leg. Attar W., coll. AUB; Ainata, 1824 m, 30.V.2017, 1♂, leg. Boustani M., Rasmont P., coll. MBOU.

Mount Lebanon: Chouf Caza, 16.VI.1964, 1♀, coll. USEK; Maaniyye, Dhour El Maaniyye, 324 m, 25.V.2019, 1♀, leg. Boustani M., coll. MBOU. Additional 1♀ and 3♂ from 3 records collected on 29.V.2019 and 7.VIII.2019 from Maaser Al Chouf.

N. Lebanon: Bcharre, Bcharre Jord, 2723 m, 24.VI.2016, 1♂, leg. Van Achter X., coll. XVA. Additional 39♀ and 41♂ from 42 records collected between 5.V.2017 and 31.VII.2019, from Tannourine El Tahta, Arz Bcharre, Jord Tannourine, and Harissa.

Flower records. Asphodelaceae: *Asphodeline taurica*; Asteraceae: *Cousinia libanotica*, *Echinops viscosus*; Boraginaceae: *Anchusa hybrida*, *Solenanthus stamineus*; Caprifoliaceae: *Cephalaria stellipilis*; Fabaceae: *Astragalus angustifolius*, *Colutea cilicica*, *Onobrychis cornuta*, *Vicia canescens*, *Vicia tenuifolia*; Lamiaceae: *Eremostachys laciniata*, *Phlomis chrysophylla*, *Salvia microstegia*, *Stachys ehrenbergii*, *Stachys cretica*.

Terzo (2021) reports the species as polylectic within Fabaceae and Lamiaceae, the preference for both these families is also observed in our records above with other families.

***Xylocopa* (*Xylocopa*) *varentzowi* Morawitz, 1895 ***

Distribution: PALAEARCTIC: Eastern Mediterranean to Afghanistan (Terzo & Rasmont 2014, Ascher & Pickering 2021).

Local distribution fig. 15.7

Material examined. Mount Lebanon: Jabal Moussa Biosphere Reserve, Peony Trail, 1420 m, 21.VIII.2018, 1♀, leg. Boustani M., coll. MBOU; Al Barouk, Shouf Biosphere Reserve, 1678 m, 2.VII.2019, 1♀, leg. Van Achter X., coll. XVA.

N. Lebanon: Hadath El Jebbeh, Road to Wadi Al Fouar, 1553 m, 21.V.2018, 1♀, leg. Boustani M.; Arz Bcharre, Reforestation Area, 2345 m, 4.VII.2018, 1♀, leg. Abi Khalil N., Boustani M., Fakhry M.; 2311 m, 11.VII.2018, 4♂, leg. Abi Khalil N., Boustani M., Fakhry M.; 2345 m, 29.VII.2018, 2♀, leg. Boustani M.; Wadi Al Fouar, Tannourine El Tahta, 1504 m, 13.V.2019, 1♀, leg. Boustani M., all coll. MBOU; Forest of the Cedars of God, Forest Limit, 1873 m, 3.VII.2019, 1♂, leg. Ghisbain G., coll. UMONS; Arz Bcharre, Reforestation Area, 2216 m, 25.VII.2019, 1♀, leg. Boustani M., coll. MBOU; 31.VII.2019, 1♀, 1♂, leg. Van Achter X., coll. XVA.

Flower records. Asteraceae: *Carlina involucrata*; Lamiaceae: *Eremostachys laciniata*, *Phlomis viscosa*, *Salvia microstegia*, *Vicia tenuifolia*.

***Xylocopa* (*Xylocopa*) *violacea* (L., 1758) ***

Distribution: PALAEARCTIC: Widespread across Europe, scattered records from North Africa and further east in the Mediterranean to Tajikistan. (Terzo & Rasmont 2014, Ascher & Pickering 2021).

Local distribution fig. 15.8

Material examined. Abundant and widespread.

Specimens with no label from AUB and USEK collection, 6♀.

Beirut: AUB Campus, 19.III, 1♂, leg. Mulugeta; AUB Campus, 5.V.1980, 2♀, 1♂ leg. Charles Z.; Kohar B., Alice

R., all coll. AUB.

Mount Lebanon: Fanar, V.1971, 1♀, leg. Traboulsi R., coll. USEK. Additional 19♀ and 7♂, from 21 records, collected between V.1986 and 7.VIII.2019 from Choueifat, Jbeil, Daraya, Mtein, Beit Chabab, Keserwan, Hboub, Beit Chabab, Mastita, Bakish, Gharzouz, Ehmej, Maaniye, Mansourieh, Maaser Al Chouf, and Barouk.

N. Lebanon: Horch Ehden, VI.2014, 1♀, leg. Boustani C., Boustani M., coll. MBOU. Additional 31♀ and 46♂ from 40 records, collected between 20.VI.2016 and 23.VIII.2019, from Arz Bcharre, Tannourine El Tahta, Jord Tannourine, Bcharre, and Horch Ehden.

S. Lebanon: Saida, IV, 1♀, leg. Chamaa O., coll. USEK; Saidoun, 25.III.2018, 1♀, leg. Baghdadi A., coll. SOILS.

Flower records. Asphodelaceae: *Asphodelus microcarpus*; Asteraceae: *Cousinia libanotica*, *Echinops gaillardotii*, *Echinops viscosus*, *Onopordum heteracanthum*, Boraginaceae: *Anchusa hybrida*, *Solenanthus stamineus*; Caprifoliaceae: *Cephalaria stellipilis*; Fabaceae: *Astragalus angustifolius*, *Colutea cilicica*, *Coronilla emeroides*; Lamiaceae: *Eremostachys laciniata*, *Phlomis chrysophylla*, *Salvia microstegia*, *Stachys cretica*, *Stachys ehrenbergii*; Malvaceae: *Alcea apterocarpa*; Rosaceae: *Cotoneaster* sp., *Prunus* sp.

Terzo (2021) reports a preference for Fabaceae and Lamiaceae, both observed in our records above along with other families.

CERATINI

Genus *Ceratina* Latreille, 1802

17 species.

Ceratina (Euceratina) acuta Friese, 1896 *

Distribution: WEST PALAEARCTIC: Mainly Ponto-Mediterranean, spanning Southern Europe and east to Kazakhstan (Terzo & Rasmont 2011, Ascher & Pickering 2021).

Local distribution fig. 15.9

Material examined. Bekaa: Jord Aarsal, Howiyit Al Borj, 2008 m, 11.VII.2019, 2♀, leg. Boustani M.

Mount Lebanon: Shouf Biosphere Reserve, Barouk-Maaser dirt road, 1769 m, 16.V.2019, 1♀, 1♂, leg. Boustani M.

N. Lebanon: Harissa, Al Jawar, 1765 m, 28.VI.2017, 1♂, leg. Boustani M.; Hadath El Jebbe, Road to Wadi Ain El Raha, 1547 m, 29.VI.2017, 1♀, leg. Boustani M.; Arz Tannourine, 1792 m, 13.VII.2017, 1♀, leg. Boustani M.; Hadath El Jebbe, Border of the Cedar Forest, 1618 m, 28.VII.2017, 1♀, leg. Boustani M.; Forest of the Cedars of God, Forest Limit, 1897 m, 2.VII.2019, 1♀, 1♂, leg. Boustani M.; Arz Tannourine, Main Gate, 1794 m, 4.VII.2019, 1♀, leg. Boustani M., coll. MBOU; Tannourine El Fawka, Salon de l'église, 1244 m, 4.VII.2019, 1♀, leg. Ghisbain G., coll. UMONS; Fehta, El Biara, 1664 m, 25.VII.2019, 3♀, leg. Boustani M.; Hadath El Jebbe, Al Fouar, 1529 m, 25.VII.2019, 1♀, leg. Boustani M., Mouawad G.; Tannourine Reserve, Trail 4, 1781 m, 27.VII.2019, 1♀, leg. Boustani M.; Forest of the Cedars of God, Forest Limit, 1897 m, 20.VIII.2019, 1♀, leg. Boustani M.; Hadath El Jebbe, Al Fouar, 1529 m, 23.VIII.2019, 2♀, Boustani M., Mouawad G., all coll. MBOU.

Flower records. Apiaceae: *Eryngium billardieri*; Boraginaceae: *Cynoglossum nebrodense*; Caryophyllaceae: *Dianthus* cf *strictus*; Caprifoliaceae: *Scabiosa argentea*; Fabaceae: *Alyssum* sp., *Ononis natrix*: Lamiaceae: *Marrubium* cf *cuneatum*; *Sideritis libanotica*, *Stachys distans*; Plumbaginaceae: *Acantholimon libanoticum*; Rosaceae: *Rubus sanctus*.

Few data are available for this species pollen preferences in literature (Terzo 2011), but it seems to have a wide range including Dipsacaceae, Asteraceae and Lamiaceae.

Ceratina (*Neoceratina*) *bispinosa* Handlirsch, 1889 (fig. 21.5)

Distribution: WEST PALAEARCTIC: Northern and eastern Mediterranean basin north to Croatia (Terzo & Rasmont 2011, Ascher & Pickering 2021).

Local distribution fig. 15.10

Unpublished records.

GBIF 2021, SEMC:

Mount Lebanon: Monteverde, near Mansourieh, 350 m, 19.VIII.1994, 1♀, determiner unspecified; 14.VIII.1994, 1♀, det. Baker D.; 18.VIII.1994, 1♂, det. Baker D.; Monteverde, 350 m, 28.VIII.1994, 1♂, det. Baker D.;13. VIII.1995, 1♀, determiner unspecified; 1♂, det. Baker D. all leg. Roche C.G.; Montazah, near Mansourieh, 250 m, 26.VI.1996, 1♀, 1♂, det. Baker D.;1♀, 1♂, determiner unspecified.

Literature.

Friese (1899): Mount Lebanon, Brumana, 14.IV–8.V.1899, among specimens from other localities, det. Friese H, leg. Morice F., Schmiedeknecht O.

Friese (1901): Specimen from Beirut.

Notes: Mentioned from Lebanon (Grace 2010).

Material examined.

BDFGM material. MNHNP: Coll. Pérez J.; Wadi Brumana, 1915; MNHUB: Brumana, 30.IV.1899, 1♀, 3.V.1899, 1♂

Author material.

Mount Lebanon: Barouk, 1086 m, 12.VIII.2019, 1♀, leg. Boustani M., coll. MBOU.

N. Lebanon: Horch Ehden, X.2014, 1♀, leg. Boustani M., Boustani C.; Hadath El Jebbe, Chemin Wadi Ain el Raha, 1519 m, 29.VI.2017, 1♀, leg. Boustani M.; 1495 m, 28.VII.2017, 1♀, leg. Boustani M.; Tannourine El Tahta, Wadi Ain El Raha, 19.VIII.2017, 2♀, leg. Boustani M., all coll. MBOU; Tannourine El Tahta, Ain El Raha, 890 m, 5.VIII.2018, 1♀, leg. Van Achter X., coll. XVA; Horch Ehden, Nabeh Jouit, 1405 m, 13.IV.2019, 1♀, 1♂, leg. Boustani M.; Tannourine El Tahta, 942 m, 25.IV.2019, 1♂, leg. Rasmont P.; Tannourine El Tahta, Mar Boutrous, 1207 m, 31.V.2019, 2♀, leg. Boustani M.; 27.VI.2019, 4♀, leg. Boustani M., all coll. MBOU; Horch Ehden, 1686 m, 24.VII.2019, 1♂, leg. Van Achter X., coll. XVA; Tannourine El Tahta, Mar Boutrous, 1207 m, 25.VII.2019, 2♀, leg. Boustani M.; 1207 m, 23.VIII.2019, 3♀, leg. Boustani M., all coll. MBOU.

Flower records. Apiaceae: *Aethionema coridifolium*; Asteraceae: *Carlina curetum* ssp. *orientalis*; Caprifoliaceae: *Cephalaria* cf *joppensis*, *Cephalaria* sp., *Scabiosa* sp., *Scabiosa argentea*; Fabaceae: *Ononis natrix*, *Medicago* sp.; Lamiaceae: *Stachys distans*.

Terzo (2011) reports floral records form Asteraceae, Fabaceae, Dipsacaceae (species listed above now in Caprifoliaceae), Lamiaceae all of which are observed in our records above.

***Ceratina* (*Euceratina*) *chalcites* Germar, 1839 ***

Distribution: WEST PALAEARCTIC: Holo-Mediterranean minus North Africa, and further north-east to Russia (Terzo & Rasmont 2011, Ascher & Pickering 2021).

Material examined. N. Lebanon: Tannourine El Tahta, Wadi Al Fouar, 1187 m, 21.V.2018, 1♀, leg. Boustani M.; Tannourine El Tahta, Al Mahbase, 893 m, 31.V.2019, 1♀, leg. Boustani M., all coll. MBOU.

Flower records. Asteraceae: *Centaurea iberica*; Malvaceae: *Alcea apterocarpa*.

***Ceratina* (*Euceratina*) *chalybea* Chevrier, 1872 ***

Distribution: WEST PALAEARCTIC: Holo-Mediterranean and some scattered records further north in Europe

Material examined. N. Lebanon: Qanat, Qornet Dammouaa, 1231 m, 22.VI.2017, 1♀, leg. Boustani M.; Hadath El Jebbeh, Border of Cedar Forest, 1681 m, 19.VII.2018, 1♀, leg. Boustani M., Jabbour J., all coll. MBOU; Horch Ehden, 1686 m, 14.VII.2019, 1♂, leg. Van Achter X.; 1625 m, 24.VII.2019, 1♀, leg. Van Achter X., all coll. XVA.

Flower records. Asteraceae: *Centaurea pallescens*; Boraginaceae: *Echium italicum*.

***Ceratina* (*Ceratina*) *cucurbitina* (Rossi, 1972)**

Distribution: WEST PALAEARCTIC: Holo-Mediterranean and further north to central Germany (Terzo & Rasmont 2011).

Local distribution fig. 15.11

Unpublished records.

GBIF 2021, SEMC:

Mount Lebanon, Monteverde, near Mansourieh, 350 m, 24.IV.1995, 1♂; Zandouka, 750 m, 10.V.1995, 1♀, all det. Baker D., leg. Roche C.G.

Literature. Specimens collected in Bcharre Cedar Wood in summer of 1960 (Mavromoustakis, 1963).

Material examined.

BDFGM material. RBIN: Mount Lebanon, Nab'as Safa [Nabeh Al Safa], 1000 m, V.1966, 1♀, leg. Fagel G.; ZSM:

Mount Lebanon, Brumana, 7.VIII.1899, 1♀.
Author material. Mount Lebanon: Der El Kamar, 800 m, 29.V.2019, 1♀, leg. Boustani M. Souk el Ghareb, Balamand University, 839 m, 23.VII.2019, 1♀, leg. Boustani M.; Barouk, 1086 m, 12.VIII.2019, 1♀, leg. Boustani M.; Maaniyye, Dhour El Maaniyye, 324 m, 25.V.2019, 3♀, leg. Boustani M., all coll. MBOU.
N. Lebanon: Tannourine Forest, 1784 m, 18.VI.2016, 2♀, leg. Boustani M., coll. MBOU. Additional 11♀ and 17♂ from 13 records, collected between 18.IV.2017 and 23.VIII.2019, from Tannourine El Tahta, Horch Ehden, Hadath El Jebbe and Tannourine El Fawka.
Flower records. Apiaceae: *Eryngium glomeratum*, Asphodelaceae: *Asphodelus microcarpus*; Asteraceae: *Anthemis pauciloba*, *Carduus argentatus*; Boraginaceae: *Anchusa hybrida*, *Echium glomeratum*; Caprifoliaceae: *Cephalaria* sp., *Cephalaria* cf *joppensis*, *Scabiosa argentea*, *Scabiosa* sp.; Fabaceae: *Vicia tenuifolia*; Hypericaceae: *Hypericum triquetrifolium*; Lamiaceae: *Nepeta curviflora*; Malvaceae: *Alcea apterocarpa*; Rosasceae: *Rubus sanctus*.
Species reported to be widely polylectic (Terzo 2011).

***Ceratina* (*Euceratina*) *dallatorreana* Friese, 1896 ***
Distribution: WEST PALAEARCTIC: Holo-Mediterranean and extending to Central Asia (Terzo & Rasmont 2011, Ascher & Pickering 2021).
GBIF 2021, SEMC: Mount Lebanon, Al Montazah, near Mansourieh, 100 m, 11.V.1995, 1♀, det. Baker D., leg. Roche C.G.
Material examined. Mount Lebanon: Laqlouq, Matoube, 1738 m, 6.VII.2019, 1♀, leg. Boustani M.; Hadath El Jebbe, Border of the Cedar forest, 1646 m, 25.VII.2019, 1♀, leg. Boustani M., all coll. MBOU.
N. Lebanon: Arz Tannourine, Tannourine Forest Reserve Outskirts, 1792 m, 13.VII.2017, 1♀, leg. Boustani M.; Hadath El Jebbe, Border of the Cedar Forest, 1618 m, 28.VII.2017, 1♀, leg. Boustani M.; Tannourine El Tahta, Wadi Al Fouar, 1187 m, 28.VI.2018, 1♀, leg. Boustani M., Jabbour J.; 19.VII.2018, 1♀, leg. Boustani M., Jabbour J., all coll. MBOU.
Flower records. Asteraceae: *Centaurea pallescens*; Caprifoliaceae: *Scabiosa argentea*; Fabaceae: *Ononis natrix*; Plumbaginaceae: *Acantholimon libanoticum*.

***Ceratina* (*Euceratina*) *denesi* Terzo, 1998 ***
Distribution: EAST MEDITERRANEAN: Previously known only from the holotype in Adana, Turkey (Terzo & Rasmont 2011).
Material examined. N. Lebanon: Tannourine El Tahta, Wadi Al Fouar, 1187 m, 19.IV.2018, 2♂, leg. Boustani M., coll. MBOU.
Flower record. Asteraceae: *Carduus argentatus*.

***Ceratina* (*Euceratina*) *dentiventris* Gerstaecker, 1869 ***
Distribution: WEST PALAEARCTIC: Holo-Mediterranean distribution, but scarce in the Maghreb (Terzo & Rasmont 2011, Ascher & Pickering 2021).
Local distribution fig. 15.12
Material examined. Bekaa: Hadath, 1441 m, 7.VII.2019, 2♂, leg. Boustani M., Ghisbain G., coll. MBOU, UMONS.
Mount Lebanon: Jabal Moussa Biosphere Reserve, Peony Trail, 1440 m, 21.VIII.2018, 1♂, leg. Boustani M.; Laqlouq, 1594 m, 6.VII.2019, 1♂, leg. Boustani M., coll. MBOU.
N. Lebanon: Tannourine El Tahta, Mar Boutrous, 1207 m, 27.VI.2019, 2♂, leg. Boustani M.
Arz Tannourine, Gate, 1796 m, 29.VI.2019, 1♀, leg. Boustani M., all coll. MBOU; Bcharre, 2042 m, 14.VII.2019, 1♂, leg. Van Achter X.; Horch Ehden, 1686 m, 14.VII.2019, 1♂, leg. Van Achter X.; 1625 m, 22.VII.2019, 1♀, leg. Van Achter X., all coll. XVA.
Flower records. Apiaceae: *Eryngium creticum*; Caprifoliaceae: *Scabiosa argentea*, *Scabiosa* sp.; Lamiaceae: *Stachys cretica*.

***Ceratina* (*Euceratina*) *mandibularis* Friese, 1896**
Distribution: WEST PALAEARCTIC: Ponto-Mediterranean (Terzo & Rasmont 2011, Ascher & Pickering 2021).

Local distribution fig. 15.13

Literature.

Friese (1899): Specimens from Beirut, 28.IV.1899; Brumana, 30.V.1899.

Mentioned by Grace (2010)

Unpublished records.

GBIF 2021, SEMC:

Aley, Ain Es Sayde, 15.VIII.1994, 1♂, det. Baker D., leg. Roche C.G.; Mount Lebanon: Monteverde, 350 m, 19.VIII.1994, 1♀, determiner unknown; 28.VIII.1994, 1♀, det. Baker D.; 1♂, determiner unknown, all leg. Roche C.G.

Al Montazah, near Mansourieh, 100 m, 11.V.1995, 2♂, det. Baker D., leg. Roche C.G.

Material examined.

BDFGM material. MNHUB: Beyrouth [Beirut], date unknown, 1♀, leg. Schmiedeknecht O.; 1♂, leg. Jehmirdek; 1♂, leg. Friese H.; 28.IV.1899, 1♀, leg. Friese H.; Bekaa: Baalbeck, 27.IV.1934, 1♂, leg. Stich R.; OÖLM: Beyrouth [Beirut], date and collector unknown, 1♂; RBIN: Beyrouth [Beirut], date and collector unknown, 1♀; BMNH: Mount Lebanon: Brumana, 30.IV.1899, 1♀, leg. Saunders E.; N. Lebanon: Trablous [Tripoli], 8.VI.1944, 1♀, leg. Cott H.B.; MNHNP: Bekaa, Ksarah, 1913, 4♀, leg. Clainysanain G.; ZSM: Mount Lebanon, Brumana, 7.V.1919, 1♀; 7.VIII.1899, 1♀.

Author material. Mount Lebanon: Maaser Al Chouf, 1143 m, 29.V.2019, 1♀, 1♂, leg. Boustani M.; 1364 m, 29.V.2019, 1♂, leg. Boustani M.; Barouk, Hayy Mar Geryos, 1121 m, 12.VIII.2019, 1♂, leg. Boustani M.; Barouk, 1086 m, 12.VIII.2019, 3♀, 3♂, leg. Boustani M., all coll. MBOU.

N. Lebanon: Tannourine El Tahta, Wadi Ain El Raha, 901 m, 11.IV.2017, 3♂, leg. Boustani M.; 900 m, 18.IV.2017, 4♂, leg. Boustani M.; Qadisha Valley, 950 m, 5.V.2017, 3♀, 1♂, leg. Nemeth T.; Tannourine El Tahta, Wadi Ain El Raha, 900 m, 11.V.2017, 2♀, leg. Boustani M.; Tannourine El Tahta, Malaa Al Nahrein, 958 m, 2.VIII.2017, 1♂, leg. Boustani M.; Tannourine El Tahta, Al Mahbase, 893 m, 25.IV.2019, 1♀, leg. Boustani M.; Tannourine El Tahta, Wadi Al Fouar, 1504 m, 13.V.2019, 1♀, leg. Boustani M., all coll. MBOU.

Flower records. Asteraceae: *Anthemis pauciloba*, *Anthemis* sp., *Carduus argentatus*; Caprifoliaceae: *Cephalaria* cf *joppensis*, *Cephalaria joppensis*; Convolvulaceae: *Convolvulus arvensis*; Lamiaceae: *Eremostachys laciniata*, *Stachys cretica*, *Stachys distans*.

***Ceratina* (*Euceratina*) *moricei* Friese, 1899**

Distribution: WEST PALAEARCTIC: Scattered in northern and eastern Mediterranean and Iran (Terzo & Rasmont 2011, Ascher & Pickering 2021).

Literature. Friese (1899): Listed under the description of a variety; *Ceratina laevifrons* var. *moricei*

Mount Lebanon, Brumana, 30.IV.1899, 1♂, det. Friese H., leg. Morice F.

Material examined.

BDFGM material. ZSM: Mount Lebanon, Brumana, 7.VIII.1899, 1♂.

Author material. N. Lebanon: Arz Tannourine, Tannourine Forest Reserve Outskirts, 1792 m, 13.VII.2017, 1♀, leg. Boustani M.; Hadath El Jebbeh, Border of the Cedar Forest, 1681 m, 22.VIII.2018, 1♀, leg. Boustani M., Jabbour J., all coll. MBOU.

Flower record. Apiaceae: *Eryngium glomeratum*; Plumbaginaceae: *Acantholimon libanoticum*.

***Ceratina* (*Euceratina*) *nigroaenea* Gerstaecker, 1869 ***

Distribution: WEST PALAEARCTIC: Northern and eastern Mediterranean (Terzo & Rasmont 2011).

Unpublished records.

GBIF 2021, SEMC:

Monteverde, near Mansourieh, 350 m, 7.VIII.1994, 2♀, determiner unknown; Monteverde, 350 m, 21.V.1995; 1♂, det Baker D., 1♂, determiner unknown; Monteverde, near Mansourieh, 350 m, 4.VI.1995, 1♀, determiner unknown; Mount Lebanon: Deir Koubel, near Choueifat, 300 m, 2.VII.1995, 1♀, determiner unknown, all leg. Roche C.G.; Monteverde, near Mansourieh, 350 m, 28.IV.1996, 1♀, determiner unknown, all leg. Roche C.G.

Material examined. Mount Lebanon: Laqlouq, 1738 m, 6.VII.2019, 1♀, 1♂, leg. Boustani M.

N. Lebanon: Tannourine Forest, 1784 m, 18.VI.2016, 1♂, leg. Boustani M.; Qadisha Valley, 950 m, 5.V.2017, 1♂, leg. Nemeth T.; Tannourine El Tahta, Wadi Ain El Raha, 900 m, 11.V.2017, 1♀, 1♂, leg. Boustani M.; 1036

m, 2.VIII.2017, 1♀, leg. Boustani M.; Tannourine El Tahta, Al Mahbase, 893 m, 31.V.2019, 1♀, leg. Boustani M.; Tannourine El Fawka, Salon de l'église, 1244 m, 4.VII.2019, 3♀, leg. Ghisbain G.; Tannourine El Tahta, Mar Boutrous, 1207 m, 25.VII.2019, 4♀, leg. Boustani M.; Arz Tannourine, Trail 4, 1781 m, 27.VII.2019, 1♀, leg. Boustani M.; Hadath El Jebbe, Al Fouar, 1529 m, 23.VIII.2019, 1♀, leg. Boustani M., Mouawad G., all coll. MBOU.
Flower records. Asteraceae: *Carduus argentatus*, *Centaurea iberica*, *Echinops gaillardotii*; Caprifoliaceae: *Scabiosa argentea*; Lamiaceae: *Stachys distans*; Rosasceae: *Rubus sanctus*.

***Ceratina* (*Euceratina*) *nigrolabiata* Friese, 1896 ***
Distribution: WEST PALAEARCTIC: Holo-Mediterranean, absent from Maghreb (Terzo & Rasmont 2011).
Material examined. N. Lebanon: Arz Tannourine, Trail 4, 1767 m, 7.VI.2017, 1♂, leg. Boustani M., coll. MBOU.

***Ceratina* (*Ceratina*) *parvula* Smith, 1854 ***
Distribution: WEST PALAEARCTIC: Holo-Mediterranean, mainly coastal areas (Terzo & Rasmont 2011).
GBIF 2021, SEMC: Mount Lebanon, Al Montazah, near Mansourieh, 250 m, 6.VI.1995, 1♀, det. Baker D., leg. Roche C.G.
Material examined. Mount Lebanon: Jabal Moussa Biosphere Reserve, Peony Trail, 1441 m, 21.VIII.2018, 1♀, leg. Boustani M., coll. MBOU.
Flower record. Caprifoliaceae: *Scabiosa argentea*.

***Ceratina* (*Euceratina*) *sakagamii* Terzo, 1998 ***
Distribution: WEST PALAEARCTIC: Turkey and Iran (Terzo & Rasmont 2011).
Material examined. N. Lebanon: Arz Tannourine, Gate Area, 1754 m, 6.VII.2019, 1♀, leg. Gekière A., coll. UMONS; Horch Ehden, 1625 m, 12.VII.2019, 1♀, leg. Van Acther X., coll. XVA.
Flower record. Caprifoliaceae: *Scabiosa* sp.

***Ceratina* (*Neoceratina*) *schwarzi* Kocourek, 1998 ***
Distribution: WEST PALAEARCTIC: Northern and eastern Mediterranean to Iran (Terzo & Rasmont 2011, Ascher & Pickering 2021).
Unpublished records. GBIF 2021, SEMC: Mount Lebanon: Monteverde, near Mansourieh, 350 m, 28.VIII.1994, 1♀; 13.VIII.1995, 1♀, 1♂, determiner unknown, leg. Roche C.G.
Material examined. Bekaa: Hadath, 1441 m, 7.VII.2019, 2♂, leg. Boustani M., coll. MBOU.
N. Lebanon: Hadath el Jebbeh, Chemin Wadi Ain El Raha, 1633 m, 29.VI.2017, 2♀, leg. Boustani M.; Arz Tannourine, Reserve Outskirts, 1792 m, 13.VII.2017, 1♀, leg. Boustani M.; Hadath El Jebbeh, Border of Cedar Forest, 1681 m, 19.VII.2018, 2♀, leg. Boustani M., Jabbour J.; Tannourine El Tahta, Mar Boutrous, 1207 m, 27.VI.2019, 1♀, leg. Boustani M., all coll. MBOU; Ehden, 1686 m, 31.VII.2019, 1♀, leg. Van Achter X.; Arz Tannourine, Gate Area, 1797 m, 9.VII.2019, 1♀, leg. Van Achter X., all coll. XVA; Hadath El Jebbe, Border of the Cedar forest, 1646 m, 25.VII.2019, 3♀, leg. Boustani M., coll. UMONS; Arz Tannourine, Gate Area, 1797 m, 31.VII.2019, 1♂, leg. Van Achter X., coll. XVA; Hadath El Jebbe, Al Fouar, 1529 m, 23.VIII.2019, 1♀, leg. Boustani M., Mouawad G.; Hadath El Jebbe, Border of the Cedar forest, 1646 m, 23.VIII.2019, 1♀, leg. Boustani M., all coll. MBOU.
Flower records. Apiaceae: *Eryngium creticum*, *Eryngium glomeratum*; Fabaceae: *Medicago* sp.; Caryophyllaceae: *Dianthus strictus*; Plumbaginaceae: *Acantholimon libanoticum*; Ranunculaceae: *Consolida hohenacker*i.

***Ceratina* (*Euceratina*) *schwarziana* Terzo, 1998 ***
Distribution: EAST MEDITERRANEAN: Known only from Turkey (Terzo & Rasmont 2011, Ascher & Pickering 2021).
Material examined. N. Lebanon: Hadath El Jebbeh, Road to Wadi Al Fouar, 1553 m, 19.VII.2018, 1♂, leg. Boustani M., Jabbour J., coll. MBOU.
Flower record. Caprifoliaceae: *Scabiosa argentea*.

***Ceratina* (*Euceratina*) *tibialis* Morawitz, 1895 ***
Distribution: WEST PALAEARCTIC: Eastern Mediterranean to Iran (Terzo & Rasmont 2011).
Material examined. Bekaa: Blaika, 1223 m, 3.VII.2019, 1♀, leg. Boustani M., coll. MBOU.

Flower record. Asteraceae: *Centaurea* cf *pallescens.*

ALLODAPINI

Genus *Exoneuridia* Cockerell, 1911

One species.

***Exoneuridia* (*Exoneuridia*) *libanensis* (Friese, 1899)**
Distribution: LEVANT: Syria, Lebanon, and Palestine (Terzo & Rasmont 2011, Ascher & Pickering 2021).
Local distribution fig. 15.14
Unpublished records. GBIF 2021, SEMC:
Bekaa, Deir Mar Maroun, 700 m, 19.V.1996, 1♀, det. Baker D., leg. Roche C.G.
Literature. Friese (1899):
Mount Lebanon: Near Broumana, 1000 m, V. 1899, males and females type series.
Material examined.
BDFGM material. MNHNP: Mount Lebanon, Brumana, no date, 1♀, leg. Friese H; 3.V.1899, 1♀, det. Terzo M.; Bekaa, Ksarah, 1913, 2♀, 1♂, leg. Claimpanain J.; MNHUB: Mount Lebanon: Brumana, 1897, 1♀, leg. Schmiedeknecht O.; 1.V.1899, 1 F, leg. Friese H; 3.V.1899, 2♀, leg. Friese H.; Beit Meri, 1899, 1♀, leg. Friese H.; OÖLM: Mount Lebanon, Beit Meri, 1900, 1♀, leg. Friese H.; Zoological Institute, Academy of Sciences of the U.S.S.R., St. Petersburg, Leningrad, Russia: Mount Lebanon, Brumana, 3.V.1899, 1♀, leg. Friese H.
Author material. Bekaa: Jord Aarsal, Wadi Al Heeban, 2000 m, 11.VII.2019, 1♀, leg. Boustani M.
Mount Lebanon: Jabal Moussa Biosphere Reserve, Peony Trail, 1491 m, 21.VIII.2018, 1♀, leg. Boustani M.; Laqlouq, Matoube, 1698 m, 6.VII.2019, 1♂, leg. Boustani M.; Jabal Moussa Biosphere Reserve, Trail Qornet El Der, 1368 m, 18.VII.2019, 1♀, leg. Boustani M., all coll. MBOU.
N. Lebanon: Tannourine El Tahta, Wadi Ain El Raha, 900 m, 5.V.2017, 1♀, leg. Boustani M.; Hadath El Jebbe, Chemin Wadi Ain El Raha, 1519 m, 18.VII.2017, 1♀, leg. Boustani M.; Arz Tannourine, Trail 1, 1798 m, 28.VII.2017, 3♀, 1♂, leg. Boustani M.; Tannourine El Tahta, Wadi Ain El Raha, 1008 m, 19.VIII.2017, 1♀, leg. Boustani M., all coll. MBOU; Arz Tannourine, Trail 1, 1799 m, 27.VII.2018, 1♀, leg. Van Achter X., coll. XVA; Arz Tannourine, Trail 4, 1781 m, 30.VI.2019, 1♀, leg. Boustani M., coll. MBOU; Horch Ehden, 1686 m, 24.VII.2019, 1♀, leg. Van Achter X., coll. XVA; Hadath El Jebbe, Al Fouar, 1529 m, 25.VII.2019, 2♀, leg. Boustani M., Mouawad G.; 23.VIII.2019, 1♀, 1♂, leg. Boustani M., Mouawad G., all coll. MBOU.
Flower records. Asteraceae: *Carduus argentatus*, *Carlina curetum* ssp. *orientalis*, *Centaurea* sp., *Echinops gaillardotii*, *Onopordum carduiforme*, *Onopordum* sp.; Caprifoliaceae: *Cephalaria setosa*, *Scabiosa argentea*; Hypericaceae: *Hypericum triquetrifolium*.

ANCYLINI

Genus *Ancyla* Lepeletier, 1841

Two species.

***Ancyla (Ancyla) asiatica* Friese, 1922**
Distribution: WEST PALAEARCTIC: Scattered records in south-eastern Europe, northern and eastern Mediterranean and Caucasus (Rasmont & Dehon 2014).
Literature. Warncke (1979): Reported from Beirut, 1912.

***Ancyla (Ancyla) stolli* Friese, 1922**
Distribution: WEST PALAEARCTIC: Scattered record in Levant and Iran (Rasmont & Dehon 2014).
Literature. Warncke (1979): Reported from Beirut, 1912.

NOMADINI

Genus *Nomada* Scopoli, 1770

16 species.

This understudied and taxonomically challenging genus in the southern part of the West Palaearctic is probably one of the most species rich genera present in Lebanon because of the high species richness of their principal hosts, the *Andrena*. Future thorough revision of Lebanese *Nomada* material is likely to substantially increase the number of species present. Based on the ratio of *Nomada* to *Andrena* in Portugal (3:5; Baldock *et al.* 2018, Wood *et al.* 2020b) and Morocco (2:5; Lhomme *et al.* 2020), we estimate a likely Lebanese species richness of between 34–52 species.

***Nomada (Nomada) babiyi* Schwarz and Standfuss, 2007 ***
Distribution: WEST PALAEARCTIC: Northern Mediterranean and South Eastern Europe (Ascher & Pickering 2021).
Material examined. N. Lebanon: Horch Ehden, 1686 m, 24.VII.2019, 1♀, det. Straka J., leg. Boustani M., coll. MBOU.

***Nomada (Nomada) basalis* Herrich-Schäffer, 1839 ***
Distribution: WEST PALAEARCTIC (Ascher & Pickering 2021).
Material examined. South Lebanon: Bramiye El Tahta, 25.IV.1973, 1♀, det. Straka J., coll. AUB.
Notes: Mentioned from Lebanon (Scheuchl & Willner 2016) without record details.

***Nomada (Nomada) bispinosa* Mocsáry, 1883 ***
Distribution: PALAEARCTIC: Europe, Maghreb, and further east to Pakistan (Ascher & Pickering 2021).
Material examined. N. Lebanon: Horch Ehden, Ain El Naasa, 1560 m, 22.V.2019, 1♂, det. Straka J., leg. Boustani M., coll. MBOU.
Flower record. Fabaceae: *Coronilla emeroides*.

***Nomada (Nomada) distinguenda* Morawitz, 1874 ***
Distribution: WEST PALAEARCTIC (Ascher & Pickering 2021).
Material examined. N. Lebanon: Tannourine Wadi Al Fouar, 1528 m, 17.VI.2016, 1♀, det. Schwarz M., leg. Boustani M., coll. MBOU.

***Nomada (Nomada) fucata* Panzer, 1798 ***
Distribution: PALAEARCTIC (Ascher & Pickering 2021).
Material examined. Bekaa: AUB Farm [Haush Sneid], 26.VII.1971, 1♂, det. Straka J., leg. Habibi, coll. AUB; Der El Ahmar, 995 m, 3.VII.2019, 1♂, det. Straka J., leg. Ghisbain G., coll. UMONS.
Flower record. Asteraceae: *Centaurea* cf *pallescens.*

***Nomada (Nomada) fuscipennis* Lepeletier, 1841 ***
Distribution: WEST PALAEARCTIC: Morocco, Algeria (Ascher & Pickering 2021).
Material examined. Mount Lebanon: Daichouniyé, 133 m, 3.IV.2017, 1♂, det. Schwarz M., leg. Boustani M., coll. MBOU.

***Nomada (Nomada) integra* Brullé, 1832 ***
Distribution: WEST PALAEARCTIC (Ascher & Pickering 2021).
Material examined. Bekaa: Kefraya, Horch El Kaser, 992 m, 9.IV.2019, 1♂, det. Straka J., leg. Boustani M., coll. MBOU.
N. Lebanon: Tannourine El Tahta, Wadi Ain El Raha, 900 m, 6.IV.2017, 1♂, det. Schwarz M., leg. Mourad A., Mourad A., coll. MBOU.

***Nomada (Nomada) israelis* Schwarz, Smit & Gusenleitner, 2018 ***
Distribution: LEVANT: Known only from Israel (Schwarz, Smit & Gusenleitner 2018).
Material examined. Bekaa: AUB Farm [Haush Sneid], 17.IV.1961, 1♂, det. Straka J., coll. AUB.
Mount Lebanon: Tourzaya, 19.IV.2018, det. Straka J., leg. Lahoud V., coll. USEK.

***Nomada (Nomada) lucidula* Schwarz, 1967 *** (fig. 21.6)
Distribution: EAST MEDITERRANEAN: Albania, Bulgaria, Greece, Turkey, Israel (Ascher & Pickering 2021, Kuhlmann *et al.* 2021).
Material examined. Mount Lebanon: Maaser Al Chouf, 1364 m, 29.V.2019, 1♂, det. Straka J., leg. Boustani M., coll. MBOU.
N. Lebanon: Qadisha, Lebanon Mountain Trail, 910 m, 9.V.2017, 1♀, det. Schwarz M., leg. Boustani M.; Qadisha, Lebanon Mountain Trail, 936 m, 9.V.2017, 1♀, det. Schwarz M., leg. Boustani M., all coll. MBOU; Hadath El Jebbeh, Al Fouar, 1656 m, 29.V.2017, 1♀, det. Schwarz M., leg. Rasmont P. coll. PRAS; Tannourine El Tahta, Wadi al Fouar, 1187 m, 19.IV.2018, 1♂, det. Schwarz M., leg. Boustani M.; Hadath El Jebbeh, Road to Wadi Al Fouar, 1553 m, 6.VI.2018, 1♂, det. Schwarz M., leg. Boustani M., all coll. MBOU; Tannourine El Tahta, Mar Boutrous, 1207 m, 5.V.2019, 1♂, det. Straka J., leg. Boustani M., coll. MBOU; Hadath El Jebbe, Al Fouar, 1529 m, 31.V.2019, 1♀, det. Straka J., leg. Boustani M., coll. MBOU.; 7.VI.2019, 1♀, 1♂, det. Straka J., leg. Boustani M., Mouawad G., coll. MBOU.
Flower records. Asteraceae: *Carduus argentatus*; Fabaceae: *Trifolium purpureum*, *Vicia tenuifolia*; Lamiaceae: *Nepeta* sp., *Stachys cretica*.

***Nomada (Nomada) nobilis* Herrich-Schäffer, 1839 ***
Distribution: WEST PALAEARCTIC (Ascher & Pickering 2021, Kuhlmann *et al.* 2021).
Material examined. N. Lebanon: Arz Tannourine, Wadi El Fouar, 1553 m, 22.V.2018, 1♀, det. Straka J., leg. Van Achter X., coll. XVA.
Flower record. Lamiaceae: *Phlomis viscosa*.

***Nomada (Nomada) pallispinosa* Schwarz, 1967 ***
Distribution: WEST PALAEARCTIC (Ascher & Pickering 2021).
Material examined. N. Lebanon: Tannourine El Tahta, Wadi Ain El Raha, 900 m, 18.IV.2017, 1♀, det. Schwarz M., leg. Boustani M.; Tannourine El Tahta, Al Mahbase, 893 m, 25.IV.2019, 1♂, det. Straka J., leg. Boustani M., all coll. MBOU.

***Nomada (Nomada) propinqua* Schmiedeknecht, 1882 ***
Distribution: WEST PALAEARCTIC: Scattered records in Europe and East Mediterranean (Ascher & Pickering 2021).
Material examined. Bekaa: Kefraya, Horch El Kaser, 992 m, 9.IV.2019, 1♂, det. Straka J., leg. Boustani M., coll MBOU.

***Nomada (Nomada) radoszkowskii* Lozinski, 1922 *** (fig. 22.1)
Distribution: PALAEARCTIC (Ascher & Pickering 2021).
Material examined. N. Lebanon: Ehden, Nabeh Jouit, 1336 m, 24.IV.2019, 1♂, det. Straka J., leg. Rasmont P., coll. PRAS.
Flower record. Asteraceae: *Taraxacum* sp.

***Nomada (Nomada) striata* Fabricius, 1793 ***
Distribution: PALAEARCTIC (Ascher & Pickering 2021).
Material examined. N. Lebanon: Hadath El Jebbe, Al Fouar, 1529 m, 7.VI.2019, 1♂, leg. Boustani M., Mouawad G., coll. MBOU.
Flower record. Fabaceae: *Vicia tenuifolia*.

***Nomada (Nomada) trispinosa* Schmiedeknecht, 1882 ***
Distribution: PALAEARCTIC (Ascher & Pickering 2021).
Material examined. S. Lebanon: Saidoun, 3.III.2018, 1♂; Saidoun, Beehives, 17.III.2018, 1♂; Saidoun, 15.IV.2019, 1♂, all det. Straka J., leg. Baghdadi A., coll. SOILS.

Nomada (Nomada) yermasoyiae **Schwarz, Smit & Gusenleitner, 2018**
Distribution: EAST MEDITERRANEAN (Schwarz, Smit & Gusenleitner 2018).
Material examined. Bekaa: Kefraya, Horch El Kaser, 992 m, 9.IV.2019, 1♀, det. Straka J., leg. Boustani M., coll. MBOU.

AMMOBATINI

Genus *Ammobates* Latreille, 1809

Three species.

Ammobates (Ammobates) latitarsis **Friese, 1899**
Distribution: EAST MEDITERRANEAN: Levant to eastern Iran (Ascher & Pickering 2021).
Literature. Mavromoustakis, 1963: S. Lebanon, Jezzine, 2.VI.1953, 2♂, leg. & det. Mavromoustakis G.A. Mentioned by Warncke (1983) and Grace (2010) from Lebanon.

Ammobates (Ammobates) oraniensis **(Lepeletier, 1841) ***
Distribution: WEST PALAEARCTIC (Ascher & Pickering 2021, Kuhlmann *et al.* 2021).
Material examined. N. Lebanon: Arz Tannourine, Reserve Outskirts, 1739 m, 7.VI.2017, 1♂, det. Dufrêne E., leg. Boustani M.; Arz Tannourine, 1765 m, 22.VI.2017, 1♀, det. Dufrêne E., leg. Boustani M., all coll. MBOU.
Flower records. Asteraceae: *Anthemis* sp.; Fabaceae: *Medicago* sp.

Ammobates (Ammobates) punctatus **(Fabricius, 1804) ***
Distribution: WEST PALAEARCTIC (Ascher & Pickering 2021).
Material examined. N. Lebanon: Arz Tannourine, Reserve Outskirts, 1792 m, 13.VII.2017, 2♂, det. Straka J., all leg. Boustani M., coll. MBOU.
Flower record. Plumbaginaceae: *Acantholimon libanoticum*.

EUCERINI

Genus *Eucera* Scopoli, 1770

34 species.

All material examined determined by Risch S.

This genus is undergoing revisions in the Levant (Dorchin *et al.* 2018, Dorchin 2019), and the species listed here probably represents two thirds of the true richness. Many collected specimens could not be listed below as they are assigned to currently undescribed or ambiguous taxa. *Synhalonia* is included in the list below as a sub-genus of *Eucera* following Dorchin *et al.* (2018). The challenging taxonomy of this genus has made it difficult to gather ecological data such as floral preferences, particularly in the female sex. *Eucera* subgenus *Eucera* seem to show a trend for Fabaceae specialization, but this requires further research. Other *Eucera* species show either specialization on other botanical families or clear polylecty (TJW unpublished data), but substantial work is required on this genus.

Because of the taxonomic uncertainty, in order to make sure that all distributions are up to date, all distributional information given has been confirmed by Risch S in addition to those presented by Ascher & Pickering 2021 and Kuhlmann *et al.* 2021, so no specific citation is mentioned after each species.

Eucera (Hetereucera) aeolopus **Pérez, 1911 ***
Distribution: EAST MEDITERRANEAN: Turkey, Iran, Syria, Jordan, Israel, Lebanon.
Material examined. N. Lebanon: Horch Ehden, 1534 m, 2.V.2017, 1♂, leg. Boustani M.; Arz Tannourine, 1766 m, 6.V.2017, 1♀, 2♂, leg. Boustani M.; 1799 m, 6.V.2017, 1♀, 2♂, leg. Boustani M.; 1739 m, 25.V.2017, 1♀, leg. Boustani M.; 1744 m, 7.VI.2017, 4♀, leg. Boustani M.; 1771 m, 22.VI.2017, 1♀, leg. Boustani M.; 1781

m, 13.VII.2017, 1♀, leg. Boustani M.; 1792 m, 13.VII.2017, 1♀, leg. Boustani M.; Fehta, El Biara, 1632 m, 14.IV.2018, 1♂, leg. Boustani M.; Arz Tannourine, 1754 m, 19.IV.2018, 1♂, leg. Boustani M.; Arz Tannourine, 1762 m, 24.IV.2018, 2♂, leg. Boustani M.; Fehta, El Biara, 1632 m, 24.IV.2018, 1♂, leg. Boustani M.; Arz Tannourine, Gate, 1796 m, 3.VI.2019, 6♀, leg. Boustani M.; Hadath El Jebbe, Border of the Cedar forest, 1632 m, 27.VI.2019, 1♀, leg. Boustani M.; Arz Tannourine, Gate, 1794 m, 4.VII.2019, 1♀, leg. Boustani M., all coll. MBOU.

Flower records. Asparagaceae: *Bellevalia* sp.; Asteraceae: *Centaurea eryngioides*, *Serratula pusilla*; Boraginaceae: *Solenanthus stamineus*; Caprifoliaceae: *Cephalaria setosa*; Caryophyllaceae: *Dianthus strictus*; Fabaceae: *Medicago* sp.; Lamiaceae: *Phlomis brachyodon*, *Stachys cretica*; Plumbaginaceae: *Acantholimon libanoticum*; Rubiaceae: *Asperula arvensis*.

***Eucera (Pareucera) albofasciata* Friese, 1895 ***

Distribution: WEST PALAEARCTIC: North Africa, Italy, south-eastern Europe, Near East, and Caucasus to Central Asia.

Material examined. N. Lebanon: Tannourine El Tahta, Wadi Ain El Raha, 900 m, 18.IV.2017, 2♀, det. leg. Boustani M.; Arz Bcharre, 1914 m, 9.V.2017, 1♂, leg. Boustani M.; Tannourine El Tahta, Al Mahbase, 893 m, 12.IV.2019, 1♀; Tannourine El Tahta, Mar Boutrous, 1207 m, 12.IV.2019, 1♀; 5.V.2019, 1♀; Hadath El Jebbe, Al Fouar, 1529 m, 2♀; 31.V.2019, 1♀, all coll. MBOU.

Flower records. Boraginaceae: *Anchusa hybrida, Solenanthus stamineus*; Fabaceae: *Lathyrus* sp., *Vicia sericocarpa*, *Vicia tenuifolia*.

***Eucera* (*Synhalonia*) *alternans* (Brullé, 1832) ***

Distribution: WEST PALAEARCTIC: North Africa and Iberia to south-eastern Europe and Near East.

Unpublished records. GBIF 2021, SEMC: Bekaa, Deir Mar Maroun, 700 m, 19.V.1996, 1♀, det. Baker D., leg. Roche C.G.

Material examined. S. Lebanon: Saidoun, El Mrouj, 7.V.2017, 1♂, det. Risch S., leg., coll. SOILS.

***Eucera (Rhyteucera) caerulescens* Friese, 1899**

Distribution: EAST MEDITERRANEAN: Cyprus, Near East, Turkey, records from Libya to be confirmed (Risch, pers. comm, 2020)

Literature. Friese (1899): Mount Lebanon, Brumana (and from Mersina, Cyprus), 2–5.IV.1899, some males and females, det. Friese H., leg. Morice F.

Material examined. Bekaa: Kefraya, Horch El Kaser, 992 m, 9.IV.2019, 1♂, leg. Boustani M., coll. MBOU.

Mount Lebanon: Marj Barja, Terbe, 17.IV.2017, 2♀, leg. Boustani M.; Marej Barja, Kaleet El Besten, 358 m, 26.IV.2019, 1♀, 2♂, leg. Boustani M., all coll. MBOU.

N. Lebanon: Arz Tannourine, 1799 m, 6.V.2017, 1♀, leg. Boustani M.; 1800 m, 6.V.2017, 1♀, leg. Boustani M.; 1739 m, 7.VI.2017, 1♀, leg. Boustani M., all coll. MBOU.

Flower record. Fabaceae: *Hymenocarpos circinnatus*, *Trifolium* sp.; Geraniaceae: *Geranium* c.f. *rotundifolium*.

***Eucera (Agatheucera) cinnamomea* Alfken, 1935 ***

Distribution: LEVANT: Syria, Lebanon, Jordan, Israel.

Material examined. Mount Lebanon: Alay [Aley], 1.VI.1973, 1♀., coll. AUB.; Maaniye, Dhour El Maaniye, 324 m, 25.V.2019, 4♀; Maaser Al Chouf, 1143 m, 29.V.2019, 1♂, all leg. Boustani M., coll. MBOU.

S. Lebanon: Saidoun, El Mrouj, 29.IV.2017, 2♂, leg. Baghdadi A., coll. SOILS.

Flower records: Asteraceae: *Anthemis pauciloba*, *Cirsium* sp.

***Eucera (Stilbeucera) clypeata* Erichson, 1835 ***

Distribution: WEST PALAEARCTIC: North Africa, Europe to Central Asia.

Material examined. Mount Lebanon: Marj Barja, Terbe, 17.IV.2017, 1♂, leg. Boustani M., coll. MBOU.

N. Lebanon: South of Jairoun, 1648m, 23.V.2012, 2♀, leg. Kasparek M.; Donnieh, Sfiri, 245 m, 27.V.2012, 1♀, leg. Kasparek M.; Donnieh, Nemrud, 245 m, 28.V.2012, 1♀, leg. Kasparek M., all coll. OÖLM; Hadath El Jebbe, Wadi Al Fouar, 1553 m, 21.V.2018, 1♂, leg. Boustani M.; Hadath El Jebbe, Wadi Al Fouar, 1553 m, 6.VI.2018, 1♀, leg. Boustani M.; Tannourine El Tahta, Mar Boutrous, 1207 m, 31.V.2019, 1♀, leg. Boustani M.; Hadath El Jebbe, Al

Fouar, 1529 m, 7.VI.2019, 2♀, leg. Boustani M., Mouawad G.; 27.VI.2019, 1♀, leg. Boustani M., Mouawad G., all coll. MBOU.

Flower records. Fabaceae: *Lotus gebelia libanoticus*, *Vicia tenuifolia*; Lamiaceae: *Phlomis chrysophylla*.; Malvaceae: *Alcea apterocarpa*.

Eucera (Eucera) cypria **Alfken, 1933 *** (fig. 22.2)

Distribution: EAST MEDITERRANEAN: Cyprus, East Aegean Island to Iran and Israel.

Local distribution fig. 15.15

Unpublished records. GBIF 2021, SEMC: Mount Lebanon: Monteverde, nr Mansourieh, 350 m, 28.IV.1996, 1♀, det. Baker D., leg. Roche C.G.

Material examined. Bekaa: Qaraoun, 792 m, 24.III.2013, 5♂, leg. Kasparek M., coll. OÖLM.

Mount Lebanon: Beit Meri, 19.IV.0000, 1♀, leg. Manassah R.; Fanar, 11.III.1965, 1♀, 2♂; Locality Unknown, 11.IV.1975, 2♀, 1♂., all coll. USEK; Daychounieh, Nahr Beirut Climbing Site, 133 m, 3.IV.2017, 6♀, 5♂, leg. Boustani M.; 27.IV.2017, 1♂, leg. Boustani M., all coll. MBOU; Falougha, 1478 m, 27.IV.2019, 2♂, leg. Boustani M., coll. PRAS.

N. Lebanon: Hadath El Jebbe, Wadi Al Fouar, 1553 m, 4.III.2018, 1♀, 1♂, leg. Boustani M., coll. MBOU. Additional 23♀ and 21♂, from 18 records, collected between 24.III.2017 and 11.V.2019, from Tannourine El Tahta, Arz Tannourine, Fehta, and Hadath El Jebbe.

S. Lebanon: Hlaliyeh, 11.IV.1975, 1♂; Saidoun, El Mrouj, 26.III.2017, 1♀, leg. Baghdadi A.; Saidoun, Lavender Garden, 4.III.2018, 2♂, leg. Baghdadi A.; Saidoun, 5.III.2018, 1♂, leg. Baghdadi A.; 24.III.2019, 1♂, leg. Baghdadi A., all coll. SOILS.

Flower records. Boraginaceae: *Anchusa hybrida*, *Solenanthus stamineus*; Fabaceae: *Vicia narbonensis*, *Vicia sericocarpa*; Lamiaceae: *Lavandula* x *intermedia.*

Eucera **(*Eucera*)** ***dalmatica*** **Lepeletier, 1841 ***

Distribution: WEST PALAEARCTIC: East Mediterranean, Near East, Turkey, SE Europe to SE France, S Spain.

Material examined. Bekaa: Der El Ahmar, 995 m, 3.VII.2019, 2♀, leg. Boustani M.

Mount Lebanon: Bhmadoun, 23.V.1981, 1♂, leg. Mireille K., coll. AUB.

N. Lebanon: Qanat, Qornet Dammouaa, 1231 m, 31.V.2017, 1♀, leg. Rasmont P., coll. PRAS.; Arz Bcharre, Reforestation Area, 1973 m, 2.VII.2019, 1♀, leg. Boustani M., coll. MBOU; Qanat, Qornet Dammouaa, 1197 m, 5.VII.2019, 1♀, leg. Van Achter X., coll. XVA.

Flower records. Boraginaceae: *Echium italicum, Vicia tenuifolia*.

Eucera (Hetereucera) ebmeri **Risch, 1999 ***

Distribution: EAST MEDITERRANEAN: East Aegean Islands to Turkey, Jordan and Israel.

Material examined. Mount Lebanon: Marej Barja, Terbe, 442 m, 24.III.2019, 1♀, leg. Boustani M., coll. MBOU.

N. Lebanon: Tannourine El Tahta, Wadi Ain El Raha, 900 m, 24.III.2017, 4♂; 18.IV.2017, 2♀; Tannourine El Tahta, Al Mahbase, 893 m, 12.IV.2019, 1♂, all leg. Boustani M., all coll. MBOU.

S. Lebanon: Saidoun, 3.III.2018, 1♂, leg. Baghdadi A., coll. SOILS.

Flower records. Fabaceae: *Trifolium clypeatum*, *Vicia sericocarpa*.

Eucera (Pileteucera) fasciata **Risch, 1999 ***

Distribution: WEST PALAEARCTIC: Eastern Mediterranean, SE Europe to Iran and Israel.

Material examined. Bekaa: Ainata, 1556 m, 30.V.2017, 2♂, leg. Boustani M., Rasmont P.

N. Lebanon: Hadath El Jebbe, Cedar Forest, 1639 m, 1♂, leg. Boustani M., all coll. MBOU.

Flower record. Asteraceae: *Serratula pusilla*.

Eucera **(*Atopeucera*)** ***friesei*** **Risch, 2003 ***

Distribution: EAST MEDITERRANEAN: south-eastern Turkey, Syria Jordan Israel.

Material examined. Bekaa: Qaraoun, 792 m, 24.III.2013, 1♂, leg. Kasparek M., coll. OÖLM.

S. Lebanon: Saidoun, 3.III.2018, 1♂, leg. Baghdadi A., coll. SOILS.

***Eucera (Atopeucera) gaullei* Vachal, 1907 ***

Distribution: EAST MEDITERRANEAN: Eastern Mediterranean; Cyprus, SE Turkey to Iran and Israel.

Local distribution fig. 15.16

Unpublished records. GBIF 2021, SEMC: Mount Lebanon, Brumana, 11.V.1953, 1♀, determiner unspecified, leg. Mavromoustakis G.A.

S. Lebanon: Liba'a [Lebaa], 1♀, det. Baker D.

Material examined. Locality Unknown, 11.IV.1975, 1♂; 21.V.1966, 1♀; No date and locality, 1♂, all coll. AUB.

Beirut: American University of Beirut, 2.III.1980, 1♀, leg. Baran S., coll. AUB.

Bekaa: Qaraoun, 792 m, 24.III.2013, 2♂, leg. Kasparek M., coll. OÖLM; Ainata, 1556 m, 30.V.2017, 3♀, leg. Rasmont P., coll. PRAS.

Mount Lebanon: Bhamdoun, 1.V.1975, 1♀., coll. AUB.; Shouf Biosphere Reserve, Horch El Baoruk, 1678 m, 2.VII.2019, 1♀; 1690 m, 4.VII.2019, 1♀, all leg. Van Achter X., coll. XVA.

N. Lebanon: Jord Ehden, 1629 m, 4.V.2017, 1♂, leg. Kotan A.; Fehta, 1715 m, 5.V.2017, 1♂, leg. Boustani M.; Hadath El Jebbe, Cedar Forest, 1639 m, 5.V.2017, 2♂, leg. Boustani M.; Hadath El Jebbe, Al Fouar, 1656 m, 24.V.2017, 1♀, leg. Rasmont P.; Hadath El Jebbe, Cedar Forest, 1639 m, 24.V.2017, 2♀, 2♂, leg. Boustani M.; 29.V.2017, 1♀, leg. Boustani M.; Fehta, El Biara, 1632 m, 14.IV.2018, 1♂, leg. Boustani M.; Arz Bcharre, 1883 m, 18.IV.2018, 2♂, leg. Boustani M.; Arz Tannourine, 1754 m, 19.IV.2018, 1♂, leg. Boustani M.; Hadath El Jebbe, Cedar Forest, 1681 m, 19.IV.2018, 2♂, leg. Boustani M.; Tannourine El Tahta, Mar Boutrous, 1207 m, 5.V.2019, 1♂, leg. Boustani M.; Arz Tannourine, Gate, 1796 m, 11.V.2019, 1♂; 1800 m, 13.V.2019, 2♂, leg. Boustani M.; Fehta, El Biara, 1664 m, 1♀; leg. Boustani M., all coll. MBOU; Arz Tannourine, Gate Area, 1754 m, 6.VII.2019, 1♀, leg. Gekière A., coll. UMONS.

Flower records. Asparagaceae: *Bellevalia flexuosa*; Boraginaceae: *Solenanthus stamineus***;** Fabaceae: *Trifolium tomentosum*, *Vicia sericocarpa*, *Vicia tenuifolia*; Geraniaceae: *Geranium libanoticum*; Lamiaceae: *Salvia multicaulis*.

***Eucera* (*Hetereucera) helvola* Klug, 1845**

Distribution: WEST PALAEARCTIC: Near East, Turkey, south-eastern Europe.

Local distribution fig. 16.1

Unpublished records. GBIF 2021, SEMC: S. Lebanon: Djezzine [Jezzine], 2.VI.1953, 2♀, det. Baker D., leg. Mavromoustakis G.A.

These could be additional specimens to the ones already reported in literature (see below) by Mavromoustakis (1963).

Literature. Mavromoustakis (1963):

Mount Lebanon: Baabdate, 25.V.1953, 1♀, 3♂, leg. & det. Mavromoustakis G.A.

S. Lebanon: Jezzine, 2.VI.1953, 6♀, 3♂, leg. & det. Mavromoustakis G.A.

Material examined. Mount Lebanon: Maaser Al Chouf, 1364 m, 29.V.2019, 4♂, leg. Boustani M., coll. Boustani M.

N. Lebanon: Donnieh, Wadi Cehennem, 23.V.2012, 1♂, leg. Kasparek M.; Donnieh, Wadi Cehennem, 30.V.2012, 1♂, leg. Kasparek M., all coll. OÖLM.; Qadisha Valley, 950 m, 5.V.2017, 1♂, leg. Nemet T.; Hadath El Jebbe, Al Fouar, 1656 m, 24.V.2017, 2♂, leg. Boustani M., all coll. MBOU. Additional 19♀ and 82♂ from 29 records, collected between 24.V.2017 and 6.VII.2019, from Hadath El Jebbe, Arz Tannourine, Fehta, Harissa, Horch Ehden, and Arz Bcharrre.

S. Lebanon: Saidoun, 23.VI.2018, 1♀, leg. Baghdadi A., coll. SOILS.

Flower records. Boraginaceae: *Anchusa italica*; Fabaceae: *Vicia tenuifolia*, *Vicia villosa*; Geraniaceae: *Geranium* sp.; Hypericaceae: *Hypericum scabrum*; Lamiaceae: *Salvia fruticosa*, *Stachys cretica*.

***Eucera (Atopeucera) hermoni* Risch, 2003 ***

Distribution: LEVANT: Syria, Israel, Jordan.

Material examined. Mount Lebanon: Maaser Al Chouf, 1364 m, 29.V.2019, 1♀, leg. Boustani M., coll. MBOU.

N. Lebanon: Arz Bcharre, 9.V.2017, 1914 m, 1♀; Arz Tannourine, 1744 m, 7.VI.2017, 1♀; Hadath El Jebbe, Wadi Ain El Raha, 1519 m, 29.VI.2017, 2♀; Arz Tannourine, 1762 m, 24.IV.2018, 1♂; Hadath El Jebbe, Cedar Forest, 1681 m, 28.VI.2018, 1♀; Hadath El Jebbe, Wadi Al Fouar, 1553 m, 28.VI.2018, 1♀; Hadath El Jebbe, Al Fouar,

5.V.2019, 1529 m, 1♂; 31.V.2019, 1♀; 7.VI.2019, 2♀, all leg. Boustani M., all coll. MBOU.
Flower records. Asteraceae: *Centaurea eryngioides*; Boraginaceae: *Solenanthus stamineus*; Fabaceae: *Medicago* sp., *Ononis natrix*, *Vicia tenuifolia*.

***Eucera* (*Synhalonia*) *hungarica* Friese, 1896 ***
Distribution: WEST PALAEARCTIC: Spain, Central, Eastern and south-eastern Europe, Turkey, and the Near East to Central Asia.
Material examined. N Lebanon: Arz Bcharre, Reforestation Area, 1975 m, 27.V.2017, 5♂, leg. Boustani M., Rasmont P.; 1993 m, 27.VI.2017, 1♀, leg. Boustani M.; Arz Bcharre, Forest Limit, 1873 m, 5.VI.2019, 2♂, leg. Boustani M, all coll. MBOU.; 3.VII.2019, 1873 m, 2♀, leg. Ghisbain G., coll. UMONS.
Flower records. Boraginaceae: *Anchusa italica*; Ixioliriaceae: *Ixiolirion tataricum*; Fabaceae: *Vicia tenuifolia*; Lamiaceae: *Salvia microstegia*.

***Eucera (Eucera) interrupta* Baer, 1850 ***
Distribution: WEST PALAEARCTIC: Europe, Turkey, Near East.
Local distribution fig. 16.2
Material examined. Bekaa: AUB Farm [Haush Sneid], 1.VI.1980, 1♀, leg. Kuri W., coll. AUB; Der El Ahmar, 989 m, 3.VII.2019, 1♀; Hadath, Army Checkpoint, 1610 m, 7.VII.2019, 1♀, all leg. Gekière A., coll. UMONS.
Mount Lebanon: Maaser Al Chouf, 1364 m, 2♂, leg. Boustani M., coll. MBOU; 29.V.2019, Akoura, 1287 m, 30.VI.2019, 1♀, leg. Ghisbain G., coll. UMONS.
N. Lebanon: Donnieh, Wadi Cehennem oberth. Quemmamine, 1393 m, 23.V.2012, 3♀, leg. Kasparek M.; South of Jairoun, 1648 m, 23.V.2012, 1♂, leg. Kasparek M.; Donnieh, Wadi Cehennem, 1600 m, 23.V.2012, 1♀, 1♂, leg. Kasparek M.; Donnieh, Wadi Cehennem, 924 m, 30.V.2012, 1♀, leg. Kasparek M., all coll. OÖLM; Hadath El Jebbe, Al Fouar, 1535 m, 24.V.2017, 1♂, leg. Boustani M., Rasmont P.; Fehta, El Biara, 1662 m, 26.V.2017, 1♂, leg. Boustani M.; Harissa, Al Jawar, 1738 m, 26.V.2017, 1♂, leg. Boustani M.; Horch Ehden, Ain El Bayda, 1691 m, 31.V.2017, 1♀, leg. Boustani M.; Bcharre, Forest of the Cedars of God, 1815 m, 22.VI.2017, 1♀, leg. Boustani M.; Arz Tannourine, 1762 m, 21.V.2018, 1♀, 7♂, leg. Boustani M.; Hadath El Jebbe, Al Fouar, 1553 m, 21.V.2018, 1♂, leg. Boustani M., all coll. MBOU. Additional 32♀ and 33♂ collected between 31.V.2019 and 6.VII.2019 from Bcharre, Arz Tannourine, Arz Bcharre, Fehta, and Hadath El Jebbe.
Flower records. Asteraceae: *Centaurea* cf *pallescens*; Boraginaceae: *Anchusa italica*; Fabaceae: *Ononis natrix*, *Vicia tenuifolia*, *Vicia villosa*; Lamiaceae: *Stachys cretica*.

***Eucera (Rhyteucera) laxiscopa* Alfken, 1935 ***
Distribution: EAST MEDITERRANEAN: Cyprus and East Aegean Islands to Iran and Israel.
Unpublished records. GBIF 2021, SEMC: Mount Lebanon: Salima, 800 m, 29.IV.1996, 1♀, det. Baker D., leg. Roche C.G.
Material examined. Bekaa: AUB Farm [Haush Sneid], 28.III.1961, 1♂, AUB Farm [Haush Sneid], 28.IV.1961, 1♂, all coll. AUB; Qaraoun, 24.III.2013, 1♀, leg. Kasparek M., coll. OÖLM.; Kefraya, Tahet El Ras, 969 m, 9.IV.2019, 1♂, leg. Boustani M., coll. MBOU.
South Lebanon: Saidoun, El Mrouj, 30.IV.2017, 1♀, leg. Baghdadi A., coll. SOILS.

***Eucera* (*Eucera*) *longicornis* (L., 1758) ssp. *atricollis* Friese, 1922 *** (fig. 22.3)
Distribution: PALAEARCTIC: Europe to East Asia
Distribution of *Eucera longicornis atricollis*: EAST MEDITERRANEAN: Near East, Turkey, SE Europe (Risch, pers. comm, 2020).
Material examined. N. Lebanon: Tannourine El Tahta, Wadi Al Fouar, 1187 m, 19.IV.2018, 2♀, leg. Boustani M.; Hadath El Jebbe, Al Fouar, 1535 m, 30.V.2017, 1♂, leg. Boustani M., Rasmont P., all coll. MBOU; Tourzaya [probably referring to Tourza], 19.IV.2018, 1♂, leg. Lahoud V.; Tannourine El Tahta, Wadi Al Fouar, 1187 m, 25.IV.2018, 1♀, leg. Boustani M.; Arz Tannourine, Trail 4, 1781 m, 13.V.2019, 1♀; Hadath El Jebbe, Al Fouar, 1529 m, 31.V.2019, 1♂; 7.VI.2019, 4♀, 6♂, leg. Boustani M., Mouawad G., all coll. MBOU.
Flower records. Boraginaceae: *Solenanthus stamineus*; Fabaceae: *Colutea cilicica*; *Vicia tenuifolia*.

***Eucera* (*Pteneucera*) *nigrifacies* Lepeletier, 1841 ***

Distribution: WEST PALAEARCTIC: North Africa and Spain to Near East and Western Asia.
Local distribution fig. 16.3

Material examined. Mount Lebanon: Chebaniyeh, 24.IV.1975, 1♂., coll. AUB.; Bourj Hammoud, 15.X.2018, 1♂, leg. Alalm, Debedrossian, Sujud, coll. USEK.

N. Lebanon: South of Jairoun, 1648 m, 23.V.2012, 3♂, leg. Kasparek M., coll. OÖLM; Arz Tannourine, 1794 m, 6.V.2017, 1♂, leg. Boustani M.; 1766 m, 6.V.2017, 1♂, leg. Boustani M.; 1794 m, 6.V.2017, 1♂**M**, leg. Boustani M.; 1800 m, 6.V.2017, 1♂, leg. Boustani M.; Tannourine El Tahta, Wadi Ain El Raha, 900 m, 11.V.2017, 1♀, leg. Boustani M.; Arz Tannourine, 1762 m, 21.V.2018, 1♂, leg. Boustani M., all coll. MBOU.; Arz Bcharre, 1975 m, 27.V.2017, 1♀, 1♂, leg. Boustani M., Rasmont P.; 1883 m, 29.VI.2018, 1♀, leg. Boustani M., Jabbour J.; Arz Tannouirne, Trail 4, 1781 m, 3.VI.2019, 1♂; Arz Bcharre, Forest Limit, 1873 m, 2.VII.2019, 2♂, all leg. Boustani M., all coll. MBOU.

Flower records. Asteraceae: *Carduus argentatus*, *Crepis* sp., *Scorzonera* sp.; Boraginaceae: *Solenanthus stamineus*; Ixioliriaceae: *Ixiolirion tataricum*; Geraniaceae: *Geranium* sp.; Papaveraceae: *Glaucium leiocarpum*; Rubiaceae: *Asperula arvensis*.

***Eucera* (*Hetereucera*) *nigripes* Klug, 1845 ***

Distribution: EAST MEDITERRANEAN: Pontic; Near East (Mountains of Turkey, Iran, Azerbaijan, Israel, Lebanon).

Material examined. No Locality, 11.IV.1975, 1♂., coll. AUB.

N. Lebanon: Arz Tannourine, 1766 m, 6.V.2017, 5♂, leg. Boustani M.; Bcharre, Reforestation Area, 1967 m, 12.V.2017, 1♂, leg. Boustani M.; Bcharre, Qornet Es Sawda, 2694 m, 27.VII.2017, 6♀, leg. Boustani M.; Hadath El Jebbe, 1529 m, 31.V.2019, 1♂, leg. Boustani M.; Arz Tannourine, Gate, 1796 m, 29.VI.2019, 2♀, leg. Boustani M., all coll. MBOU.; Jord Tannourine, 2166 m, 30.VI.2019, 1♀, leg. Van Achter X., coll. XVA; Arz Bcharre, Forest Limit, 1873 m, 3.VII.2019, 2♀; Jord Tannourine, 2166 m, 6.VII.2019, 3♀, all leg. Ghisbain G., coll. UMONS.

Flower records. Asteraceae: *Centaurea eryngioides*, *Cousinia libanotica*; Boraginaceae: *Anchusa italica*, *Solenanthus stamineus*; Fabaceae: *Vicia tenuifolia*

***Eucera* (*Agatheucera*) *obsoleta* Pérez, 1911 ***

Distribution: WEST PALAEARCTIC: Near East, Turkey, south-eastern Europe, Italy.

Material examined. Mount Lebanon: Marej Barja, Terbe, 326 m, 17.IV.2017, 1♂, leg. Boustani M., coll. MBOU.

N. Lebanon: Arz Tannourine: Trail 4, 1781 m, 13.V.2019, 1♂, leg. Boustani M., coll. MBOU.

***Eucera* (*Hetereucera*) *palaestinae* Friese, 1922 ***

Distribution: EAST MEDITERRANEAN: Turkey, Iran, Cyprus, Lebanon, Syria, Israel.

Material examined. Mount Lebanon: Falougha, Cedar woods, 1480 m, 27.IV.2019, 1♂, leg. Boustani M., coll. MBOU.

N. Lebanon: Arz Tannourine, 1766 m, 6.V.2017, 3♂, leg. Boustani M.; Hadath El Jebbe, Cedar Forest, 1639 m, 24.V.2017, 1♀, leg. Boustani M., all coll. MBOU.

Flower records. Boraginaceae: *Solenanthus stamineus*; Fabaceae: *Vicia tenuifolia*.

***Eucera* (*Hetereucera*) *parnassia* Pérez, 1902 ***

Distribution: EAST MEDITERRANEAN: SE Europe to Iran and Israel.

Material examined. Mount Lebanon: Barja, 17.IV.1980, 1♀, leg. Zrein S., coll. AUB.

***Eucera (Pteneucera) penicillata* Risch, 1997 *** (fig. 22.4–5)

Distribution: EAST MEDITERRANEAN: Greece, Turkey, Jordan, Syria, Israel. Cyprus.

Material examined. Bekaa: Kefraya, 1009 m, 27.IV.2019, 2♂, leg. Boustani M., coll. MBOU; Aamiq, 985 m, 27.IV.2019, 3♂, leg. Boustani M., coll. MBOU; 1♀, 2♂, leg. Rasmont P., coll. PRAS.

Flower records. Asteraceae: *Onopordum heteracanthum*.

***Eucera (Rhyteucera) pici* Vachal, 1907 ***

Distribution: EAST MEDITERRANEAN: South-eastern Turkey, Syria, Jordan, Israel.

Material examined. S. Lebanon: Saidoun, 15.IV.2018, 1♀; 24.III.2019, 1♂, leg. Baghdadi A., coll. SOILS.
Flower record. Fabaceae: *Trifolium* sp.

***Eucera* (*Synhalonia*) *plumigera* Kohl, 1905 *** (fig. 22.6–23.1)
Distribution: WEST PALAEARCTIC: Near East, Turkey, and south-eastern Europe.
Local distribution fig. 16.4
Material examined. Beirut: American University of Beirut, 4.V.1979, 1♂, leg. Zeina K.; 16.III.0000, 1♂, leg. Samet., all coll. AUB.
Bekaa: Ainata, 1824 m, 30.V.2017, 1♀, leg. Boustani M., Rasmont P., coll. MBOU., Kefraya, 960 m, 27.IV.2019, 1♂, leg. Boustani M., coll. MBOU.; Aamiq, 27.IV.2019, 985 m, 1♂, leg. Rasmont P. coll. PRAS.
Mount Lebanon: Aabey, 21.VII.1975, 1♂; Kfar Selwan, 23.VII.1975, 1♂, all coll. AUB; Marej Barja, Terbe, 326 m, 17.IV.2017, 1♂, leg. Boustani M., coll. MBOU.; Marej Barja, Qaalet Al Besten, 362 m, 26.IV.2019, 2♀, leg. Rasmont P., coll. PRAS.; Maaser Al Chouf, 29.V.2019, 1♂, leg. Boustani M; Horch El Barouk, Shouf Biosphere Reserve, 1614 m, 3.VII.2019, 1♀; 1458 m, 3.VII.2019, 1♀, leg. Van Achter X, coll. XVA.
N. Lebanon: Donnieh, bei Quemmamine, 23.V.2012, 1♂, leg. Kasparek M., coll. OÖLM. Additional 4♂ from 3 records collected between 23.V.2012 and 27.V.2012, from Jairoun, South of Jairoun and Donnieh; Tannourine El Tahta, Wadi Ain El Raha, 900 m, 18.IV.2017, 1♂, leg. Boustani M., coll. MBOU. Additional 7♀ and 28♂ from 24 records, collected between 5.V.2017 and 27.VI.2019, from Tannourine El Tahta, Hadath El Jebbe, Arz Tannourine, Arz Bcharre, and Qanat.
S. Lebanon: Hilaliyah, 8.IV.1975, 1♂., coll. AUB.
Flower records. Asphodelaceae: *Asphodelus microcarpus*; Boraginaceae: *Anchusa italica*, *Anchusa hybrida*, *Echium italicum*; Fabaceae: *Vicia tenuifolia*, *Ononis natrix*; Lamiaceae: *Eremostachys laciniata*, *Phlomis chrysophylla*, *Phlomis viscosa*.

***Eucera* (*Eucera*) *punctulata* Alfken, 1942 ***
Distribution: WEST PALAEARCTIC: Near East, Turkey, and south-eastern Europe.
Material examined. N. Lebanon: Arz Tannourine, 1754 m, 02.IV.2018, 1♂; 1762 m, 14.IV.2018, 2♂; Tannourine El Tahta, Al Mahbase, 893 m, 12.IV.2019, 1♂, all leg. Boustani M., coll. MBOU.
Flower record. Boraginaceae: *Solenanthus stamineus*.

***Eucera* (*Atopeucera*) *spinipes* Risch, 2003 ***
Distribution: EAST MEDITERRANEAN: Turkey, Syria, Lebanon, Jordan, Israel, Iran.
Material examined. Mount Lebanon: Chebaniyeh, 24.IV.1975, 1♂., coll. MBOU.

***Eucera* (*Hetereucera*) *squamosa* Lepeletier, 1841 ***
Distribution: WEST PALAEARCTIC: Near East, Turkey, south-eastern Europe, North Africa.
Material examined. Specimen label unreadable, 1♀, coll. AUB.
Mount Lebanon: Laqlouq, 1752 m, 30.VI.2019, 5♀, leg. Boustani M., coll. MBOU.
N. Lebanon: Arz Tannourine, Gate area, 1754 m, 29.VI.2019, 1♀, 4♂, leg. Ghisbain G.; 6.VII.2019, 2♂, leg. Gekière A., all coll. UMONS.

***Eucera* (*Hetereucera*) *syriaca* Dalla Torre, 1896 ***
Distribution: EAST MEDITERRANEAN: Near East, Cyprus.
Material examined. Mount Lebanon: Hammana, 17.VII.1975, 1♀, coll. AUB.
N. Lebanon: Arz Tannourine, 1762 m, 24.IV.2018, 1♂, leg. Boustani M., coll. MBOU.

***Eucera (Hetereucera) taurica* Morawitz, 1870 ***
Distribution: PALAEARCTIC: Southern Europe, Turkey to Central Asia.
Material examined. Mount Lebanon: Maaser Al Chouf, 1143 m, 29.V.2019, 2♂, leg. Boustani M., coll. MBOU.

***Eucera* (*Rhyteucera*) *vulpes* Brullé, 1832 ***
Distribution: WEST PALAEARCTIC: France and NE-Spain to the Levant.
Unpublished records. GBIF 2021, SEMC: Listed under the synonym *Eucera parvula* Friese, 1896

Mount Lebanon, Brumana, 1.V.1899, 2♀, 1♂, det. Baker D.; 11.V.1953, 2♀, determiner unknown, all leg. Mavromoustakis G.A.; Mount Lebanon, Monteverde, nr. Mansourieh, 350 m, 30.IV.1995, 1♂, det. Baker D.; 5.IV.1996, 3♂, determiner unknown; 1♂, det. Baker D.; 28.IV.1996, 1♀, det. Baker D.; Al Montazah, nr. Mansourieh, 250 m; 30.IV.1996, 1♀, det. Baker D.; 1♀, determiner unknown; all leg. Roche C.G.
Material examined. Locality not precise: AUB Farm (Bekaa) or AUB campus (Beirut), 20.IV.1981, 1♂, leg. Mireille K., coll. AUB.
Bekaa: AUB Farm [Haush Sneid], 26.IV.1961, 1♂, leg. Hajj R., coll. AUB.
Mount Lebanon: Bhamdoun, 28.IV.1975, 1♂., coll. AUB.

***Eucera (Eucera) wattsi* Dorchin, 2019**
Distribution: LEVANT: Lebanon, Israel (Ascher & Pickering 2021).
Dorchin (2019) reports it from Lebanon based on an examined male specimen likely from Monteverde [Mount Lebanon: near Mansourieh, 300 m asl]. Many specimens from the Baker D. collection (SEMC) collected by Roche G.C. come from this locality.
Material examined. Label locality "Ebadyah", could be referring to Mount Lebanon: Aabadiyeh (Aley), 11.IV.1975, 4♂, coll. AUB.
Mount Lebanon: Nahr Al Safa, 8.III.1973, 1♂, coll. AUB.
S. Lebanon: Hilaliyah, 11.IV.1975, 1♂, coll. AUB.

***Eucera (Synhalonia) zeta* Dalla Torre, 1896 ***
Distribution: WEST PALAEARCTIC: East Aegean Islands, Cyprus. Turkey to Central Asia.
Material examined. Bekaa: AUB Farm [Haush Sneid], 22.III.1964, 1♂, leg. Minassian, coll. AUB.

Genus *Tetralonia* Spinola, 1838

Four species.

We consider *Tetraloniella* as a synonym of *Tetralonia* following Dorchin *et al.* (2018), however we retain *Tetralonia* as a separate well-supported genus.

All material examined determined by Risch S.

Bees of the genus are known to be floral specialists (Amiet 2007).

***Tetralonia* (*Tetralonia*) *graja* Eversmann, 1852 ***
Distribution: WEST PALAEARCTIC: Spain to Iran and Israel.
Material examined. N Lebanon: Arz tannourine, 1781 m, 13.VII.2017, 1♂, leg. Boustani M., coll. MBOU.
Flower record. Caprifoliaceae: *Cephalaria setosa*.

***Tetralonia* (*Tetraloniella*) *malvae* Rossi, 1790**
Distribution: PALAEARCTIC: Europe to Central Asia.
Unpublished records. GBIF 2021, SEMC: Mount Lebanon, Chouf, El Barak [El Barouk], 1100 m, 12.VI.1995, 1♂, det. Baker D., leg. Roche C.G.
Literature. The holotype of the synonymised taxon *Eucera crinita* Klug, 1845 labeled "Syria" is found in current Lebanese territory (Baker 1997)
Material examined. Mount Lebanon: Jabal Moussa, Roman ruins (Qornet el Der), 1403 m, 1♀; Jabal Moussa, Trail Qornet El Der, 1368 m, 1♂, leg. Van Achter X, coll. XVA.
N. Lebanon: Donnieh, Nemrud, 245 m, 28.V.2012, **2**♂, leg. Kasparek M., coll. OÖLM; Tannourine, Wadi Al Fouar, 1528 m, 17.VI.2016, 1♀, 3♂, leg. Boustani M.; Harissa, Al Jawar, 1736 m, 23.VI.2018, **1**♂, leg. Boustani M.; Fehta, El Biara, 1662 m, 28.VI.2017, **2**♂, leg. Boustani M.; Harissa, Al Jawar, 1765 m, 28.VI.2017, **1**♂, leg. Boustani M.; Harissa, Al Jawar, 1738 m, 28.VI.2017, **1**♂, leg. Boustani M.; Hadath El Jebbe, Wadi Al Fouar, 1553 m, 8.VI.2018, **1**♂, leg. Boustani M., Fakhry M., Abou Khalil N.; 28.VI.2018, **1**♂, leg. Boustani M., Jabbour J.; Hadath El Jebbe, Al Fouar, 1529 m, 27.VI.2019, 2♂, leg. Boustani M., Mouawad G., Fehta, El Biara, 1664 m, 30.VI.2019, 1♂, leg. Boustani M.; all coll. MBOU.; Qanat, Qornet Dammouaa, 1197 m, 1♀, 2♂, leg. Van Achter X., coll. XVA.
Flower record. Malvaceae: *Alcea apterocarpa*.

***Tetralonia (Glazunovia) nigriceps* Morawitz, 1894 ***
Distribution: WEST PALAEARCTIC: North Africa. East Aegean Islands and Cyprus, Turkey to Central Asia, Israel.
Material examined. Bekaa: Der El Ahmar, 989 m, 3.VII.2019, 1♂, leg. Gekière A.; 995 m, 3.VII.2019, 4♀, leg. Gekière A.; 4♀, 1♂, leg. Ghisbain G., all coll. UMONS; 3♀, leg. Boustani M., coll. MBOU.
Flower records. Asteraceae: *Centaurea* cf *pallescens*, *Onopordum heteracanthum*.

***Tetralonia* (*Tetralonia*) *scabiosae* Mocsáry, 1881 ***
Distribution: WEST PALAEARCTIC: Italy, Eastern Europe to East Mediterranean, southern Russia.
Material examined. Mount Lebanon: Barouk, 1086 m, 12.VIII.2019, 1♀, leg. Boustani M., coll. MBOU.
N. Lebanon: Arz Tannourine, 1800 m, 19.VIII.2006, 2♀, leg. Nemer N., coll. TCFNR; 1748 m, 28.VII.2017, 6♂, leg. Boustani M.; 1798 m, 28.VII.2017, 2♂, leg. Boustani M., coll. MBOU.; Arz Tannourine, Trail 1, 1799 m, 2♂, 27.VII.2018, 2♂, leg. Van Achter X, coll. XVA.
Flower record. Caprifoliaceae: *Cephalaria* cf *joppensis*, *Cephalaria setosa*.

ANTHOPHORINI

Subgeneric classification follows Brooks (1988), and was verified by author Rasmont P. after examining type material. Type localities were added when the subgenus has been updated from the classification of Brooks. The floral preferences of this tribe are little known and require further investigations, especially in their eastern Mediterranean range.

Many specimens of this tribe could not be assigned to a species with a sufficient level of confidence, therefore we only list the taxa that could be confirmed through coloration and morphology and by comparison to type material.

All material examined determined by Rasmont P.

Genus *Amegilla* Friese, 1897

Eight species.

***Amegilla* (*Zebramegilla*) *albigena* (Lepeletier, 1841) *** (fig. 23.3)
Distribution: PALAEARCTIC: Holo-Mediterranean and extending east to Russia (Rasmont 2014a).
Local distribution fig. 16.5
Unpublished records. GBIF 2021, SEMC: Mount Lebanon, Aley, Ain Es Sayde, 15.VIII.1994, 1♂, det. Baker D., leg. Roche C.G.
Material examined. Common and widespread. Specimens with no labels: 1♀, coll. AUB.
Bekaa: Hadath, Army Checkpoint, 1610 m, 7.VII.2019, 1♀, leg. Boustani M., coll. MBOU; Passage Akoura-Hadath, 1820 m, 7.VII.2019, 1♀, leg. Gekière G.; **2 F,** leg. Ghisbain G., coll. UMONS; Anjar, Army Barracks, 967 m, 23.VII.2019, 1♀, leg. Boustani M.; Anjar, Guest House, 973 m, 23.VII.2019, 5♂, leg. Van Achter X.; 1♂, leg. Boustani M., all coll. MBOU.
Mount Lebanon: Falougha, 24.VI.1975, 1♀; Qartaba, Matoube, 1648 m, 23.VII.2017, 2♀, leg. Boustani M., coll. MBOU. Additional 13♀ and 1♂ from 10 records, collected between Mansourieh, Akoura, Shouf Biosphere Reserve, Laqlouq, Jabal Moussa, Kaslik, and Barouk,
N. Lebanon: Qanat, Qornet Dammoua, 1231 m, 31.V.2017, 3♀, leg. Rasmont P., coll. PRAS. Additional 22♀ and 5♂ from 20 records, collected between 14.VII.2017 and 23.VIII.2019, from Fehta, Harissa, Bcharre, Arz Tannourine, Arz Bcharre, and Hadath El Jebbe.
South Lebanon: Saidoun, El Mrouj, 15.VI.2017, 1♀, leg. Baghdadi A., coll. SOILS.
Flower records. Apiaceae: *Eryngium glomeratum*; Asteraceae: *Centaurea pallescens*, *Echinops gaillardotii*, *Echinops viscosus*; Boraginaceae: *Anchusa italica*, *Echium glomeratum*, *Echium italicum*, *Heliotropium* sp.; Fabaceae: *Astragalus cruentiflorus*, *Ononis spinosa*.; Hypericaceae: *Hypericum triquetrifolium*; Lamiaceae: *Lavandula* x *intermedia*, *Origanum ehrenbergii*, *Phlomis brachyodon*, *Phlomis* cf *brachyodon*, *Salvia hierosolymitana*, *Scutellaria brevibracteata*, *Stachys cretica*, *Stachys distans*, *Stachys ehrenbergii*; Ranunculaceae: *Consolida hohenackeri*.

Amegilla albigena afra
= *Anthophora albigena afra* Priesner, 1957
Material examined. N. Lebanon: Arz Bcharre, God Reforestation Area, 2345 m, 29.VI.2018, 2♀, leg. Boustani M., Jabbour J., coll. MBOU.
Flower records. Fabaceae: *Vicia canescens*; Lamiaceae: *Stachys ehrenbergii*.

***Amegilla* (*Micramegilla*) *fasciata* (Fabricius, 1775)**
Distribution: WEST PALAEARCTIC: France, Iberian Peninsula, Greece and North Africa (Rasmont 2014a)
Literature. Mavromoustakis (1963): N. Lebanon, Qadisha, 22.VI.1960, 1♀, leg. & det. Mavromoustakis G.A.

***Amegilla* (*Amegilla*) *garrula* (Rossi, 1790) ***
Distribution: WEST PALAEARCTIC: Southern Europe (Rasmont 2014).
Local distribution fig. 16.6
Unpublished records. GBIF: Ikerd (2019): Brooks R.W., 1988: Beirut, 15 mi E, 6.VIII.1964, det. Brooks R.W., 1988. This record was not found in Brooks (1988).
GBIF 2021, SEMC: Mount Lebanon, Aley, Ain Es Sayde, 15.VIII.1994, 1♂, det. Baker D., leg. Roche C.G.
Material examined. Mount Lebanon: Qartaba, Matoube, 1648 m, 23.VII.2017, 1♂, leg. Boustani M., coll. MBOU; Beit Meri, Deir El Kalaa, St John Baptist, 764 m, 3.VIII.2018, 1♂, leg. Van Achter X.; Mazraat Al Daher, 579 m, 19.VII.2019, 1♀, leg. Van Achter X., all coll. XVA.
S. Lebanon: Saidoun, 24.VI.2018, 1♀, 1♂, leg. Baghdadi A.; Saidoun, 4.VIII.2018, 1♂, leg. Baghdadi A., all coll. SOILS.
Flower records. Lamiaceae: *Lamium* sp., *Lavandula x intermedia*, *Salvia hierosolymitana*, *Stachys* sp.; Verbenaceae: *Lantana camara*.

***Amegilla* (*Micramegilla*) *montivaga* (Fedtschenko, 1875) ***
Distribution: WEST PALAEARCTIC: Scattered records from North Africa (Rasmont 2014a)
Material examined. Mount Lebanon: Barouk, Hayy Mar Geryos, 1121 m, 12.VIII.2019, 1♂, leg. Boustani M., coll. MBOU.
Flower record. Boraginaceae: *Heliotropium* sp.

***Amegilla* (*Amegilla*) *quadrifasciata* (de Villers, 1789) *** (fig. 23.2)
Distribution: WEST PALAEARCTIC: Holo-Mediterranean, and further North in Europe (Rasmont 2014a).
Material examined. Bekaa: AUB Farm [Haush Sneid], 28.VI.1962, 1♀, leg. Ahmadi H., coll. AUB.
Mount Lebanon: Shouf Biosphere Reserve, 1679 m, 2.VII.2019, 1♀, leg. Van Achter X., coll. XVA.
N. Lebanon: Qanat, Qornet Dammoua, 1231 m, 31.V.2017, 1♀, leg. Rasmont P., coll. PRAS; Fehta, El Biara, 1632 m, 18.VIII.2018, 1♀, leg. Boustani M., Jabbour J.; Tannourine Reserve, Trail 4, 1781 m, 27.VII.2019, 1♀, leg. Boustani M., all coll. MBOU.
Flower records. Boraginaceae: *Echium italicum*, Lamiaceae: *Scutellaria brevibracteata*, *Stachys* sp.; Plumbaginaceae: *Plumbago europaea*.
Notes: Grace (2010): Records mentioned from Lebanon in June. No details on locality or year are given.

***Amegilla* (*Zebramegilla*) *salviae* (Morawitz, 1876) ***
Distribution: WEST PALAEARCTIC: Southern Europe, Iberian Peninsula and Egypt (Rasmont 2014a).
Material examined. Mount Lebanon: Kaslik, 154 m, 5.VIII.2019, 1♀, leg. Van Achter X., coll. XVA.
N. Lebanon: Tannourine El Tahta, Mar Boutros, 1155 m, 27.VI.2019, 1♀, leg. Van Achter X., coll. XVA.
Flower records. Boraginaceae: *Heliotropium* sp., Fabaceae: *Ononis natrix*.

***Amegilla* (*Zebramegilla*) *savignyi* (Lepeletier, 1841) ***
Distribution: WEST PALAEARCTIC: Scattered records from North Africa (Rasmont 2014a).
Unpublished records. GBIF 2021, SEMC: Mount Lebanon, Aley, Ain Es Sayde, 15.VIII.1994, 1♂, det. Baker D., leg. Roche C.G.
Literature. Friese (1897): Listed from Syria under *Amegilla (Zebramegilla) magnilabris* (Fedtschenko, 1875),

could be located in current Lebanese territory.
Material examined. N. Lebanon: Tannourine Reserve, Trail 4, 1781 m, 30.VI.2019, 1♀, leg. Boustani M., coll. MBOU; Arz Tannourine, Gate Area, 1797 m, 14.VII.2019, 1♀, leg. Van Achter X., coll. XVA; Hadath El Jebbe, Border of the Cedar Forest, 1646 m, 25.VII.2019, 1♀, leg. Boustani M.; Jord Tannourine, 2034 m, 27.VII.2019, 1♂, leg. Boustani M.; Arz Tannourine, Gate Area, 1796 m, 23.VIII.2019, 2♂, leg. Boustani M., all coll. MBOU.
Flower records. Lamiaceae: *Scutellaria brevibracteata*; Plumbaginaceae: *Plumbago europaea*, Ranunculaceae: *Consolida hohenackeri*.

***Amegilla* (*Micramegilla*) *velocissima* (Fedtschenko, 1875) ***
Distribution: PALAEARCTIC: Scattered records in Russia, Azerbaijan, Italy and Spain (Rasmont 2014a)
Material examined. N. Lebanon: Tannourine El Tahta, Wadi Ain El Raha, 1008 m, 19.VIII.2017, 1♂, leg. Boustani M.
Flower record. Asteraceae: *Carlina curetum* ssp. *orientalis*.

Genus *Anthophora* Latreille, 1803
23 species

***Anthophora* (*Paramegilla*) *harmalae* (Morawitz, 1877)**
Distribution: PALAEARCTIC: Scattered records in Russia, Azerbaijan, Turkey, Lebanon, Cyprus, Algeria (Rasmont 2014b).
Literature. Listed under *Amegilla harmalae* (Morawitz, 1877):
Mavromoustakis (1963): N. Lebanon, Bcharré, 19.VI.1960, 1♀, 1♂**;** Qadisha**,** 21.VI.1960, 2♀**;** Bcharre Forest, 4.VII.1960, 3♀, all leg. & det. Mavromoustakis G.A.

***Anthophora* (*Pyganthophora*) *aestivalis* (Panzer, 1801) *** (fig. 23.4–5)
Distribution: WEST PALAEARCTIC: Southern Europe and scattered in North Africa (Rasmont 2014b).
Local distribution fig. 16.7
GBIF 2021, SEMC: sudl. v. Trip (could be referring to South of Tripoli), III, 1♀, determiner unknown.
Material examined. Common.
Bekaa: AUB Farm [Haush Sneid], 15.IV.1961, 1♀, leg. Hajj R.; AUB Farm [Haush Sneid], 8.V.1964, 1♀, leg. Rashid; AUB Farm [Haush Sneid], 17.V.1964, 1♂, leg. Shaikh; AUB Farm [Haush Sneid], IV.1979, 1♀, leg. Haidar, all coll. AUB; Passage Akoura-Hadath, 1820 m, 7.VII.2019, 2♀, leg. Ghisbain G., coll. UMONS; Passage Akoura-Hadath, 1766 m, 7.VII.2019, 1♀, leg. Van Achter X., coll. XVA.
Mount Lebanon: Shouf Biosphere Reserve, Gate, 1769 m, 16.V.2019, 1♂, leg. Boustani M.; Shouf Biosphere Reserve, Barouk-Maaser dirt road, 1769 m, 16.V.2019, 1♂, leg. Boustani M., coll. MBOU; Shouf Biosphere Reserve, 1912 m, 5.VII.2019, 1♀, leg. Van Achter X., coll. XVA.
N. Lebanon: Donnieh, bei Quemmamine, 1600 m, 23.V.2012, 4♂, leg. Kasparek M., coll. MKAS; Jairoun, 1042 m, 29.V.2012, 1♂, leg. Kasparek M; Horch Ehden, 1567 m, 19.VI.2016, 1♀, leg. Boustani M.; Arz Tannourine, Reserve Outskirts, 1766 m, 6.V.2017, 1♂, leg. Boustani M., all coll. MBOU. Additional 121♀ and 50♂ from 53 records, collected between 12.V.2017 and 12.VII.2019, from Arz Bcharre, Hadath El Jebbeh, Arz Tannourine, Qanat, Horch Ehden, and Bcharre.
Flower records. Asparagaceae: *Bellevalia* cf *trifoliata*, *Bellevalia flexuosa*; Boraginaceae: *Anchusa italica*, *Cynoglossum nebrodense*, *Echium italicum*, *Solenanthus stamineus*; Fabaceae: *Astragalus emarginatus*, *Onobrychis cornuta*, *Ononis natrix*, *Medicago* sp., *Vicia canescens*, *Vicia tenuifolia*, *Vicia villosa*; Lamiaceae: *Nepeta curviflora*, *Phlomis* cf *brachyodon*, *Salvia fruticosa*, *Salvia multicaulis*, *Stachys ehrenbergii*; Papaveraceae: *Glaucium leiocarpum*; Plantaginaceae: *Anarrhinum orientale*.

***Anthophora* (*Lophanthophora*) *affinis* Brullé, 1832 ***
=*Anthophora biciliata* Lepeletier, 1841
=*Anthophora liturata* (Lepeletier, 1841)
Distribution: WEST PALAEARCTIC: Circum-Mediterranean, Russia, Turkey, Caucasus (Rasmont 1995). The

possible presence of the species in Central Asia is unclear.
Note: Brooks (1988) initiated a very confusing situation in mixing this taxon with *Anthophora mucida* Gribodo. These species are nevertheless well distinct. Rasmont (1995) made a complete re-description of both taxa and of the similar *Anthophora agama* Radoszkowski. (Rasmont 2014b)
Material examined. N. Lebanon: Ehden, Ain El Baida, 1626 m, 31.V.2017, 1♂, coll. PRAS; Horch Ehden, Ain El Naasa, 1560 m, 22.V.2019, 1♂, leg. Boustani M.; Arz Bcharre, Forest Limit, 1873 m, 2.VII.2019, 1♀, leg. Boustani M., all coll. MBOU; Arz Bcharre, Forest Limit, 1873 m, 3.VII.2019, 2♀, leg. Boustani M., coll. MBOU; 2♀, leg. Gekière A., coll. UMONS; 4♀, leg. Ghisbain G., coll. UMONS.
Flower record. Fabaceae: *Vicia tenuifolia*.

***Anthophora* (*Lophanthophora*) *agama* Radoszkowski, 1869 ***
Distribution: WEST PALAEARCTIC: Holo-Mediterranean, and further east to Russia (Rasmont 2014b).
Unpublished records. GBIF 2021, SEMC: Mount Lebanon, Deir El Harf, 1100 m, 19.V.1996, 1♀, det. Baker D., leg. Roche C.G.
Literature. Listed under *Anthophora caucasica* Radoskowski, 1874
Friese (1897): Listed from Syria, could be located in current Lebanon, 2♂, det. Friese H., leg. Friese H.
Material examined. Specimens without label, 2♀, 1♂, coll. AUB.
Bekaa: Bawarij, 10.V.1975, 1♀, coll. AUB.
N. Lebanon: Qanat, Qornet Dammouaa, 1242 m, 5.VII.2019, 1♀, leg. Gekière A., coll. UMONS.
Flower record. Boraginaceae: *Echium italicum*.

***Anthophora* (*Lophanthophora*) *bifasciata* Fedtschenko, 1875 ***
Distribution: WEST PALAEARCTIC: Kazakhstan (Rasmont 2014b).
Material examined. BDFGM: Becharré [Bcharre], 20.VI.1931, 1♀, det. Rasmont P., leg. Zerny, coll. NMV.

***Anthophora* (*Lophanthophora*) *canescens* Brullé, 1832 ***
Distribution: WEST PALAEARCTIC: Holo-Mediterranean (Rasmont 2014b).
Unpublished records. GBIF 2021, SEMC: sudl. v. Trip, could be referring to South of Tripoli (N. Lebanon), III, 1♂, det. Baker D.
Material examined. Bekaa: AUB Farm [Haush Sneid], 10.IV.1961, 1♂; 17.IV.1961, 1♂, leg. Nasr H.; 22.V.1961, leg. Ali S.M., all coll. AUB.
Mount Lebanon: Aley, 5.V.1944, 1♀, leg. Talhouk A.S., coll. AUB.
N. Lebanon: Tannourine El Tahta, Wadi Ain El Raha, 900 m, 11.IV.2017, 1♂; Hadath El Jebbe, Road to Wadi Al Fouar, 1553 m, 2.IV.2018, 1♀, all leg. Boustani M., coll. MBOU.
Flower records. Asphodelaceae: *Asphodelus microcarpus*; Fabaceae: *Vicia sericocarpa*.

***Anthophora* (*Heliophila*) *concinna* (Klug, 1845)**
Distribution: EAST MEDITERRANEAN: Turkey, Egypt (Rasmont 2014b).
Literature. The holotype of *Megilla concinna* was described by Klug based on material collected by Ehrenberg and Hemprich in "Syria", which is localised in current Lebanese territory based on the collection dates and the expedition itinerary (Baker 1997).

***Anthophora* (*Anthophora*) *crinipes* Smith, 1854 *** (fig. 23.6–24.1)
Distribution: PALAEARCTIC: Holo-Mediterranean, further north in Europe and east to Kyrgyzstan (Ascher & Pickering 2021).
Local distribution fig. 16.8
Material examined. Bekaa: AUB Farm [Haush Sneid], 1♂, leg. Chaudry AH., coll. AUB.
Mount Lebanon: Ballouneh, 17.IV.2017, 1♂, leg. Mrad L, coll. USEK; Laqlouq, Matoube, 1657 m, 30.IV.2017, 1♂, leg. Boustani M., coll. MBOU; Reserve Naturelle de Bentaël, 340 m, 23.IV.2019, 1♂, leg. Rasmont P., coll. PRAS.
N. Lebanon: Harissa, Chir El Ribez, 1730 m, 11.VI.2017, 1♂, leg. Boustani M., coll. MBOU; Tannourine El Tahta, 942 m, 25.IV.2019, 1♀, 1♂, leg. Rasmont P., coll. PRAS.

Flower records. Boraginaceae: *Anchusa hybrida*; Lamiaceae: *Lamium* sp., *Salvia fruticosa*.

***Anthophora* (*Pyganthophora*) *dalmatica* Pérez, 1902 *** (fig. 24.2)
Distribution: WEST PALAEARCTIC: Scattered records in south eastern Europe (Rasmont 2014b).
Material examined. N. Lebanon: Arz Bcharre, 1975 m, 27.V.2017, 1♂, leg. Rasmont P., coll. PRAS; Arz Bcharre, Forest Limit, 1873 m, 2.VII.2019, 1♀; 3.VII.2019, 1♂, all leg. Boustani M., coll. MBOU.
Flower records. Boraginaceae: *Anchusa italica*; Fabaceae: *Vicia tenuifolia*.

***Anthophora* (*Lophanthophora*) *dispar* Lepeletier, 1841 ***
Distribution: WEST PALAEARCTIC: Holo-Mediterranean (Rasmont 2014b).
Literature. Friese (1897): Mentioned from Syria, the locality could be in current Lebanese territory.
Material examined. Mount Lebanon: Bentaël, 11.III.2016, 1♂, leg. Boustani M., Zgheib Y.
N. Lebanon: Tannourine El Tahta, Wadi Ain El Raha, 900 m, 24.III.2017, 2♂; 940 m, 27.III.2017, 1♂; 11.IV.2017, 1♂; Hadath El Jebbe, Wadi Al Fouar, 1553 m, 2.IV.2018, 1♀; Tannourine El Tahta, Wadi Al Fouar, 1187 m, 7.IV.2018, 2♂; Tannourine El Tahta, Mar Boutrous, 1207 m, 12.IV.2019, 1♂, all leg. Boustani M., all coll. MBOU.
S. Lebanon: Saidoun, Sahlet, 19.III.2017, 1♂, leg. Baghdadi A., coll. SOILS.
Flower records. Asphodelaceae: *Asphodelus microcarpus*; Boraginaceae: *Anchusa hybrida*.

Anthophora* (*Caranthophora*) *dufourii* Lepeletier, 1841
Distribution: WEST PALAEARCTIC: South-eastern Europe, East Mediterranean and further east to Iran (Ascher & Pickering 2021)
Literature. Friese (1897): Mentioned from Syria, the locality could be in current Lebanese territory.
Material examined. N. Lebanon: Harissa, Chir El Ribez, 1730 m, 11.VI.2017, 2♀, leg. Saade N., coll. MBOU.
Flower record. Lamiaceae: *Salvia fruticosa*.

***Anthophora* (*incertae sedis*) *heliopolitensis* Pérez, 1910**
Distribution: LEVANT: Lebanon, Israel (Rasmont 2014b).
Unpublished records. GBIF 2021, SEMC: South Lebanon, Djezin [Jezzine], 1♀, det. Baker D.
Literature. Mavromoustakis (1963): Bekaa, Baalbeck, 29.V.1953 3♀**;** Bcharré, 20.VI.1960, 2♀**;** 22.VI.1960, 1♀, 23.VI.1960, 1♀; all leg. & det. Mavromoustakis G.A.
Notes: Records mentioned by Grace (2010)

***Anthophora* (*Lophanthophora*) *mucida* Gribodo, 1873 *** (fig. 24.3–4)
= *Anthophora biciliata* Lepeletier,1841
Distribution: WEST PALAEARCTIC: Holo-Mediterranean and east to Russia (Rasmont 2014).
Local distribution fig. 16.9
Material examined. Bekaa: Zahle, 6.V.1964, 1♀, leg. Arafat A., coll. AUB.
Mount Lebanon: Laqlouq, Matoube, 1657 m, 30.IV.2017, 1♂, leg. Boustani M., coll. MBOU; Marej Barja, Qaleet Al Besten, 362 m, 26.IV.2019, 1♀, leg. Rasmont P.; Falougha, 1478 m, 27.IV.2019, 1♀, leg. Rasmont P., all coll. PRAS.
N. Lebanon: Harissa, Fehta, 1700 m, 4.V.2017, 1♀, leg. Boustani M.; Hadath El Jebbeh, Al Fouar, 1535 m, 24.V.2017, 1♀, leg. Rasmont P.; Horch Ehden, Ain El Baida, 1626 m, 31.V.2017, 1♂, leg. Rasmont P.; Tannourine El Tahta, Wadi Al Fouar, 1187 m, 7.IV.2018, 2♀, leg. Boustani M.; Arz Bcharre, 1883 m, 18.IV.2018, 1♀, 1♂, leg. Rasmont P.; Horch Ehden, Nabeh Jouit, 1422 m, 24.IV.2019, 1♂, leg. Rasmont P., all coll. PRAS; Tannourine El Tahta, El Masbak, 1110 m, 25.IV.2019, 1♀, 2♂, leg. Boustani M., Rasmont P.; Fehta, El Biara, 1664 m, 11.V.2019, 1♀, leg. Boustani M., all coll. MBOU.
S. Lebanon: Saidoun, Beehives, 18.III.2018, 1♀, leg. Baghdadi A., coll. SOILS.
Flower records. Asparagaceae: *Muscari racemosum*; Boraginaceae: *Anchusa hybrida*; Fabaceae: *Vicia sericocarpa*, *Vicia villosa*; Lamiaceae: *Lamium* sp., *Lamium striatum*, *Phlomis* cf *viscosa*., *Salvia multicaulis*.

***Anthophora* (*Pyganthophora*) *nigriceps* Morawitz, 1886** (fig. 23.5–6)
Distribution: WEST PALAEARCTIC: Scattered records in the Levant, south-eastern Europe and west of the Caspian Sea (Rasmont 2014b).

Local distribution fig. 16.10

Unpublished records. GBIF 2021, SEMC: South Lebanon, Liba'a [Lebaa], 1♂, det. Baker D.

Literature. Mavromoustakis (1963): Mount Lebanon, Falougha, 17.V.1953, 1♀**;** Jebel Knaisse**,** 18.V.1953, 7♀, 1♂, all det. & leg. Mavromoustakis G.A.

Mentioned by Grace (2010) from June without locality details.

Material examined. Abundant and widespread, on the wing from March until June.

Bekaa: Anjar, IV.1979, 1♀, leg. Boghos D; Quaraoun, 792 m, 24.III.2013, 1♂, leg. Kasparek M., coll. MKAS; Kefraya (West Bekaa), 1107 m, 27.IV.2019, 1♀, leg. Rasmont P., coll. PRAS.

Mount Lebanon: Shouf Biosphere Reserve, Barouk-Maaser dirt road, 1769 m, 16.V.2019, 1♀, leg. Boustani M., coll. MBOU.

N. Lebanon: Donnieh, 2142 m, 23.V.2012, 1♀, leg. Kasparek M.; Donnieh, Jairoun/Kfar Bebnine Forest, 1637 m, 26.V.2012, 1♀, leg. Kasparek M., coll. MKAS; Tannourine El Tahta, Ain El Raha, 900 m, 27.III.2017, 2♂, leg. Boustani M.; Chatine, Bifurcation de Balaa, 1440 m, 18.IV.2017, 1♀, leg. Boustani M., all coll. MBOU. Additional 86♀ and 20♂ from 43 records collected between 2.V.2017 and 30.VI.2019, from Horch Ehden, Fehta, Arz Tannourine, Hadath El Jebbeh, Tannourine El Tahta, Arz Bcharre, and Jord Tannourine.

S. Lebanon: Saidoun, South of Beehives, 25.III.2018, 1♀, leg. Baghdadi A., coll. SOILS.

Flower records. Asparagaceae: *Bellevalia flexuosa*, *Bellevalia* sp., *Bellevalia nivalis*, *Muscari racemosum*; Asphodelaceae: *Asphodeline lutea*; Boraginaceae: *Anchusa hybrida*, *Solenanthus stamineus*; Brassicaceae: *Thlaspi* sp.; Fabaceae: *Astragalus emarginatus*, *Onobrychis cornuta*, *Trifolium purpureum*, *Trifolium tomentosum*, *Vicia sericocarpa*, *Vicia villosa*; Lamiaceae: *Nepeta curviflora*, *Salvia multicaulis*.

***Anthophora* (*Pyganthophora*) *orientalis* Morawitz, 1877 *** (fig. 25.1–2)

Distribution: PALAEARCTIC: Northern Mediterranean and Russia (Rasmont 2014b).

Material examined. Bekaa: West Bekaa, Kefraya, 1107 m, 27.IV.2019, 1♀, leg. Rasmont P.

N. Lebanon: Tannourine El Tahta, El Masbak, 1112 m, 25.IV.2019, 1♂; Tannourine El Tahta, Mar Boutros, 1181 m, 25.IV.2019, 3♂, leg. Rasmont P.

Flower records. Asparagaceae: *Bellevalia nivalis*; Boraginaceae: *Anchusa hybrida*.

***Anthophora* (*Pyganthophora*) *pedata* Eversmann, 1852 *** (fig. 25.3)

Distribution: WEST PALAEARCTIC: Scattered in south eastern Europe (Rasmont 2014b).

Material examined. N. Lebanon: Bcharre, Dahr El Adib, 2585 m, 1♂; Jord Tannourine, 2469 m, 28.V.2017, 2♂; Tannourine, Jabal Al Mnaitra, 2455 m, 28.V.2017, 2♂; 2471 m, 1♂; Bcharre, Dahr El Adib, 2407 m, 8.VI.2017, 1♂; Arz Bcharre, 1883 m, 18.IV.2018, 1♂, all leg. Rasmont P., coll. PRAS; Jord Tannourine, 2296 m, 30.VI.2019, 1♀, leg. Ghisbain G., coll. UMONS.

Flower records. Fabaceae: *Astragalus angustifolius*, *Astragalus coluteoides*, *Onobrychis cornuta*, Lamiaceae: *Lamium striatum*.

***Anthophora* (*Melea*) *plagiata* (Illiger, 1806) ***

Distribution: PALAEARCTIC: North Mediterranean and further north in Europe, Russia, and Algeria (Rasmont 2014b).

Material examined. BDFGM: Material Examined from Lebanon (no locality added on the label), 1900, 1♂, leg. Schmiedeknecht O., coll. OÖLM.

***Anthophora* (*Anthophora*) *plumipes* (Pallas, 1772) *** (fig. 25.4–5)

Distribution: PALAEARCTIC: Mediterranean basin, Europe and Russia (Rasmont 2014b).

Local distribution fig. 16.11

Unpublished records. GBIF 2021, SEMC:

Listed under "*Anthophora (Anthophora) plumipes palestinensis*"

Mount Lebanon, Monteverde, nr Mansourieh, 350 m; 18.II.1996, sex and determiner unknown; 22.II.1996, 1 specimen, sex unknown, det. Baker D.; 1 specimen, sex and determiner unknown, 18.III.1996, 1♀, det. Baker D.; all leg. Roche C.G.

Material examined. Common and widespread.

Specimen without label, 7♀, 1♂**.**, coll. AUB.

Beirut: AUB Campus, 18.IV.1980, 1♂, leg. Kwaybah N.; AUB Campus, 4.III.2008, 1♂; AUB Campus, 25.III.2008, 1♂, leg. KB/RB., all coll. AUB.

Bekaa: AUB Farm [Haush Sneid], 19.III, 1♀; Anjar, 28.VI.1962, 1♀; AUB Farm [Haush Sneid], 27.III.1964, 1♀, leg. Minassian; Ras Baalbeck, 5.V.2018, 1♀, leg. Harran E., all coll. AUB.

Mount Lebanon: Bhamdoun, 30.IV.1981, 1♀, leg. Rawi, coll. AUB; Bentaël, 11.III.2016, 2♂, leg. Boustani M. Zgheib Y; Marej Barja, Daher, 350 m, 7.III.2017, 1♀, leg. Boustani M., all coll. MBOU. Additional 6♀ and 5♂ from 9 records collected between 12.IV.2017 and 16.V.2019, from Wadi Chahine, Faytroun, Laqlouq, Mradiyeh, Ain Saadeh, Marej Barja, Bentaël, Jbeil, and Shouf Biosphere Reserve.

N. Lebanon: Arz Tannourine, 1800 m, 22.V.2009, 1♀, leg. Nemer N., coll. TCFNR; Donnieh, Jairoun/Kfar Bebnine Forest, 1637 m, 26.V.2012, 1♀, leg. Kasparek M.; Jairoun, 1042 m, 29.V.2012, 1♀, leg. Kasparek M., all coll. MKAS; Tannourine El Tahta, Ain El Raha, 900 m, 24.III.2017, 2♂, leg. Boustani M.; 1♀, leg. Harb M, all leg. MBOU; Additional 82♀ and 46♂ from 50 records, collected between 27.III.2017 and 22.V.2019, from Tannourine El Tahta, Arz Tannourine, Horch Ehden, Fehta, Hadath El Jebbe, Harissa, Jord Tannourine, and Arz Bcharre.

S. Lebanon: Saida, 2.III.1980, 1♀, leg. Bana T.; Hilaliyah, 4.VIII.1995, 1♀; Hilaliyah, 22.VIII.1995, 1♀, all coll. AUB; Saidoun, El Mrouj, 26.III.2017, 1♂, leg. Baghdadi A., coll. SOILS. Additional 2♀ and 2♂ from 4 records collected between 13.V.2017 and 24.III.2019, all from Saidoun, coll. SOILS.

Flower records. Asphodelaceae: *Asphodeline brevicaulis*; Asteraceae: *Carduus argentatus*; Boraginaceae: *Anchusa hybrida*, *Solenanthus stamineus*; Brassicaceae: *Rapistrum rugosum*; Caryophyllaceae: *Silene* sp.; Fabaceae: *Astragalus* sp., *Lotus gebelia libanoticus*, *Trifolium clypeatum*, *Trifolium* sp., *Vicia sericocarpa*, *Vicia tenuifolia*, *Vicia villosa*; Lamiaceae: *Lamium* sp., *Lamium striatum*, *Nepeta* sp., *Salvia hierosolymitana*, *Salvia multicaulis*; Ranuncuaceae: *Delphinium ithaburense*; Scrophulariaceae: *Verbascum* sp.

***Anthophora* (*Paramegilla*) *ponomarevae* Brooks, 1988 ***

Distribution: WEST PALAEARCTIC: Ukraine, Israel (Rasmont 2014b).

Material examined. Bekaa: Passage Akoura-Hadath, 1820 m, 7.VII.2019, 1♀, leg. Boustani M., coll. MBOU; 1♀, leg. Gekière A., coll. UMONS; 1♀, leg. Ghisbain G., coll. UMONS.

Flower records. Fabaceae: *Astragalus cruentiflorus*; Lamiaceae: *Teucrium orientale*.

***Anthophora* (*Lophanthophora*) *robusta* (Klug, 1845)**

Distribution: PALAEARCTIC: Southern Europe, scattered in North Africa, Russia (Rasmont 2014b).

Local distribution fig. 16.12

Material examined. Bekaa: AUB Farm [Haush Sneid], 3.IV.1962, 1♀, leg. Mirah; 13.IV.1962, 1♂, det. Shaikh; 12.V.1962, 1♀, leg. Mirah; 26.V.1962, 1♀, 1♂, leg. Chaudry A.H., all coll. AUB; Passage Bcharré-Ainata, 1982 m, 3.VII.2019, 1♀, leg. Boustani M., coll. MBOU; Passage Akoura-Hadath, 1820 m, 7.VII.2019, 1♀, leg. Ghisbain G., coll. UMONS.

Mount Lebanon: Shouf Biosphere Reserve, 1679 m, 2.VII.2019, 2♀, 1♂**;** 1614 m, 3.VII.2019, 2♀**;** 1679 m, 3.VII.2019, 3♀; 1912 m, 5.VII.2019, 1♀, all leg. Van Achter X., all coll. XVA.

N. Lebanon: Cedern b. Bécharré [Arz Bcharre], 1900 m, 30.VI.1931, 1♂, leg. Zerny, coll. NMV; Arz Tannourine, 1784 m, 18.VI.2016, 1♀, leg. Boustani M.; Bcharre Jord, 2723 m, 24.VI.2016, 1♀, leg. Boustani M.; Harissa, Chir Al Ribez, 1730 m, 3.VI.2017, 1♂; 11.VI.2017, 1♀, leg. Saade N., all coll. MBOU; Arz Tannourine, Gate Area, 1754 m, 23.VI.2018, 1♂, leg. Boustani M.; Arz Tannourine, Trail 4, 1762 m, 5.VII.2018, 1♀, leg. Boustani M.; Bcharre, Army Checkpoint, 2023 m, 2.VII.2019, 2♀, leg. Boustani M., coll. MBOU; 1♀, leg. Ghisbain G.; Arz Bcharre, Forest Limit, 3.VII.2019, 1873 m, 2♀, 3♂, leg. Ghisbain G., all coll. UMONS.

Flower records. Boraginaceae: *Anchusa italica*; Caprifoliaceae: *Centranthus* sp.; Fabaceae: *Vicia tenuifolia*; Lamiaceae: *Nepeta curviflora*, *Nepeta* sp., *Phlomis* cf *brachyodon*, *Stachys* sp.; Ranunculaceae: *Delphinium ithaburense*.

***Anthophora* (*Lophanthophora*) *robusta* (Klug, 1845) *ssp. caliginosa* Klug, 1845**

Literature. The holotype of *Megilla caliginosa* was described by Klug based on material collected by Ehrenberg and Hemprich in "Syria", which is localised in current Lebanese territory based on the collection dates and the expedition itinerary (Baker 1997).

Friese (1897): Mentioned from Syria, the locality could be in current Lebanese territory.

Material examined. Bekaa: Passage Bcharré-Ainata,1982 m, 3.VII.2019, 1♀, leg. Ghisbain G., coll. UMONS. Mount Lebanon: Shouf Biosphere Reserve, 1679 m, 2.VII.2019, 1♀, leg. Van Achter X., coll. XVA.

N. Lebanon: Jord Tannourine, 2231 m, 30.VI.2019, 1♀, leg. Ghisbain G.; Arz Bcharre, Forest Limit, 1873 m, 3.VII.2019, 2♀, leg. Ghisbain G., all coll. UMONS.

Flower records. Fabaceae: *Vicia tenuifolia*; Lamiaceae: *Stachys* sp.

***Anthophora* (*Pyganthophora*) *rogenhoferi* Morawitz, 1872** (fig. 25.6)

Distribution: WEST PALAEARCTIC: Levant, Greece, Italy (Rasmont 2014b).

Local distribution fig. 17.1

Unpublished records. GBIF 2021, SEMC: Bekaa (labelled Mt. Lebanon), Hazerta, 1400 m, 6.V.1996, 1♀, det. Baker D., leg. Roche C.G.

Literature. Mavromoustakis (1963): Mount Lebanon, Jebel Knaisse, 18.V.1953, 2♂, leg. & det. Mavromoustakis G.A.

Material examined. Specimens without labels, 1♀, 1♂, coll. AUB.

Bekaa: AUB Farm [Haush Sneid], 1964, 1♂, leg. Mechoui A, coll. AUB; Aamiq (West Bekaa), 985 m, 27.IV.2019, 1♀, leg. Boustani M., coll. MBOU.

N. Lebanon: Fehta, 1700 m, 4.V.2017, 1♂, leg. Boustani M.; Fehta, El Biara, 1664 m, 11.V.2019, 1♂, leg. Boustani M., all coll. MBOU.

Flower records. Fabaceae: *Trifolium repens*; Lamiaceae: *Salvia multicaulis*.

***Anthophora* (*Paramegilla*) *sagemehli* Morawitz, 1883 ***

Distribution: PALAEARCTIC: Iran, Azerbaijan, Russia (Rasmont 2014b).

Unpublished records. GBIF 2021, SEMC: Mount Lebanon, Deir El Harf, 1100 m, 1♀, det. Baker D., leg. Roche C.G.

Material examined. N. Lebanon: Bcharre, Plateau Qornet Es Sawda, 2882 m, 12.VII.2018, 2♀, leg. Boustani M., Jabbour J., coll. MBOU; Arz Bcharre, Forest Limit, 1873 m, 3.VII.2019, 2♀, leg. Ghisbain G., coll. UMONS.

Flower records. Fabaceae: *Astragalus cruentiflorus*, *Vicia tenuifolia*.

***Anthophora* (*Paramegilla*) *socia* (Klug, 1845)**

Distribution: WEST PALAEARCTIC: Greece, Syria (Rasmont 2014).

Literature. Holotype labelled "Syria" (Westrich 1999), and can be traced back to current Lebanese territory (Baker 1997) as the material is part of the material examined by Klug (1845).

Genus *Habropoda* Smith, 1854

Three species.

***Habropoda (Habropoda) hakkariensis* Schwarz & Gusenleitner, 2001 *** (fig. 26.1–2)

Distribution: EAST MEDITERRANEAN: Turkey (Rasmont 2014c).

Material examined. N. Lebanon: Hadath El Jebbeh, Al Fouar, 1535 m, 24.V.2017, 1♀, 2♂, leg. Boustani M., Rasmont P., coll. PRAS; Arz Tannourine, Trail 3, 1790 m, 25.V.2017, 1♀, 3♂, leg. Boustani M.; Arz Tannourine, Ourskirts, 1769 m, 26.V.2017, 3♂, leg. Boustani M., all coll. MBOU; Hadath El Jebbeh, Al Fouar, 1535 m, 30.V.2017, 2♀, 10♂, leg. Boustani M., Rasmont P.; Horch Ehden, Ain El Baida, 1626 m, 31.V.2017, 2♂, leg. Rasmont P., coll. PRAS; Hadath El Jebbe, Al Fouar, 1529 m, 31.V.2019, 2♂, leg. Boustani M.; Hadath El Jebbe, Al Fouar, 1529 m, 7.VI.2019, 1♀, 9♂, leg. Boustani M., Mouawad G.; Arz Tannourine, Gate area, 1754 m, 7.VI.2019, 1♀, 1♂, leg. Boustani M., Mouawad G.; Hadath El Jebbe, 1704 m, 7.VI.2019, 1♀, leg. Boustani M., Mouawad G., all coll. MBOU; Arz Tannourine, Gate area, 1754 m, 29.VI.2019, 1♂, leg. Ghisbain G., coll. UMONS.

S. Lebanon: Hilaliyah, 6.IV.1975, 1♀, coll. AUB.

Flower records. Fabaceae: *Vicia tenuifolia*; Caprifoliaceae: *Lonicera nummulariifolia*; Lamiaceae: *Stachys cretica*.

***Habropoda (Habropoda) tarsata* (Spinola, 1838) *** (fig. 26.3–4)
Distribution: PALAEARCTIC: Northern Mediterranean, Levant and Russia (Rasmont 2014c).
Local distribution fig. 17.2
Material examined. Specimens without label, 1♀, 2♂, coll. AUB.
Beirut: AUB Campus, 10.III.1981, 1♂, leg. Dadnr M., coll. AUB.
Mount Lebanon: Bikfayya, 9.VI.1975, 1♂, Rouset El Ballout [Rouaysset El Ballout], 2.VII.1975, 1♂; Ehmej, 14.II.2018, 1♂, leg. Attieh P., all coll. AUB; Wadi Chahrour, 30.V.2017, 1♀, leg. Nemer N., coll. TCFNR.
N. Lebanon: Tannourine El Tahta, Wadi Ain Al Raha, 1406 m, 28.IV.2017, 1♂, leg. Boustani M., coll. MBOU. Additional 7♀ and 14♂ from 11 records, collected between 28.IV.2017 and 22.V.2019, from Tannourine El Tahta, Horch Ehden, and Hadath El Jebbeh.
S. Lebanon: Hilaliyah, 11.XI.1975, 2♀; 6.IV.1975, 2♂**;** Kfar Silwan, 23.VII.1975, 1♀, all coll. AUB.
Flower records. Asphodelaceae: *Asphodelus microcarpus*, *Asphodelus* sp.; Boraginaceae: *Anchusa hybrida*, *Solenanthus stamineus*; Fabaceae: *Coronilla emeroides*, *Lathyrus inermis*, *Vicia villosa*.

***Habropoda (Habropoda) zonatula* Smith, 1854 *** (fig. 26.5–6)
Distribution: WEST PALAEARCTIC: Northern and eastern Mediterranean and east to Azerbaijan (Rasmont 2014c).
Material examined. N. Lebanon: Hadath El Jebbeh, Al Fouar, 1535 m, 24.V.2017, 2♂, leg. Boustani M. Rasmont P.; Hadath El Jebbeh, Al Fouar, 1656 m, 24.V.2017, 3♀, leg. Rasmont P., all coll. PRAS; Harissa, Jabal El Jouar, 1738 m, 26.V.2017, 1♀, leg. Boustani M., coll. MBOU; Hadath El Jebbeh, Al Fouar, 1656 m, 29.V.2017, 2♀, leg. Rasmont P., coll. PRAS; Hadath El Jebbeh, Border of the Cedar Forest, 1646 m, 31.V.2019, 1♀, leg. Boustani M.; Arz Bcharre, Forest Limit, 1873 m, 5.VI.2019, 1♂, leg. Boustani M.; Arz Tannourine, Gate area, 1754 m, 7.VII.2019, 1♂, leg. Boustani M., Mouawad G., all coll. MBOU.
Flower records. Fabaceae: *Vicia tenuifolia*.

MELECTINI

Genus *Melecta* Latreille, 1802
Seven species.

***Melecta* (*Melecta*) *aegyptiaca* Radoszkowski, 1876**
Distribution: WEST PALAEARCTIC: Scattered records around the Mediterranean basin (Rasmont 2016).
Literature. Lieftinck (1980): Mentioned from Beirut, 1924, det. Friese H., leg. Friese H.

***Melecta* (*Melecta*) *albifrons* (Forster, 1771)**
Distribution: WEST PALAEARCTIC (Rasmont 2016).
Literature. Lieftinck (1980):
Mount Hermon, 1900 m, 9.VI.1975, 1♀, det. Lieftinck M.A., leg. Kaplan M.
Mount Hermon, 1900 m, 27.VII.1971, 1♀, det. Lieftinck M.A., leg. Bytinski-Salz H.

***Melecta* (*Melecta*) *albifrons* (Forster, 1771) ssp. *albovaria* (Erikson, 1840)**
Literature. Lieftinck (1980): Bechara [Bcharre], 1900 m, 1♂, det. Lieftinck M.A., leg. Zerny; and one♀ reported from "Syria".

***Melecta* (*Melecta*) *fulgida* Lieftinck, 1980**
Distribution: WEST PALAEARCTIC (Rasmont 2016).
Literature. Lieftinck (1980): Syria, Beyruth [Beirut] located in current Lebanese territory, no date, 1♂, det. Lieftinck M.A., leg. Staudinger.

***Melecta* (*Melecta*) *guichardi* Lieftinck, 1980**
Distribution: WEST PALAEARCTIC: Scattered records in northern and eastern Mediterranean, Spain and Caucasus (Rasmont 2016).

Literature. Lieftinck (1980): Beirut, 1900, 2♀, leg. Staudinger.

***Melecta* (*Eupavlovskia*) *obscura* Friese, 1895 *** (fig. 27.1)
Distribution: WEST PALAEARCTIC: South-eastern Europe and Caucasus (Rasmont 2016).
***Melecta* (*Eupavlovskia*) *obscura* Friese, 1895 ssp. *simulatrix* (Lieftinck, 1969)**
Material examined. N. Lebanon: Hadath El Jebbeh, Al Fouar, 1535 m, 24.V.2017, 1♂, Rasmont P., Boustani M.; 30.V.2017, 3♂, leg. Boustani M., Rasmont P. all coll. PRAS; 1529 m, 7.VI.2019, 3♀, leg. Boustani M., Mouawad G., coll. MBOU.
Flower record. Fabaceae: *Vicia tenuifolia.*

***Melecta* (*Melecta*) *transcaspica* Morawitz, 1895**
Distribution: WEST PALAEARCTIC: North-eastern Mediterranean to the Caspian Sea East (Rasmont 2016).
Unpublished records. GBIF 2021, SEMC: Mount Lebanon, Deir el Harf, 1100 m, 1♀, 1♂, det. Baker D., leg. Roche C.G.
Literature. Lieftinck (1980): [N. Lebanon]: Nd. Liban., Cedern b. Becharré, 1900 m, 6.VI.1931, 1♂, det. Lieftinck M.A., leg. Zerny H.; Nr. Cedars Hotel, 6400 ft., 15.VI.1944, 1♂, det. Lieftinck M.A., leg. Cott H.B.

***Melecta* (*Melecta*) *tuberculata* Lieftinck, 1980**
Distribution: WEST PALAEARCTIC: Scattered records in Southern Europe and eastern Mediterranean (Rasmont 2016).
Literature. Lieftinck (1980): Labelled Syria, Beirut/12, located in current Lebanese territory, no date, 1♂, det. Lieftinck M.A., leg. Stoll, additional notes: "M. aegyptiaca, det.?" (MNB).

Genus Thyreus Panzer, 1806

Two species.

***Thyreus (Thyreus) histrionicus* (Illiger, 1806)**
Distribution: WEST PALAEARCTIC: Southern Europe and Mediterranean basin (Rasmont 2014d).
Literature. Lieftinck (1968): Beirut, IV.1919, 1♀, det. Lieftinck M.A., leg. Sewell E.S.
N. Lebanon, Bcharré, 4.VII.1931, 1♂, det. Lieftinck M.A., leg. Zerny H.
Bekaa, Akbé [Aaqbeh], VIII.1890, 1♀, det. Lieftinck M.A., leg. Delagrange.

***Thyreus (Thyreus) ramosus* (Lepeletier, 1841)**
Distribution: PALAEARCTIC: Southern Europe and Mediterranean basin and further east to Russia (Rasmont 2014d).
Unpublished records. GBIF 2021, SEMC: Bekaa, Deri Mar Maroun, 700 m, 9.V.1996, 1♂**;** det. Baker D., leg. Roche C.G.
Literature. Lieftinck (1968): Beirut, 1967, 2♀, det. Lieftinck M.A.

BOMBINI

Genus *Bombus* Latreille, 1802

Four species.

All Material examined determined by Rasmont P.

The wide range of floral preferences observed by Boustani *et al*. 2020, are reported here again with the addition of recent observations. Workers are referred to as "W".

***Bombus (Megabombus) argillaceus* (Scopoli, 1763)** (fig. 27.2)
Distribution: PALAEARCTIC: Eastern Mediterranean distribution, stretching north to Czech Republic (Rasmont & Iserbyt 2010–2014) east to Russia, and south to Israel (Ascher & Pickering 2021).

Widespread in Lebanon from sea level to 2500 m of altitude and found in a wide range of habitats (Boustani *et al.* 2020). Local distribution fig. 17.3

Unpublished records. BDFGM: 1938, sex unknown, Reinig WF; Bcharre, VI.1977, 1♀, det. Campo & Rasmont, KLZR, coll. OOLL (mentioned in Boustani *et al.* 2020).

Material examined. Mount Lebanon: Dahr Al Baydar, 17.VII.1973, 1 W, Sawfar, 1973, 1W, Bhamdoun, 28.IV.1975, 1♀, all coll. AUB; Arsoun, 2.V.2016, 1♀, leg. Boustani M., Kyrk S; Aintoura, Bkerki Valley, 8.V.2017, 1♀, leg. Nemeth T., all coll. MBOU. Additional 5W and 9♂ from 6 records collected between 14.VI.2017, and 15.VIII.2019, from Baskinta, Qornayel, Akoura, Mazraat Al Daher, Souk El Ghareb, and Maaser Al Chouf.

N. Lebanon: Horch Ehden, 1567 m, 19.VI.2016, 1♀, leg. Boustani M.; Arz Bcharre, 1928 m, 20.VI.2016, 1♀, leg. Boustani M., all coll. MBOU. Additional 10♀, 37W, and 12♂ from 36 records, collected between 2.V.2017 and 31.VII.2019, from Horch Ehden, Hadath El Jebbeh, Harissa, Horch Ehden, Arz Bcharre, Arz Tannourine, Horch Ehden, Bcharre, and Qanat.

S. Lebanon: Hilaliyah, 6.IV.1975, 1♀; Nahr Al Zahrani, 8.VI.1985, 1W, leg. Usayran W., all coll. AUB.

Flower records. Asteraceae: *Centaurea solstitialis*; Caprifoliaceae: *Cephalaria setosa* Caryophyllaceae: *Dianthus strictus*; Fabaceae: *Ononis natrix*, *Phlomis chrysophylla*, *Vicia canescens*, *Vicia tenuifolia*, *Vicia villosa*; Lamiaceae: *Marrubium libanoticum*, *Salvia microstegia*, *Scutellaria brevibracteata*, *Stachys ehrenbergii*; Plantaginaceae: *Linaria aucheri*; Ranunculaceae: *Delphinium ithaburense*.

***Bombus (Subterraneobombus) melanurus* (Lepeletier, 1836)** (fig. 28.2)

Distribution: PALAEARCTIC: Central Asia, reaching the Caucasus and eastern Turkey to the west (Rasmont *et al.* 2015).

Also restricted to altitudes above 1800 m in Lebanon (Boustani *et al.* 2020). Local distribution fig. 17.4

Literature mentioned in Boustani *et al.* (2020) from BDFGM: Qadisha, 1200 m, no date, 1♀, det. Williams P.H., leg. Higgins L.G., coll. BMNH; Arz Lubnan [Arz Bcharre], 1900 m, 5.VI.1931, 1♀, det. Williams P.H., leg. Zerny, coll. BMNH.

Material examined. N. Lebanon: Bcharre, Dahr El Adib, 2611 m, 20.VI.2016, 1W, leg. Boustani M.; Jord Bcharre, 2723 m, 24.VI.2016, 2♀, leg. Boustani M., all coll. MBOU. Additional 2♀, 18W, and 55♂, from 24 records, collected between 23.V.2017 and 20.VIII.2019, from Bcharre, Arz Bcharre, and Jord Tannourine.

Flower records. Asteraceae: *Cirsium lappaceum*, *Cousinia libanotica*; Boraginaceae: *Anchusa strigosa*; Fabaceae: *Vicia canescens*, *Vicia tenuifolia*; Lamiaceae: *Stachys ehrenbergii*; Papaveraceae: *Glaucium leiocarpum*.

***Bombus (Sibiricobombus) niveatus* (Kriechbaumer, 1870) ssp. *vorticosus* (Gerstäcker, 1872)** (fig. 28.1)

Distribution: PALAEARCTIC: Centred on the Aegean Sea, reaching the eastern part of European Russia to the north, Iran to the east, and Israel to the south (Rasmont *et al.* 2015).

Currently seems restricted to altitudes above 1800 m, despite older records from lower altitude areas (Boustani *et al.* 2020). Local distribution fig. 17.5

Literature records mentioned in Boustani *et al.* (2020), from BDFGM: 1 specimen, sex unspecified, 1870; Cedern b. Bisharri [Arz Bcharre], 12.VI.1931, 2 specimens, sex unspecified, Zerny H.; Locality not found "Barnasa, Duhor", 17.V.1936, 2♀**;** 22.V.1936, 2♀, det. Arnoldi, coll. MZNSP; Bekaa, 1990, 2 specimens, sex unspecified; Mount Hermon, 2010, 1♂**.**

Material examined. Mount Lebanon: Qartaba, Matoube, 1648 m, 23.VII.2017, 1W, leg. Boustani M.

N. Lebanon: Horch Ehden, VI.2014, 1W, leg. Boustani C., Boustani M., Bcharre, Dahr El Adib, 2611 m, 20.VI.2016, 1♀, leg. Boustani M., coll. MBOU. Additional 23♀, 97W, and 76♂ from 52 records, collected between 8.VI.2017 and 20.VIII.2019, from Bcharre, Arz Bcharre, and Jord Tannourine.

Flower records. Asteraceae*:* *Centaurea pallescens*, *Cirsium lappaceum*, *Cousinia libanotica*; Fabaceae: *Astragalus angustifolius*, *Astragalus cruentiflorus*, *Vicia canescens*, *Vicia tenuifolia*; Lamiaceae: *Stachys cretica*, *Stachys ehrenbergii*.

***Bombus (Bombus) terrestris* (L., 1758) ssp. *calabricus* Krüger, 1958** (fig. 27.3–4)

Distribution of *B. terrestris*: PALAEARCTIC: Centered on the Mediterranean (except Egypt) stretching north to Stockholm and east to Altai (Rasmont *et al.* 2008, 2015; Rasmont & Iserbyt 2010–2014).

Widespread in Lebanon on the entire altitude range, missing information from Southern parts of Lebanon (Boustani *et al.* 2020). Local distribution fig. 17.6

Material examined. Abundant and widespread.

Bekaa: Bawarij, 10.V.1975, 1W, coll. AUB; Ammiq, 973 m, 17.VIII.2017, 1♂, leg. Yammine W; Ammiq, 973 m, 5.IX.2017, 3W, leg. Yammine W., all coll. Yammine W.; Kefraya, 1101 m, 27.IV.2019, 2♀, leg. Boustani M., coll. MBOU.

Mount Lebanon: Sawfar, 21.VI.1973, 2W; Falougha, 24.VI.1975, 2W; Aley, 25.VIII.1975, 1♂, all coll. AUB; Maameltein, Ras Al Maameltein, 21.III.1981, 1♀, leg. Shwayri; Hboub, 2.XII.2013, 1♀, leg. Makdissi R., all coll. USEK. Additional 2♀, 14W, and 8♂ from 14 records, collected between 3.XII.2014 and 7.VIII.2019, from Halate, Arsoun, Fatri, Baskinta, Beit Chabab, Qartaba, Jounieh, Qornayel, Jabal Moussa Biosphere Reserve, Mansourieh, Mazraat Al Daher, and Barouk.

N. Lebanon: Donnieh, 1200 m, 20.VI.2011, 7W, 1♀**;** Donnieh, Wadi Cehennem oberth. Quemmamine, 1393 m, 23.V.2012, 4W, 1♂**;** Donnieh, Nemrud-See, 245 m, 28.V.2012, 1♂**;** Jairoun, 1042 m, 29.V.2012, 6W; Jairoun, 29.V.2012, 1W, all leg. Kasparek M, coll. MKAS.; Horch Ehden, V.2014, 1W**;** Horch Ehden, VI.2014, 2W, 1♂**;** Horch Ehden, VII.2014, 2W, 1♂, all leg. Boustani C, Boustani M., all coll. MBOU; Batroun, XI.2014, 1♀, leg. Najem N., Saade C., coll. USEK; Horch Ehden, 1567 m, 19.VI.2016, 2W, 2♂, leg. Boustani M., Kyrk S.; Arz Bcharre, 1928 m, 20.VI.2016, 1W, leg. Boustani M., all coll. MBOU. Additional 15♀, 49W, and 87♂ form 69 records, collected between 22.VI.2016 and 23.VIII.2019, from Arz Bcharre, Hadath El Jebbe, Wadi Quannoubine, Jord Bcharre, Arz Tannourine, Horch Ehden, Harissa and Jord Tannourine.

Flower records. Apiaceae: *Prangos asperula*; Asphodelaceae: *Asphodelus microcarpus*; Asteraceae: *Centaurea eryngioides*, *Cousinia libanotica*, *Echinops gaillardotii*, *Echinops viscosus*; Berberidaceae: *Berberis libanotica*; Boraginaceae: *Cynoglossum nebrodense*, *Echium italicum*, *Solenanthus stamineus*; Caprifoliaceae: *Cephalaria setosa*, *Lonicera nummulariifolia*;; Fabaceae: *Colutea cilicica*, *Genista libanotica*, *Ononis natrix*, *Vicia canescens*, *Vicia tenuifolia*, *Vicia villosa*; Lamiaceae: *Lotus gebelia* var *libanoticus*, *Marrubium libanoticum*, *Nepeta italica*, *Origanum ehrenbergii*, *Stachys cretica*, *Stachys ehrenbergii*; Malvaceae: *Alcea apterocarpa*; Ranunculaceae: *Ranunculus demissus*; Salicaceae: *Salix* sp.; Scrophulariaceae: *Verbascum* sp.

APINI

Genus *Apis* L., 1758

One species.

***Apis mellifera* L., 1758.** Domesticated, widespread.

Discussion

This paper assembles a total of **573** species of which **492** are taxa confirmed from examined material and primary literature sources. The high number of newly reported species, **289**, shows that Lebanon has been undersampled and understudied for wild bees as is the case for most other insect groups. Though these initial results allow for preliminary biogeographical analysis and regional comparisons, they also illuminate the very substantial knowledge shortfalls concerning the conservation status and population trends of the Lebanese bee fauna.

Though the results we present here are the most comprehensive to date, a more accurate assessment of the true level of bee diversity in Lebanon requires a clearer picture of the local species groups. Currently, several genera and species complexes occurring in the Levant are undergoing revisions such as *Andrena* (Wood *et al.* 2020a), *Anthophora* (Rasmont *et al.* in prep.) *Anthidiini* (Kasparek, in prep.), and *Eucera* (Dorchin *et al.* 2018). A good example of poorly understood genera can be found in the tribe Anthophoriini, in which *Anthophora* and *Amegilla* were last revised by Brooks (1988). Since then, no relevant update has been made, with many undescribed species and specimens with unclear identities from the Levant that require taxonomic attention.

In addition, some species have none or very little information available on their floral preferences and nesting ecology. Here we provide flower records for most species, including preferences of some of the less common taxa reported here for the first time. These observations allow for a preliminary assessment of the foraging range of some species, but require further verifications through pollen load analysis. Understanding floral preferences are important for the conservation of native plants, and many of the reported species forage on plants endemic to Lebanon (i.e. *Vicia canescens, Cousinia libanotica, Stachys ehrenbergii*). The foraging preferences of the local bee fauna can also be expanded to their potential role in pollinating introduced plant species and agricultural crops. In addition, a good knowledge of the adequate nesting resources allows for a more accurate evaluation when designating protected areas for instance, as the presence of the food plant or host species is not always enough. Therefore, this ecological insight is also valuable in a decision-making context.

The species reported from Lebanon are predominantly composed of West Palaearctic taxa (n=311, 54.3%), others with a broader Palaearctic distribution (n=108, 18.8%), a rather similar proportion of taxa restricted to the East Mediterranean region (n=124, 21.7%), with an additional 4.9% (n=28) of species further restricted to the Levant. This leaves 0.3% (n=2) endemic species (i.e. *Andrena scrophulariae* and *Andrena prodigiosa*). These proportions follow similar patterns to the Portuguese bee fauna (Baldock *et al.* 2018, Wood *et al.* 2020b), with a majority of widespread taxa but with 21.1% of species restricted to the West Mediterranean, of which a third (6.2% of all species) are endemic to Iberia. Until now, the only known Lebanese endemics are the newly described species of *Andrena* (Wood *et al.* 2020a), both of which are likely to occur elsewhere in the Levant. On the other hand, the nearby island of Cyprus has 21 endemic reported bee species (Varnava *et al.* 2020). We expect its number of endemics to be much higher than in Lebanon even though both countries have comparable surface areas. Indeed, Cyprus is an island whereas the Lebanese territory is shaped by the great rift, extending the Mediterranean and arid habitats from Turkey in the north and to Egypt in the south, and the potential for movement of species across the borders is therefore much greater. In addition, the Anti-Lebanon mountain chain is shared with two neighbouring countries. This means that there is no geographical barrier around Lebanon that would be suitable for faunal endemism. The biogeography of the Lebanese bee fauna is therefore better analysed at the scale of the entire Levant, which is more geographically relevant to draw conclusions. However, being in a highly rugged area at the heart of the Levant, the Lebanese bee fauna is already highly diverse within the territory and the current surface/diversity ratio is high with 573 species from a surface area of 10,452 km², compared to other Mediterranean mainland countries such as Portugal (Baldock *et al.* 2018) that has 722 species total for 92,000 km². Further comparisons with small sized countries can also be made as the case of Slovenia (20,300 km²): 632 species, and Croatia (56,600 km²): 724 species (Ascher & Pickering 2021, see Lhomme *et al.* 2020), highlighting again the important number of bee taxa in Lebanon compared to its size. The true number of species is probably closer to 700 when considering the local coastal and arid areas that have been poorly sampled so far, and the aforementioned taxonomic issues that makes the identification of certain species groups difficult.

Overall, affinities of the Lebanese bee fauna seem to include (i) species from the mountains of Turkey, and more broadly Western Asia for many taxa found at the higher altitudes, (ii) species with Holo-Mediterranean and Ponto-Mediterranean distributions typical to humid Mediterranean habitats, and (iii) species found in arid habitats of the Levant and the Maghreb. The faunal affinities with the Turkish mountains observed by Boustani *et al.* (2020) for high altitude bumblebees, and by Wood *et al.* (2020a) for *Andrena* seem to be present in other groups as well. In the Xylocopinae for instance, *Xylocopa parviceps* that is predominantly restricted to altitudes above 1900 m in the mountains of Turkey and *Ceratina denesi* which was previously known from Adana (Turkey) (Terzo & Rasmont 2014) were both found in the higher altitudes of Mount Lebanon. Another example is *Habropoda hakkariensis* that until now was only reported from the Hakkari mountains in Turkey above 1000 m of altitude (Schwarz & Gusenleitner 2001, Rasmont 2014c). This work expands the known distribution range of these species, while providing records from their southernmost limit. As the mountainous plateau that follows the occidental fault stretching from Turkey south to the Sinai dwindles in altitude after the 3000 m peak of Mount Lebanon, and the 2814 m peak of Mount Hermon, these species are very unlikely to be found further south. These geographically isolated bee populations on the higher altitude plateau should be prioritised when working on conservation plans. On the other hand, it should also be recognised that many of the bee taxa presented here are also widespread throughout the Mediterranean basin, as can be seen with comparisons to the recently compiled Cypriot (Varnava *et al.*, 2020), Portuguese (Baldock *et al.* 2018, Wood *et al.* 2020b), and Maltese faunas (Balzan *et al.* 2016). Similarities with the Maghreb fauna are shown through many common *Anthophora* and *Xylocopa* species with Morocco, and roughly a quarter to two thirds common taxa in other genera such as *Andrena*, *Ceratina*, *Lasioglossum*, and *Eucera* (Lhomme *et al.* 2020). In addition, genera *Halictus* and *Lasioglossum* are among the most species rich along with *Andrena*, in line with findings of Lhomme *et al.* (2020) for Morocco and Varnava *et al.* (2020) for Cyprus. To date, no comprehensive work has summarised the state of the art knowledge of the bee faunas of Algeria, Tunisia, and Libya, but the common species between the Lebanese and Moroccan faunas are likely to be found throughout Northern Africa (Patiny & Michez 2007).

The current knowledge of the Lebanese bee fauna provides little insight into the rarity and population trends of the local bees, and needs to be put in an appropriate context. Available IUCN conservation statuses of bee species have been assessed largely based on European distributions until now (Nieto *et al*. 2014), and country level assessments have been produced only for countries with a long history of bee fauna documentation like Switzerland, Belgium, or the Czech Republic (Cordillot & Klaus 2011, Straka & Bogusch 2017, Drossart *et al*. 2019). A detailed knowledge of the local distribution of bees is essential to produce accurate assessments, and this lack of knowledge for Lebanon highlights the importance of working towards a monitoring program that will allow the production of a national Red List of bees based on recent empirical data. However, this can be limited by access difficulties to several Lebanese regions due to geographical barriers and safety reasons.

Finally, additional collections in the coastal strip, the Bekaa valley and the Anti-Lebanon mountains are necessary to further our knowledge on the local bee fauna and to have a better representation of all habitats within Lebanon. Additionally, in order to allow for local expertise on bee taxa to develop, reference collections should be deposited in a suitable Lebanese institution such a university or a natural reserve where they can be accessible for study.

Conclusion

This checklist highlights the diversity of the wild bee fauna of Lebanon and encourages further research and monitoring the present taxa. The compiled data in this paper that comes mainly from recent collections and literature contributes to a first checklist of the local bee fauna.

The local bee species have to be considered in conservation regulations as entities to protect, but also as active participants in the reproductive ecology of wild plants. They can also be introduced in long-term plans for sustainable agriculture as more information is available to estimate their pollination service value. This list also aims to provide preliminary ecological information on the currently known species, which can be used to inform environmental decision making. The local apifauna should be taken into account as well before importing non-native pollinators such as honeybees and bumblebees for agricultural pollination.

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ANNEX I. Additional species list

This Annex assembles all species reported solely from the online databases GBIF and Discover life (Ascher & Pickering 2021), specimens in literature without original records or examined material to back them up, and unpublished records that have not been recently validated. This list also includes reports from the Lebanese border that could not be placed in Lebanon with certainty, such as older records from the borders along Mount Hermon, and all the material labelled "Syria" before the end of the French mandate, and that could be in the current Lebanese territory.

Material from the OÖLM has been checked for the following species as many collections from the Levant have been deposited there. We could not find specimens from Lebanon for any of them. It is likely that physical specimens from these taxa are present in other historical collections, and their presence in neighbouring countries implies that they are probably present in Lebanon as well. However, without a record from literature based on a physical specimen or recent material they cannot be added to the confirmed taxa list.

The order of the taxa follows the same order as the main manuscript listing.

HYLAEINAE

Genus *Hylaeus* Fabricius, 1793

***Hylaeus* (*Hylaeus*) *angustatus* (Schenck, 1859)**
Distribution: WEST PALAEARCTIC (Ascher & Pickering 2021).
Mentioned from Lebanon by Ascher & Pickering (2021) and Scheuchl & Willner (2016).

***Hylaeus* (*Dentigera*) *brevicornis* Nylander, 1852**
Distribution: PALAEARCTIC (Ascher & Pickering 2021).
Mentioned from Lebanon by Ascher & Pickering (2021) and Scheuchl & Willner (2016).

***Hylaeus (Dentigera) gredleri* Förster, 1871**
Distribution: WEST PALAEARCTIC (Ascher & Pickering 2021).
Mentioned from Lebanon by Ascher & Pickering (2021) and Scheuchl & Willner (2016).

***Hylaeus (Prosopis) maculatus* (Alfken, 1904)**
Distribution: WEST PALAEARCTIC: East Mediterranean to Iran, Algeria (Ascher & Pickering 2021).
Mentioned from Lebanon (Ascher & Pickering 2021).

***Hylaeus* (*Spatulariella*) *punctatus* (Brullé, 1832)**
Distribution: WEST PALAEARCTIC (Ascher & Pickering 2021).
Mentioned from Lebanon by Ascher & Pickering (2021) and Scheuchl & Willner (2016).

***Hylaeus* (*Dentigera*) *rubicola* Saunders, 1850**
Distribution: WEST PALAEARCTIC: Scattered records from NE Mediterranean, Egypt, Spain (Ascher & Pickering 2021).
Mentioned from Lebanon (Ascher & Pickering 2021).

***Hylaeus* (*Hylaeus*) *trifidus* (Alfken, 1936)**
Distribution: WEST PALAEARCTIC: Northern and eastern Mediterranean (Ascher & Pickering 2021).
Mentioned from Lebanon (Ascher & Pickering 2021).

Andrenidae

ANDRENINAE

Genus *Andrena* Fabricius, 1775

The species below were listed in Wood *et al.* (2020a) and are reproduced here without distribution details or notes to avoid redundancy. General distribution categories can be found in ANNEX III.

***Andrena* (*Truncandrena*) *bassana* Warncke, 1969**

***Andrena* (*Truncandrena*) *canae* Strand, 1915**

***Andrena* (*Simandrena*) *combinata* (Christ, 1791)**

***Andrena* (*Simandrena*) *dorsata* (Kirby, 1802)**

***Andrena* (*Notandrena*) *erythrocnemis* Morawitz, 1870**

***Andrena* (*Carandrena*) *falcinella* Warncke, 1969**

***Andrena* (*Melandrena*) *grandilabris* Pérez, 1903**

***Andrena* (*Margandrena*) *hyacinthina* Mavromoustakis, 1958**

***Andrena* (*Nobandrena*) *iliaca* Warncke, 1969**

***Andrena* (*Poecilandrena*) *kilikiae* Warncke, 1969**

***Andrena* (*Simandrena*) *lepida* Schenck, 1861**

***Andrena* (*Didonia*) *mucida* Kriechbaumer, 1873**

***Andrena* (*Parandrenella*) *nisoria* Warncke, 1969**

***Andrena* (*Notandrena*) *nitidiuscula* Schenck, 1853**

***Andrena* (*Fumandrena*) *pandosa* Warncke, 1968**

***Andrena* (*Poliandrena*) *polita* Smith, 1847**

***Andrena* (*Chlorandrena*) *tadauchii* Gusenleitner, 1998**

***Andrena* (*Poliandrena*) *toelgiana* Friese, 1921**

***Andrena* (*Truncandrena*) *truncatilabris* Morawitz, 1877**

***Andrena* (*Truncandrena*) *ulula* Warncke, 1969**

***Andrena* (*Notandrena*) *urdula* Warncke, 1965**

***Andrena* (*Simandrena*) *venerabilis* Alfken, 1935**

PANURGINAE

Genus *Camptopoeum* Spinola, 1843

***Camptopoeum (Camptopoeum) nigrotus* (Warncke, 1987)**
Distribution: PALAEARCTIC: Levant, Uzbekistan (Ascher & Pickering 2021).
Mentioned from Lebanon (Ascher & Pickering 2021).

***Camptopoeum (Camptopoeum) sacrum* Alfken, 1935**
Distribution: PALAEARCTIC: Levant, Pakistan (Ascher & Pickering 2021).
Mentioned from Lebanon (Ascher & Pickering 2021).

***Camptopoeum (Camptopoeum) variegatum* (Morawitz, 1876)**
Distribution: PALAEARCTIC: Northern and eastern Mediterranean to Turkmenistan, Maghreb (Ascher & Pickering 2021).
Mentioned from Lebanon (Ascher & Pickering 2021).

HALICTIDAE

ROPHITINAE

Genus *Rophites* Spinola, 1808

***Rophites* (*Rophites*) *algirus* Pérez, 1895**
Distribution: WEST PALAEARCTIC: Spanning Europe to the Caucasus East and Scattered around the Mediterranean basin (Pauly & Patiny 2011).
Mentioned from Lebanon by Ascher & Pickering (2021) and Scheuchl & Willner (2016).

Genus *Dufourea* Lepeletier, 1841

***Dufourea* (*Cyprirophites*) *cypria* Mavromoustakis, 1952**
Distribution: LEVANT (Ascher & Pickering 2021).
Mentioned from Lebanon (Ascher & Pickering 2021).

HALICTINI

Genus *Lasioglossum* Curtis, 1833
***Lasioglossum* (*Evylaeus*) *calceatum* (Scopoli, 1763) [= *L.* (*Sphecodogastra*) *calceatum*]**
Distribution: WEST PALAEARCTIC (Ascher & Pickering 2021).
Mentioned from Lebanon by Ascher & Pickering (2021) and Scheuchl & Willner (2016).

***Lasioglossum* (*Evylaeus*) *debilior* (Pérez, 1910) [= *L.* (Sphecodogastra) *debilior*]**
Distribution: WEST PALAEARCTIC: Northern and eastern Mediterranean to eastern Iran (Pauly 2016a).
Mentioned from Lebanon (Ascher & Pickering 2021).

***Lasioglossum* (*Evylaeus*) *euboeense* (Strand, 1909) [= *L.* (*Sphecodogastra*) *euboeense*]**
Distribution: WEST PALAEARCTIC: Scattered records in Southern Europe (Pauly 2016a).
Mentioned from Lebanon by Ascher & Pickering (2021) and Scheuchl & Willner (2016).

***Lasioglossum (Dialictus) ituraeum* Ebmer, 1972**
Distribution: WEST PALAEARCTIC: Levant and Iran (Pauly 2016c).
Literature. Ebmer *et al.* 1990: Mount Hermon, 1♂, coll. leg. MNHUB.
Bytinki & Ebmer 1974: Mount Hermon, 1♀, det. Pauly A.

***Lasioglossum* (*Ctenonomia*) *vagans* (Smith, 1857)**
Distribution: PALAEARCTIC: Stretching from North Africa and the East Mediterranean to Japan (Ascher & Pickering 2021).
Mentioned from Lebanon (Ascher & Pickering 2021).

Genus *Seladonia* Robertson, 1918

***Seladonia (Seladonia) gemmea* (Dours, 1872)**
Distribution: WEST PALAEARCTIC: Mediterranean basin (Pauly 2016d).
Literature. Blüthgen (1955): Listed under *Halictus gemmeus*, Dours, 1952

Reported from Syria, through a Friese specimen labelled so. The locality could be in current Lebanese territory.

DASYPODAINAE

Genus *Dasypoda* Latreille, 1802

***Dasypoda (Dasypoda) pyriformis* Radoszkowski, 1887**
Distribution: WEST PALAEARCTIC: Northern Mediterranean basin (Michez *et al.* 2004).
Literature. Listed under *Dasypoda schlettereri* Friese, 1900
Friese (1901): 1♂ reported from Syria. Locality could be in current Lebanese territory.

MEGACHILIDAE

OSMIINI

Genus *Chelostoma* Latreille, 1809

***Chelostoma* (*Foveosmia*) *forcipatum* (Benoist, 1928)**
Distribution: EAST MEDITERRANEAN: Turkey, Israel (Müller 2021).
Mentioned from Lebanon (Ascher & Pickering 2021).

Genus *Stenoheriades* Tkalcu, 1984

***Stenoheriades (Stenoheriades) asiatica* (Friese, 1921)**
Distribution: EAST MEDITERRANEAN (Ascher & Pickering 2021).
GBIF 2021, SEMC: Labeled *Stenoheriades asiaticus*
Mount Lebanon, Monteverde nr. Mansourieh, 350 m, 6.V.1994, 1♂, leg. Roche C.G., determiner unknown.

Genus *Hoplitis* Klug, 1807

***Hoplitis* (*Hoplitis*) *erythrogastra* (Mavromoustakis, 1954)**
Distribution: WEST PALAEARCTIC: Scattered records in the eastern Mediterranean and North Africa (Müller 2021).
Mentioned from Lebanon by Müller (2021) and Ascher & Pickering (2021).

***Hoplitis* (*Anthocopa*) *semirubra* (Friese, 1899)**
Distribution: LEVANT (Müller 2021).
Literature. Friese (1899): Mentioned from Syria, could be located in current Lebanese territory.

Genus *Osmia* Panzer, 1806

***Osmia* (*Pyrosmia*) *laticauda* Stanek, 1969**
Distribution: EAST MEDITERRANEAN: Turkey, Israel (Müller 2021).
GBIF 2021, SEMC: Identified as *Osmia tichodroma* Warncke, 1992
Mount Lebanon, Monteverde nr. Mansourieh, 350 m, 28.IV.1996, 1♀; Mount Lebanon, Salima, 800 m, 29.IV.1996, 1♀; determiner not specified for both occurrences, leg. Roche C.G.

***Osmia* (*Pyrosmia*) *hellados* Zanden, 1984**
Distribution: WEST PALAEARCTIC: South-eastern Europe and Levant (Müller 2021)

GBIF 2021, SEMC: Identified as *Osmia gallarum hellados* Zanden, 1984.
Mount Lebanon, Monteverde nr. Mansourieh, 350 m, 28.IV.1996, 1♀, leg. Roche C.G.

***Osmia* (*Helicosmia*) *signata* Erichson, 1835**
Distribution: WEST PALAEARCTIC: Southern Europe, Scattered records in Northern Africa, Levant, and further east to Russia (Müller 2021).
GBIF 2021, SEMC: Unknown location, label indicates Libanon [Lebanon], 1♂, 1900, det. Zanden G., leg. Schmiedeknecht O.

Genus *Ochreriades* Mavromoustakis 1956

***Ochreriades (Ochreriades) fasciatus* (Friese, 1899)**
Distribution: LEVANT: Syria, Jordan, Israel (Müller 2021)
Unpublished records. GBIF 2021, SEMC: South Lebanon, probably from Chaaitiyeh, June, 1♀, det. Baker D.
Literature. Friese (1899): Listed from Syria, could be located in current Lebanon.

ANTHIDIINI

Genus *Anthidium* Fabricius, 1804

***Anthidium* (*Anthidium*) *tesselatum* Klug, 1832**
Distribution: WEST PALAEARCTIC: Northern Africa, Eastern Mediterranean, Turkey, Iran (Ascher & Pickering 2021).
Literature. Mentioned from Lebanon by Warncke (1980) with no locality or date.
The presence of this species cannot be confirmed until recently collected material from this taxon has been found.

Genus *Icteranthidium* Michener, 1948

***Icteranthidium (Icteranthidium) ferrugineum* (Fabricius, 1787)**
The species needs taxonomic revision.
Distribution: WEST PALAEARCTIC: Scattered around the Mediterranean, Arabian Peninsula, and east to Kazakhstan (Ascher & Pickering 2021).
GBIF 2021, SEMC: S. Lebanon, Sour, 8.VIII.1995, 1♂, det. Baker D., leg. Roche C.G.

Genus *Pseudoanthidium* Friese, 1898

***Pseudoanthidium* (*Neanthidium*) *octodentatum* (Pérez, 1895)**
Distribution: WEST PALAEARCTIC: Records from Morocco and Libya. Ascher & Mentioned from Lebanon (Ascher & Pickering 2021).

Genus *Stelis* Panzer, 1806

***Stelis* (*Heterostelis*) *annulata* (Lepeletier, 1841)**
Distribution: WEST PALAEARCTIC: Extending from Algeria in the west to Turkey in the east in the Mediterranean. Stretching North to France and Switzerland (Kasparek 2015).
Mentioned from Lebanon without locality details (Ascher & Pickering 2021).

***Stelis* (*Stelis*) *simillima* Morawitz, 1876**
Distribution: WEST PALAEARCTIC (Kasparek 2015, Ascher & Pickering 2021, Kuhlmann *et al.* 2021).
This species was only reported by Grace (2010) under the synonym *Stelis genalis* Pasteels, 1969, Kasparek (2015) does not report it from Lebanon. This species listing is yet to be confirmed.
Literature. Grace (2010) reports it from Lebanon only, without date or locality details.

MEGACHILINI

Genus *Coelioxys* Latreille, 1809

***Coelioxys* (*Coelioxys*) *aurolimbata* Förster, 1853**
Distribution: WEST PALAEARCTIC (Kuhlmann *et al.* 2021).
Mentioned from Lebanon by Ascher & Pickering (2021) and Scheuchl & Willner (2016).

Genus *Megachile* Latreille, 1802

***Megachile (Eutricharaea) communis* Morawitz, 1875**
Distribution: WEST PALAEARCTIC: Central Asia (Ascher & Pickering 2021).
GBIF 2021, SEMC: Bekaa, Der Mar Maroun, 700 m, 26.V.1996, 1♂, determiner unknown; 2.VI.1996, 1♀, determiner unknown, 1♂, det. Baker D.; 9.VI.1996, 1♂, determiner unknown; all leg. Roche C.G.
Viewing the distribution of this species, the taxon name may be wrongly assigned to the specimens, they have to be re-examined for confirmation.

***Megachile (Chalicodoma) lefebvrei* (Lepeletier, 1841)**
Distribution: WEST PALAEARCTIC: Northern and Western Mediterranean basin, Iran (Ascher & Pickering 2021).
GBIF 2021, SEMC: S. Lebanon: Hasbaya, 22.VI.1945, 1♀, det. Baker D., leg. Cawkell E.; Sour s.l., 28.V.1995, 1♀, det. Baker D., leg. Roche C.G.

***Megachile (Eutricharaea) schmiedeknechti* Costa, 1884**
Distribution: WEST PALAEARCTIC: Scattered records in France, Italy, Malta (Ascher & Pickering 2021).
GBIF 2021, SEMC: N. Lebanon, Jebel Kammouha, 1200 m, 1.X.1995, 1♂, det. Baker D., leg. Roche C.G.

***Megachile* (*Eutricharaea*) *rubrimana* Morawitz, 1893**
Distribution: WEST PALAEARCTIC: Scattered records in Southern and Eastern Europe and Central Asia (Ascher & Pickering 2021).
GBIF 2021, SEMC: S. Lebanon, Sour s.l., 28.V.1995, 1♂, det. Baker D., leg. Roche C.G.

APIDAE

NOMADINI

Genus *Nomada* Scopoli, 1770

***Nomada (Nomada) glaberrima* Schmiedeknecht, 1882**
Distribution: WEST PALAEARCTIC: South-eastern Europe, northern and eastern Mediterranean to Eastern Russia (Ascher & Pickering 2021).
Literature. Reported by Grace (2010) with no details.

***Nomada (Nomada) caspia* Morawitz, 1894**

Distribution: PALAEARCTIC: Stretching between Croatia to the west and Turkmenistan to the east (Ascher & Pickering 2021).
Mentioned from Lebanon (Ascher & Pickering 2021).

Nomada (Nomada) confinis **Schmiedeknecht, 1882**
Distribution: WEST PALAEARCTIC: Southern Europe, Levant and east to Iran (Ascher & Pickering 2021).
Mentioned from Lebanon by Ascher & Pickering (2021) and Scheuchl & Willner (2016).

Nomada (Nomada) fenestrata **Lepeletier, 1841**
Distribution: PALAEARCTIC: Scattered records around the Mediterranean and east to Pakistan (Ascher & Pickering 2021).
Mentioned from Lebanon (Ascher & Pickering 2021).

EPEOLINI

Genus *Epeolus* Latreille, 1802

Epeolus (Epeolus) bischoffi **(Mavromoustakis, 1954)**
Distribution: EAST MEDITERRANEAN: Levant and Cyprus (Ascher & Pickering 2021).
Mentioned from Lebanon (Ascher & Pickering 2021).

CERATINI

Genus *Ceratina* Latreille, 1802

Ceratina **(*Euceratina*)** ***bifida*** **Friese, 1900**
Distribution: WEST PALAEARCTIC: Ponto-Mediterranean (Terzo & Rasmont 2011).
Reported from Lebanon by Terzo (1998).

Ceratina **(*Euceratina*)** ***zwakhalsi*** **Terzo & Rasmont 1997**
Distribution: EAST MEDITERRANEAN: Levant and further east to Iran (Terzo & Rasmont 2011).
Mentioned from Lebanon (Ascher & Pickering 2021), reported from Anti-Lebanon mountains (Terzo & Rasmont 2011).

AMMOBATOIDINI

Genus *Ammobatoides* Radoszkowski, 1868

Ammobatoides (Ammobatoides) abdominalis **(Eversmann, 1852)**
Distribution: WEST PALAEARCTIC (Ascher & Pickering 2021).
Mentioned from Lebanon (Ascher & Pickering 2021) and reported by Grace (2010) with no details.

EUCERINI

Genus *Eucera* Scopoli, 1770

Eucera **(*Atopeucera*)** ***alfkeni*** **Risch, 2003**
Distribution: EAST MEDITERRANEAN Israel, Syria and Iran.
Mentioned from Lebanon: N. Lebanon: Cedern bei Becharre [Arz Bcharre] (Ascher & Pickering 2021).

***Eucera (Cubitalia) baal* Engel, 2006**

Distribution: LEVANT: Lebanon, Israel (Ascher & Pickering 2021).

A very similar species *Cubitalia monstruosa* (Risch, 1999) has been described from Turkey.

Literature. Engel M.S., 2006: Mount Hermon, 1500 m, 26.IV.1992, 1♀, det. Engel M. leg. Kasher R.

***Eucera (Hetereucera) bidentata* Pérez, 1887**

Distribution: WEST PALAEARCTIC: SE Europe, Cyprus, Turkey, Syria, Jordan, Israel. To be expected in Lebanon.

GBIF 2021, SEMC: Beirut, Garden of St. Joseph University, 28.III.1949, 1♂, determiner unspecified, leg. Kullenberg B.

***Eucera (Eucera) nigrescens* Pérez, 1879**

Distribution: PALAEARCTIC: Southern Europe and east to Russia, eastern Mediterranean and further east to Turkmenistan (Ascher & Pickering 2021).

GBIF 2021, SEMC: Beirut, Jardin des Jésuites, 1♂, determiner unknown, leg. Kullenberg B.

Mount Lebanon, Monteverde, nr. Mansourieh, 350 m, 27.III.1994, 1♂, det. Baker D.; 22.II.1996, 1♂, det. Baker D.; 18.III.1996, 1♂, determiner unknown, all leg. Roche C.G.

Notes: *Eucera nigrescens* Pérez is replaced in the east Mediterranean area by the similar *E. cypria* Alfken. The occurrence of *E. nigrescens* is very unlikely.

***Eucera* (*Pareucera*) *nigrita* Friese, 1895**

Eucera nigrita is a junior synonym of *E. albofasciata* Friese.

Distribution: WEST PALAEARCTIC (Ascher & Pickering 2021).

One non referenced record from Lebanon without locality (Ascher & Pickering 2021).

ANTHOPHORINI

Genus *Amegilla* Friese, 1897

***Amegilla* (*Zebramegilla*) *punctifrons* (Walker, 1871)**

Distribution: EAST MEDITERRANEAN: Egypt (Rasmont 2014a).

GBIF 2021, SEMC: Bekaa, Xara [Ksara], VII–VIII.1934, 1♂, det. Brooks R., leg. Werner.

Genus *Anthophora* Latreille, 1803

***Anthophora* (*Lophanthophora*) *atricilla* Eversmann, 1846 ***

Distribution: WEST PALAEARCTIC: Scattered records in the Caucasus and eastern Mediterranean (Rasmont 2014b).

Material examined. Specimen without label, 1♀, coll. AUB

This taxon will need to be confirmed with recent material as the only specimen examined has no label.

***Anthophora* (*Pyganthophora*) *atroalba* Lepeletier, 1841**

Distribution: WEST PALAEARCTIC: Southern Europe, Mediterranean basin (Rasmont 2016).

Mentioned from Lebanon (Ascher & Pickering 2021).

This taxon is possibly confused with *A. dalmatica* which is present in Lebanon.

***Anthophora (Lophanthophora) biciliata* Lepeletier, 1841**

Distribution: WEST PALAEARCTIC: Scattered records in the Northern Mediterranean basin. (Ascher & Pickering 2021).

Taxon wrongly synonymised with *A. affinis* and *A. mucida* (Rasmont 1995).

GBIF 2021, SEMC: Mount Lebanon, Nahr El Kelb [Naher Al Kaleb] (from label information), 12.V.1953, 1♀, determiner unknown, leg. Mavromoustakis G.A.

***Anthophora* (*Paramegilla*) *blanda* Pérez, 1895**
Distribution: WEST PALAEARCTIC: Scattered records in the Maghreb (Rasmont 2014b).
BDFGM: Syria, VIII.1899, 1♂, det. Rasmont P., leg. Morice F., coll. Vogt, Leiden.
This locality probably refers to current Lebanon.

***Anthophora* (*Lophanthophora*) *hispanica* (Fabricius, 1787)**
Distribution: WEST PALAEARCTIC: Western, southern and eastern Mediterranean basin (Rasmont 2014b).
Literature. Friese (1897): Mentioned from Syria, the locality could be in current Lebanese territory.

MELECTINI

Genus *Melecta* Latreille, 1802

***Melecta* (*Melecta*) *ashabadensis* Radoszkowski, 1893**
Distribution: PALAEARCTIC: Very few records from Turkmenistan, and Turkey (unconfirmed) (Rasmont 2014).
Literature. Friese (1895): Mentioned from Syria, could be located in current Lebanon.

***Melecta* (*Melecta*) *festiva* Lieftinck, 1980**
Distribution: WEST PALAEARCTIC: Southern Europe, East Mediterranean, Caucasus (Rasmont 2016).
Literature. Lieftinck 1980: Records from Israel: Mount Hermon, 1650 m, 8.VI.1975, 4♂, det. Lieftinck M.A., leg. Kugler; 1700 m, 11.VI.1976, 1♀, 1♂, det. Lieftinck M.A., leg. Simon D.; 1400 m, 31.V.1978, 1♂, det. Lieftinck M.A., leg. Furth D.; 1800 m, 11.VI.1976, 1♂, det. Lieftinck M.A., leg. Freidberg A.; 1650 m, 8.VI.1975, 1♀, det. Lieftinck M.A, leg. Kugler.

***Melecta* (*Melecta*) *luctuosa* (Scopoli, 1770)**
Distribution: WEST PALAEARCTIC: (Rasmont 2016).
Mentioned from Lebanon (Ascher & Pickering 2021).

ANNEX II

Excluded species. This Annex groups all of the species which we are confident have been incorrectly identified. They are therefore excluded from the list of unconfirmed species.

Genus *Panurgus* Panzer, 1806

***Panurgus (Panurgus) cavannae* Gribodo, 1880**
Literature. Friese (1901): Several specimens from Beirut, 21.IV– 5.V.
Notes. Synonymised with *Panurgus siculus* Morawitz, 1872 by Warncke (1972). *Panurgus siculus* has a distribution of southern Italy, Corsica, and Sardinia (Patiny 2012). Warncke (1972) treated both *P. siculus* and *P. posticus* as subspecies of *P. dentipes* Latreille, 1811 due to their morphological similarity. Additionally, the *P. posticus* material that Warncke described from Lebanon was also from Beirut, and so we suspect that it may be the same material that Friese called *P. cavannae*. Certainly, we consider the presence of a Corsico-Sardinian-Italian endemic in Lebanon highly unlikely.

Genus *Halictus* Latreille, 1804

***Halictus atrovirens* Pérez, 1903**
Distribution: WEST PALAEARCTIC: Mediterranean basin (Pauly 2016c).

Junior synonym of *Lasioglossum soror* (Saunders, 1901), see Pauly (2016c).
Literature. Bytinski-Salz & Ebmer (1974): Reported from Mount Hermon.

Genus *Protosmia* Ducke, 1900

***Protosmia (Nanosmia) asensioi* Griswold & Parker, 1987**
The restricted distribution of this taxon to Spain and Portugal (Müller 2021) is likely to indicate a misidentification. Examination is necessary to confirm this record.
GBIF 2021, SEMC: Bekaa (labelled Mt. Lebanon), Hazerta, 1400 m, 6.V.1996, 1♂, det. Baker D., leg. Roche C.G.

Genus *Xylocopa* Latreille, 1802

***Xylocopa hottentotta* Smith, 1854**
Distribution: Sub-Saharan Africa (Terzo & Ramont 2014).
Literature. Friese (1901): Mentioned from Syria without locality details.
There has been a great deal of confusion on the old records of this taxon in Northern Africa and the Levant. These records could be either referebale to either *X. sulcatipes* Maa, 1970 or *X. ustulata* Smith, 1854 (Terzo & Ramont 2014), but we feel confident that they do not correspond to true *X. hottentotta*.

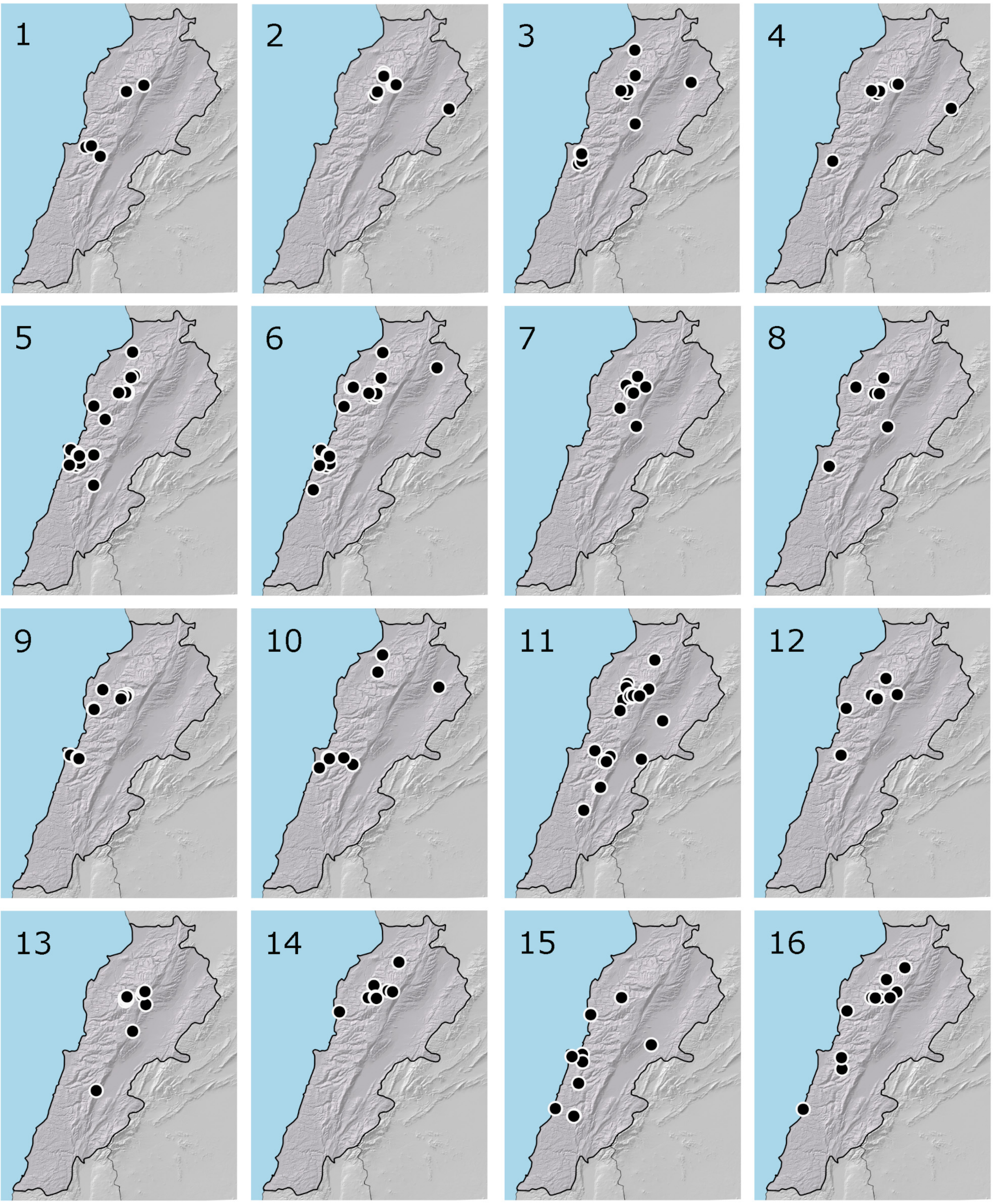

FIGURE 10. Local distribution maps of material examined and literature of **1** *Colletes similis*, **2** *Colletes tuberculatus*, **3** *Hylaeus imparilis*, **4** *Hylaeus kahri*, **5** *Hylaeus lineolatus*, **6** *Hylaeus longimacula*, **7** *Hylaeus meridionalis*, **8** *Hylaeus syriacus*, **9** *Hylaeus taeniolatus*, **10** *Hylaeus variegatus*, **11** *Andrena flavipes*, **12** *Andrena hesperia*, **13** *Andrena labialis*, **14** *Andrena nigroaenea*, **15** *Andrena rufomaculata*, **16** *Andrena similis*.

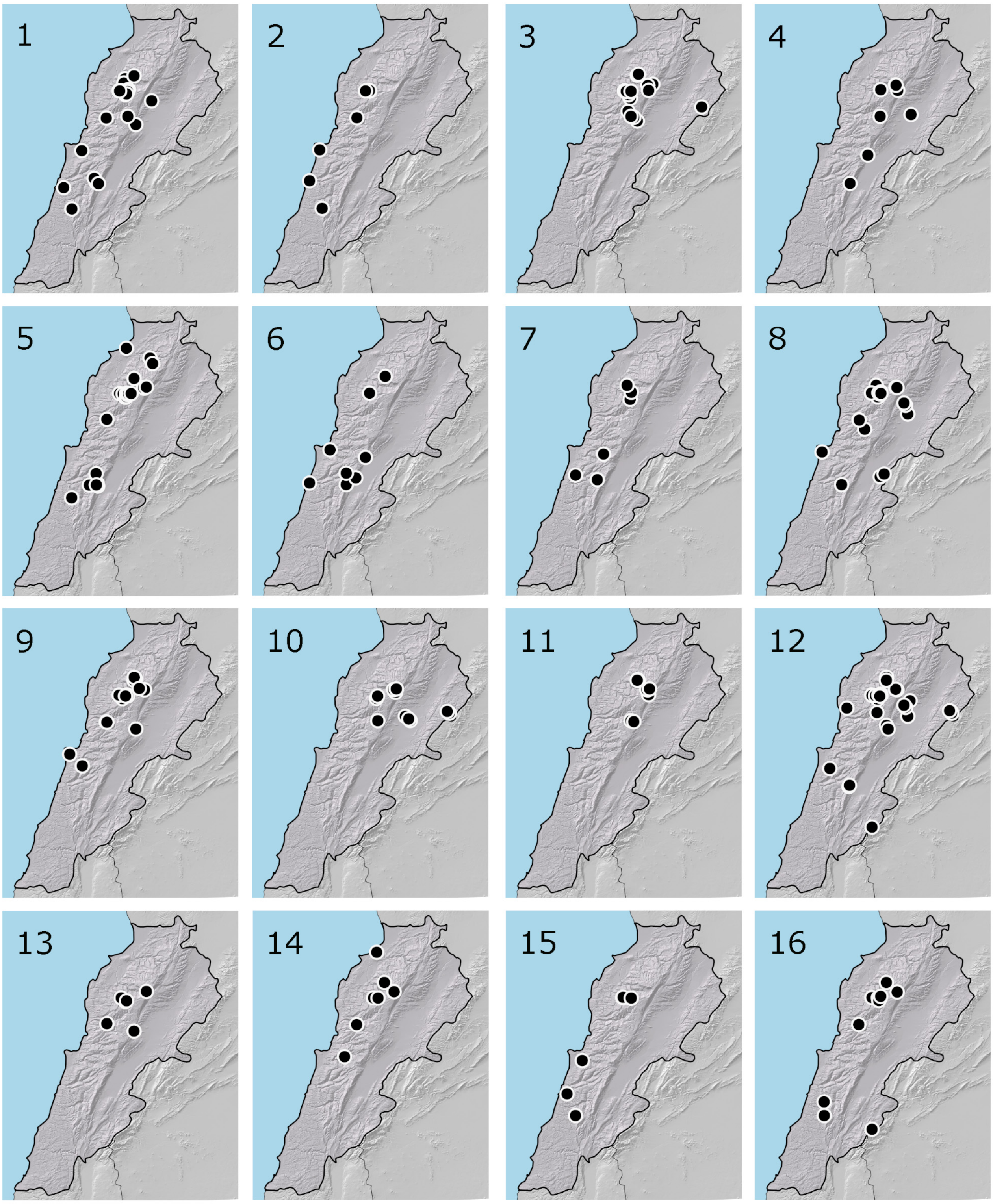

FIGURE 11. Local distribution maps of material examined and literature of **1** *Halictus aegypticola*, **2** *Halictus berlandi*, **3** *Halictus beytueschebapensis*, **4** *Halictus brunnescens*, **5** *Halictus patellatus*, **6** *Halictus resurgens*, **7** *Halictus sexcinctus*, **8** *Seladonia cephalica*, **9** *Seladonia subaurata*, **10** *Seladonia tuberculata*, **11** *Seladonia vestita*, **12** *Lasioglossum anellum*, **13** *Lasioglossum angusticeps*, **14** *Lasioglossum brevicorne*, **15** *Lasioglossum cristula*, **16** *Lasioglossum dolichocephalum*.

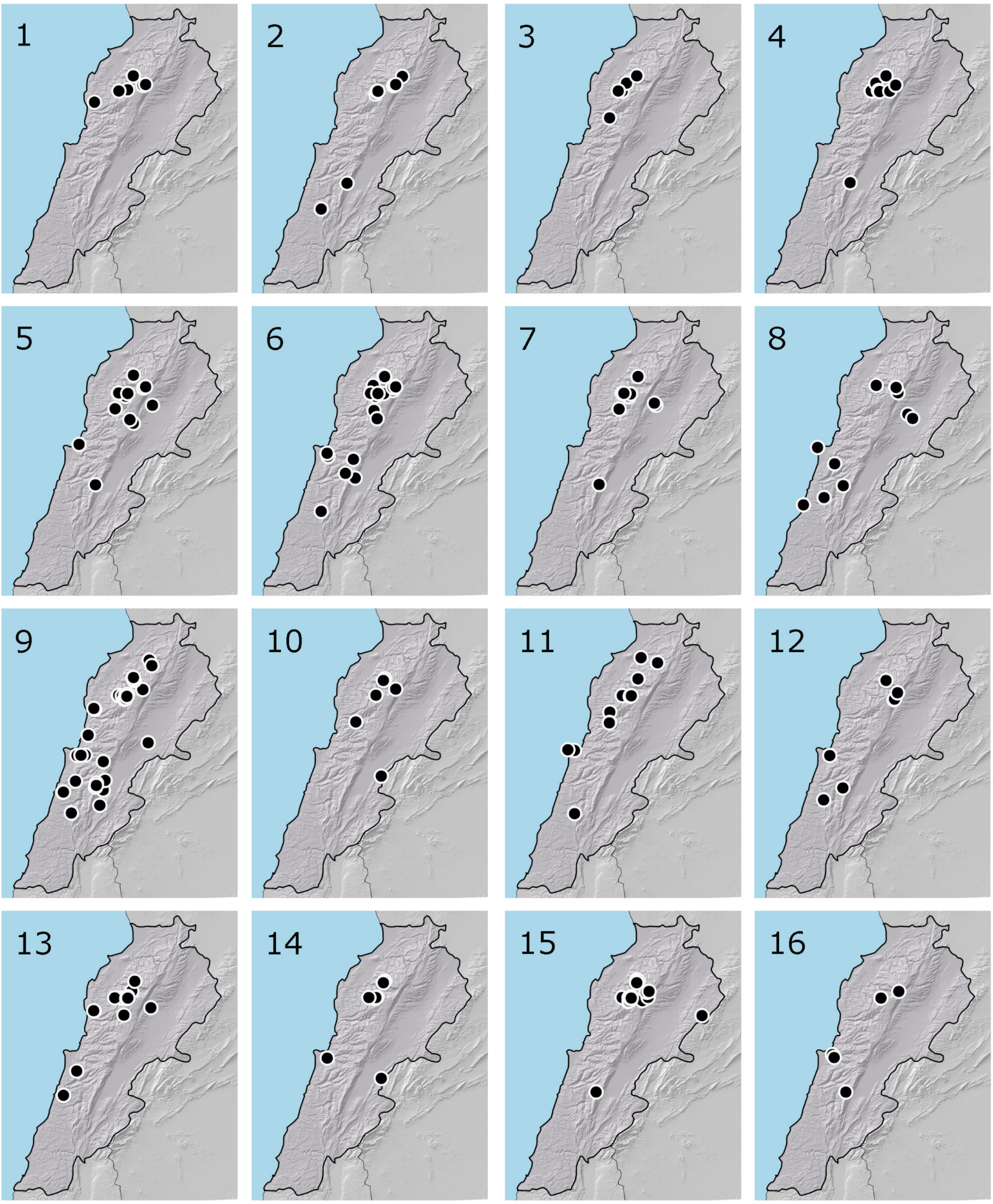

FIGURE 12. Local distribution maps of material examined and literature of **1** *Lasioglossum elatum*, **2** *Lasioglossum enslini*, **3** *Lasioglossum interruptum*, **4** *Lasioglossum laeve*, **5** *Lasioglossum laticeps*, **6** *Lasioglossum lineare*, **7** *Lasioglossum longirostre*, **8** *Lasioglossum malachurum*, **9** *Lasioglossum marginatum*, **10** *Lasioglossum morio*, **11** *Lasioglossum nigripes*, **12** *Lasioglossum politum*, **13** *Lasioglossum pseudosphecodimorphum*, **14** *Lasioglossum punctatissimum*, **15** *Lasioglossum semiaeneum*, **16** *Lasioglossum tadschicum*.

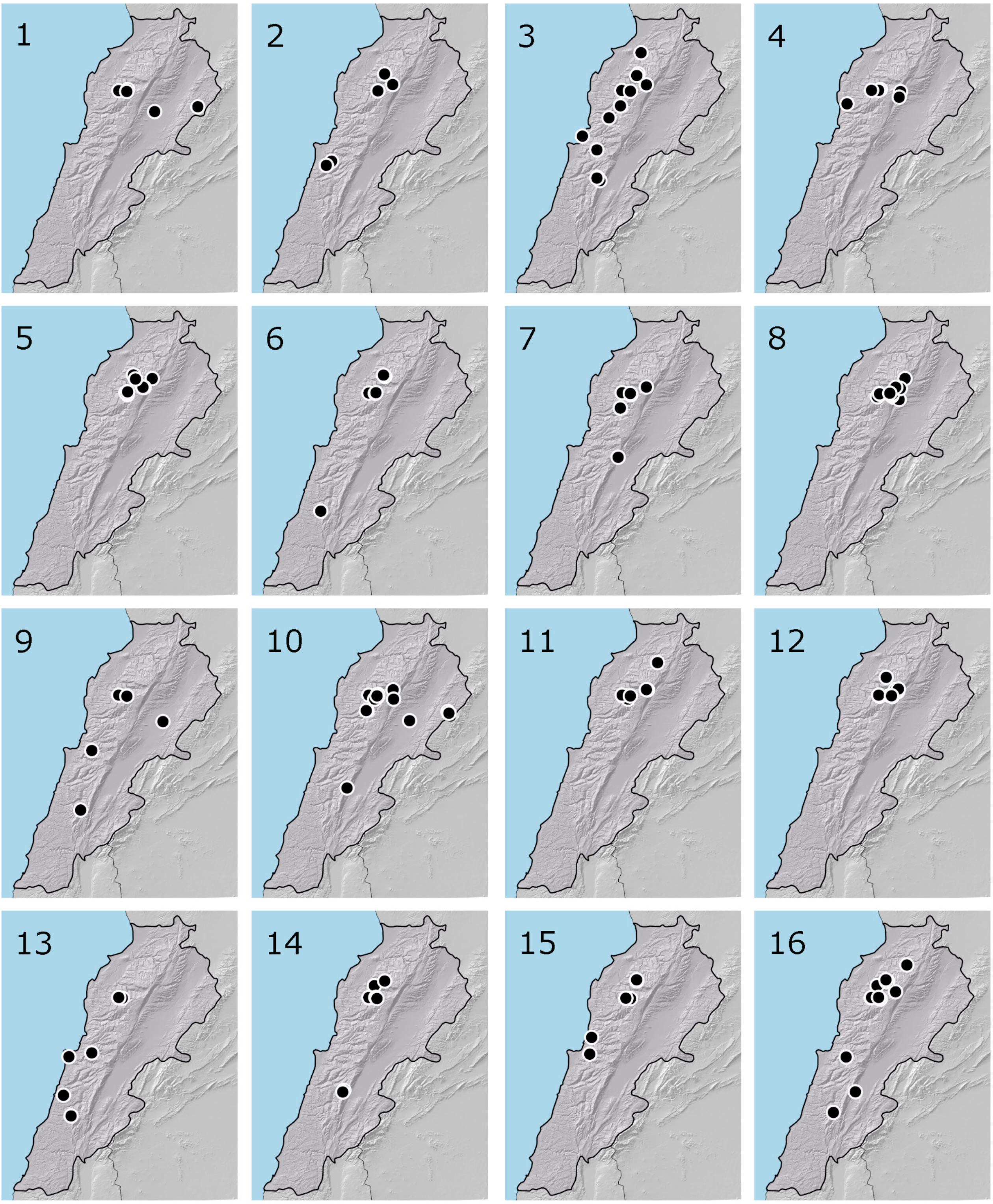

FIGURE 13. Local distribution maps of material examined and literature of **1** *Lasioglossum truncaticolle*, **2** *Lasioglossum villosulum*, **3** *Heriades truncorum*, **4** *Hoplitis pallicornis*, **5** *Osmia aurulenta*, **6** *Osmia bicornis*, **7** *Osmia caerulescens*, **8** *Osmia difficilis*, **9** *Osmia dimidiata*, **10** *Osmia distinguenda*, **11** *Osmia melanogaster*, **12** *Osmia mustelina*, **13** *Osmia niveata*, **14** *Osmia scutellaris*, **15** *Osmia submicans*, **16** *Protosmia longiceps*.

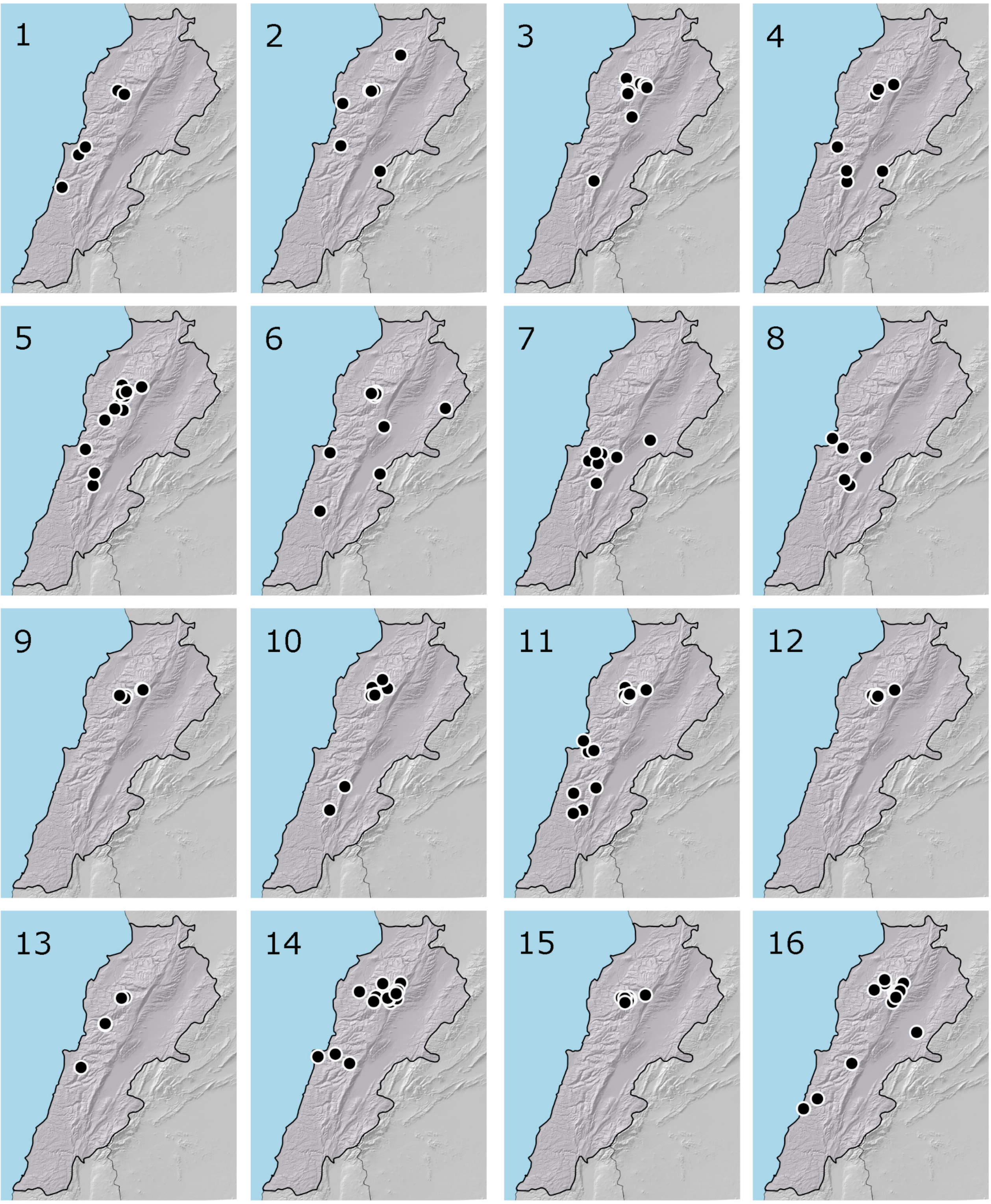

FIGURE 14. Local distribution maps of material examined and literature of **1** *Protosmia monstrosa*, **2** *Anthidiellum strigatum*, **3** *Anthidium christianseni*, **4** *Anthidium loti*, **5** *Anthidium manicatum*, **6** *Anthidium undulatum*, **7** *Anthidium wuestneii*, **8** *Eoanthidium judaeense*, **9** *Icteranthidium grohmanni*, **10** *Rhodanthidium caturigense*, **11** *Rhodanthidium septemdentatum*, **12** *Megachile apicalis*, **13** *Megachile doriae*, **14** *Megachile manicata*, **15** *Megachile montenegrensis*, **16** *Megachile parietana*.

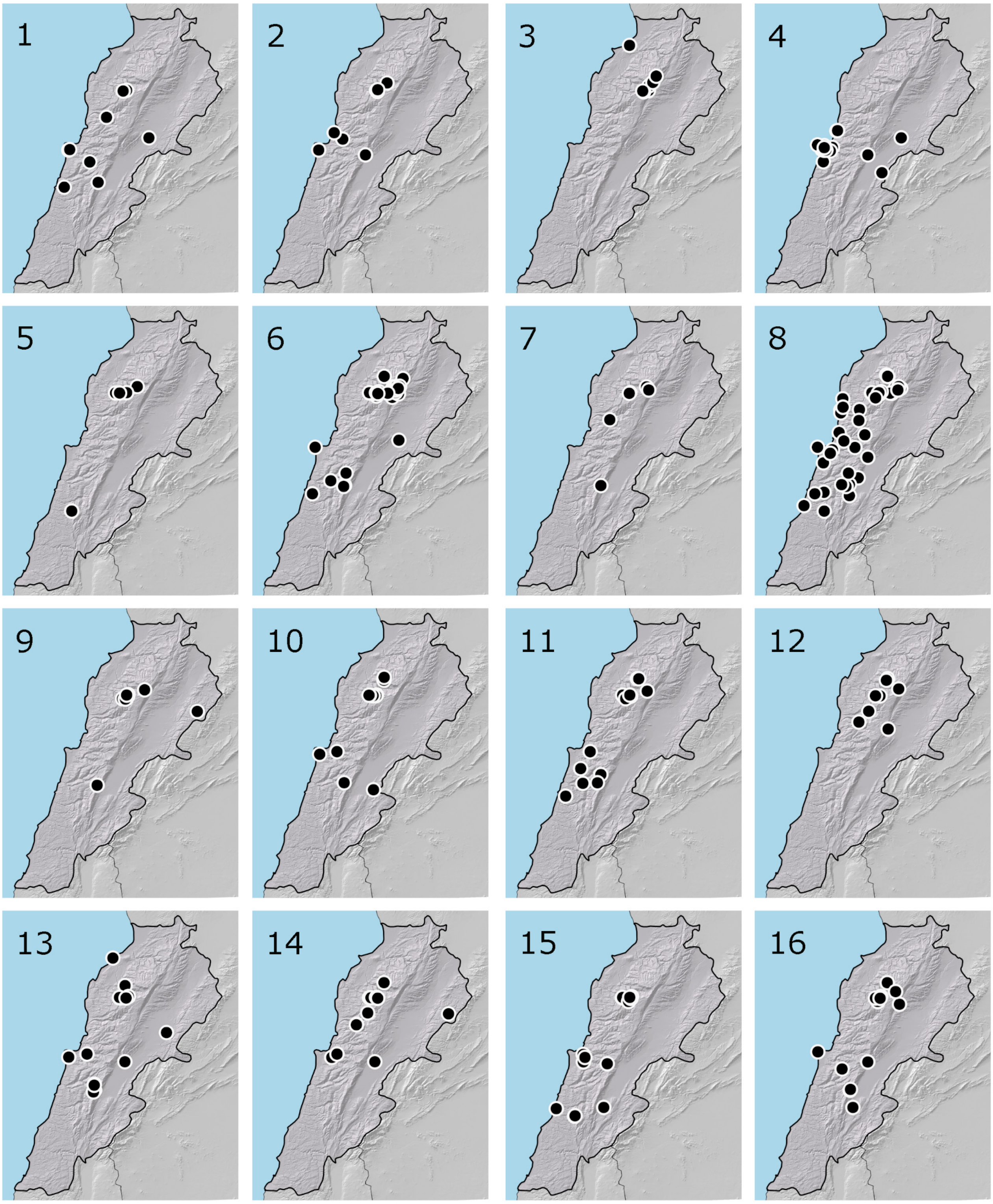

FIGURE 15. Local distribution maps of material examined and literature of **1** *Xylocopa iris*, **2** *Xylocopa olivieri*, **3** *Xylocopa parviceps*, **4** *Xylocopa pubescens*, **5** *Xylocopa rufa*, **6** *Xylocopa valga*, **7** *Xylocopa varentzowi*, **8** *Xylocopa violacea*, **9** *Ceratina acuta*, **10** *Ceratina bispinosa*, **11** *Ceratina cucurbitina*, **12** *Ceratina dentiventris*, **13** *Ceratina mandibularis*, **14** *Exoneuridia libanensis*, **15** *Eucera cypria*, **16** *Eucera gaullei*.

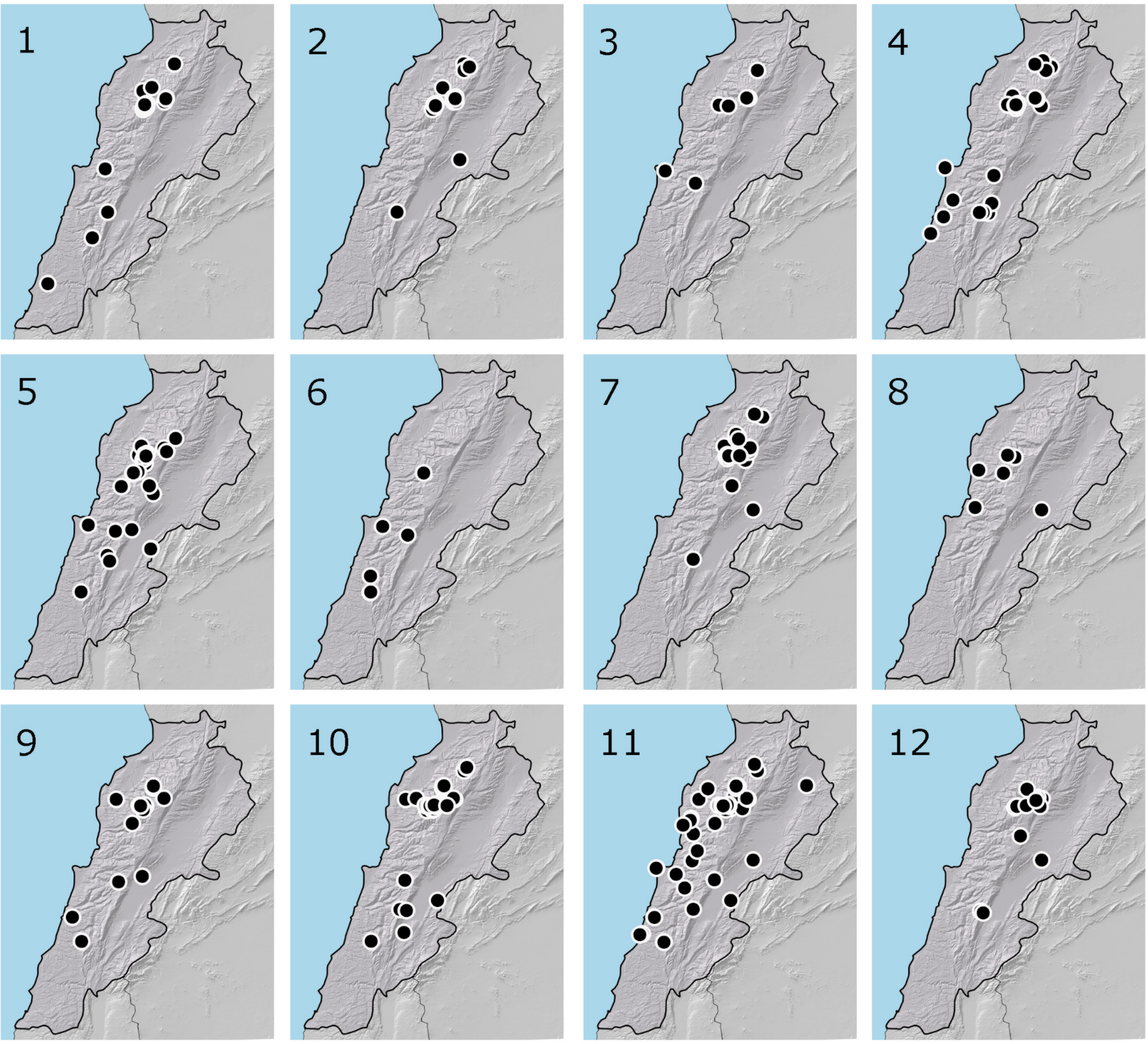

FIGURE 16. Local distribution maps of material examined and literature of **1** *Eucera helvola*, **2** *Eucera interrupta*, **3** *Eucera nigrifacies*, **4** *Eucera plumigera*, **5** *Amegilla albigena*, **6** *Amegilla garrula*, **7** *Anthophora aestivalis*, **8** *Anthophora crinipes*, **9** *Anthophora mucida*, **10** *Anthophora nigriceps*, **11** *Anthophora plumipes*, **12** *Anthophora robusta*.

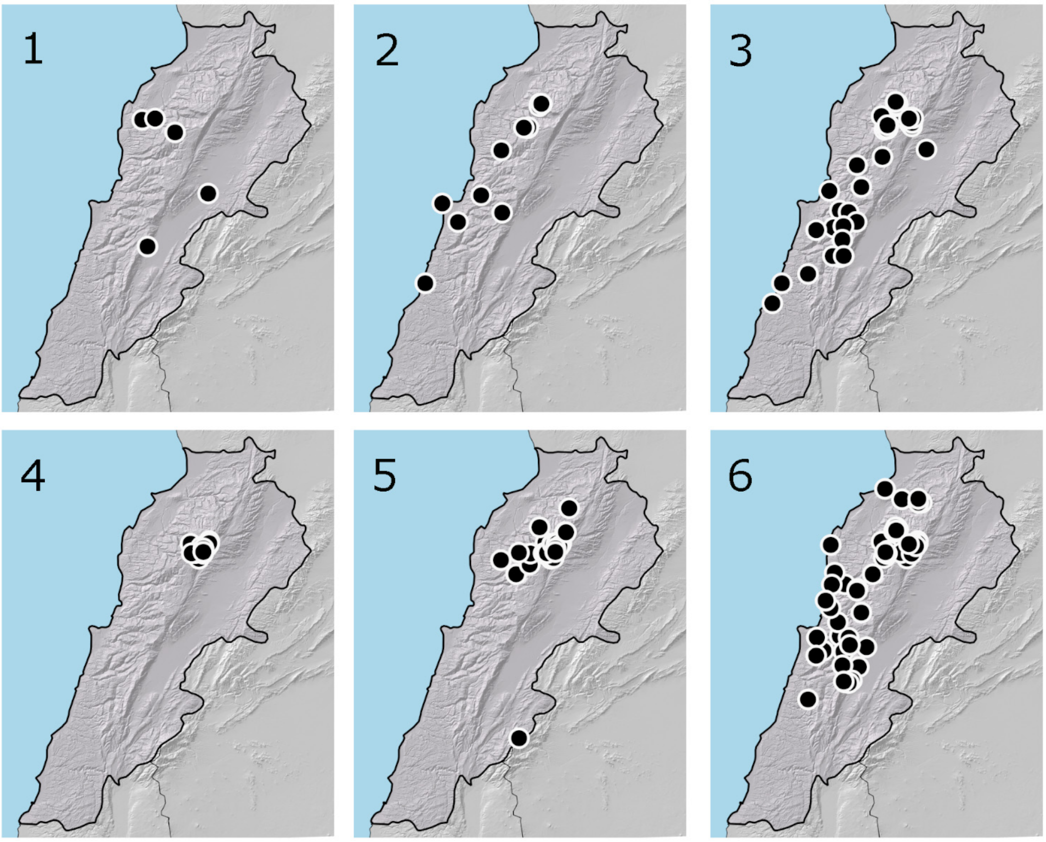

FIGURE 17. Local distribution maps of material examined and literature of **1** *Anthophora rogenhoferi*, **2** *Habropoda tarsata*, **3** *Bombus argillaceus*, **4** *Bombus melanurus*, **5** *Bombus niveatus*, **6** *Bombus terrestris*.

FIGURE 18. 1 *Hylaeus sidensis*♂, **2** *Andrena colletiformis*♂, **3** *Andrena elmaria*♀, **4** *Andrena flavipes*♀, **5** *Andrena rufula*♀, **6** *Hoplitis pallicornis*♂. All pictures by Pierre Rasmont.

FIGURE 19. 1 *Osmia andrenoides*♂, **2** *Osmia difficilis*♂, **3** *Osmia dilaticornis*♀, **4** *Osmia versicolor*♂, **5** *Anthidium manicatum*♀, **6** *Anthidium manicatum*♂. All pictures by Pierre Rasmont.

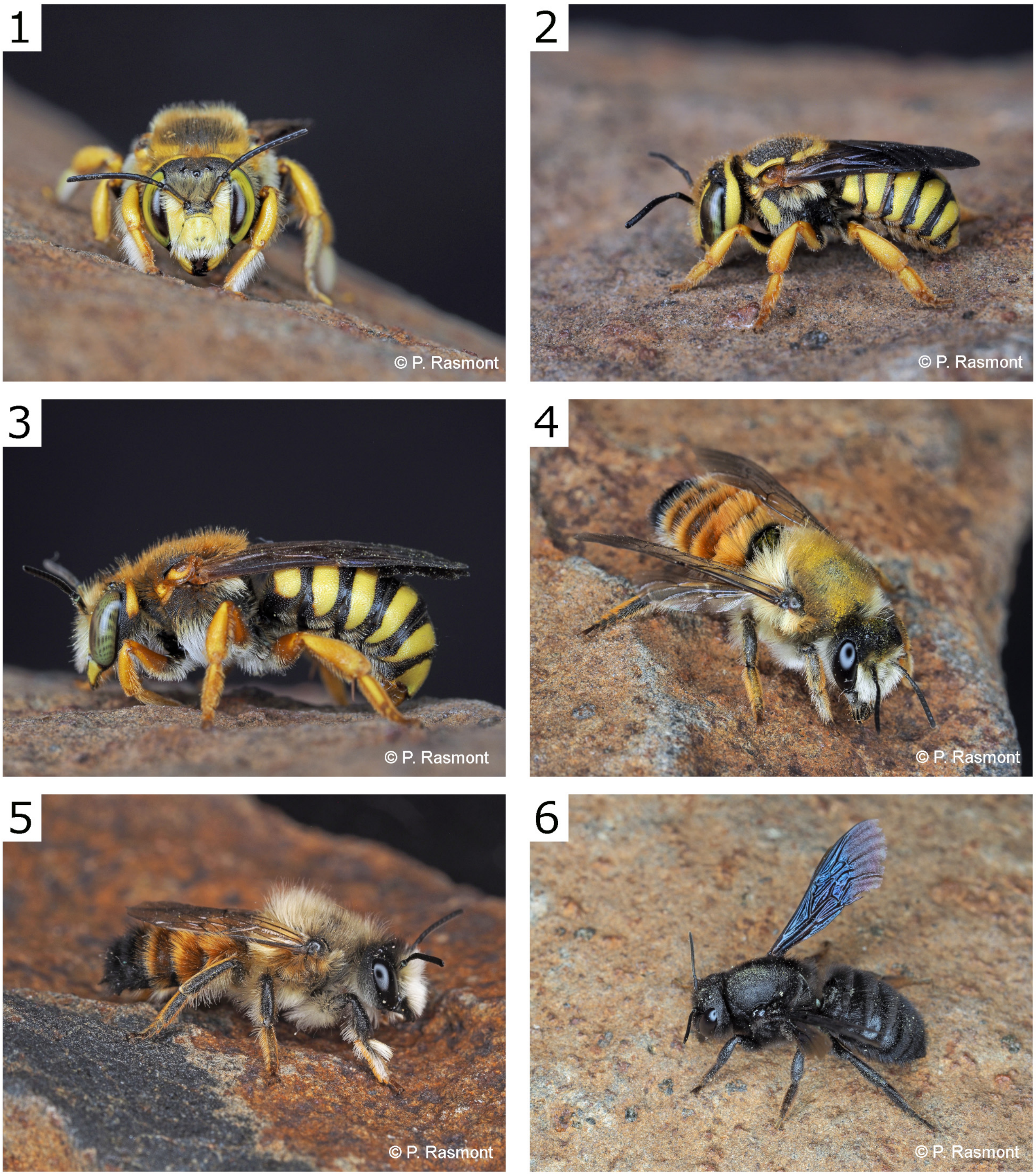

FIGURE 20. **1** *Anthidium trispinosum*♂, **2** *Rhodanthidium caturigense*♀, **3** *Rhodanthidium septemdentatum*♂, **4** *Megachile manicata*♀, **5** *Megachile manicata*♂, **6** *Megachile parietana*♀. All pictures by Pierre Rasmont.

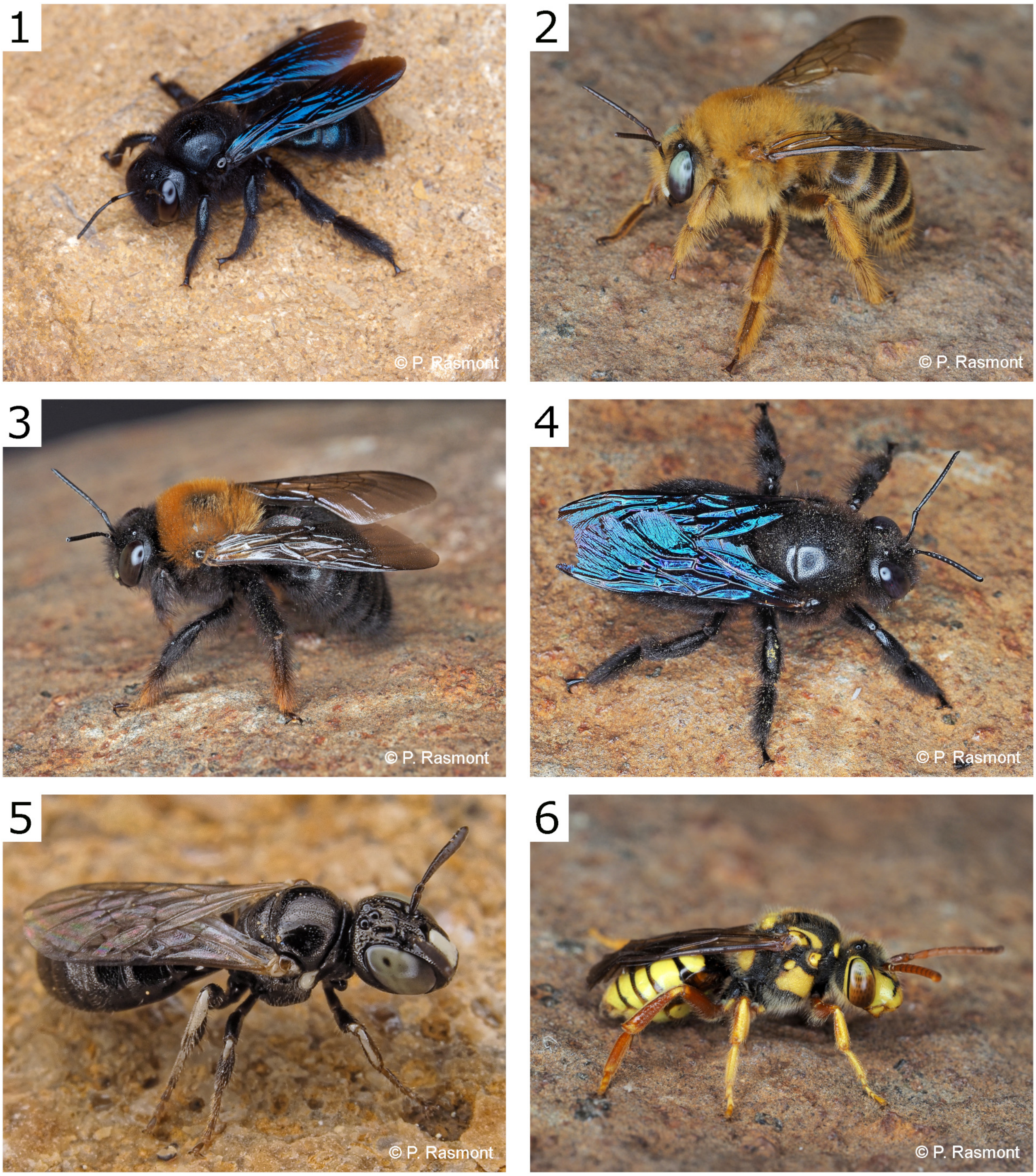

FIGURE 21 . 1 *Xylocopa iris*♀, **2** *Xylocopa olivieri*♂, **3** *Xylocopa parviceps*♂, **4** *Xylocopa valga*♂, **5** *Ceratina bispinosa*♂, **6** *Nomada lucidula*♂. All pictures by Pierre Rasmont.

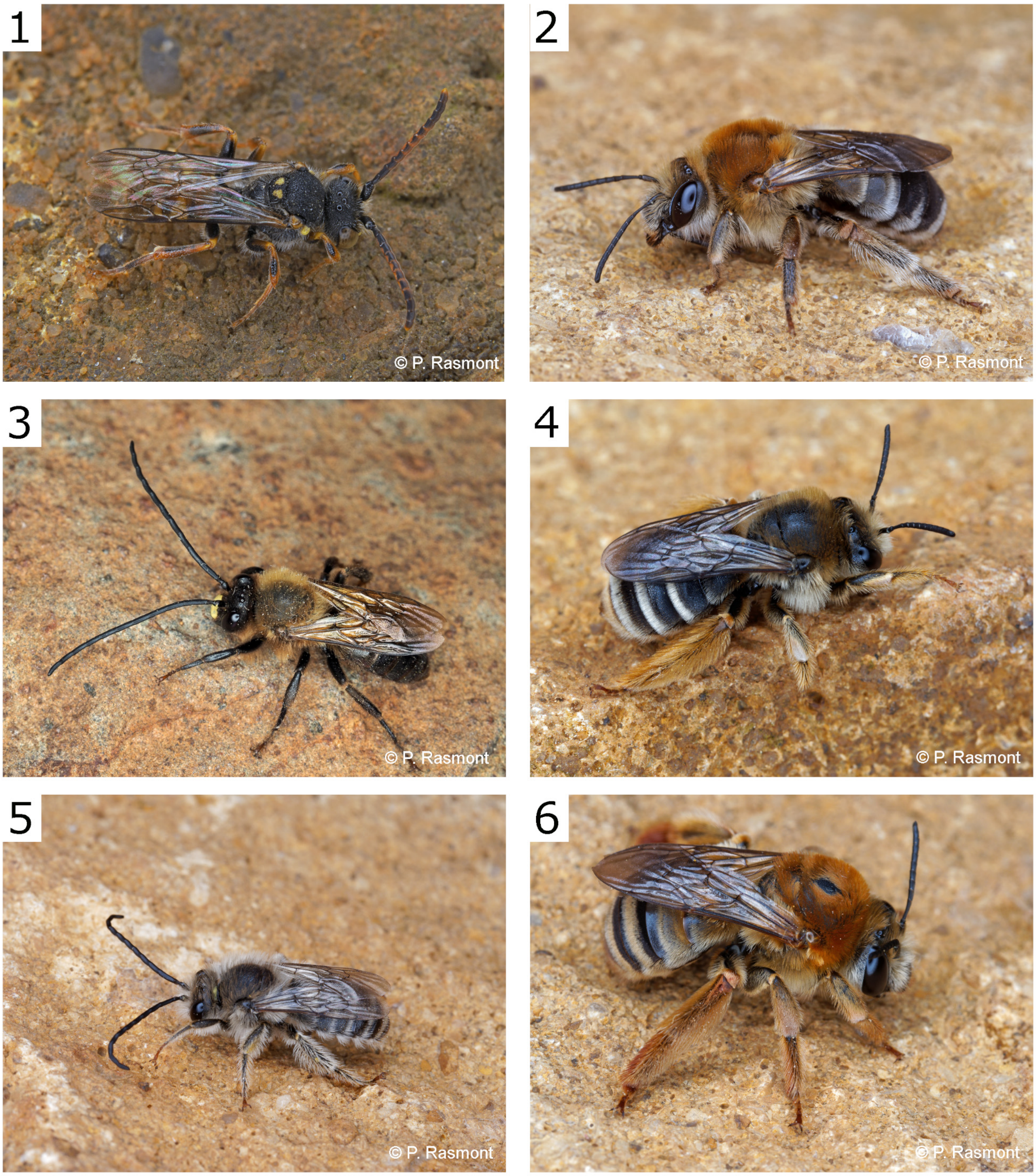

FIGURE 22. 1 *Nomada radoszkowskii*♂, **2** *Eucera cypria*♀, **3** *Eucera longicornis atricollis*♂, **4** *Eucera penicillata*♀, **5** *Eucera penicillata*♂, **6** *Eucera plumigera*♀. All pictures by Pierre Rasmont.

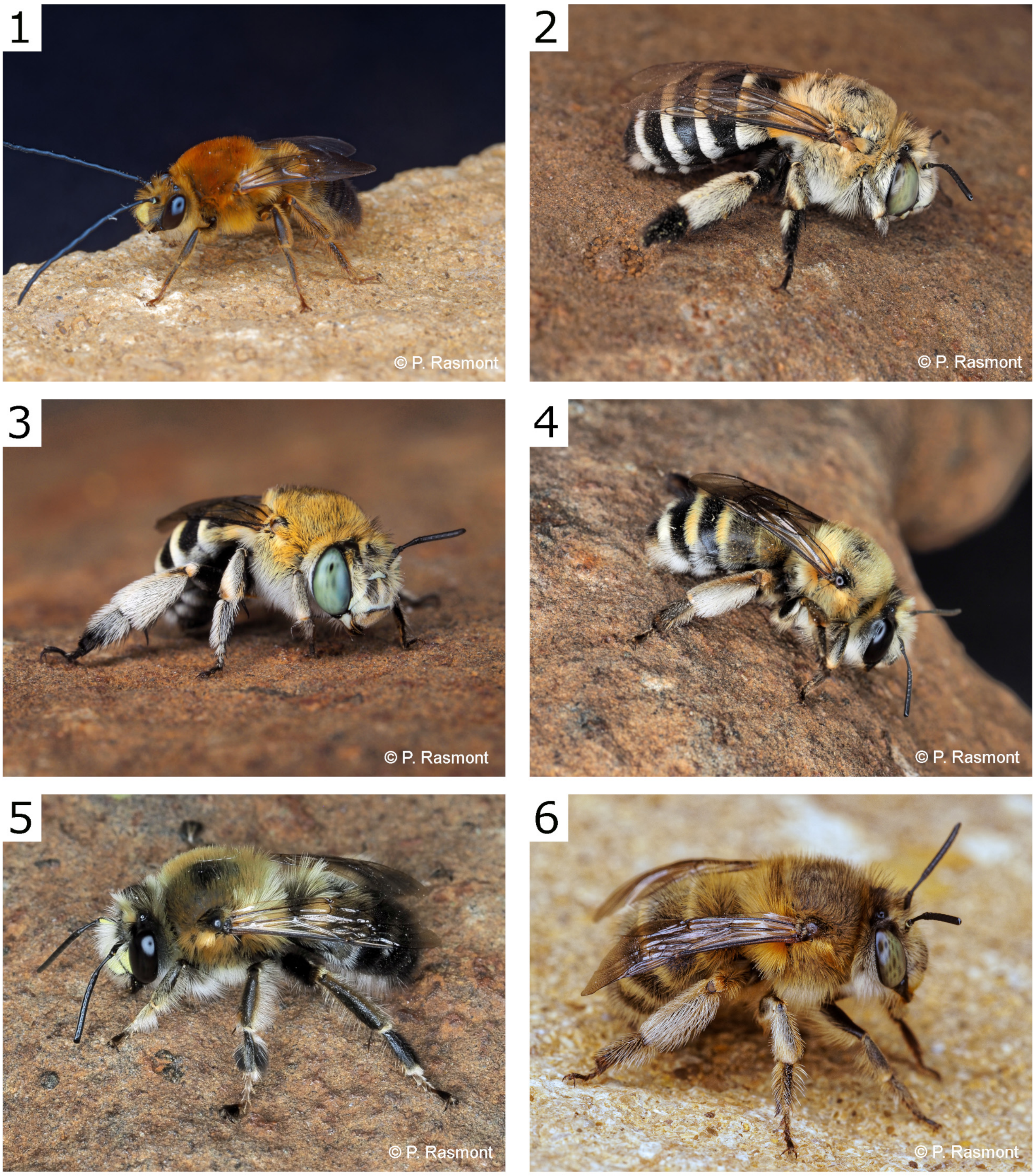

FIGURE 23. **1** *Eucera plumigera*♂, **2** *Amegilla quadrifasciata*♀, **3** *Amegilla albigena*♀, **4** *Anthophora aestivalis*♀, **5** *Anthophora aestivalis*♂, **6** *Anthophora crinipes*♀. All pictures by Pierre Rasmont.

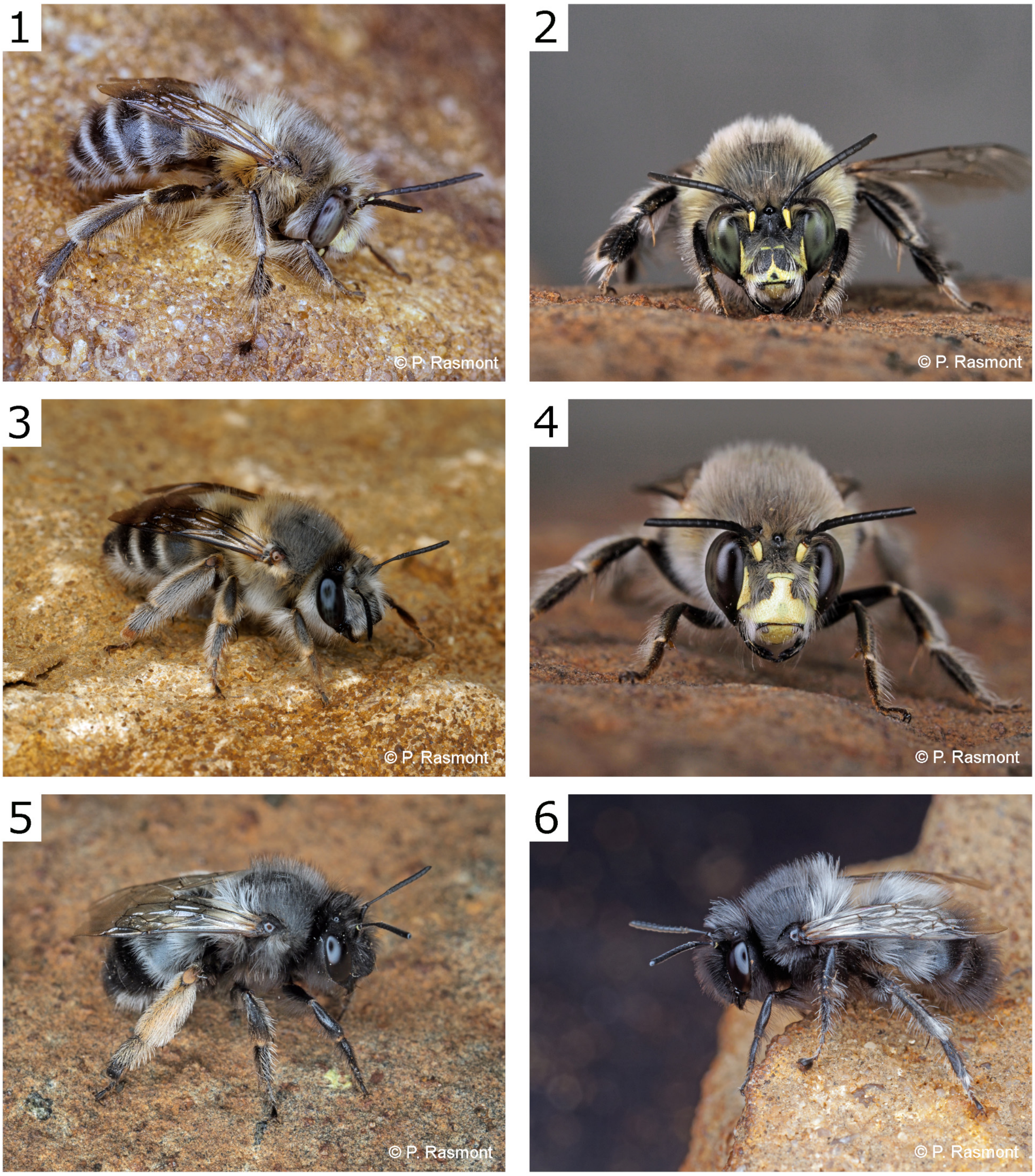

FIGURE 24. **1** *Anthophora crinipes*♂, **2** *Anthophora dalmatica*♂, **3** *Anthophora mucida*♀, **4** *Anthophora mucida*♂, **5** *Anthophora nigriceps*♀, **6** *Anthophora nigriceps*♂. All pictures by Pierre Rasmont.

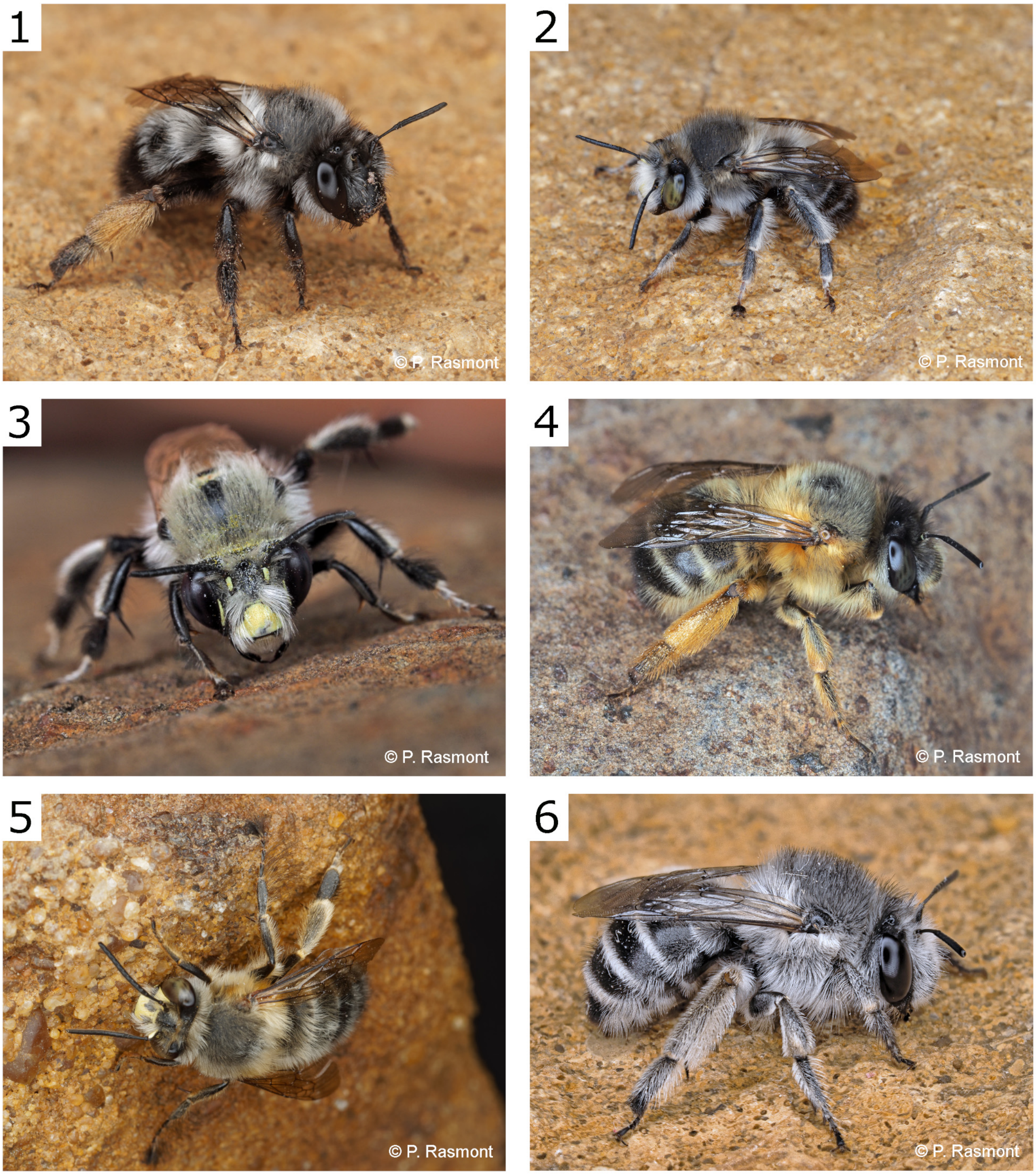

FIGURE 25. 1 *Anthophora orientalis*♀, **2** *Anthophora orientalis*♂, **3** *Anthophora pedata*♂, **4** *Anthophora plumipes*♀, **5** *Anthophora plumipes*♂, **6** *Anthophora rogenhoferi*♀. All pictures by Pierre Rasmont.

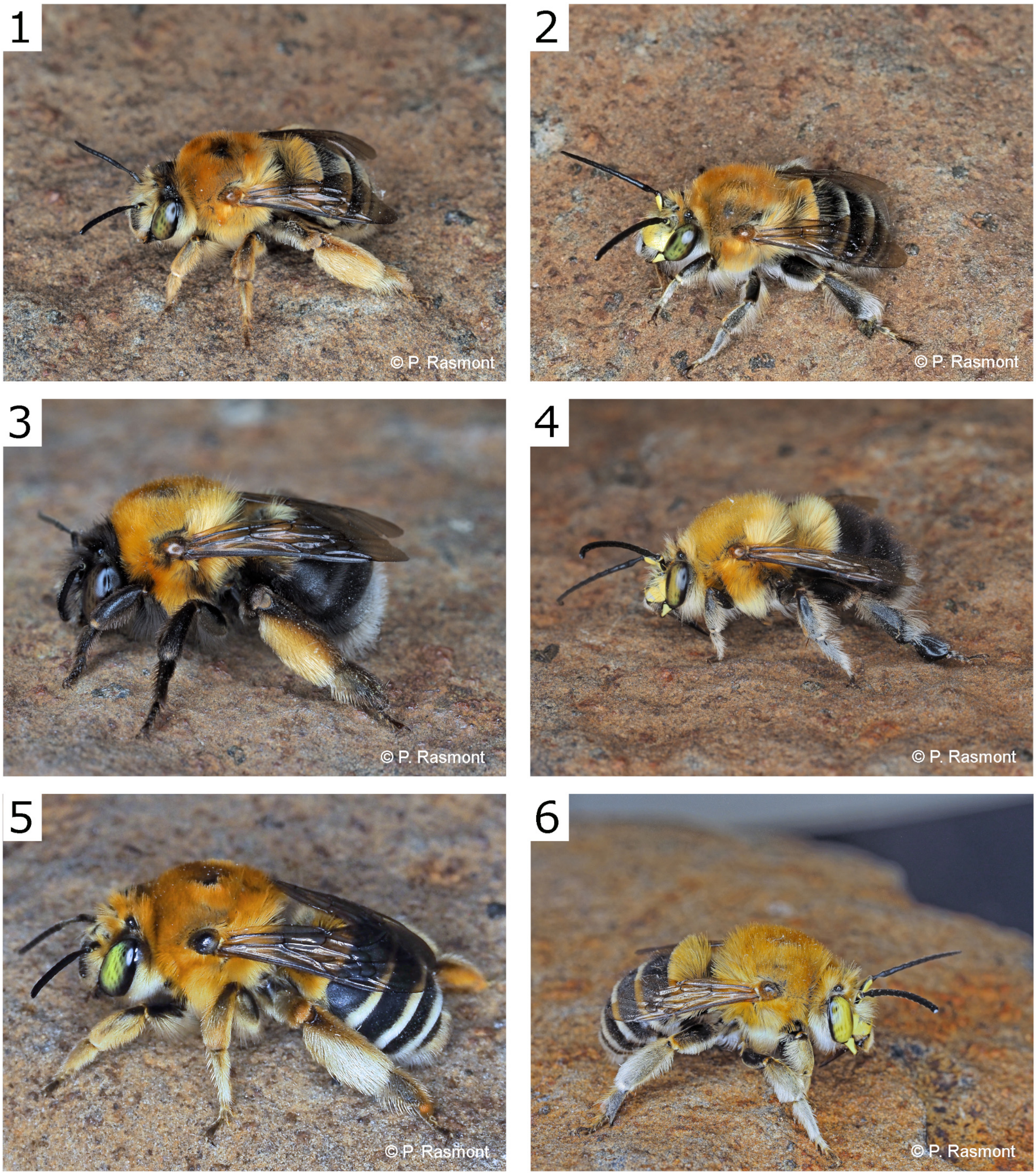

FIGURE 26. 1 *Habropoda hakkariensis*♀, **2** *Habropoda hakkariensis*♂, **3** *Habropoda tarsata*♀, **4** *Habropoda tarsata*♂, **5** *Habropoda zonatula*♀, **6** *Habropoda zonatula*♂. All pictures by Pierre Rasmont.

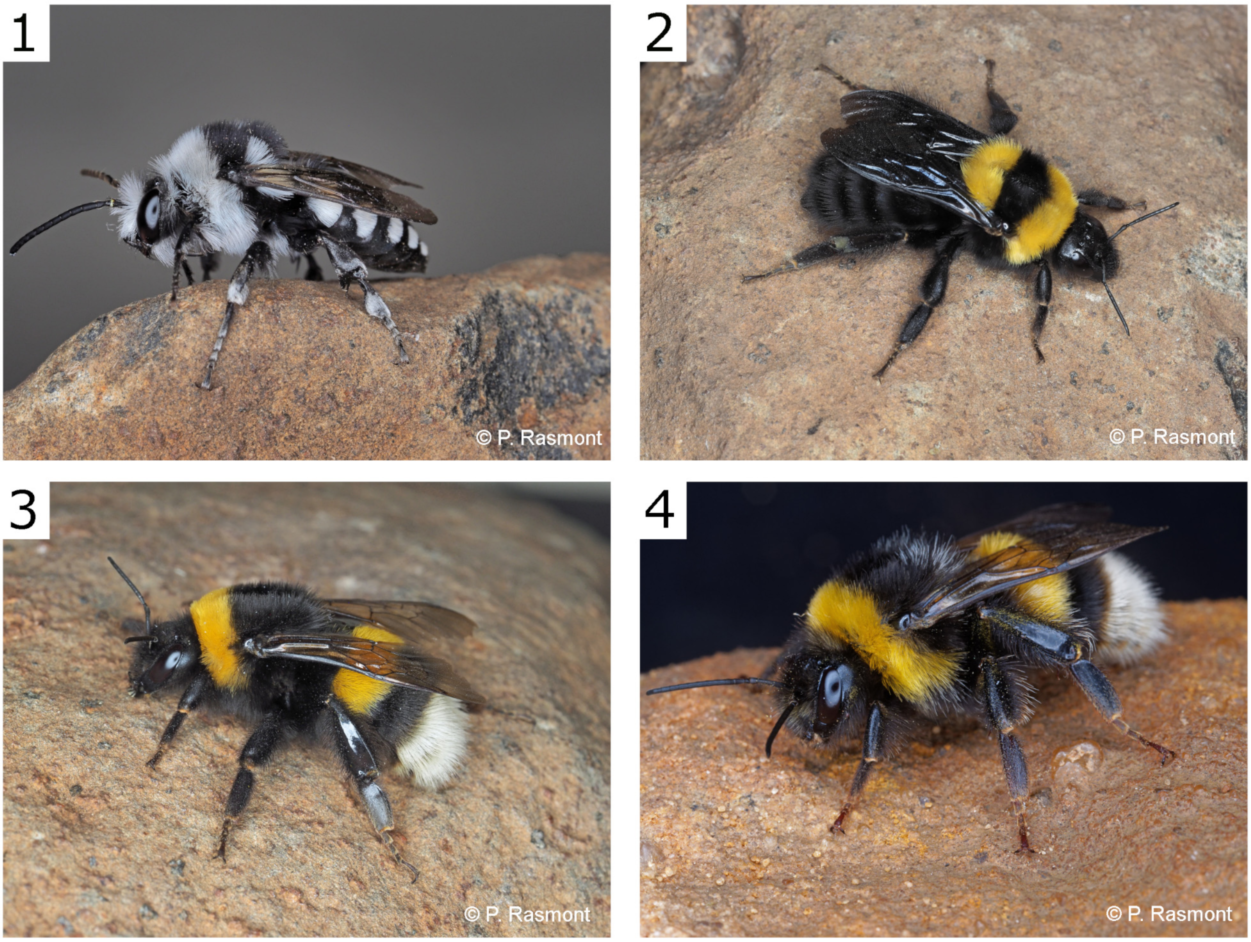

FIGURE 27. 1 *Melecta obscura simulatrix*♂, **2** *Bombus argillaceus*♀, **3** *Bombus terrestris calabricus*♀, **4** *Bombus terrestris calabricus*♂. All pictures by Pierre Rasmont.

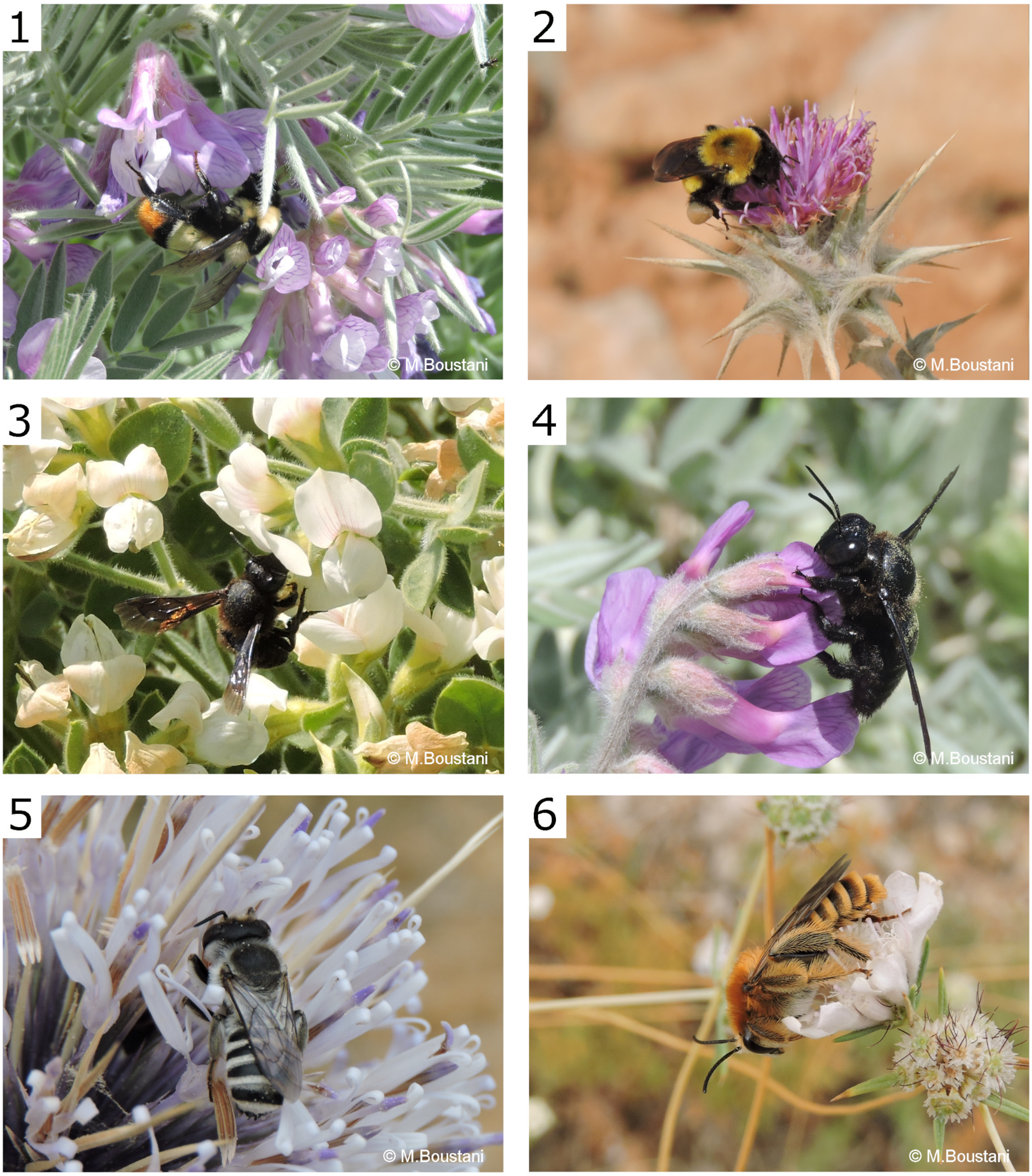

FIGURE 28. 1 *Bombus niveatus vorticosus*♀ on *Vicia canescens*, **2** *Bombus melanurus*♀ on *Cousinia libanotica*, **3** *Megachile parietana*♀ on *Lotus gebelia libanoticus*, **4** *Xylocopa valga*♂ on *Vicia canescens*, **5** *Megachile doriae*♂ on *Echinops* sp., **6** *Dasypoda spinigera*♀ on *Scabiosa argentea*. Pictures taken by Mira Boustani.

Chapter 2

Heat stress resistance variability in the Lebanese bee fauna

Left: *Bombus melanurus* ♀; right: *Xylocopa valga* ♂. Pictures by Mira Boustani.

This chapter tackles the heat stress resistance of a variety of model species with different distributions and traits from the montane areas of North Lebanon.

Manuscript:

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Associated Annex: Annex II

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Chapter 2: Heat stress resistance variability in the Lebanese bee fauna

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Abstract

Wild bees are facing many environmental challenges that are reshaping their distributions and even causing extinctions. One of the main threats is climate change as it generates a higher frequency of extreme climatic events such as heat waves. Therefore, assessment of the heat resistance of species is an important tool for geographical range forecast and status of wild bee species. We focused on the eastern Mediterranean country of Lebanon and assessed interspecific and inter-individual variability of the heat stress resistance of 15 species from seven genera in relation to sex, dry weight, collection altitude, and collection day gradient. We measured the time before heat stupor (THS) of the male and female specimens at the heatwave temperature of 40 °C. At an interspecific level, we show that different taxa show differences in heat stress resistance, and that dry weight has a positive correlation with THS. We also show that *Xylocopa valga, Anthophora plumipes,* and *A. nigriceps* display a difference in heat resistance between males and females, and that dry weight is positively correlated with the THS of *Bombus terrestris, Xylocopa valga* and *X. violacea*. We show that altitude is negatively correlated with the THS of *Bombus terrestris,* and a positive correlation in the case of *Xylocopa valga* and *X. violacea*. Finally, there was a positive correlation of Julian day on both *Xylocopa valga* and *X. violacea* THS. We then highlight that more than half of the tested species have a low heat stress resistance.

Introduction

During recent decades, major population shifts in wildlife have been observed at continental scales. One of the most notable changes is population declines that have been demonstrated across faunas (IUCN, 2021; Krause & Tilker, 2021), and flora (Bakkenes *et al.*, 2002; Richner *et al.*, 2014), leading to mass extinctions (Parmesan, 2006; Dirzo *et al.* 2014; Pievani, 2014). In parallel, other populations are migrating across altitude (Lenoir *et al.*, 2008; Herrera *et al.*, 2018) and latitude gradients (Jump *et al.*, 2009; Martinet *et al.*, 2015a). Climate change is one of the main drivers of these wildlife shifts (Cramer & Leemans, 1993; Jetz *et al.*, 2007; Jenkins *et al.* 2011) through long-term temperature increase and an unprecedented frequency and intensity of short-term extreme climatic events (Easterling *et al.*, 2000; Meehl & Tebaldi, 2004).

Insect populations are highly affected by climate change (Kiritani, 2013) and many have been declining in the last decades (Wagner,2019). Insects can cope with heat stress through behaviours such as sheltering (Uvarov, 1931; Bodlah *et al.*, 2017; Sheikh *et al.*, 2017), and physiological responses such as the production of heat shock proteins (Salvucci *et al.*, 2000; King & McRae, 2015). However, extreme heat has been shown to negatively affect all stages of insect development from larval stages (Kemp & Bosch, 2005; Kierat *et al.* 2017), adult survival (Mironidis & Savopoulou-Soultani, 2010; Piyaphongkul *et al.*, 2012; Sales *et al.*, 2021), to fitness and reproductive abilities (Zizzari & Ellers 2011, Nguyen *et al.* 2013, Martinet *et al.* 2020). Indeed, temperatures above their critical thermal limits are still detrimental, resulting in neural and endocrinal dysfunctions (Neven, 2000; Jørgensen *et al.*, 2020) and consequently death.

One of the most studied insect groups in regarding their decline is pollinators (Hanley *et al.*, 2015; Melathopoulos *et al.*, 2015; Borges *et al.*, 2020), especially bees, as this would result in important economic and ecosystem services losses (Garatt *et al.*, 2014; Klatt *et al.*, 2014). Bumble bee declines have been observed at a global scale (Cameron & Sadd, 2020), and at continental scales such as North America (Cameron *et al.*, 2011) and Europe (Kosior *et al.*, 2007). Additionally, distributional predictions were made for European bumblebee distributions on basis of historic data (Rasmont *et al.*, 2015), predicting a high change of range contraction for the majority of species.

Assessments of bee species statuses can also be conducted through direct measurement methods (Uvarov, 1931; Martinet *et al.* 2015b; Oyen *et al.*, 2016; Oyen *et al.*, 2018, Martinet *et al.*, 2021). Experimental methods can estimate climatic risk factor for species and can be an alternative in the absence of historic data. Heat resistance for instance can be measured through dynamic methods (Oyen *et al.*, 2016; Oyen *et al.*, 2018) in which the temperature is ramped up progressively to delimitate the higher temperature threshold of the bee species. Another method is subjecting the specimens to a static high temperature representative of a heat wave (Martinet *et al.*, 2015b; Martinet *et al.*, 2021) to estimate species heat resistance under such temperatures.

However, our current knowledge of bee populations vulnerability to climate change is mainly centred around high latitude cold-adapted taxa (Cameron *et al.*, 2011; Martinet *et al.*, 2015b; Oyen *et al.*, 2016). In contrast, comparatively little is known about the large bee diversity of Asia and Africa for which there are also important predictions temperature increases (Cui *et al.*, 2021). The Mediterranean region is one the less studied areas in this regard, where pollinators play an important ecological role (Potts *et al.*, 2006; Herrera, 2019) and contribute to agricultural productivity (Balzan *et al.*, 2018; Bartual *et al.*, 2018).

The present study focuses on several bee species from Lebanon, a country located in the little-studied East Mediterranean strip, at the crossing point between Europe, Asia, and Africa. We focus on social and solitary high-altitude taxa contrasted with coastal and widespread taxa. The chosen area includes many potentially vulnerable species at the southern limits of their distribution (Boustani *et al.*, 2021) for which no data exists on vulnerability to heat stress. In the absence of historical data on the bee fauna of the region, we use an experimental method to assess local species vulnerability to heat waves. We adopt a species-centric approach to measure heat stress resistance and suggest a heat resistance status for each taxon.

We test here whether i) there is difference between the heat stress resistance of males and females, ii) whether taxon and dry weight influence interspecific variability of heat stress resistance, and iii) whether dry weight, altitude, and Julian day influence inter-individual variability of heat stress resistance.

We hypothesise that females will be more heat resistant than males, that taxon and dry weight will have an effect on interspecific variability of heat stress resistance (i.e. that dry body weight is positively correlated with heat resistance), and that dry weight, altitude, and Julian day influence the variability of intraspecies heat stress resistance.

Materials and Methods

Sampling sites and collection methods

Sampling was carried out throughout 2018 and 2019 spring and summer in Lebanon. Specimens were collected between 8:00 and 17:00 on sunny days with no or little wind to maximize chances of collecting targeted bee taxa. After catching by hand net, specimens were placed in individual plastic containers with a cardboard support inside and placed in a car cooler (Dometic CoolFreeze CF11 10.5 L) set between 10-12°C to avoid any overheating in the containers. The choice of temperature is explained in the following section.

Sampling sites were chosen based on abundance of the target bee species and their commonly foraged flowers, and each target species had at least two collection localities 3 km apart. Sample sites included coastal areas and sites starting from an altitude of 900 m to collect a maximum of targeted high-elevation species. Some medium-altitude sites were chosen for complementary collections of bumblebees.

Choice of species

Targeted species are from seven different genera (i.e. *Bombus*, *Xylocopa*, *Anthophora*, *Anthidium*, *Habropoda*, *Eucera*, and *Megachile*), including eusocial taxa (genus *Bombus* and a facultative sociality in *Xylocopa pubescens*) with the remaining taxa being solitary. The species present different local distributions; *Xylocopa pubescens* is restricted to the coastal and semi-arid areas, *Bombus terrestris*, *B. argillaceus*, *Xylocopa valga*, *X. violacea*, *Anthophora plumipes*, *A. nigriceps*, *Anthidium manicatum*, and *Eucera plumigera* are widespread, and *Bombus niveatus vorticosus* and *B. melanurus* are restricted to 1800 m of altitude and above (Boustani *et al.* 2021).

Assessment of hyperthermic stress resistance

We measured time before heat stupor (THS) following the protocol designed by Martinet *et al.* (2015b, 2020). The specimens were placed in an incubator (Herp Nursery II) at 40°C, coupled with a thermostat (Lucky Reptile TC2-PRO Thermo Control Pro II). Humidity was monitored by (Lucky Reptile Thermometer Hygrometer PRO) and kept at 40-60 % by adding water at the bottom. The temperature of 40°C was chosen in this case as it is the maximum temperature recorded in Beirut (Rafic Hariri International Airport, Meteorological Department) and also being an average temperature associated to heat waves across more than 90 countries (Lemos & Rood, 2010; Russo *et al.*, 2015; Ragone *et al.*, 2018).

Bees are fed with sugar syrup before the test to control for any difference in the feeding state before the test and left to rest at 10-12°C in a cooler (Dometic CoolFreeze CF11 10.5L). Temperature is set to above 8°C (standby and non-stressful temperature for cold-adapted bees like bumblebees; Heinrich, 1975; Owen *et al.*, 2013), adopted by Martinet *et al.* (2015a; 2021) to adapt the protocol to the Mediterranean taxa. After at least 2 hours of resting with food available *ad libitum*, the bees were then taken out of the cooler for an hour at room temperature in order to create a progressive return to normal activity before moving the specimens to the incubator.

Bees are then placed in individual plastic tubes with perforated top, bottom, and sides to allow for air flow and temperature homogenisation. The tubes are devoid of any support for the bees to allow for free movement, and no sustenance is offered during the heat test. Specimens are tested by batches of maximum 20 specimens and placed only in the upper section of the incubator in front of the fan (where measurement showed temperature is most stable). Specimens were then monitored through the transparent door of the incubator.

The Time before Heat Stupor (THS) was measured using a chronometer that is started once the specimens are in the incubator. THS corresponds to the time from the insertion into the incubator after a buffer time of five minutes until the heat stupor. Specimens are considered to have reached heat stupor when they are lying on their back and unable to return to normal position when the tube is rotated (Uvarov, 1931). This state is defined by the onset of muscle spasms (Lutterschmidt & Hutchison, 1997a,b). Once this is verified, the insect is removed from the incubator to recover at room temperature, although many specimens died right after reaching THS.

The test was then stopped at 10 hours (600 minutes), this period has been chosen as it represents the maximum length of high temperature on the course of on day. Since the specimens are not fed during the test, the 10-hour period is not exceeded in order to avoid the bias from starvation (Martinet *et al.*, 2015b).

Specimens were weighed right before the test and after removing them from the incubator using Ace CT-50 Portable Miligram Scale, precision ± 0.001g, and weighed after complete dehydration (dry weight) using Lyovac GT2 LEYBOLD-HERAEUS.

Statistical Analyses

THS difference between males and females

We compared heat resistance between males and females with Kaplan-Meier survival curves using “Survminer” R package (Kassambra *et al.*, 2021). Censoring was applied to specimens that did not experience THS during the 10-hour test period. The individuals that “dropped out” of the test and could not spend the 10-hour period in the incubator were eliminated from the analyses. The test was performed for all species with a large enough sample number (N > 11 for each sex) i.e. *Xylocopa violacea*, *X. valga*, *Anthophora plumipes*, *A. nigriceps*, and *Anthidium manicatum*. Medians are not estimated in Kaplan-Meier when the percentage of survivors (in this case specimens exiting the test without THS) is above 50% (Zwiener *et al.*, 2011). Therefore, male and female medians for *Xylocopa pubescens* could not be compared.

Effect of Taxon on THS

As some species displayed a significant difference between males and females THS, sexes were tested in separate groups when testing for Taxon effect. We use Kaplan-Meier survival curves using “Survminer” R package (Kassambra *et al.*, 2021) to assess differences between different taxa.

Effect of dry weight interspecific and intraspecies THS

We first used Shapiro to test whether the data was normally distributed. We used a scatterplot to visualize the correlation between THS and dry weight on the entire dataset to test for interspecific variability, and used non-parametric Spearman tests to investigate correlations. We repeated this analysis for individual species to test for intraspecific variability: *Bombus terrestris, B. niveatus*, *B. melanurus*, *Xylocopa violacea*, *X. valga*, *Anthophora plumipes,* and *A. nigriceps*.

Effect of Altitude on intraspecies THS

Correlation between altitude and THS was calculated for the taxa which had a sample size (n>30), i.e. *Bombus terrestris*, *B. niveatus*, *B. melanurus*, *Xylocopa violacea,* and *X. valga*. We first used Shapiro to test whether the data was normally distributed. We used a scatterplot to visualize the correlation between THS and altitude and then used non-parametric Spearman tests to investigate correlations.

Effect of collection date (Julian Day) on intraspecies THS

We first used Shapiro to test whether the data was normally distributed. We used a scatterplot to visualize the correlation between THS and Julian Day and used non-parametric Spearman tests to investigate correlations.

Results

THS difference between males and females (Figure 1)

In the case of *Xylocopa violacea* and *Anthidium manicatum* (Figure 1-A, Figure 1-E), differences between males and females THS are not significant (p > 0.05). In the case of *X. pubescens* (Figure 1-F) as the survival rate was > 50%, the median values could not be computed.

In contrast, results show that females are significantly more heat resistant than males in the case of *Xylocopa valga* (Figure 1-D, females n=34, median=590, males n=25, median=216) , *Anthophora plumipes* (Figure 1-C, females n=26, median=48,5, males n= 22, median=19.5) and *A. nigriceps* (Figure 1-B, females n=43, median=59, males n=7, median=33). Therefore, males and females are treated as different groups in the following analyses.

Effect of Taxon on THS

There is a significant difference between the THS of the different taxa in the males and the females (p<0.05). Survival differences between taxa have been tested grouping all species but have been plotted in different figures for better visibility.

Females are ordered by increasing THS as follows (Figure 2): *Xylocopa pubescens* (n=15, median=*NA*) > *X. valga* (n=34, median=590 mins) > *X. violacea* (n=21, median=538 mins) > *Anthidium manicatum* (n=12, median=189 mins) > *Megachile montenegrensis* (n=14, median=162 mins) > *M. parietana* (n=16, median=95 mins) > *Anthophora nigriceps* (n=43, median=59 mins) > *A. plumipes* (n=26, median=48.5 mins).

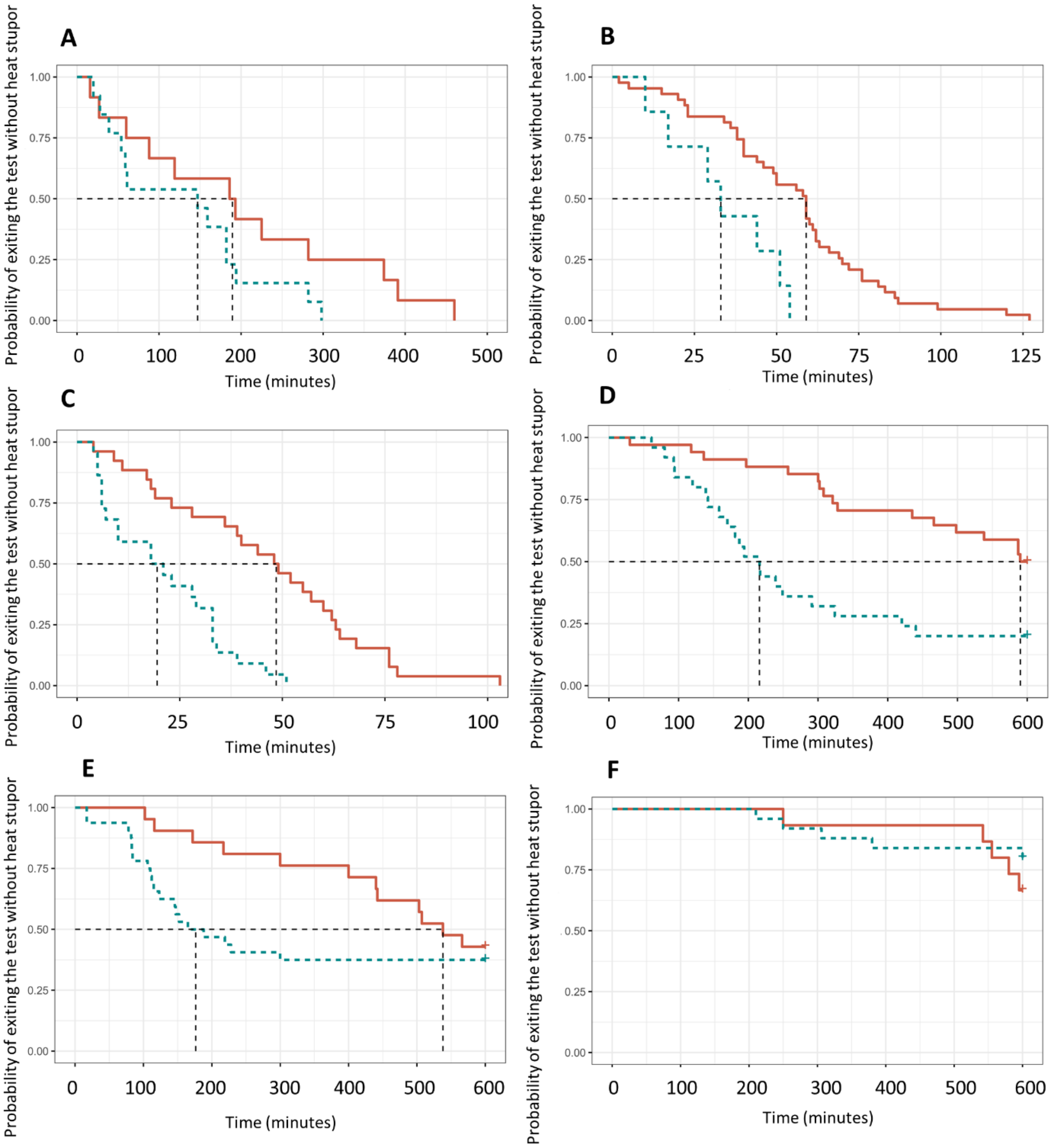

Figure 1: Heat stress resistance test curves of males (blue dotted lines) and females (red lines) of A) *Anthidium manicatum*, B) *Anthophora nigriceps*, C) *A. plumipes*, D) *Xylocopa valga*, E) *X. violacea*, F) *X. pubescens*. The black dotted lines represent the medians.

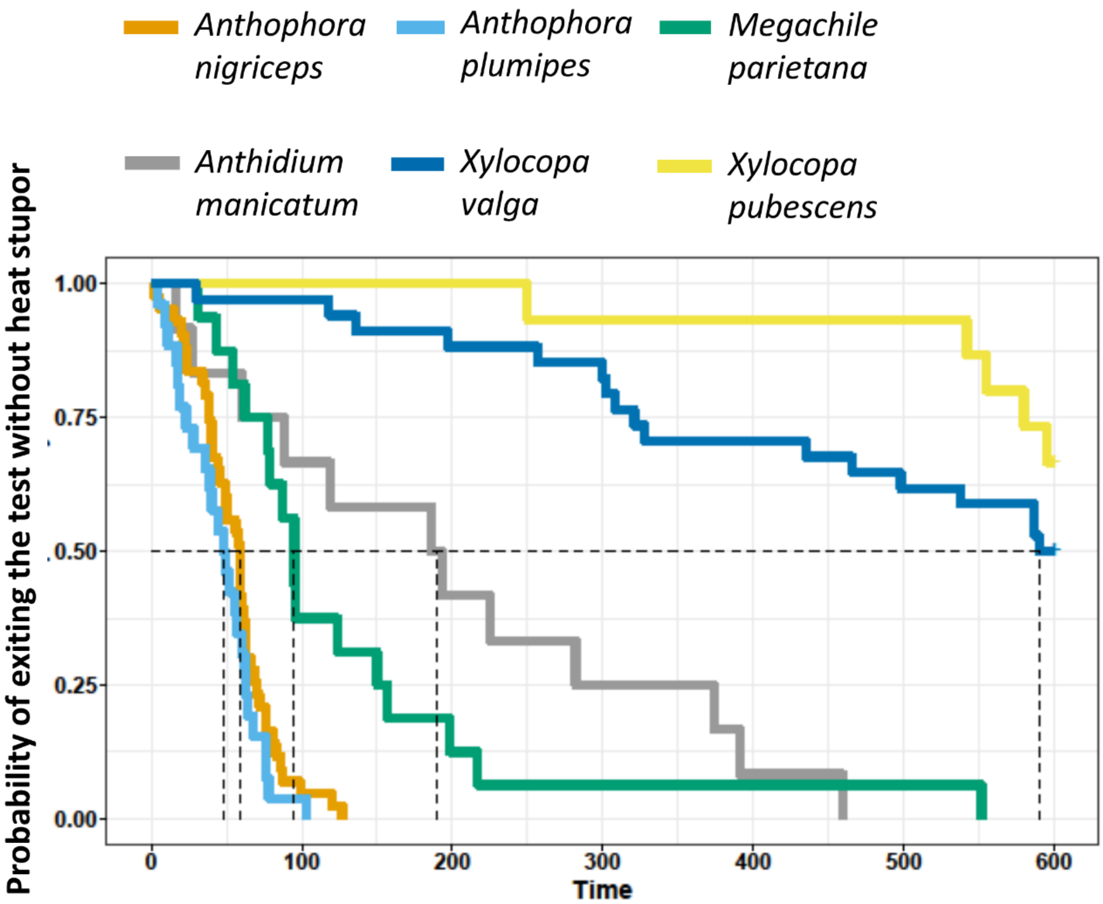

Figure 2: Heat stress resistance test curves of females of *Anthophora nigricpes*, *Anthophora plumipes*, *Megachile parietana*, *Anthidium manicatum*, *Xylocopa valga*, *Xylocopa pubescens*. The black dotted lines represent the medians.

Males are ordered by increasing THS as follows (Figures 3 and 4): *Xylocopa pubescens* (n=25 mins, median not calculated due to high survival rate) > *Bombus terrestris* (n=44, median=252.5 mins) > *Xylocopa valga* (n=25, median=216 mins) > *X. violacea* (n=32, median=176.5) > *Anthidium manicatum* (n=13, median=147 mins) > *Bombus argillaceus* (n=13, median=132 mins) > *Eucera sp.* 1 (n=10, median=100 mins) > *E. plumigera* (n=7, median=66 mins) > *Habropoda hakkariensis* (n=8, median=54.5 mins), *Bombus melanurus* (n=39, median=46 mins), *B. niveatus*, (n=49, median=34 mins), *Anthophora nigriceps* (n=7, median=33 mins), *A. plumipes* (n=22, median=19.5 mins)

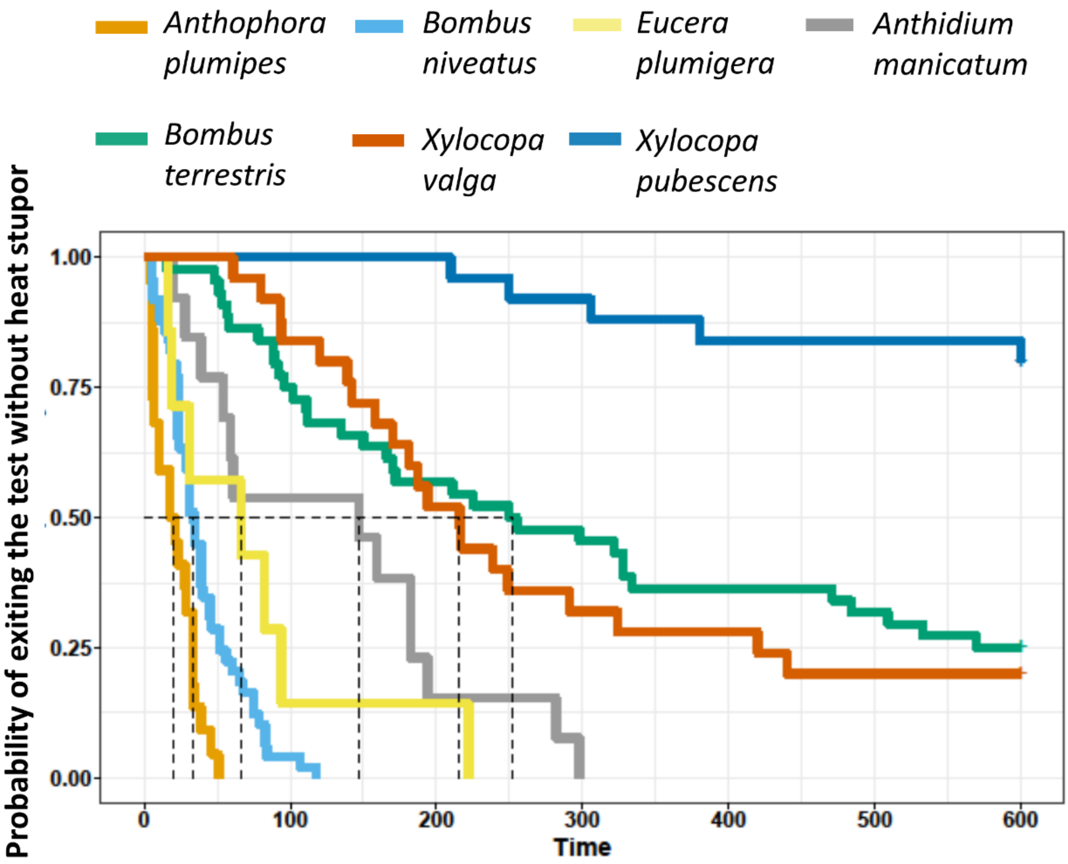

Figure 3: Heat stress resistance test curves of males of *Anthophora plumipes*, *Bombus niveatus*, *Eucera plumigera*, *Anthidium manicatum*, *Bombus terrestris*, *Xylocopa valga*, and *X. pubescens*. The black dotted lines represent the medians.

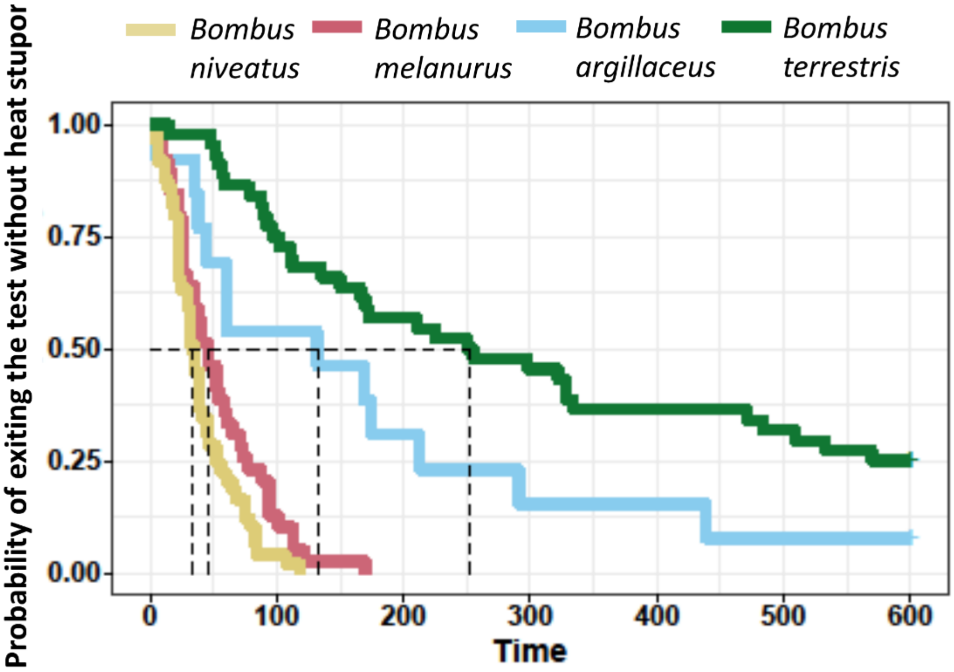

Figure 4: Heat stress resistance test curves of males of *Bombus niveatus*, *Bombus melanurus*, *Bombus argillaceus*, and *Bombus terrestris*. The black dotted lines represent the medians.

Effect of dry weight on interspecific and intraspecies THS

On an interspecific level, there is a positive correlation between dry weight and THS (rho=0.684; $p<0.05$). On an inter-individual level, there is a positive correlation for *Bombus terrestris* (rho= 0.352; $p<0.05$), *Xylocopa violacea* (rho= 0.575; $p<0.05$), and *X. valga* (rho= 0.528; $p<0.05$). In contrast, no correlation was observed for *Bombus niveatus, B. melanurus*, *Anthophora plumipes*, and *A. nigriceps*.

Effect of Altitude on intraspecies THS

Bombus niveatus and *B. melanurus* had no correlation ($p > 0.05$). In constrast, for *Bombus terrestris* ($p<0.05$) THS had a negative correlation with higher altitude, and *Xylocopa valga* and *X. violacea* both have a positive correlation with higher altitude ($p<0.05$)

Effect of collection date (Julian Day) on intraspecies THS

Xylocopa violacea (rho=0.765; $p<0.05$) and *X. valga* (rho=0.460; $p<0.05$) have a positive correlation with increasing value of Julian Day. In other words, specimens collected later during the season display a higher THS. In contrast, *Bombus terrestris, B. melanurus*, *Anthophora nigriceps,* and *A. plumipes* THS had no correlation with Julian day.

Table 1: Summary table of THS medians for males and females with distribution information and size catgeory. The global distributions are taken from Rasmont *et al*. (2015) for bumblebees and Ascher and Pickering (2021) for the other genera. Local distribution (altitude range) taken from Boustani *et al*. (2021).

Taxon	THS Median Males (mins)	THS Median Females (mins)	Global Distribution	Local Distribution (Altitude in meters)	Size Category
Anthidium manicatum	147	189.5	Palearctic	0-3000	Small-bodied
Anthophora nigriceps	33	59	West Palearctic	0-3000	Small-bodied
Anthophora plumipes	19.5	48.5	Palearctic	0-3000	Small-bodied
Bombus argillaceus	132	*NA*	Palearctic	0-3000	Large-bodied
Bombus melanurus	46	*NA*	Palearctic	1800-3000	Large-bodied
Bombus niveatus	34	*NA*	Palearctic	1800-3000	Large-bodied
Bombus terrestris	252.5	*NA*	Palearctic	0-3000	Large-bodied
Megachile parietana	*NA*	95	West Palearctic	0-3000	Small-bodied
Eucera sp. 1	100	*NA*	Levant	0-3000	Small-bodied
Habropoda hakkariensis	54.5	*NA*	East Mediterranean	1500-1750	Large-bodied
Megachile montenegrensis	*NA*	162	Palearctic	900	Small-bodied
Eucera plumigera	66	*NA*	West Palearctic	0-1800	Small-bodied
Xylocopa pubescens	*NA*	*NA*	West Palearctic	0-1000	Large-bodied
Xylocopa valga	216	590	West Palearctic	0-3000	Large-bodied
Xylocopa violacea	176.5	538	Palearctic	0-3000	Large-bodied

Discussion

Our results show that heat stress resistance varies predominantly between species, but can also vary intraspecifically between sexes and different body sizes. We show that males and females of some taxa have differences in their heat stress resistance, and that females are systematically more resistant in those cases. Male and female bees have important role differences in species reproduction (Michener 2006). Except rare biparental bee cases such as *Ceratina nigrolabiata* (Mikát *et al.* 2021), males are not invested in caring for the offspring. Therefore, a heat wave compromising male fertility could have damaging effects on the species fitness (Martinet *et al.* 2020), but these effects will also be detrimental if they concern females (McAfee *et al.* 2020). Differences in heat resistance between sexes could be explained by the longer flight and activity periods of females. This can imply withstanding higher temperatures more efficiently by producing heat shock proteins (Zhao *et al.*, 2021). Furthermore, the haploid male – diploid female system for bees (Cook, 1993) could be responsible for more genes being expressed in females. This difference has been observed between haploid and diploid males of *Apis* (Yan *et al.*, 2016), but is yet to be tested between male and female solitary bees to our knowledge.

In contrast, Gonzalez *et al.* (2020) reports no difference between male and female *Xylocopa*. Different measurement methods (Terblanche *et al.*, 2007) and chosen temperature ramping rate (Oyen & Dillon, 2018) can be the cause of these outcome differences.

We also find an effect of taxon on heat resistance, in line with results in literature (Martinet *et al.* 2015b, Oyen *et al.* 2016, Oyen *et al.* 2018, Gonzalez *et al.* 2020; Zambra *et al.* 2020, Martinet *et al.* 2021). Furthermore, our results within *Bombus* mirror those of (Martinet *et al.*, 2015b; Oyen, *et al.*, 2016; Zambra *et al.* 2020, Martinet *et al.* 2021) where widespread species such as *Bombus terrestris* are more resistant to heat stress than restricted taxa in altitude or latitude. Indeed, the species with more efficient physiological processes are more likely to cope with heat stress without damage (González-Tokman *et al.*, 2020). Furthermore, these differences can be explained by the species displaying higher plasticity and adaptability to different habitats (Ayrinhac *et al.* 2004), as well as genetic variability (Gueth et al, 2021).

When testing for the effect of dry weight, we show a positive correlation with interspecific variability of heat stress resistance. Studies comparing different genera show that species from the larger-bodied genus thermoregulate more efficiently, i.e larger *Bombus* versus smaller bee taxa (Bishop & Armbruster, 2002), and species from larger Euglossini genera versus smaller ones (May & Casey, 1983). Similarly, in our results the larger-bodied *Bombus* and *Xylocopa* include the most heat resistant species and seem to be driving this overall trend.

Additionally, we show an inter-individual variability of heat resistance with body weight for the widespread taxa large-bodied (*Bombus terrestris*, *Xylocopa violacea*, and *X. valga*) in contrast with Oyen *et al.* (2016), Martinet *et al.* (2020), and Maebe *et al.* (2021) who that found no correlation, as well as Heinrich & Heinrich (1983) who found the opposite trend. In contrast, smaller bodied *Anthophora plumipes*, *A. nigriceps* (both locally widespread), and larger bodied *Bombus melanurus*, and *B. niveatus* (both locally restricted) did not display any intraspecific variability. This suggests that although body size can explain part of the variability of the heat stress resistance, it seems to only be the case for taxa that are both large-bodied and widespread. Other factors need to be explored as potential drivers of inter-individual variability in thermal tolerance such as physiological plasticity resulting from temperature acclimation (Terblanche & Chown, 2006), and environmental factors that could be stimulating the enhanced response to heat stress.

The environmental factor we tested for was altitude and it shows similar trends in inter-individual variability. Indeed, only the widespread large-bodied taxa showed a correlation of heat stress resistance with altitude starting with a negative relationship in the case of *Bombus terrestris*. As altitudinal distribution of species is determined by their thermoregulation capacity (Hodkinson, 2005), we would expect that the higher altitude specimens subjected to more extreme temperatures to have decreased thermoregulation abilities. For instance, Gonzalez *et al.* (2020) show that thermal maximum of *X. violacea* decreased with altitude. In contrast, there is a positive correlation between altitude and the heat stress resistance of both *Xylocopa violacea* and *X. valga* in our case. As these two taxa are the only ones with a variability of heat stress resistance in correlation with Julian day (collection date), the positive relationship can be explained by an enhanced heat response as summer temperatures rise. This could be driven by the enhanced production of heat shock proteins when facing higher temperatures (Zhao & Jones, 2012; Cahan *et al*., 2016), or the availably of better quality of nutrition later during the season (Sisodia & Sindh, 2012; Vanderplanck *et al.*, 2019; Iltis *et al.*, 2021).

Finally, our result show that more than half of the species we tested have low heat stress resistance. As a result, they are likely to undergo substantial population damage in case of a heat wave. This highlights that insects in warm temperate climates can still be vulnerable heat stress (Andrew *et al.* 2013), and suggests a heightened sensitivity of the individuals at the southern range of their distribution (Bestion *et al.* 2015). Indeed, *Bombus melanurus* and *Habropoda hakkariensis* that ranked among the lowest in heat stress resistance are at their southernmost distribution limit in Lebanon (Boustani *et al.*, 2020). *Bombus niveatus* is also close to the southern limit in Lebanon and was not found under 1800 m a.s.l. in recent surveys (Boustani *et al.*, 2020), but it is expanding towards the north of its distribution (Rasmont *et al.* 2015). This suggests a possible altitudinal shift at the southern limit and latitudinal range shift towards the north by this species (Kerr *et al.*, 2015). In contrast, the expanding *Bombus terrestris* (Martinet *et al.*, 2015a; Rasmont *et al.*, 2015), *B. argillaceus*

(Rasmont *et al.*, 2015), *Xylocopa violacea* (Banaszak *et al.*, 2019), *X. valga* (Huflejt & Jerzy, 2016), and *Anthidium manicatum* (Gibbs & Sheffield, 2009) all display a higher heat resistance.

The remaining species that ranked low in heat stress resistance are also widespread taxa (i.e. *Megachile montenegrensis, Megachile parietana*, *Anthophora nigriceps, A. plumipes*, and *Eucera plumigera*). This suggests that although heat stress resistance can explain a species range shift or current distribution, the processes that allow these taxa to colonize many habitats and a wide latitude range may not be enough to ensure their resilience in changing climatic conditions. Therefore, conservation plans should consider all aspects allowing for the species survival, from the wide distribution buffering the effects of climatic stress, to the morphological and physiological traits involved in responses to heat stress.

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Chapter 3

Variation in wild bee community composition along an altitudinal transect in the Mediterranean mountains of Lebanon

View of the forest of the Cedars of God reforestation area and the mountainous plateau of Ainata El Arz (North Lebanon) near the peak of Mount Lebanon.
Picture by Mira Boustani.

This chapter focuses on the variability community composition of a montane altitudinal transect in North Lebanon. We describe the trends and explore altitude and flora as drivers of this variability.

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Chapter 3: Variation in wild bee community composition along an altitudinal transect in the Mediterranean mountains of Lebanon

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Abstract

Altitude is linked to several biotic and abiotic processes that play an important role in structuring faunal and floral diversity. Wild bee communities are often variable across different altitudes primarily thought to be due to climatic constraints. Although the available flora could also be an important driver of bee community variability, it has seldom been explored in an altitudinal transect setting. We focus here on Lebanon, an eastern Mediterranean country with a mountainous landscape and high bee diversity. We studied the variability of the bee community on the western slope of Mount Lebanon over the course of two years, finding a decreasing trend in bee species richness, generic richness, and bee abundance with increasing altitude. We also find that variation in the wild bee community along the transect is mainly due to species turnover. Furthermore, both altitude and flower species richness have an effect on bee species richness, but only floral richness affects bee abundance. Finally, we find a correlation between flower and bee communities nestedness for both years, and a correlation between turnover of flower and bee communities for a single year. We highlight the role of both altitude and floral community in structuring the bee communities along the transect, and the importance of montane habitats to maintain the local biodiversity of bees.

Introduction

Altitude is one of the most important factors structuring biodiversity across space. Indeed, mountains host multiple geological and ecological processes that generate diverse communities in these ecosystems (Antonelli *et al.*, 2018; Perrigo *et al.*, 2020). One well-studied driver determining faunal and floral composition with increasing altitude is decreasing temperature. Indeed, species distributions are limited by their maximum and minimum temperature resistances (Hodkinson, 2005), and by the energetic cost of thermoregulation outside their optimal distribution (Londoño *et al.*, 2017). Additionally, temperature can impose phenological (Hill & Hodkinson, 1995) and developmental constraints (Azrag *et al.*, 2018), limiting species distribution across altitudes. Other factors such as differences in rainfall (Gathorne-Hardy *et al.*, 2001; Tattersfield *et al.*, 2006) and humidity (García-López, 2012) are also influential. Furthermore, biotic conditions structure species distribution in mountain ranges mainly through food availability and species adaptation to the nutritional (Bissell, 2013; Green, 2013; Redjadj *et al.*, 2014).

The changing conditions along an altitudinal transect can cause the proportion of species shared between different altitudes to be very small (Novotny *et al.*, 2005). For instance, a common phenomenon in insect communities is species replacement (turnover) along the altitudinal gradient (de Groot & Vrezec, 2019). This turnover can be due to the effect of temperature (Faria *et al.*, 2013), but it has also been shown to be strongly linked to plant community structure (Coelho *et al.*, 2017).

Historic observations of fauna and flora on altitudinal transects are often used to understand how changes in abiotic and biotic conditions partition communities (McCain & Grytnes, 2010). Pollinators, especially wild bees, have been the focus of studies around the world as they play an important role in the reproduction of many wild and cultivated plants (Goulson, 2003; Winfree, 2010). Indeed, bees depend on floral resources as their main food source (Michener, 2007; Leach & Drummond, 2018). Furthermore, the high sensitivity of wild bees to environmental conditions (Schindler *et al.*, 2013; Odanaka & Rehan, 2019), and their altitude range shifts in response to climate change (Kuhlmann *et al.*, 2012; Pyke *et al.*, 2016) make them a good model for the study of community variability in altitude. Observations of wild bee community responses to altitude have mainly focused on temperate and neotropical mountain ranges. The most common trends in these climatic regions are species richness decrease with altitude (Perillo *et al.*, 2017; Pinto *et al.*, 2019), as well as abundance (Huebner, 2017; Perillo *et al.*, 2017). Additionally, as bee species diversity and abundance diminish with higher altitudes, a phylogenetic clustering is observed, driven by environmental filtering (Hoiss *et al.*, 2012; Sydenham *et al.*, 2015). Families, genera, or species will show a variety of trends (Bruun *et al.*, 2006) and will also vary in different climatic settings (McCain & Grytnes, 2010).

Plant community composition influences pollinator community composition, diversity, and abundance (Nielsen *et al.*, 2012). Furthermore, the diversity and density of available floral resources structure bee communities at the local scale (Hegland & Boeke, 2006; Nielsen *et al.*, 2012; Reverté *et al.*, 2019). Bee species show plasticity in their floral choice, being in many cases able to shift host plants when their main host is not available (Williams, 2003).

Consequently, plant-bee relationships can fluctuate between years if species are not consistently specialized in their flower choices (Petanidou *et al.*, 2008).

As one of the most species-rich regions globally (Blondel *et al.*, 2010), the Mediterranean harbours a variety of wild bee species with rich communities and complex pollination networks (Blionis & Vokou, 2001; Petanidou *et al.*, 2008; Mazzeo *et al.*, 2015; Kratochwil *et al.*, 2019). The mountainous landscape around the basin creates several high-altitude regions that act as diversity and endemism reservoirs (Médail & Diadema, 2009; Infusino *et al.*, 2016). Lebanon is a country with a highly mountainous landscape located in the eastern Mediterranean strip. The landscape is shaped by two mountain chains that run parallel to the coastline, and the Mount Lebanon range is adjacent to the thin coastal plain. The high shift in altitude between sea level and the 3000 meters a.s.l. peak and abrupt slope of Mount Lebanon generates a diversity of habitats that become progressively arid after the peak of the mountain chain towards the east (Abi Saleh & Safi, 1988). Consequently, the highly undulated topography and proximity of the mountains to the sea suggests that bee communities in Lebanon may be structured differently than the commonly observed trends elsewhere in the Mediterranean.

Our study focuses on an altitudinal transect on the western slope of Mount Lebanon where the change in elevation is the greatest. Our objectives are i) to describe the bee community trends at species, genus, and family levels across this altitudinal gradient, ii) describe the composition of the bee community, and iii) study how the variation in the plant community affects the distribution of bee communities across this altitudinal gradient.

Materials and Methods

Study sites

A total number of 13 sites were sampled in 2018 and repeated in 2019 with the addition of one site. The sampling was carried out over two years to avoid any biases resulting from the frequent fog and strong wind in the sampled area, and to raise the number of repetitions per site. Table 1 below provides the altitudes, vegetation cover classification, and number of repetitions per year for every site. Annexes I and II provide every site locality and geographical coordinates and the repetition dates.

Sites were chosen along an altitudinal gradient between 900 and 2900 m a.s.l. (Figure 1, Table 1). Following the vegetation cover classifications suggested by Abi Saleh & Safi (1988) we sampled in the Supramediterranean (1000–1500 m; sites A, B, C), Montane Mediterranean (1500–2000 m; sites D, E, F, G, H, I, J) and Oromediterranean (>2000 m; sites K, L, M, N). All sites are on the western slopes of the Mount Lebanon mountain chain in the humid Mediterranean climate. To best represent the Montane Mediterranean level that has a more complex habitat range, we chose wooded (D, G, H, I) and non-wooded sites (E, F, J).

Sites were grouped in two clusters between the areas of Tannourine and Bcharre to constitute an accessible and reproducible altitudinal transect between 900 and 3000 m a.s.l. as shown in the map (Figure 1): sites A to H in the Tannourine area with 1 to 3 km between them, except for G and H that were 100 m apart; and sites I to N in the Bcharre area with 1 to 10 km between them. Site H was chosen near the Tannourine Reserve gate, and only 100 m apart from site G, to also represent areas with disturbances as it falls outside the protected boundaries.

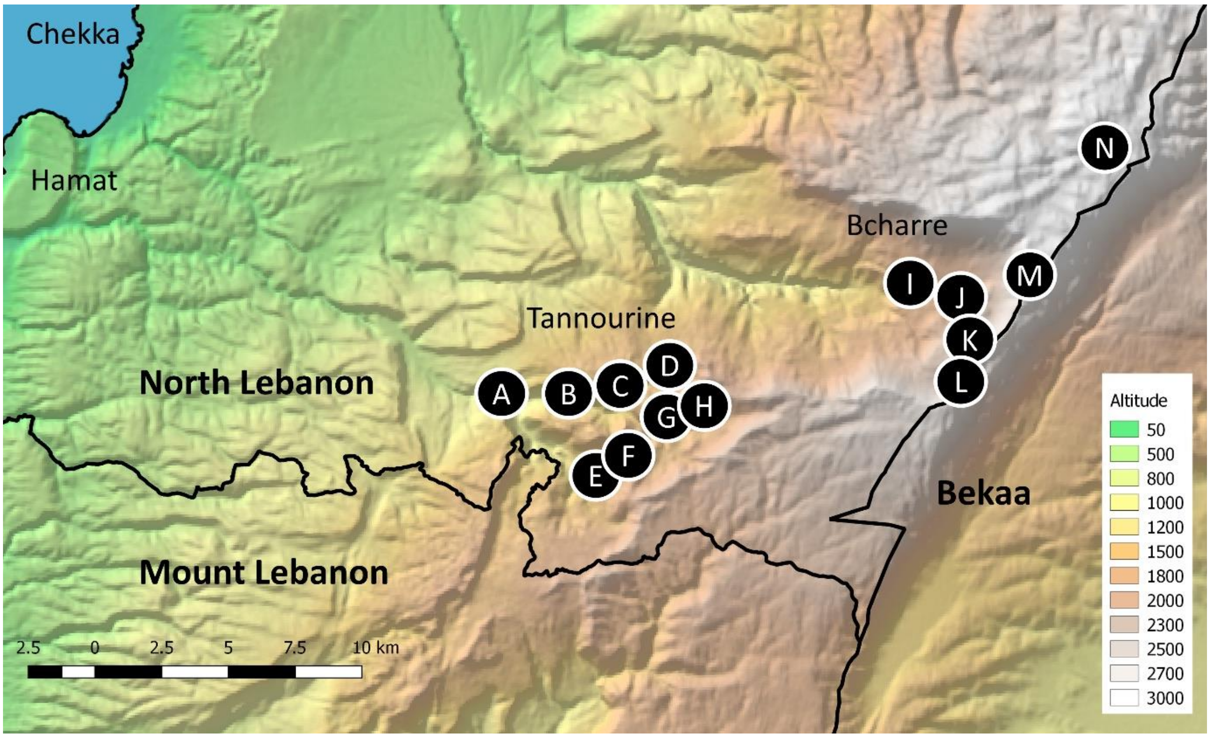

Figure 1: Localities of the sampling sites on the eastern slope of Mount Lebanon between 900 and 3000 m a.s.l. The borders show the province delimitations.

Table 1: Site listing with the altitude, vegetation cover are classified as follows: Supramediterranean: 1000–1500 m, where we included site A as it follows the typical vegetation of this category, Montane Mediterranean 1500–2000 m, and Oromediterranean >2000 m. Wooded sites are indicated.

Site	Altitude	Vegetation cover	Sampling Repetitions in 2018	Sampling Repetitions in 2019
A	900	Supramediterranean	*NA*	3
B	1187	Supramediterranean	6	6
C	1519	Supramediterranean	6	6
D	1639	Montane Mediterranean	6	5
E	1662	Montane Mediterranean	6	5
F	1765	Montane Mediterranean	6	5
G	1739	Montane Mediterranean	6	5
H	1766	Montane Mediterranean	6	5
I	1883	Montane Mediterranean	4	5
J	1933	Montane Mediterranean	5	5
K	2345	Oromediterranean	4	4
L	2585	Oromediterranean	2	2
M	2882	Oromediterranean	2	2
N	2911	Oromediterranean	2	2

Sampling method

Collection began at all sites on both years when snow melted starting from late March to late August. A new collection was carried out for every time new plant species flowered with roughly 2-4 weeks between visits and stopped at the last wave of summer flowers.

As all the plots have an irregular surface and a patchy distribution of flowering plants, collections were carried out on plots of 20*20 m^2 using transect walks that circled flowering plants and bare areas for 30 minutes on each site. All sampling visits were carried out by one person in order to avoid collector bias (Westphal *et al.*, 2008). Between two and five sites were visited during the same day if the weather conditions were adequate and between 10:00 and 16:00. Collections were all carried out on sunny days without clouds or with a slightly cloudy cover, if the weather was cloudy collections were postponed to a sunny day later during the week. Bees were collected using hand nets by sweeping on the flowers and around the flowering clumps. Specimens were stored in plastic vials and were killed using ethyl acetate or by freezing. Posteriorly collected specimens were pinned for conservation. Collection and conservation methods followed Michez *et al.* (2019). The visited flowers were recorded and sampled for herbarium when field determination was not possible. Plant determinations were made using Mouterde (1966, 1970, 1984).

Specimen determinations

Specimens were determined to species level by specialists as follows; Colletini: Kuhlmann M. (Germany), Hylaeinae: Dathe H. (Germany), Andreninae and Panurginae: Wood T.J. (Belgium), Halictidae: Pauly A., (Belgium), Sphecodes: Straka J. (Czech Republic), Melittidae: Michez D. (Belgium), Megachilini: Praz C. (Switzerland), Coelioxys: Schwarz M. (Austria), Osmiini: Müller A. (Switzerland), Anthidiini: Litman J. (Switzerland), and Kasparek M. (Germany), Anthophorini: Rasmont P. (Belgium), Eucerini: Risch S.

(Germany), Xylocopinae: Terzo M. (Belgium), Nomadinae: Straka J. (Czech Republic), Bombini: Rasmont P. (Belgium).

When a species name could not be given with confidence the specimen was assigned a morphotype name or number. When none of these was possible it was used with the genus or subgenus name only. Some specimens (approximately 100) were lost or damaged during shipment and were excluded from the analysis.

Statistical analyses

Data was digitised using Data Fauna Flora 5.1.2 (Barbier *et al.* 2000), then exported to Excel tables for analysis. Mapping was done with Quantum GIS 2.18.27.

All analyses were performed in the statistical environment R (R Core Team 2021). To test for the possible relationship of spatial distribution of the sites and the altitudinal gradient, we performed a spatial autocorrelation analysis with the Moran's I. We found that the elevation was strongly spatially autocorrelated ($I = 0.28$, $p = 0.0026$). As space and altitude were strongly correlated, we decided to work only with altitude for further analysis.

1. *Relationship between altitude and bee communities*

We analysed the effect of altitude on bee community abundance, bee species, genus, and family. We performed a separate Generalised Linear Mixed Models (GLMM) for every case with a Poisson distribution of the data. The data were pooled for the different sampling events for every site. Altitude was used as the only explanatory variable and log transformed to avoid scaling problems with the response variable. Sample size was 27 replicates, 14 sites of which 13 were sampled on both years. Year of sampling was included as a random effect in the models. GLMMs were performed using the function 'glmer' in the 'lme4' package (Bates *et al.*, 2015) of R.

2. *Community composition variability*

To describe variation in bee community composition we calculated beta-diversity between sites with the Sørensen qualitative dissimilarity index using the betapart package (Baselga *et al.* 2021) for R. To account for the effect of altitude in the change of bee community composition, we performed a Mantel test with the beta-diversity indices and a distance matrix with the difference in altitude in metres between sites implemented in the package Vegan for R (Oksanen *et al.* 2020). We performed the analysis with the data of the two years of sampling separately. Sample size was 78 possible combinations of pairs of plots in the 2018 data and 91 possible combinations of pairs of plots in the 2019 data. The number of permutations used in the Mantel test was 9999 for both cases.

Moreover, we wanted to know if the changes in bee community composition across the altitudinal gradient is due to species replacement or to species loss. For this purpose, we used the division of beta-diversity into nestedness and turnover. We performed a Mantel test between each dissimilarity matrix containing the nestedness or the turnover component of beta-diversity and the matrix of difference in altitude in metres. We performed each analysis twice, with the data of the two years of sampling separately.

To visually represent the species turnover along the altitudinal gradient, we generated a Venn diagram with the three vegetation level categories: Supramediterranean (900 – 1500 m), Montane mediterranean (1500– 2000 m), and Oromediterranean (> 2000).

3. *Relationship between plant community and bee community*

3.1. *Effect of plant richness on bee richness and abundance*

In order to test if the main driver of bee variability is variation in the plant community rather than altitude, we tested the importance of the plant community in the distribution of the bee community along the altitudinal gradient. We considered the effect of plant richness on bee richness, and the effect of plant richness on bee abundance. Plant richness is the total number of visited flowers recorded per site. We performed a GLMM for each case with a Poisson distribution of the data. The models include altitude (log transformed) and the richness of plant species per site as explanatory variables. The multicollinearity between explanatory variables was assessed using the variance inflation factor (vif) with the function 'vif' within the package 'car' (Fox *et al.*, 2019). Variables were only kept when the value was lower than 4 (Zuur *et al.*, 2010). The interaction between altitude and plant richness was not included in the model because the vif factor raised critically when including it and had to be removed. Year of sampling was included in the model as a random effect. To see if not both explanatory variables had an effect on bee richness, we performed a model selection procedure. The departure model was the full model including both explanatory variables. To select the models with the best fit, we used AICc, the Akaike's information criterion with a correction for low sample sizes. We selected those with ΔAICc < 2 (Burnham & Anderson, 2002). Only one model was selected with the selected criteria, the full model. Model selection was performed using the function 'dredge' in the 'MuMIn' package (Bartoń, 2020). In the case of bee abundance, the same explanatory variables and random effect were used. Based on the model selection procedure, we selected the model with only plant richness in this case.

3.2. Relationship between plant and bee community composition

Lastly, we analysed the relationship between plant and bee community composition. The plant community considers only the plant species observed being visited by bees. We correlated separately the two components of beta-diversity, nestedness and turnover, of flower and pollinator communities. To remove the variability in bee community composition explained by the altitudinal gradient and to account only for the effect of the plant community composition, we conducted partial Mantel tests between the three matrices (bees, plants, and altitude). As in the previous analysis, the data for the two years were tested separately.

Results

We recorded 1989 individual bees belonging to 286 species and morphospecies, 42 genera and six bee families. The community of flowers visited by bees was composed of 129 plant species and 24 plant families. Considering the two years of sampling separately, 786 individual bees and 168 bee species were collected in 2018, while 1203 individuals and 232 bee species were collected in 2019. From the collected specimens, 81 species belong to Apidae, 80 to Megachilidae, 70 to Halictidae, 39 to Andrenidae, 15 to Colletidae, and 1 to Mellitidae (Figure 2-A). The most abundant family overall was Apidae (878 specimens), followed by Halictidae (485 specimens), Megachilidae (387 specimens), Colletidae (120 specimens), Andrenidae (118 specimens), and Mellitidae (1 specimen) (Figure 2-B).

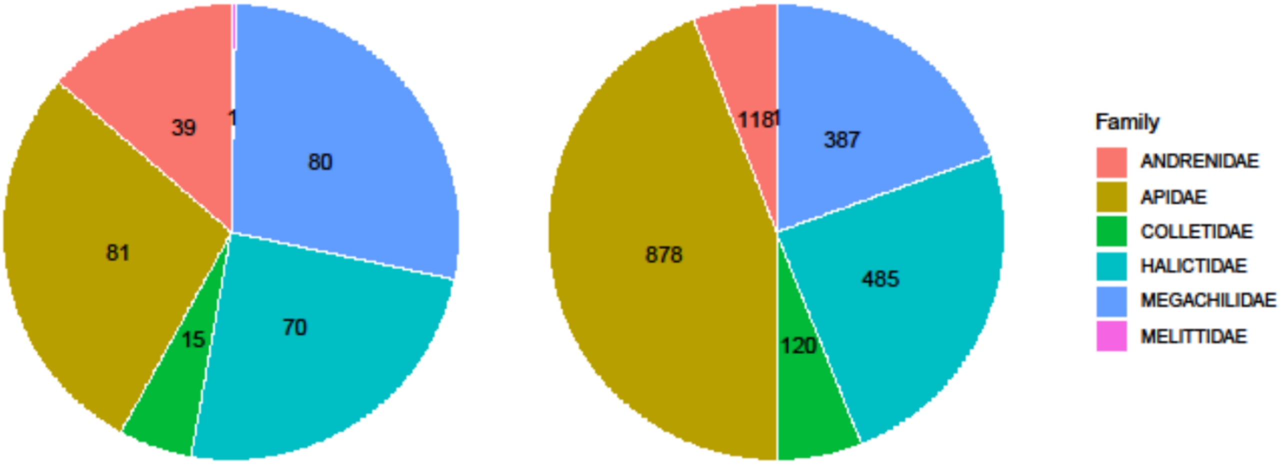

Figure 2: A) Number of species per family, B) Number of collected specimens per family.

1. *Relationship between altitude and bee communities (Figure 3)*

The relationship between bee abundance and altitude was significantly negative (parameter estimate: -0.463, n= 27, df= 24, p<0.001). Furthermore, the relationship between bee species richness and altitude was also significantly negative (parameter estimate: -0.995, n=27, df= 24, p<0.001). Similarly, bee genera richness shows a significant negative relationship with altitude (parameter estimate: -0.999, n=27, df= 24, p<0.001). In contrast, bee family richness did not vary significantly with altitude (n=27, df= 24, p = 0.43).

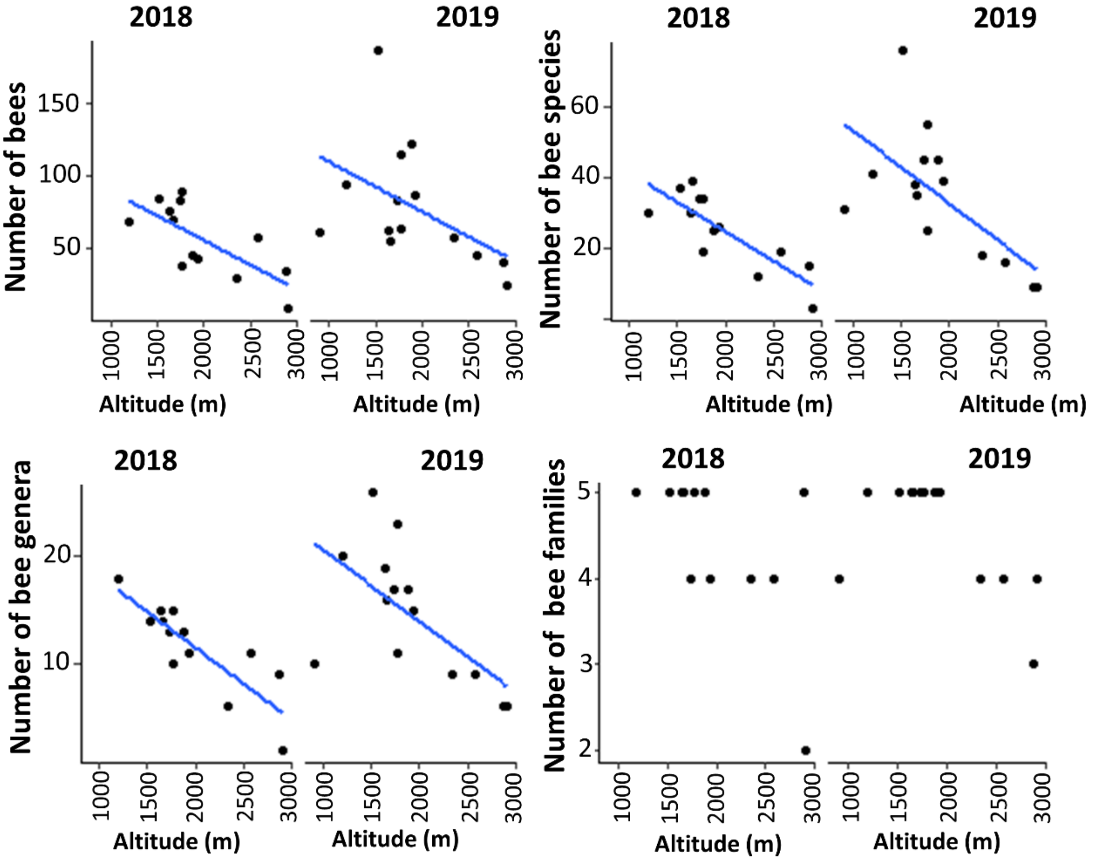

Figure 3: Relationship between number of bees (bee abundance) and altitude (top left), number of bee species (bee species richness) and altitude (tope right), number of bee genera (bee generic richness) and altitude (bottom left), and number of bee families (bee family richness) and altitude (bottom right) for years 2018 and 2019.

2. Community composition variability

The relationship between qualitative beta diversity (Sørensen index) and difference in altitude between sites is significant for 2018 (r =0.75, p<0.001), and 2019 (r=0.76, p<0.001).

Partitioning of beta diversity shows that the relationship between the turnover (replacement) of species and the differences in altitude between sites is significant both in 2018 (r =0.75, p<0.001), and in 2019 (r=0.62, p<0.001). On the other hand, the relationship between nestedness (site communities being subsets of a larger community) and difference in altitude between sites is not significant both in 2018 (p=0.99), and 2019 (p =0.63). In other words, the smaller communities of the higher altitude are due to species replacement and not to having a subset of the lower altitude communities (Figure 4).

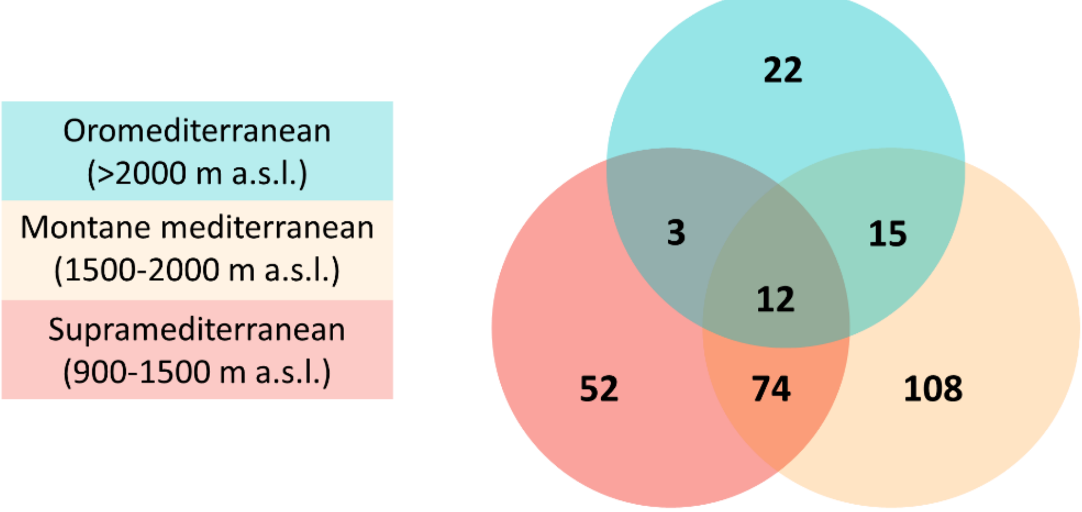

Figure 4: Venn Diagram showing the proportion of shared species between the different vegetation cover categories.

3. *Relationship between plant community and bee community*

3.1. Effect of plant richness on bee richness and abundance (Figure 5)

Both altitude and flower richness had a significant effect on bee richness (n=27, df= 23; Plant richness: parameter estimate= 0.07, p <1.0e-5; Altitude: parameter estimate: -0.61, p < 0.0002). In contrast, only floral richness had a significant effect on bee abundance (n=27, df= 23; Plant richness: parameter estimate= 0.06, p <0.001).

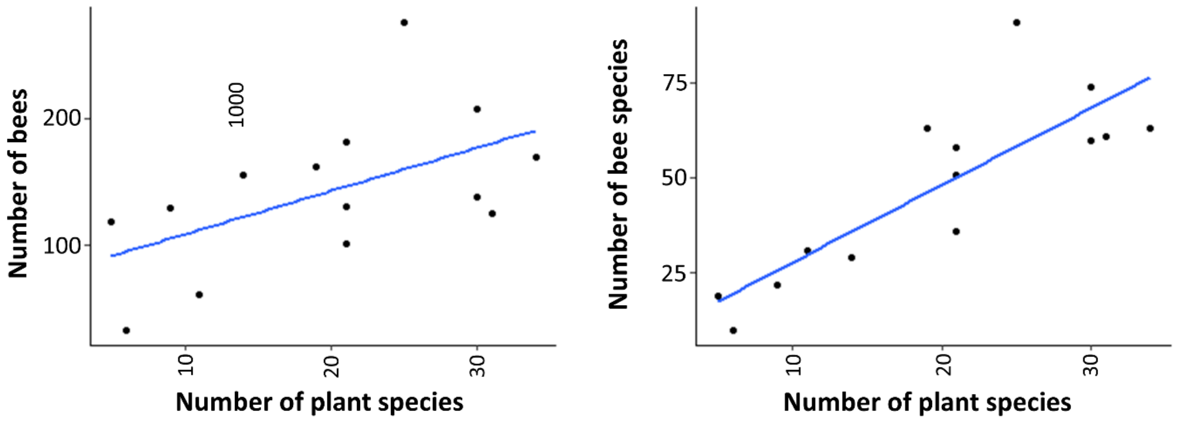

Figure 5: Relationship between number of bees (bee abundance) and number of plant species (plant richness) (left), and relationship between number of bee species (bee richness) and number of plant species (plant richness).

3.2. Relationship between plant and bee community composition

When testing for correlation between the variability in the composition of plant communities and bee communities along the altitudinal gradient, there is no correlation of bee and plant community turnover in 2018 (p=0.5271), but there is a correlation in 2019 (p=2e-04, r =0.47). In contrast, the correlation in the nestedness component of beta-diversity between bees and plants is significant in both 2018 (p=1.62e-2, r=0.26), and 2019 (p=2.3e-3, r=0.39).

Discussion

Our results show that bee species richness, genus richness, and abundance have a strong negative correlation with altitude. Additionally, community composition varies along the altitudinal transect, driven by species turnover. We also show that flower species richness and altitude are both drivers of bee species richness, but bee abundance is only influenced by flower species richness. Finally, there is a variability in the relationship between plant community and bee community between years.

We show a negative relationship between bee species richness and altitude, in line with observation of other bee communities in tropical mountains (Perillo *et al.*, 2017; Pinto *et al.*, 2019), and mountains in Mexico (Osorio-Canadas *et al.*, 2021). This is thought to be due to the restrictive effects of lower temperatures and changes in food availability at higher altitudes (Classen *et al.*, 2015; Iraheta *et al.*, 2015; Mayr *et al.*, 2020). We sampled from 900 to 3000 m a.s.l., however, a transect starting at sea level could have shown a peak at mid-altitude as seen for other insects (Brehm *et al.*, 2007; McCain & Grytnes, 2010).

We also show that bee generic richness decreases with altitude, but there was no significant trend in bee family richness with altitude. Although species level richness is the most representative of the bee community, bee genus can be a good way to test for a filtering effect of landscape on the bee community (Cely-Santos & Philpott, 2019). In fact, bees within a genus tend to have similar traits and behaviours (Michener, 2007) and the contemporary concept of a genus is monophyletic (Praz *et al.*, 2008; Gibbs *et al.*, 2013; Dorchin *et al.*, 2018). Therefore, decreasing generic diversity can suggest a phylogenetic clustering and functional filtering of wild bees (Hoiss *et al.*, 2012; Harmon-Threatt & Ackerly, 2013; Sydenham *et al.*, 2014). Concerning family level, as all families are widespread on the sampled transect this coarse taxonomic level is not suitable to study community trends.

Abundance decreasing concurrently with altitude is also common in bee communities (Hoiss *et al.*, 2012; Perillo *et al.*, 2017; Pinto *et al.*, 2019), but the opposite trend (Baumann *et al.*, 2021), and a series of abundance peaks (Uehara-Prado & Garófalo, 2006) have also been observed. This suggests that there is no general pattern for the correlation between bee community abundance and altitude (Pinto *et al.*, 2019), and that other community-related and environmental factors are needed to explain the variability on each transect. In our case, bee abundance decrease can be due to reduced flower abundance (Holzschuh *et al.*, 2013; Quistberg *et al.*, 2016) in higher altitudes.

We show that community composition varies with altitude. Indeed, individual species may only occupy small parts of the transect, bound by the variability and limits of their temperature tolerances (Dangles *et al.*, 2008; Gonzales *et al.*, 2020). Additionally, morphological traits such as body size and hair length can also affect thermoregulation and consequently distribution along elevation gradients (Osorio-Canadas *et al.*, 2016; Peters *et al.*, 2016). We also show that changes in community composition along the altitudinal transect are largely due to turnover, i.e. species replacement, as seen by Perillo *et al.* (2017). In other words, the higher altitude communities are not subsets of the lower altitude communities but are progressively populated by different bee species. Furthermore, the high turnover of bee species between sites can generate a high community diversity at regional scales (Rollin *et al.*, 2015; Winfree *et al.*, 2018), though there are relatively small distances between sites in our case (0.1-10 km), the rapid altitude shift (2100 m) and strong mountain slopes (Marini *et al.*, 2009; Zhou *et al.*, 2015) are probably also contributing to both turnover and higher community diversity.

In addition to the structuring of bee communities with altitude, we show that visited flower richness influences bee richness. This positive effect of flower richness has been observed in managed landscapes (Land *et al.*, 2020; Lane *et al.*, 2020; Kratschmer *et al.*, 2021), semi-natural habitats (Mallinger *et al.*, 2016), and natural habitats (Reverté *et al.*, 2019). However, lower temperatures (Classen *et al.*, 2015) and topographic complexity (Lippok *et al.*, 2014) can influence floral resources, which indirectly affect bee richness. Therefore, the effect of flower richness should always be considered in relation to other environmental variables that may be strongly correlated.

Finally, there is a correlation in the turnover component of beta-diversity between bees and plants only for 2019. Plant turnover has been shown to be tightly linked to insect turnover (Pellisier *et al.*, 2013). This strong relationship would indicate a high level of specialization (Kemp *et al.*, 2017), in our case plant-pollinator interactions. Therefore, in 2019 where there is a correlation of bee and plant turnover, the bee communities are fluctuating in parallel to flower communities between the sampled sites. In contrast, a lack of relationship would indicate that pollinators act as generalists and adjust their floral choices to the local flower community. Consequently, the lack of turnover in 2018 suggests higher foraging flexibility.

The correlation in the nestedness component of beta-diversity between bees and plants is significant in both years. Indeed, bee species are not consistently specialized in their flower choices (Petanidou *et al.*, 2008), and this can be due to temporal fluctuations of their abundance (Chacoff *et al.*, 2017). This causes specialized taxa to be among the first to disappear with the loss of their forage plant (Rader *et al.*, 2014).

Consequently, the variability of the bee community is driven by altitude and flower communities, but flower communities can be more influential for abundance and inter-annual fluctuations. This strong combined effect of abrupt altitude shifts and changes in the foraged flower community is probably generalized to all slopes of Mount Lebanon and Anti-Lebanon mountain chains. However, the decreasing trends of bee species richness and abundance stem from a sampling of the western slope of Mount Lebanon fall under the humid Mediterranean climate (Abi Saleh & Safi, 1988) with a progressively impoverished flora (Mouterde, 1966, 1970, 1984). This means the eastern slope of Mount Lebanon and slopes of Anti-Lebanon that fall in more arid climates may show different trends of community variability. Finally, we highlight the importance of a management plan encompassing the entire transect and focusing on the conservation of plant biodiversity in order to maintain this highly diverse bee community.

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General Discussion

View of the Lebanese-Syrian border in the Aarsal highlands (Bekaa Governorate). Picture by Mira Boustani

General Discussion

This section expands on the results of the three chapters and their implications and brings forward the links between them. We also discuss the feasibility of research on the wild bee fauna in Lebanon in the near future and provide some guidelines.

In the first chapter of this thesis, we highlighted the diversity of the local bee fauna by producing the first state of the art work on the bees of Lebanon. We also identified the knowledge gaps and highlighted the challenges of working with a little-known fauna. In the second chapter, we tested wild bee taxa from different genera, distributions, socialities, and sizes and provided a heat stress resistance evaluation. In the third chapter, we focused on a montane altitudinal transect in order to examine the trends shown by the different wild bee communities and whether altitude or flower community turnover is the most important driver of variability. We showed that the overall trend with increasing altitude is a loss of diversity and abundance, and that community variability between altitudes is driven by turnover. We also showed that both altitude and flower community turnover influence variability in bee communities.

1. A faunistic list as a starting point

1.1. Presentation of a checklist

Faunal and floral lists, or species checklists, are a list of species from one or more taxonomic groups in a given geographic context. This can be a relatively small area such as a natural reserve (Ballelli *et al.*, 2020; Egorov *et al.*, 2020), or have a larger scale such as a country (Geoffroy & Iorio, 2009; Farekas, 2020), a continent (Wasscher & Bos, 2000; Dressler, 2005), or become a worldwide initiative (Govaerts *et al.*, 2021). Checklists are often the first step for biodiversity monitoring and plans (Funk, 2006; Turghan *et al.*, 2020), evolving into red lists such as the IUCN red list that are equally important for species conservation

(Hayward, 2011; Akçakaya, 2018). Indeed, it is important to archive knowledge within administrative entities, and country level checklists are crucial to spark interest in the local species. However, a biogeographical approach, often encompassing several countries, is equally important for faunistic studies.

In an era of climate change and species declines, baseline information is necessary for groups with an economic importance such as wild bees (Goulson, 2003; James & Pitts-Singer, 2008; Sanjerehei, 2014). The economic argument is allowing wild bees to finally enter the conservation effort scene. However, these service-based arguments do very little to protect the rare and more vulnerable bee taxa (Klein *et al.*, 2015).

Hence the importance of adopting a checklist approach focusing on the entire fauna as a starting point for environmental decision-making. This will allow a first insight on the knowledge of the bee fauna, the presence and quality of historical data, and the opportunity to highlight knowledge gaps. This is especially important for countries like Lebanon, where the wild bee fauna was until now largely unknown. Most importantly, a checklist is representative of the knowledge we have at that point in time, and this state of the art knowledge needs to be constantly updated as our understanding of bee faunas progresses.

1.2. Taxonomic knowledge

Because of their use as a baseline for ecological work around species, nomenclature accuracy is key when producing checklists, highlighting the need for a continual updating of priority names (Dubois, 2017). The importance of a solid taxonomic base to properly frame the target species in monitoring and assessment (Watson *et al.*, 2015), and to avoid misleading false identifications (Dayrat, 2011) is therefore emphasised. Consequently, pooling species groups when assigning statuses is problematic as it undermines the needs of individual species (Scherz *et al.*, 2019). A misuse of the species determinations can also lead to false estimations of biodiversity (Iskandar & Erdelen, 2006). In addition, uses of threatened species lists should consider their capacity to provide environmental insight before employing it in environmental decision-making (Possingham *et al.*, 2002).

Taxonomic expertise is difficult to attain and is declining as a result of being pushed back from funded projects (O'Toole, 2002). This means that there is an increasing demand for taxonomic accuracy, but very few initiatives to actively include it in academic work thus encouraging more people to develop a taxonomic expertise (Kim & Byrne, 2006). In parallel, genetic sequencing has become a common tool in untangling difficult taxonomic groups (Tautz *et al.*, 2003). However, it cannot fully replace taxonomic work and must be combined with morphological criteria for species delimitation (Cognato *et al.*, 2020).

1.3. Data combinations to fill the gaps

Historical data is often collected opportunistically, and may not accurately reflect bee species phenology and historical population changes (Meiners *et al.*, 2020; Guzman *et al.*, 2021). Therefore, the data needs to be pre-treated before being used to study population trends (Van Dooren, 2019). In the case of countries such as Lebanon with very few historical data (Boustani *et al.*, 2021), one way to gain more resolution is to combine it with museum and private collections. For example, from historical records of bumblebees in Lebanon, there was no mention of the most common taxon *Bombus terrestris*. In the first chapter of this thesis (Boustani *et al.*, 2020), the historical presence of *Bombus terrestris* was confirmed through private collections, occurrences from grey literature, and specimens deposited in museums. Furthermore, this allowed us to rule out the possibility of its incursion after the import of colonies. Hence, the importance of combining all available resources, and of considering the quality of historical data before using it in future predictions.

1.4. *How representative is Lebanon of the Levant – challenges of a large-scale study*

Lebanon has a highly diversified range of habitats (Abi Saleh & Safi, 1988), and a very high floristic (Pullaiah, 2018) and faunistic diversity (Tohme *et al.*, 1986) compared to its surface area. Since Lebanon has very few wild bee endemics (Wood *et al.*, 2020; Boustani *et al.*, 2021) that are most probably present elsewhere in the neighbouring countries, a more relevant biogeographical scale is necessary to construct an accurate image of the local bee fauna. However, studying the bee fauna at the scale of the Levant poses many challenges led mainly by the political tensions between countries (Meier, 2020). Furthermore, as countries neighbouring Lebanon also have little-known wild bee faunas (Shebl *et al.*, 2021), an independently compiled report remains impossible for the moment.

2. Bridging inventories and experimental methods

2.1. *Experimental methods to fill the historical gap*

Historical data and museum collections are often used to measure species decline (Colla *et al.*, 2012; Scheper *et al.*, 2014; Mathiasson & Rehan, 2019; Van Dooren, 2019), and can also give insight into how these species distributions will evolve under climate change (Silva *et al.*, 2015; Rasmont *et al.*, 2016; Dew *et al.*, 2019; Martínez-López *et al.*, 2021). However, in the absence of a solid historical database as in the case of Lebanon, we can still use experimental methods to assess the vulnerability of bee species to future extreme climatic events (Martinet *et al.*, 2020; Zambra *et al.*, 2020; Maebe *et al.*, 2021). In chapter 2 of this thesis, we focused on heat stress resistance of a variety of local bee taxa as heat waves are becoming more frequent and higher in intensity (Meehl & Telbadi, 2004), and also because heat stress risk in the Mediterranean region has increased drastically (Diffenbaugh *et al.*, 2017).

Determining bee species and pinpointing their localities and foraged flowers was a first step to the choice of model species that were targeted for the heat stress resistance tests in chapter 2. Additionally, the possibility of determining the specimens to a high level allowed us to target species from difficult groups such as *Anthophora* and *Eucera*.

2.2. Many species are vulnerable to extreme heat events: the consequences of climate change

In recent studies on wild bees (Martinet *et al.*, 2020; Maia-Silva *et al.*, 2021, Zhao *et al.*, 2021), as well as chapter 2 of this thesis, we show that most species are vulnerable to heat stress. This is especially relevant for species restricted in latitude (Martinet *et al.*, 2020), and altitude (Oyen *et al.*, 2016; Gonzalez *et al.*, 2020, chapter 2), but we also show that this is the case for small-bodied widespread species that would still be vulnerable albeit their wide distribution. This highlights that there is a "majority of losers" in wild bee communities under climate change (Kammerer *et al.*, 2021), where most species risk declines or even extinction, versus the minority that are able to expand (Rasmont *et al.*, 2015; Ghisbain *et al.*, 2021). Indeed, climate change has been driving the decline of many wild bee taxa (Potts *et al.*, 2010; Kerr *et al.*, 2015). Therefore, quantifying their heat stress resistance can be an important tool to predict which taxa will be the most vulnerable to future climate change.

2.3. The problem in the choice of model species

Because of the accessibility of testing widespread and reared species, most studies on the heat resistance of bees target domesticated or very abundant species such as *Bombus* (Rasmont *et al.*, 2015; Martinet *et al.*, 2020; Maebe *et al.*, 2021), or *Osmia* (Kierat *et al.*, 2017, CaraDonna *et al.*, 2018). These species have the advantage of being readily available at all developmental stages and with sufficient numbers of individuals of both sexes for experimental manipulation. However, when targeting less abundant or cryptic species, it may be challenging to acquire enough specimens from both sexes or castes. This an essential step of gaining a better understanding of the future of bees under climate change as uncommon species tend to be neglected in environmental schemes (Kleijn *et al.*, 2006). Furthermore, there is little information available on their vulnerability as shown by the high proportion of Data Deficient taxa of the IUCN Red list of Europe (Nieto *et al.*, 2014). Hence, we highlight the importance of including less represented species in the experimental designs as much as possible. In our case, mass samplings were needed to acquire enough specimens as most target species are impossible to determine on the field, and often fly simultaneously. Accurate taxonomy is of paramount importance to determine the tested specimens and link the heat stress resistance results to species, rather than species-groups that are not ecologically relevant.

2.4. Limitations of experimental methods

Several difficulties can arise while using bees as experimental models, these are mainly i) logistical in relation to the execution of the experiment, and ii) physiological in relation to the state of the specimens before and during the tests.

Experimental methods require logistical arrangements that allow for the testing of the specimens right after their collection from the field (Martinet *et al.*, 2015; Oyen *et al.*, 2016), which requires several hours of electrical power. This can be problematic in the case of Lebanon and other developing countries with frequent power shortages as the manipulations cannot always be carried out on time. Therefore, a setup with rechargeable batteries or a power generator are required in advance in this case.

Furthermore, the quality of nutrition of bees has been shown to affect their heat stress resistance (Vanderplanck *et al.*, 2019). Additionally, Greenop *et al.* (2020) suggest that heat stress can affect bee foraging efficiency and several environmental stressors have been shown to affect bee cognitive functions (Klein *et al.*, 2016). Therefore, these additional stressors may have a synergetic effect if added to bad nutrition. Although we could control the nutritional state unevenness by offering sugar syrup *ad. libitum*, the handling of the bees, especially the solitary taxa (for which very few behavioural studies are available) and their seclusion in small containers may be stressing the specimens and affecting their nutrition intake. One potential solution would be to test the specimens in large flying cages in rooms with controlled temperatures.

Finally, the acclimation temperature of 10-12°C we chose fall between the 8°C used in Martinet *et al.* (2015) for *Bombus*, and below the 16-19 °C used in Gonzales *et al.* (2020) for *Xylocopa*. Our temperature choice is meant to suit the potentially sensible Mediterranean taxa without. However, there is no information to our knowledge on the resistance of the solitary taxa we tested to cold temperatures, and this acclimation may still be stressful to some of the species we targeted. Further studied on the solitary species are needed to find their optimal resting temperature range.

3. Working on altitudinal transects

3.1. Resistance to temperature: A link to species distribution

Temperature is an important factor in structuring species distributions (Bale, 2002; Dixon & Hopkins, 2010). Therefore, climate change is affecting the distributions of insects worldwide, as manifested through insect outbreaks (Pureswaran *et al.*, 2018; Harvey *et al.*, 2020), and population declines (Halsch *et al.*, 2020; Wagner, 2020). These studies often adopt a latitude range approach, but a study focused on a smaller-scale altitudinal range can provide an interesting insight into population range shifts and occupancy under different climatic conditions (Merill *et al.*, 2007; Chen *et al.*, 2009).

3.2. The ambiguity of using altitude as a variable

When referring to altitude, it is important to properly define the studied variable across the altitudinal gradient (Körner, 2007). Many biotic (*e.g.* vegetation) and abiotic conditions (e.g. temperature, precipitation) change along transects (McCain & Grytnes, 2010), potentially in correlation with each other. However, this correlation poses an inherent challenge to disentangling which variable we are testing, as choosing altitude would also select a wide range of intercorrelated variables. In addition, other local conditions on an altitudinal transect can influence the fauna such as microclimates (Montejo-Kovacevich *et al.*, 2020), terrain slope (Marini *et al.*, 2009), and orientation (Merino-Sáinz & Anadón, 2015). Additionally, using a smaller sampling scale with replicates on the same sites is often used to study the effect of season on bee community variability (Rollin *et al.*, 2015; Nooten *et al.*, 2020). Consequently, when using replicates from different seasons on an altitudinal transect, the effect of seasonality may mask the effect of altitude on the entire bee community. Therefore, spatial and temporal scales should be well-defined and other conditions that could be potential drivers in fauna and flora variability should also be considered.

3.3. Do different angles show different stories?

Bee diversity surveys can give different estimates depending on the collection methods (Westphal *et al.*, 2008). Furthermore, the use of visited plant data can affect the outcome of bee-plant network measurements. For instance, *Bombus* are not consistent in their floral choice for nectar (Russel *et al.*, 2017), and using all flower visitation data may show a higher foraging flexibility than focusing solely on collected pollen. There may also be different outcomes if we chose to include one or both sexes as they have different foraging preferences (Roswell *et al.*, 2019). Finally, although knowledge of food plant and specialization requires pollen analyses (Muller, 1996; Glaum *et al.*, 2021), flower visitation networks are still a good proxy for the study of pollen preferences at community level (de Manicor *et al.*, 2020).

3.4. The mountains in Lebanon: importance for species diversity

Mediterranean mountains encompass a wide range of habitats and plant diversity (Blondel *et al.* 2010), and they have been shown to harbour a high bee diversity (Iserbyt *et al.*, 2008; Herrera *et al.*, 2019; Minachilis *et al.*, 2020). Additionally, bees also play an important role as pollinators in these Mediterranean habitats (Petanidou & Ellis, 1993; Bosch *et al.*, 1997; Traveset & Navarro, 2018; Minachilis *et al.*, 2021).

In chapter 3, our study provides the first insight into the high diversity and variability of the wild bee fauna in the Lebanese mountains, where we record 286 species visiting 129 flowering species on the montane transect. Therefore, we highlight the importance of the conservation of the montane habitats that support this high bee diversity. However, biodiversity in Lebanon faces challenges such as the poorly planned urbanization spread (Masri, 1999; Masri *et al.*, 2002), and possible damages from overgrazing (El Hajj *et al.*, 2015). Furthermore, the massive and unplanned introductions of honeybee in Lebanon has the potential to compromise the local wild bee diversity as seen in many other areas (Ropars *et al.*, 2020; Lázaro *et al.*, 2021). The saturation of many rural areas with beehives is making high-altitudes a more popular choice for summer season, resulting in saturation in those areas as well. Therefore, the most important habitats for the wild bee fauna in Lebanon depend on land-use decision making and management, and efforts for a conservation plan should be put in place as soon as possible for these important montane areas.

4. Conservation recommendations

4.1. Towards conservation: what can these short-term studies tell us on local bees ?

Wild bees have an important ecological value as pollinators of wild plants. The transect we focused on in this thesis has a high flower diversity and many endemics (Bou Dagher-Kharrat *et al.*, 2018). Consequently, the disappearance of local bees in the higher altitudes can have negative effects on the local flora. Studies on local bees should therefore focus both on the bee fauna and its importance for the pollination and fitness of the wild flora.

This section aims to provide recommendations on a selected list of species considering the results of this thesis, as well as general recommendations on the next steps of research on bees in Lebanon and their integration in citizen initiatives

4.2. Introducing wild bees to different target audiences

The first target audience in wild bees can be the public. This can be done through social media such as Facebook and Instagram. Curated social media content can raise awareness on the local bee's biodiversity and to highlight their importance. The traction generated by the recent interest of the public in the outdoors and wildlife observation creates a good timing to disseminated information on wild bees (See Annex 4 for more details and examples of content for Lebanon).

Furthermore, dissemination of information around wild bees requires common names in the official language, Arabic in the case of Lebanon. This is equally important for both dissemination for the public and for official use in legislations on species protection. One of the ways of producing common names is re-adapting or translating the Latin name. Although this is feasible in countries where the first language has a Latin root such as French, to Arabic speakers such names sound alien and do not hold any meaning. Therefore, one of the most important steps in communication around wild bees for Arabic speakers would be producing Arabic common names for the local bees (See Annex 5 for the introduction of the work in progress of common names for wild bees in Arabic).

Another key audience in introducing wild bees is local farmers. Fruit tree and vegetable cultivations are very common in Lebanon, and farmers can benefit directly from local pollinators. Therefore, workshops, field visits, and curated content aimed at farmers should be prepared in order to introduce wild bees and their potential role in pollination and consequently in higher productivity. As agriculture in Lebanon is now at a turning point with soaring prices of fertilisers and pesticides, it is a good time to introduce farming methods with less interventions and more room for biodiversity inclusion.

4.3. Suggestions for species recommendations

The information we have until now sets a baseline for the Lebanese bee fauna, but massive efforts are still required to assess conservation statuses for most of the bees of Lebanon. Furthermore, the only species we are able to comment on until now are widespread, or very abundant. In contrast the rare and more localised species may be much more vulnerable to climate change as we have seen in chapter 2 and will need targeted efforts.

As an example of species that will require different treatments based on the information we have, we selected three species of *Bombus*: *B. terrestris* which is widespread and *B. niveatus* and *B. melanurus* which are restricted in distribution and potentially vulnerable. We also selected two *Xylocopa* and two *Anthophora* species which are all widespread but have performed differently in heat stress resistance. We recommend considering the different aspects that could render a species vulnerable when producing a conservation status.

Bombus terrestris: Although this species is widespread in Lebanon, there were no published records of its presence before 2020 (Boustani *et al.*, 2020). This case highlights the importance of a monitoring that is as exhaustive as possible, and the importance of considering local subspecies of *Bombus terrestris* that can be reared before importing colonies.

Bombus niveatus: This species has older records at latitudes lower than 1800 m a.s.l. However, it is only found above this altitude in our recent surveys. Although this species has a Least Concern status in the European IUCN list (Nieto *et al.*, 2014), it has a restricted distribution in Lebanon and is close to the southernmost limit of its known distribution (Boustani *et al.*, 2020). Additionally, we show in the second chapter that this species has a very low heat resistance. Therefore, we recommend monitoring with a study of its ecological role within the higher altitude pollination networks.

Bombus melanurus: This species is also restricted above 1800 m a.s.l. in Lebanon and is at its southernmost distribution point (Boustani *et al.*, 2020). Additionally, this species has no IUCN status to date, and we show in the second chapter that it has a very low heat resistance. As in the case of *B. niveatus*, we recommend a monitoring of this species and a closer look at the pollination role.

Xylocopa violacea* and *Xylocopa valga: Both widespread (Boustani *et al.*, 2021) and with a high heat resistance (chapter 2). In spite being widespread very little is known about their foraged flowers.

Anthophora nigriceps* and *Anthophora plumipes: Both widespread in Lebanon (Boustani *et al.*, 2021) but has low heat resistance (chapter 2), we recommend that these species be monitored especially as their very little is known about their ecological role otherwise.

4.4. Does research on wild bees have a place in Lebanon in the near future ?

The situation in Lebanon has been worsening at both the economic level (Youssef *et al.* 2019), and at the environmental level (Baayoun *et al.*, 2019; Massoud *et al.*, 2019). In the midst of this instability, what place is there for the advancement of the research on the wild bee fauna? The current situation not only affects the possibility of conducting field trips for both political and safety reasons, but also the compromises the long-term perspectives for specimen conservation in local institutions. Therefore, research projects must take every opportunity to conduct specimen collection and field surveys. Additionally, specimens resulting from the studies should temporarily be conserved in museums outside Lebanon until they (or duplicates) can be deposited local institutions. Furthermore, periodic collections can focus on collecting specimens for future genetic sequencing and these can be conserved in ethanol until barcoding is possible. Finally, any data related to collected specimens should be stored digitally or published whenever possible.

4.5. Bees as indicators

The sensitivity of wild bees to a wide range of environmental conditions makes them a common choice as indicators for the monitoring of agricultural ecosystems (Schindler *et al.*, 2013), land use management (Odanaka & Rehan, 2019), and habitat evaluation (Twerd *et al.*, 2021). However, this can be challenging when there is little information on species biology, distribution, and a good knowledge of taxonomy (Añino *et al.*, 2019), and in the absence of extensive sampling to set an expectations baseline (Duelli & Obrist, 2003). Additionally, the foraging activity of bees on the field is dependent on weather conditions (Vicens & Bosch, 2000; Peat & Goulson, 2005). Therefore, the collection can be hindered by the frequent changes in cloud cover, wind, or fog. In the case of Lebanon, except for *Andrena* (Wood *et al.*, 2020), no genera have been recently revised and many new species need to be described. Additionally, very little is known on local species ecology and what the composition of the bee community in natural habitats is in Lebanon. Furthermore, the weather conditions are highly variable during the day especially in the mountains. Consequently, the knowledge of the bee fauna is still not solid enough to support the use of bees as ecological indicators, and the irregular weather conditions might require repeating or postponing sampling days.

4.6. Is citizen science a possibility in Lebanon ?

Citizen science initiatives around wild bees are recently gaining traction (Bloom & Crowder, 2020) and being used as data sources to study bee fauna trends (Appenfeller *et al.*, 2020; Vereecken *et al.*, 2021). While feasible in some European countries where the bee fauna is well-known, working on the bee fauna of Lebanon requires a better knowledge of the local taxa, and moderators capable of determining the species with a good level of confidence via pictures. Indeed, optimizing the quality of the datasets would require expert assistance (Le Féon *et al.*, 2016). Although some species such as *Bombus* or *Xylocopa* could be determined via pictures, this is not the case for the majority of the bee fauna and specimens collection is still a necessity. Therefore, citizen science initiatives are not applicable at the moment. However, first steps in that direction can be made. This would imply raising awareness about the local bee fauna (see Annexes 4 & 5), building a reference collection that is accessible to local scientists, and building a database of available literature and dissemination that can be useful for the determination of the local taxa.

5. Synthesis

- The bee fauna of Lebanon is highly diversified, but each species is bound to its altitude range
- The bee fauna is very variable along the altitudinal transect driven by both altitude and floral communities
- Mountain ecosystems are key for both the study and conservation of local bee fauna in an era or climate change
- Bees heat stress resistance can be exacerbated by a restricted distribution in altitude, but is also a menace to many widespread taxa
- Local assessments of the bee species should be made with intensive collections combined with all available experimental methods to fill the historical data gap
- Taxonomic accuracy is key for heat resistance or community-level studies to ensure the results are ecologically relevant

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Annexes

Anthidium rotundum ♀ on a *Centaurea* sp. flower. Picture by Mira Boustani.

Annex I: Associated Annex of Chapter 1

Wood, T.J., **Boustani M.**, & Rasmont P. (2020). A revision of the Andrena (Hymenoptera: Andrenidae) of Lebanon with the description of six new species. *Annales de la Société entomologique de France (N.S.)*. (56)4, 279–312.

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Annex II: Associated Annex of Chapter 2

Martinet, B., Dellicour, S., Ghisbain, G., Przybyla, K., Zambra, M., Lecocq, T., **Boustani, M.**, Baghirov, R., Michez, Rasmont P. (2020) Global effects of extreme temperatures on wild bumblebees. *Conservation biology: the journal of the Society for Conservation Biology*, 35(5), 1507–1518. https://doi.org/10.1111/cobi.13685

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Annex III:

Wood, T.J., Ghisbain, G., Rasmont, P., Kleijn, D., Raemakers, I., Praz, C., Killewald, M., Gibbs, J., Bobiwash, K., **Boustani, M.**, Martinet, B., & Michez, D. (2021). Global patterns in bumble bee pollen collection show phylogenetic conservation of diet. *Journal of Animal Ecology*, 90, 2421–2430. https://doi.org/10.1111/1365-2656.13553

Supplementary material available at: https://besjournals.onlinelibrary.wiley.com/doi/full/10.1111/1365-2656.13553

Annex IV: Raising awareness on the wild bees of Lebanon through social media.

Annex V: Arabic names for the Middle East and North Africa wild bees.

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A revision of the *Andrena* (Hymenoptera: Andrenidae) of Lebanon with the description of six new species

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Summary. Lebanon has a rich but chronically understudied bee fauna. As part of ongoing efforts to better understand bee diversity in Lebanon we present a critical revision of the speciose genus *Andrena* based primarily on the examination of specimens collected from contemporary surveys, as well as previously undetermined material from museum collections. *Andrena* (*Aciandrena*) *abruptifovea* **n. sp**. from Lebanon, *A.* (*incertae sedis*) *cedricola* **n. sp**. from Lebanon and Syria, *A.* (*Euandrena*) *scrophulariae* **n. sp**. from Lebanon, and *A.* (*incertae sedis*) *prodigiosa* **n. sp**., from Lebanon, are described. *A.* (*Chlorandrena*) *edentula* **n. sp**. and *A.* (*Rufandrena*) *parvispinae* **n. sp**., both from north-western Syria, are described due to their proximity to northern Lebanon. The previously unknown male of *A.* (*Pallandrena*) *christineae* Dubitzky, 2006 is also described. *A.* (*Poliandrena*) *unifasciata* Friese, 1899 **stat. rev**. which was described from Lebanon is removed from synonymy with *A.* (*Poliandrena*) *caspica* Morawitz, 1886, and the relationship between these two taxa and *A.* (*Poliandrena*) *unicincta* Friese, 1899 is clarified. Altogether, these changes increase the number of *Andrena* species known from Lebanon to 86, including species known previously only from Turkey or Israel. In total, 25 and 23 species are also reported as newly recorded for Jordan and Syria, respectively. Based on the diversity of *Andrena* in neighbouring countries in the Levant, it is probable that the true number of *Andrena* species in Lebanon is well over 100.

Résumé. Révision des *Andrena* (Hymenoptera : Andrenidae) du Liban, avec la description de six espèces nouvelles. Le Liban a une riche faune d'abeilles trop peu étudiée de manière chronique. Comme contribution à l'effort actuel pour mieux comprendre la diversité des abeilles du Liban, nous présentons ici une révision critique du genre *Andrena*, connu pour être riche en espèce. Cette révision est basée sur l'examen de spécimens collectés durant des recherches récentes, ainsi que de matériel indéterminé de collections de musées. Les espèces nouvelles suivantes sont décrites du Liban : *Andrena* (*Aciandrena*) *abruptifovea* **n. sp**. (Liban), *A.* (*incertae sedis*) *cedricola* **n. sp**. (Liban et Syrie), *A.* (*Euandrena*) *scrophulariae* **n. sp**. (Liban), and *A.* (*incertae sedis*) *prodigiosa* **n. sp**. (Liban). Les espèces suivantes sont décrites du nord-ouest de la Syrie, à proximité du Liban : *A.* (*Chlorandrena*) *edentula* **n. sp**. et *A.* (*Rufandrena*) *parvispinae* **n. sp**. Le mâle encore inconnu d'*A.* (*Pallandrena*) *christineae* Dubitzky, 2006, est aussi décrit. *A.* (*Poliandrena*) *unifasciata* Friese, 1899 **stat. rev**., décrit du Liban, est retiré de la synonymie d'*A.* (*Poliandrena*) *caspica* Morawitz, 1886, tandis que les relations entre ces deux derniers taxons et *A.* (*Poliandrena*) *unicincta* Friese, 1899, sont clarifiées. Tout compté, ces changements augmentent le nombre d'espèces d'*Andrena* connues du Liban à 86, y compris des espèces qui auparavant n'étaient connues que de Turquie et Israël. Au total, 25 et 23 espèces sont aussi comptées pour la première fois de Jordanie et de Syrie, respectivement. En se basant sur la diversité des *Andrena* dans les autres pays du Levant, il est probable que le nombre total d'espèces du Liban excède 100.

http://www.zoobank.org/urn:lsid:zoobank.org:pub:9FC27F37-A201-4C17-BE46-1C2AAA337CCB

Keywords: Levant; endemic species; alpine; solitary bees; taxonomy

The genus *Andrena* Fabricius, 1775 is the second most species-rich genus of bees worldwide after *Lasioglossum* Curis, 1833 (Ascher & Pickering 2020). The genus is richest in Mediterranean and xeric areas, so unsurprisingly the Eastern Mediterranean including the Levant is a hotspot of *Andrena* diversity. The *Andrena* fauna of the Eastern Mediterranean was extensively revised by Klaus Warncke in the 1960s and 1970s, with important papers focusing on Greece (Warncke 1965a), Israel (Warncke 1969a), and Turkey (Warncke 1965b, 1969b, 1975a, 1975b). Despite these extensive efforts, new *Andrena* species continue to be described from this region at regular intervals (e.g. Gusenleitner 1998; Scheuchl et al. 2004; Grünwaldt et al. 2005; Scheuchl & Hazir 2012; Schwenninger 2015; Kratochwil 2015; Pisanty et al. 2016, 2018), and it is still too early to put a number on the true species richness of Eastern Mediterranean *Andrena*.

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Lebanon is a small country in the Levant, but it has a wide variety of ecological regions and biotypes (Abi-Saleh & Safi 1988), and a rich but chronically understudied bee fauna. For example, there are only four published papers that report detailed *Andrena* records from Lebanon (Friese 1899; Mavromoustakis 1962; Warncke 1969a; Schuberth et al. 2001). This situation is not helped by historical changes in the geographic scope of Lebanon. In the early part of the 20th century Lebanon was part of Ottoman Syria until the end of the First World War, where what is today modern Lebanon, Syria, and Hatay province in Turkey was ceded to France as part of the Mandate for Syria and the Lebanon following the Sykes–Picot agreement between Britain and France (Traboulsi 2012). Therefore, literature prior to 1918 would refer simply to 'Syria' (e.g. Friese 1899) without allowing contemporary authors to identify a locality or distinguish between modern day Lebanon or Syria. Even later works would simply give very little distributional information, for example Friese (1922) who reported *Andrena cubiceps* Friese, 1914 var. *fulvopilosa* from "Syrien, Adana [Turkey]", making it impossible to know if this taxon is present in Lebanon or not. However, though there is a lack of clarity over the exact country referred to in what historic literature is available, this does not greatly change the overall picture of a lack of literature itself and historical study. Only three species of *Andrena* have been described with a *locus typicus* in what is now modern day Syria (one currently considered valid) and two from modern day Lebanon (two considered valid, see entry for *Andrena unifasciata* Friese, 1899 below) compared to the nearly 200 species described from Israel and Turkey (e.g. Warncke 1969b; Warncke 1975b; Gusenleitner 1998; Scheuchl & Hazir 2012; Pisanty et al. 2016, 2018). Against this background, the contemporary study is not particularly limited by the confusion over historical geographic terminology.

As part of efforts to improve our understanding of Lebanese bees, the country has been surveyed for multiple years and museum material located in order to critically revise the national fauna. Collection efforts focused on important plant areas such as Tannourine Cedars, Bcharre Cedars and Horch Ehden in northern Lebanon which harbour a high proportion of endemic plants (Bou Dagher-Kharrat et al. 2018), and which may therefore also contain range-restricted and previously undescribed bee species, as is the case for other invertebrate groups (Larsen 1974; Németh 2019). As part of this effort, here we revise the *Andrena* fauna of Lebanon, describe six new species from Lebanon and Syria, and present additional data on some species newly recorded in the nearby countries of Jordan and Syria. Collecting sites for material examined by this project are shown in Figure 1, with full geographic coordinate details in online supplementary material. This paper is not intended to be a revision of the Syrian or Jordanian *Andrena* faunas, but as part of an extensive revision of undetermined museum material from the Levant by the lead author a number of new country records were detected. Therefore, where species listed here as present in the Lebanese fauna were also newly detected in these two other countries, this information is given. The Jordanian and Syrian *Andrena* faunas will be revised in later publications.

Methodology

Revisions to the *Andrena* subgeneric system of classification are ongoing (Pisanty et al. 2020), and classifications are likely to change substantially in the future. However, this will require extensive revisionary work over many years, and so for now we broadly follow the subgeneric system of Warncke (1968) with modifications for when changes to this system are simple, clear, and well-supported (Gusenleitner & Schwarz 2002; Pisanty et al. 2020).

Specimens collected during this study were collected by hand net and killed with ethyl acetate or by freezing. At some collection localities, blue, yellow, and white pan traps were used. These were filled to the ¾ mark with water plus colourless and odourless soap and left for 48 hours before collection. Each collection station used three sets of triplets (one of each colour, separated by 1 m) which were themselves separated by 10 m.

All data were digitised using Data Fauna Flora 5.1.2 (Barbier et al. 2000) and mapped with Quantum GIS 2.18.27. All geographic co-ordinates are given using the datum World Geodetic System of 1984 (WGS 1984). Where detailed records are available from the literature, these are included (Friese 1899; Mavromoustakis 1962; Schuberth et al. 2001). An additional publication (Grace 2010) presented an overview of the wild bee species of the Eastern Mediterranean, reporting 55 species of *Andrena* from Lebanon. However, the underlying data supporting these listings is unclear and so here we take a conservative position and only list this publication where other lines of evidence exist, never in isolation. Twenty-three unconfirmed species from Grace (2010) are listed in online supplementary material with notes. Species marked with an asterisk * in the main manuscript have not previously been reported from Lebanon in any form.

Morphological terminology follows Michener (2007). Specimens were measured from the vertical plane of the front of the head to the tip of the metasoma to the nearest 0.5 mm. Photographs were taken using an Olympus E-M1 Mark II with a 60 mm macro lens and were stacked using Zerene Stacker 1.04 (Zerene Systems, USA) and plates were prepared in GNU Image Manipulation Program (GIMP) 2.10.

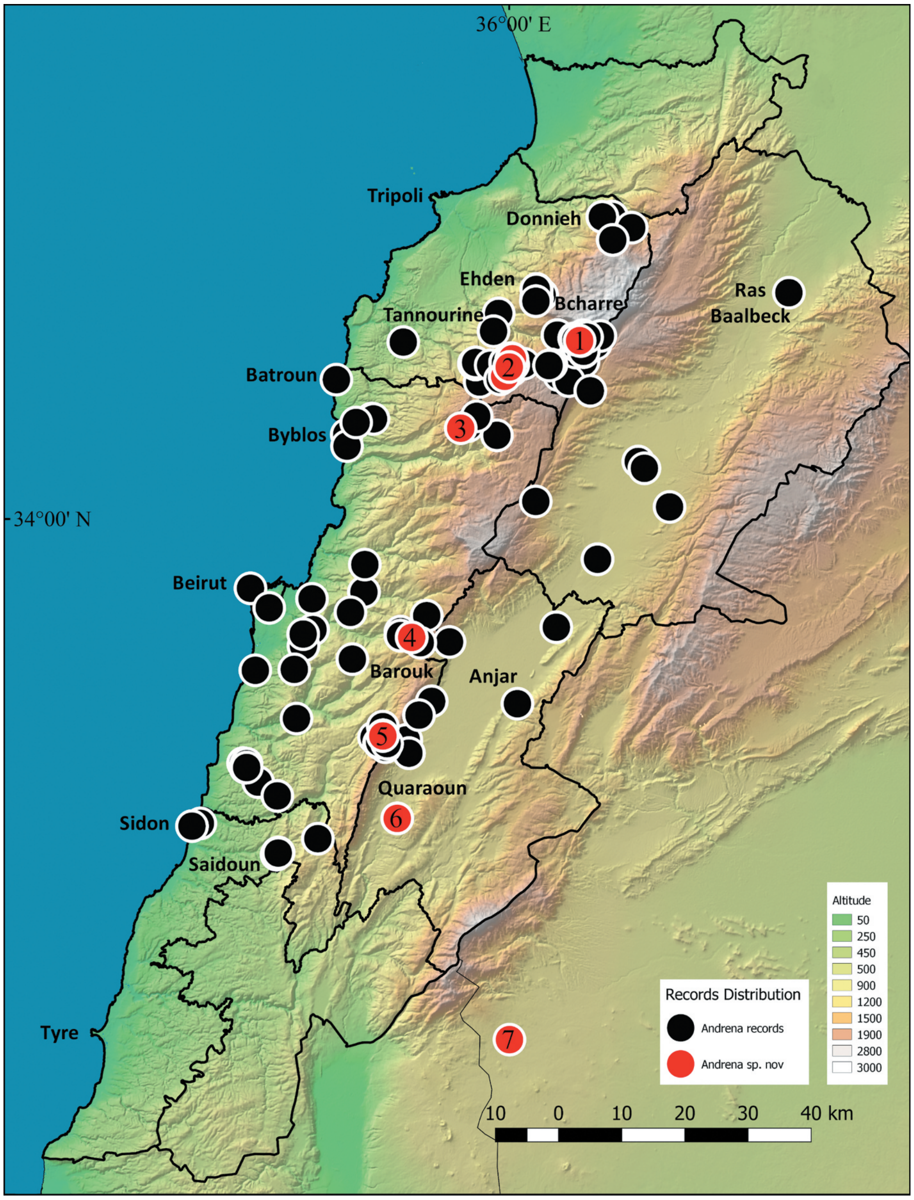


Figure 1. Map of Lebanon with the collecting locations of material examined during this project (black dots). Additionally, specific collection locations for species newly described here from Lebanon are indicated (red dots), including one additional location from Syria. Full sampling details can be found in online supplementary material. Geographic relief is indicated, with altitude measured in metres above sea level.

Abbreviations

DACN = Department of Agriculture collection, Nicosia, Cyprus
MSC = Maximillian Schwarz personal collection, Ansfelden, Austria
OÖLM = Oberösterreich Landesmusum, Linz, Austria
RBIN = Royal Belgian Institute of Natural Sciences, Brussels, Belgium
SOILS = Soils Permaculture Association, Saidoun, Lebanon
TCFNR = Tannourine Cedar Forest Nature Reserve, Tannourine, Lebanon
TJW = Personal collection of Thomas Wood, Mons, Belgium
USEK = Holy Spirit University of Kaslik, Jounieh, Lebanon
UMONS = University of Mons, Mons, Belgium
XVA = Xavier van Achter personal collection, Mons, Belgium

Results

Descriptions of new species

***Andrena* (*Aciandrena*) *abruptifovea* Wood, n. sp.**

http://www.zoobank.org/urn:lsid:zoobank.org:act:97069DFB-7648-4BA8-A0BD-B37FF27F55EB

Type material. Holotype: ♂, LEBANON, Mount Lebanon, Chouf Biosphere Reserve, Barouk trails, 1772 m [33°41'10"N 35°41'56"E, Figure 1, location 5], 16.V.2019, leg. Boustani, *Thlaspi* spp. Deposited at the RBIN.

Paratypes: LEBANON: Mount Lebanon, Chouf Biosphere Reserve, Barouk trails, 1772 m, 16.V.2019, 5♂ [#1–5], 1♀ [#6], leg. Boustani, *Thlaspi* spp.; N Lebanon, Harrisa, Al Jawar, 1758 m, 11.V.2019, 1♂ [#7], 1♀ [#8], leg. Boustani, *Brassica* spp. (Figure 1, location 2); N Lebanon, Tannourine Reserve, 1781 m, 13.V.2019, 1♀ [#9], leg. Boustani, *Thlaspi* spp. (Figure 1, location 2); N Lebanon, Arz Tannourine Gate area, 1754 m, 2.IV.2018, 1♀ [#10], leg. Boustani (Figure 1, location 2); N Lebanon, Hadath El Jebbe, border of the Cedar forest, 1618 m, 5.V.2017, 1♀ [#11], leg. Boustani (Figure 1, location 2); N Lebanon, Arz Bcharre, Forest of the Cedars of God, 1897 m, 20.V.2019, 1♂ [#12], leg. Boustani, *Alyssum* spp. (Figure 1, location 1). Paratypes are deposited at the RBIN [#1–5; #9; #11], the DACN [#7–8], and in the personal collection of TJW [#6; #10; #12].

Description of female. Body length 6 mm (Figure 2).

Head. Slightly longer than broad, frons, paraocular areas, gena, and vertex dull metallic green, clypeus black (Figure 3). Clypeus clearly domed and weakly punctured, punctures separated by 2–3 puncture diameters. Underlying surface shagreened and weakly shining, becoming shinier at the apical margin. Process of labrum narrow, triangular, pointed, clearly longer than wide (Figure 4). Face, gena, vertex, and scape with short white hairs, these not exceeding the length of the scape. Antennal segments 1–5 black, segments 6–12 predominantly orange below and above, segment 3 slightly exceeding 4 + 5 in length. Fovea narrow, equalling the width of an antenna above where they occupy half the distance between a lateral ocellus and the top of the compound eye, fovea abruptly narrowed to approximately 30% of their maximum width about 2/3rd of the way from the top of the compound eye to the level of the antennal insertions. Ocelloccipital distance extremely short, almost non-existent, posterior ocellus almost touching vertex.

Mesosoma. Scutum and scutellum densely shagreened, weakly shining, with a subtle green-purple metallic sheen (Figure 4), weakly and shallowly punctured, punctures separated by 2–3 puncture diameters. Pronotum non-carinate. Episternum and propodeum finely shagreened, weakly shining, propodeal triangle well differentiated, finely reticulate, weakly shining. Episternum and propodeum laterally with long white hairs, these not exceeding the length of the scape, scutum and scutellum with shorter white hairs. Legs dark, apical tarsal segments lightened orange, pubescence white. Floccus, femoral, and tibial scopa white. Wings hyaline, venation amber, nervulus antefurcal.

Metasoma. Terga dark with hints of a bronze metallic sheen, evenly shagreened and weakly shining, apical margins of T2–4 slightly depressed and lightened pale yellow (Figure 5). T2–3 with weak apical lateral hair fringes, these widely interrupted. T5 and hairs flanking pygidial plate orange-golden. Pygidial plate triangular, pointed, flattened and without a raised central area.

Description of male. Body length 5–5.5 mm (Figure 6).

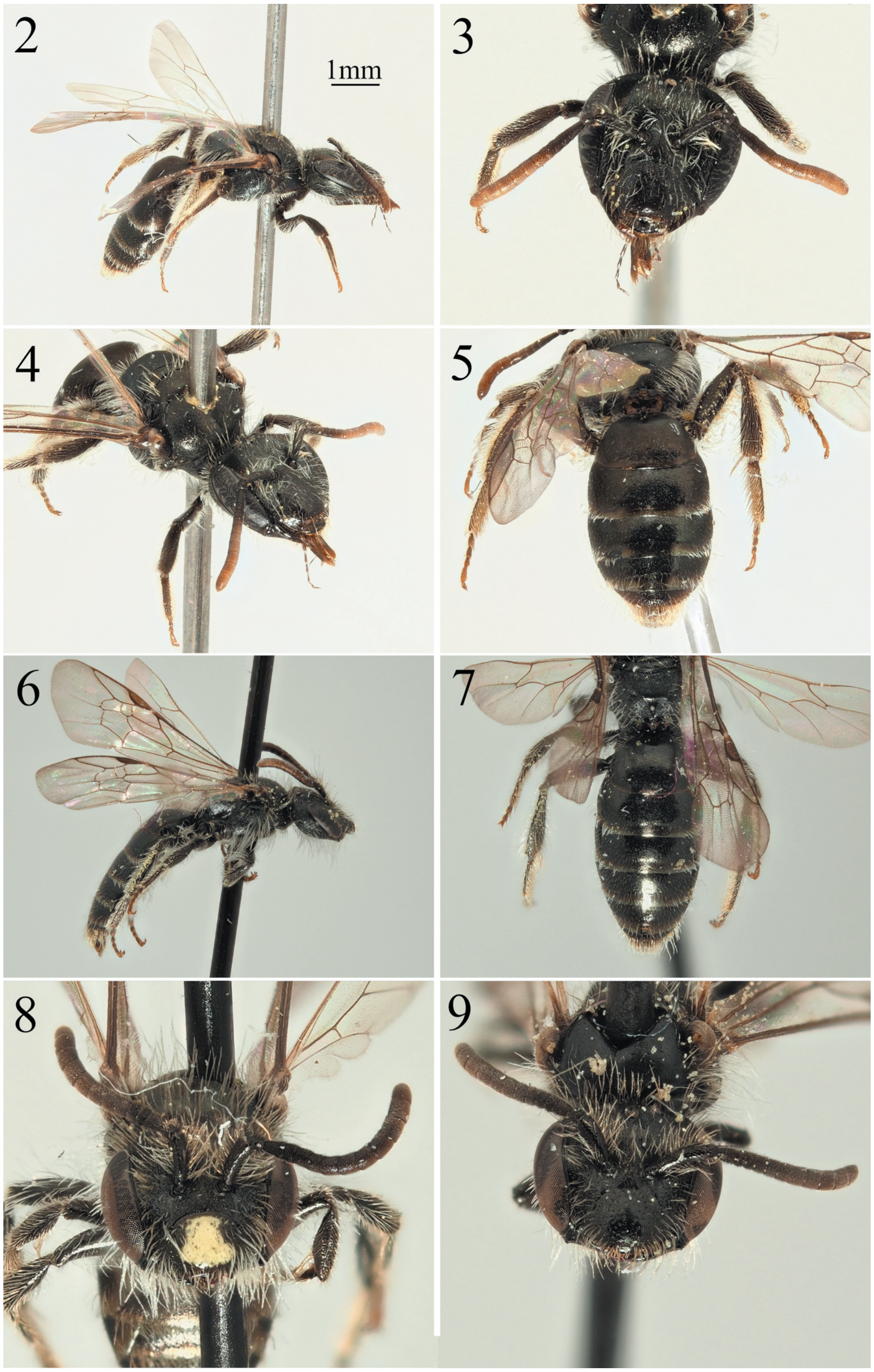
Head. Black, as wide as long. Clypeus domed, evenly shagreened, weakly shining, clearly punctured, punctures separated by 1–2 puncture diameters laterally, becoming sparser centrally to form a broad almost impunctate line. Clypeus most commonly predominantly yellow marked (Figure 8) but this can vary from 80–90% coverage to 50% coverage to completely black (Figure 9). Pubescence as in the female. Antennal segments 1–6 dark, segments 7–13 slightly lightened orange below, segment 3 slightly shorter than 4 + 5 in length. Ocelloccipital distance short, wider than female, at most ¼ width of posterior ocellus.

Mesosoma. As in the female.

Metasoma. Tergites as in the female, weakly shining with uniform even shagreenation (Figure 7). T2–4 with weak apical lateral hair fringes, also interrupted widely. Genitalia simple (Figure 10), gonocoxites with weak rounded apical teeth, penis valve slightly widened centrally, gonostyli with parallel sides, forming a slight apical point, becoming slightly translucent at their apexes.

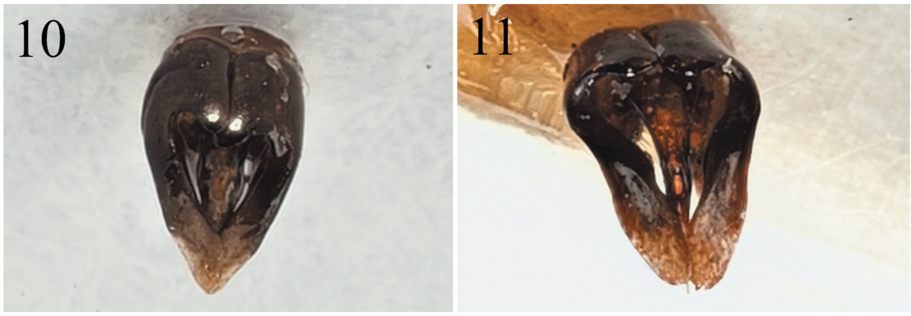
Diagnosis. *Andrena abruptifovea* can be placed into the subgenus *Aciandrena* in the female sex by the combination of small size, black integument, narrow facial fovea, and a shagreened propodeal triangle, and in the male sex by the additional character of a yellow marked clypeus.

Is most similar to *Andrena* (*Aciandrena*) *pulicaria* Warncke, 1975 from Greece and Turkey, most notably in the male sex where the clypeus is domed and partly yellow marked (Figure 8, though the coloration can be variable, see Figure 9), in contrast to other *Aciandrena* species where the male clypeus is completely flat or flattened and completely or almost completely yellow marked (e.g. *A. pratincola* Warncke, 1974 and *A. lamiana* Warncke, 1965, respectively). It can easily be separated by a comparison of the genitalia as *A. pulicaria* has a



Figures 2–9. *Andrena* (*Aciandrena*) *abruptifovea* **n. sp. 2**, Female profile, **3**, female face, **4**, female labrum, **5**, female tergites, **6**, male profile, **7**, male tergites, **8**, male face, yellow marked form, **9**, male face, black form.

clear, rounded protrusion on the inner margin of the gonostyli (Figure 11; also illustrated in Warncke 1975b). The genital capsule is similar to the recently described *A. israelica* Scheuchl & Pisanty, 2016 with moderately pronounced gonocoxal teeth, but the gonostyli of *A. abruptifovea* are longer and come to a clearer point (Figure 10, but not as clear as in species like *A. aciculata* Morawitz, 1886, see illustrations in Warncke 1972). The two species can also be separated because the clypeus of *A. israelica* is flattened and black. In a series of six males



Figures 10–11. *Andrena* (*Aciandrena*), male genitalia. **10**, *A.* (*A.*) *abruptifovea* **n. sp.; 11**, *A.* (*A.*) *pulicaria* Warncke, 1975.

of *A. abruptifovea* taken from the type locality, two had a predominantly yellow clypeus, three had a partially yellow clypeus, and one was completely black. However, they were all domed, and the two species can be separated on this basis rather than simply by colour.

In the female sex, *A. abruptifovea* can also be placed close to *A. pulicaria* because of the domed clypeus that is basally and centrally shagreened and weakly shiny but becoming clearly shiny at the apical margin. However, the two can be clearly separated by the labral process which like an equilateral triangle in *A. pulicaria* (roughly as long as wide) but like an isosceles triangle in *A. abruptiofovea* (clearly longer than wide, Figure 4). The foveae are also more sharply and abruptly narrowed below (Figure 4, also clearly distinguishing this taxon from *A. israelica* and *A. judaea* Scheuchl & Pisanty, 2016) and the tergal integument is much less strongly sculptured, shagreened and therefore weakly shining (Figure 5), hammer shagreened and dull in *A. pulicaria*.

Additional *Aciandrena* material is available from lower elevations from Israel and Syria that is very close morphologically to *A. abruptifovea*. However, it differs in the male sex because the clypeus is flatter, and the genital capsule is shorter, with comparatively shorter and less pointed gonostyli, and the penis valve is thinner and more parallel sided without the slightly bulging sides medially that can be seen in *A. abruptifovea* (Figure 10). In the female sex, the clypeus is slightly less domed and the fovea, whilst constricted below like *A. abruptifovea*, are narrower overall (occupying slightly less than half of the space between a lateral ocellus and the compound eye at their maximal width, for *A. abruptifovea* occupying half this space). These differences are subtle, particularly in the female sex, but given the difference in male genitalia morphology we take the position that these are not the same taxon as *A. abruptifovea*, and their status needs to be established, preferably with molecular techniques.

Other material examined *(Andrena* (*Aciandrena*) species close to *A. abruptifovea)***.** ISRAEL: Jerusalem env., 20.III.1993, 3♀, leg. D. Abel; SYRIA: An Nasrah env. [Al-Nasrah], 8–13.IV.2005, 2♀, leg. S. Jald; Tartus, 250 m, St. Georg-Klost., 3.IV.1988, 1♀, leg. L. Blank; Tartus, Safita, 10 km N, 300 m, 3.IV.1988, 2♂, 1♀, leg. L. Blank; Aleppo, 500 m, Simeons-Kloster, 19.IV.1988, 1♀, leg. L. Blank; Latakia, 750 m, Qaranjah, 3.IV.1988, 1♀, leg. L. Blank, currently all TJW.

Distribution. Known from high altitude sites in central and northern Lebanon.

Floral preferences. All floral records were made from Brassicaceae. Other *Aciandrena* species for which data are available show exclusive use of Brassicaceae (TJW *unpublished data*), and this may be the case for *A. abruptifovea* but more study is required.

Etymology. The name *abrupti* (abrupt, sudden) + *fovea* (the facial fovea that help to characterise *Andrena* in the female sex) was chosen to describe the abruptly constricted fovea that run along the inner margins of the compound eyes, helping distinguishing this species from other Levantine members of the subgenus.

Andrena (*Chlorandrena*) *edentula* Wood, n. sp.

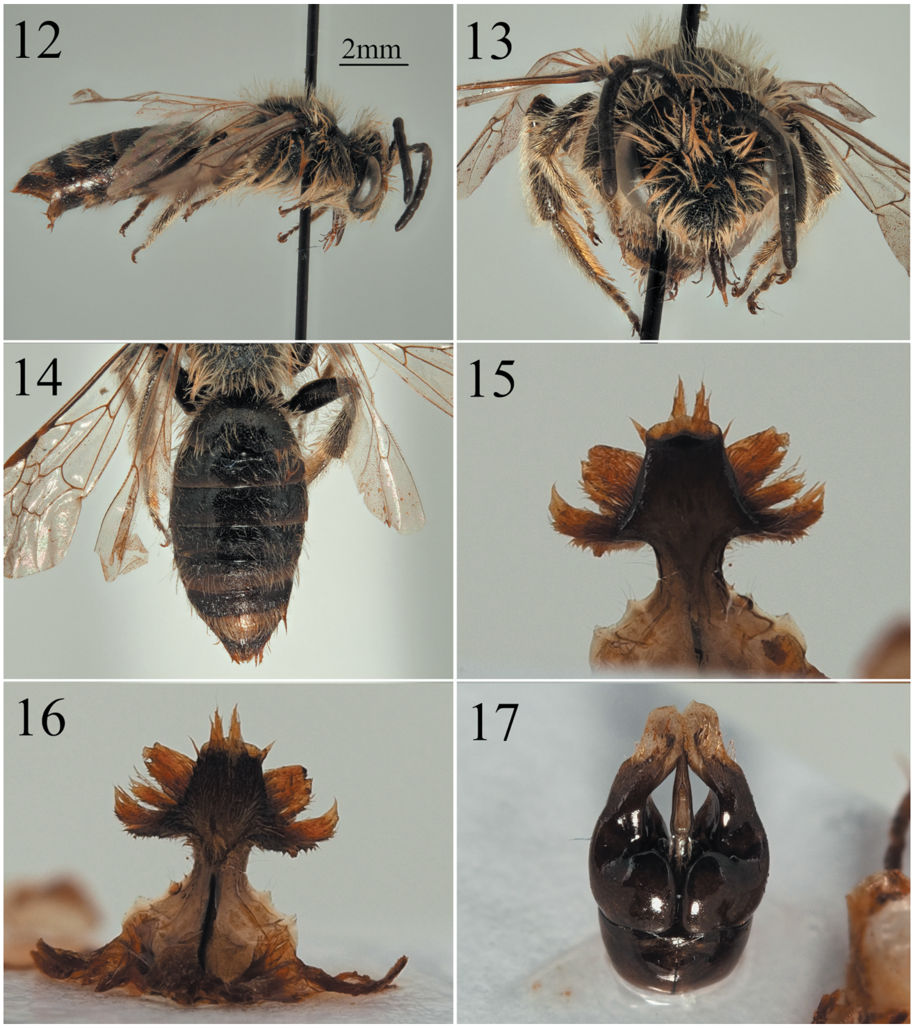
http://www.zoobank.org/urn:lsid:zoobank.org:pub:25E04964-3516-4666-9871-82DD924CC373

Type material. Holotype: ♂, SYRIA occ., An Nasrah env [Al-Nasrah, 34°47'37"N 36°17'23"E], 8–13.IV.2005, leg. J. Saki. Deposited at the OÖLM.

Female. Unknown.

Description of male. Body length 11 mm (Figure 12).

Head. As long as wide, dark but with a very subtle slight metallic sheen, most obvious in the centre of the clypeus (Figure 13). Clypeus black, with shallow raised reticulation forming weak lateral carinae, underlying surface microreticulate, weakly shining. Process of labrum broadly trapezoidal, twice as wide as long, front margin widely and shallowly emarginate. Face, gena, vertex, and scape with light brown-yellow hairs, the longest of these equalling the scape in length. Antennae dark, antennal



Figures 12–17. *Andrena* (*Chlorandrena*) *edentula* **n. sp. 12**, Male profile; **13**, male face; **14**, male tergites; **15**, male sternite 8; dorsal view; **16**, male sternite 8; ventral view; **17**, male genitalia.

segments 3–13 below with extremely short and dense hairs giving a lightened silvery impression, segment 3 shorter than 4 + 5. Ocelloccipital distance slightly exceeding diameter of posterior ocellus.

Mesosoma. Scutum and scutellum strongly shagreened, densely punctate, punctures separated by 0.5–1 puncture diameter, underlying surface weakly shining. Pronotum non-carinate. Scutellum centrally with a very small area free of punctures, underlying surface smooth and shining. Episternum and propodeum reticulate, underlying surface weakly shining, propodeal triangle well marked with a weak carina and by a change in sculpture, basally with short longitudinal carinae, dull. Episternum, propodeum, scutum, and scutellum with long light brown-yellow hairs, the longest of these on the episternum clearly exceeding the length of a scape. Legs dark, final tarsal segments slightly lightened red-brown, pubescence yellow. Wings hyaline, venation and stigma amber, nervulus interstitial.

Metasoma. Tergites dark, apical margins of T2–5 slightly lightened red-brown (Figure 14). Tergites clearly and densely punctured, punctures of typical *Chlorandrena* crater form with raised rim, this most apparent on T1, punctures on following tergites progressively with less clearly marked rims, punctures separated by 1 puncture diameter. Underlying surface on tergal discs weakly shagreened, shining, tergal margins with clear lateral microreticulation, dull. Pubescence weak, without clear pattern, T1–5 generally with sparse yellow to dark brown hairs, T6 with apical margin covered by a loose fringe of yellow hairs, these not obscuring the underlying surface. S8 in dorsal view greatly widened, with short laterally projecting teeth basally, apically with a short lamellate projection, weakly pointed (Figure 15). S8 in ventral view with thick laterally projecting hair tufts that clearly obscure the underlying surface (Figure 16). Centrally and ventrally at the level of the laterally teeth with a thin and inconspicuous ventrally projecting hair tuft, perpendicular to the sternal plate itself. Genitalia with weakly pronounced gonocoxite teeth, these almost absent (Figure 17). Penis valve very narrow, almost the same width throughout its length. Gonostyli broad, only slightly narrowing apically where they form a flattened and lamellate apex with a small projecting point, internal margin with a raised carina.

Diagnosis. *Andrena edentula* can be quickly placed into the *Chlorandrena* because of the deep and distinct 'crater punctures' on the terga that are impressed with a slightly raised rim. It can be further placed into the *rhenana*-group because sternite 8 is broad with lateral tooth-like projections (Figure 15; Schwenninger 2015). The *rhenana*-group was recently revised in the West Palearctic (Schwenninger 2015), but *A. edentula* is unlike any previously described member, as sternite 8 is extremely short and has thick lateral hair tufts (Figure 16), centrally and ventrally at the level of the lateral teeth with a tuft of long hairs that projects perpendicularly and ventrally away from the sternal plate, and the genitalia are unique with the normally clear gonocoxal teeth greatly reduced and an extremely narrow penis valve (Figure 17). The gonostyli show an affinity to other members of the *rhenana*-group as their apexes are flattened and lamellate, forming only a weak point, with a raised carina along their inner margin, like *A. orientana* Warncke, 1965 and *A. taraxaci* Giraud, 1861, but the combination of weak gonocoxal teeth and the narrow penis valve are unique. Using the key of Schwenninger (2015), *A. edentula* keys to couplet 10 at which point it matches neither species as the genitalia are markedly divergent.

Distribution. Known only from the *locus typicus* in north-western Syria. This locality is just 20 km north of the Lebanese border, and so the species may be present in northern Lebanon.

Floral preferences. None recorded but members of the *Chlorandrena* are very strongly tied to Asteraceae (Cichorieae or Anthemideae, Schmid-Egger & Scheuchl 1997; Amiet et al. 2010; TJW unpublished data).

Etymology. The name *edentula* (toothless) was chosen because the male genitalia have greatly reduced gonocoxal teeth which is unusual for members of the *rhenana*-group (Schwenninger 2015).

Andrena (*Euandrena*) *scrophulariae* Wood, n. sp.

http://www.zoobank.org/urn:lsid:zoobank.org:pub:A8E26F5F-D7DB-4AE8-A82F-FA3C0C098122

Type material. Holotype: ♀, LEBANON: N Lebanon, Arz Tannourine, Gate Area, 1754 m [34°12'25"N 35°55'55"E, Figure 1, location 2], 20.V.2018, leg. Boustani, *Scrophularia* spp. Deposited at the RBIN. BOLD sequence entry number: HYMAA061-20.

Paratypes: LEBANON: N Lebanon, Arz Tannourine, Gate Area, 1754 m, 20.V.2018, 3♀ [#1-3], leg. Boustani, *Scrophularia* spp. Paratypes are deposited at the RBIN [#1], the DACN [#2], and in the personal collection of TJW [#3].

Description of female. Body length 9–9.5 mm (Figure 18).

Head. Dark, but with a clear greenish metallic sheen, this particularly pronounced on the basal part of the clypeus as the colour transitions from weak metallic green (clypeus margins) to black (centre of the clypeus, Figure 19). Clypeus domed and centrally flattened, clearly and strongly punctured, punctures separated by 1 (laterally) to 2 (centrally) puncture diameters. Clypeus with a faint longitudinal impunctate line centrally. Clypeus shagreened laterally, transitioning to smooth and shining centrally. Process of labrum twice as long as broad, clearly emarginate apically (Figure 20). Face centrally with white hairs, laterally with black hairs. Gena and scape with white hairs, vertex with a mixture of black and white hairs, the longest of these hairs equalling the length of the scape. Antennae dark, segments 5–12 slightly lightened grey below, segment 3 exceeding 4 + 5 in length, slightly shorter than 3 + 4 + 6. Foveae comma shaped, equalling the width of an antenna above where they occupy half of the space between a lateral ocellus and the top of the compound eye, narrowing below to 60% of their maximum width, filled with a light brown to dark brown pilosity depending on the angle of observation. Ocelloccipital distance slightly shorter than width of posterior ocellus.

Mesosoma. Scutum densely shagreened, weakly shining, clearly punctured, punctures separated by 1–2 puncture diameters, underlying integument with faint metallic sheen but not as pronounced as on the face. Pronotum non-carinate. Scutellum laterally the same as the scutum, but centrally smooth and shining, without shagreenation. Episternum and propodeum dull, weakly reticulate, propodeal triangle visible by a change in sculpturing, almost without rugosity except basally. Episternum, propodeum, scutum, and scutellum with long whitish branched hairs, these equalling the length of the scape. Legs dark, tarsi not noticeably lightened, pubescence light brown. Floccus and femoral scopa white, tibial scopa light orange, composed of simple hairs. Wings slightly yellowed, venation amber, nervulus antefurcal.

Metasoma. Tergites dark, narrow apical part of tergal margins lightened translucent yellow (Figure 21). T1 without shagreenation, smooth and shiny, following tergites with subtle shagreenation, predominantly shiny. T1

Figures 18–21. *Andrena* (*Euandrena*) *scrophulariae* **n. sp. 18**, Female profile; **19**, female face; **20**, female labrum; **21**, female tergites.

with sparse but clear and small punctures, punctures separated by 3 puncture diameters, following tergites more densely and weakly punctured, punctures separated by 2 puncture diameters. T1 with a fringe of long hairs on its apical margin, these hairs clearly exceeding the length of the margin itself. T2–4 with fringes of shorter and denser hairs, these only slightly exceeding the length of the margins themselves and obscuring the underlying surface. T5 and the hairs flanking the pygidial plate dark brown. Pygidial plate flat, without central raised portion, densely punctured, with impunctate and slightly raised margin.

Male. Unknown.

Diagnosis. *Andrena scrophulariae* clearly has comma-shaped fovea that are relatively broad above and narrowed below, and would initially seem to be a good fit for the *Euandrena*. However, it has an elongate face (Figure 19) and the process of the labrum is much more elongate than is typical for *Euandrena* (Figure 20), suggesting possibly affinity with *Didonia* (Warncke 1968). Most specifically, *A. scrophulariae* resembles *A.* (*Didonia*) *solenopalpa* from France and Spain that has a similarly elongate face. However, COI barcode data unequivocally places *A. scrophulariae* within the *Euandrena* (C. Praz and TJW unpublished data). Additionally, provisional molecular *Andrena* phylogenies (S. Bossert *in litt.*) suggest that *A. solenopalpa* may be nested within the *Euandrena* and the *Ptilandrena* (Pisanty et al. 2020; see also Praz et al. 2019 for discussion over the paraphyly of these two subgenera). Indeed, previous authors have found problems with the concept of *Didonia* and have split off several previous *Didonia* species into a new subgenus *Hamandrena* based on the presence of strong hooked bristles on the galea (not including *A. solenopalpa* that lacks these bristles, Dubitzky et al. 2010). Given these outstanding problems surrounding *Andrena* classification, we take the approach of placing this taxon within the large *Euandrena* group, and await future subgeneric reclassification efforts with interest.

Andrena scrophulariae can easily be separated from *A. solenopalpa* by the shape of the labral process, which is widely triangular in *A. solenopalpa* but elongate trapezoidal in *A. scrophulariae* with a clearly emarginate front margin. It has a longer face than any currently described species of Eastern Mediterranean *Euandrena*.

Distribution. Known only from Arz Tannourine (Harissa) in northern Lebanon, but given what is known about other high altitude Cedar forests and their associated *Andrena* communities this species is likely to be more widespread across this region.

Floral preferences. All specimens were collected from unidentified *Scrophularia* (Scrophulariaceae) species. The one available pollen load contained pure *Scrophularia* pollen. The elongated face of the female suggests a strong association with flowers with deep corollas, but more study is required before firm conclusions can be drawn.

Etymology. The name *scrophulariae* (of *Scrophularia*) was chosen because of the use of this genus as a pollen source.

***Andrena* (*incertae sedis*) *cedricola* Wood, n. sp.**

http://www.zoobank.org/urn:lsid:zoobank.org:pub:53413ABA-919A-4D87-BC94-0545BAF4191A

Type material. Holotype: ♀, LEBANON, N Lebanon, Hadath El Jebbe, border of the Cedar forest, 1646 m [34° 12'58"N 35°56'13"E, Figure 1, location 2], 13.V.2017, leg. Boustani, Brassicaceae. Deposited at the RBIN.

Paratypes: LEBANON: N Lebanon, Hadath El Jebbe, border of the Cedar forest, 1618 m, 5.V.2017, 1♂ [#1], 1♀ [#2], leg. Boustani; Mount Lebanon, Falougha, Cedar woods, 1480 m, 27.IV.2019, 1♀ [#3], leg. Boustani (Figure 1, location 4); Mount Lebanon, Laqlouq, Matoube, 1657 m, 30.IV.2017, 1♀ [#4], leg. Boustani (Figure 1, location 3); N Lebanon, Harrisa, Al Jawar, 1758 m, 11.V.2019, 2♂ [#5-6], leg. Boustani, white *Brassica* (Figure 1, location 2); SYRIA: Faouar [probably Camp Faouar UNDOF, Golan Heights, c. 1000 m – it is not clear exactly where this sampling point is, and the author may have been at a higher altitude towards Mount Hermon], 31.III.2001, 1♂ [#7], leg. J. Plass (Figure 1, location 7). Paratypes are deposited at the RBIN [#2; #6], the DACN [#3; #5], the OÖLM [#7], and the personal collection of TJW [#1; #4].

Description of female. Body length 7.5–8 mm (Figure 22).

Head. Black, as long as wide (Figure 23). Clypeus slightly domed, shagreened, weakly shining, with scattered but clear punctures, punctures separated by 1–3 puncture diameters. Process of labrum triangular, slightly longer than wide (Figure 24). Face, gena, and scape with short white hairs, these becoming longer and more yellowish on the vertex, the length of these hairs approaching but not exceeding the length of the scape. Antennae predominantly dark, segments 9–12 becoming very slightly lightened orange below, segment 3 slightly longer than 4 + 5, shorter than 4 + 5 + 6. Fovea relatively broad above, exceeding the width of an antenna, but only occupying 1/3rd of the distance between a lateral ocellus and the top of the compound eye, narrowing below to 50% of their maximum width. Ocelloccipital distance narrow, at most 2/3 width of posterior ocellus.

Mesosoma. Scutum and scutellum shagreened, weakly to strongly shining centrally, surface clearly and evenly punctured, punctures separated by 1–2 puncture diameters. Pronotum non-carinate. Episternum and propodeum shagreened and reticulated, dull, propodeal triangle clearly delineated with a shallow marginal carina, internal surface with clear raised reticulation. Episternum and propodeum laterally with white hairs, scutum and scutellum dorsally with shorter light brown hairs. Legs uniformly dark, pubescence whitish. Floccus, femoral and tibia scopa white. Wings hyaline, venation brown, nervulus antefurcal.

Metasoma. Tergites dark, T1 entirely and T2–4 with apical areas without shagreenation, smooth and shiny (Figure 25). T2–4 basally with shagreenation and extremely scattered and sparse punctures. T1 sparsely but finely punctured, punctures separated by 2–3 puncture diameters. T2–4 both basally and apically with loose lateral hair patches and hair fringes respectively (Figure 25). T5 and hairs flanking pygidial plate light brown, laterally with scattered white hairs. Pygidial plate flat, without raised central portion, densely punctate with a thin impunctate margin.

Description of male. Body length 6.5–7 mm (Figure 26).

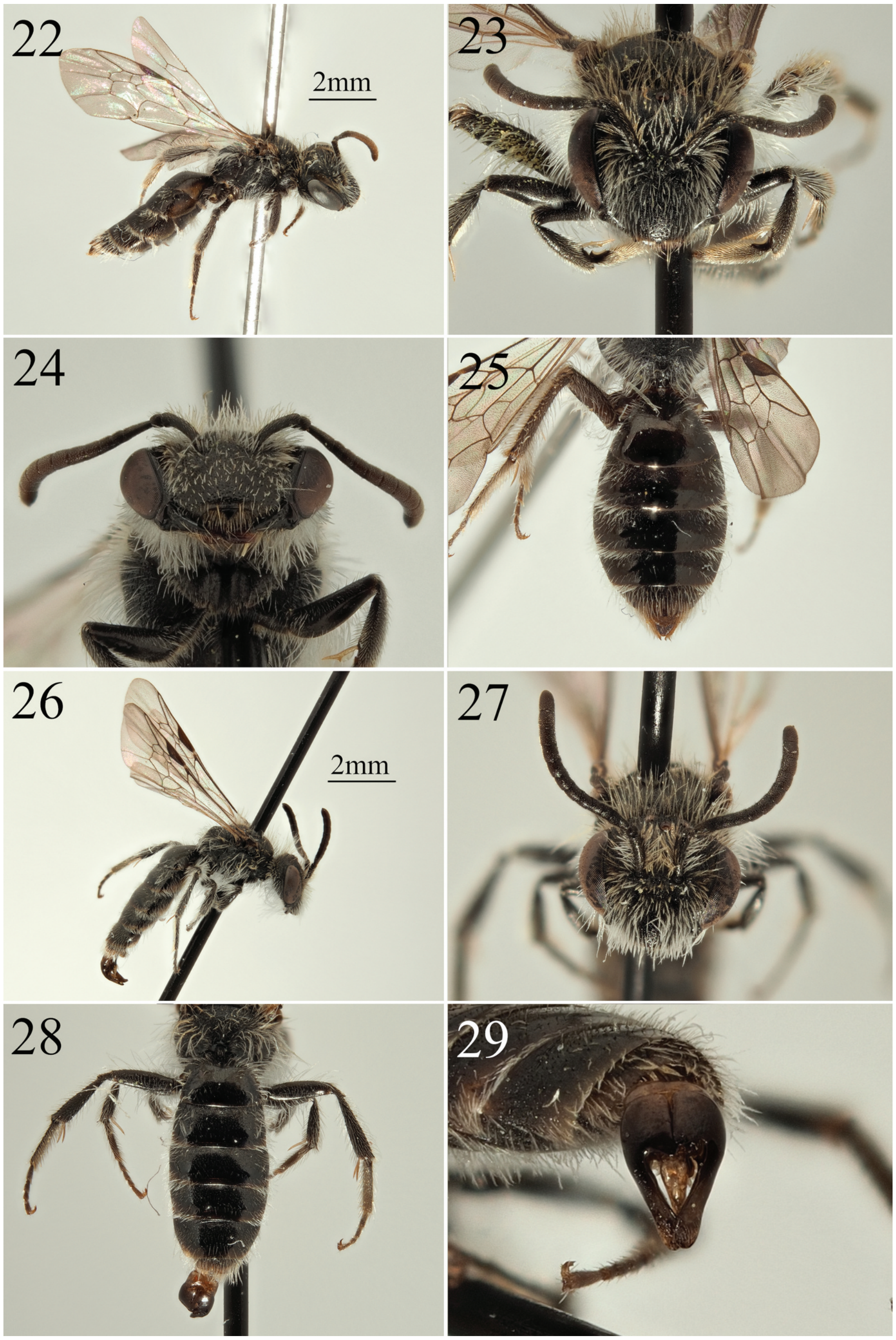
Head. Black, slightly wider than long (Figure 27). Clypeus black, sculpturing as in the female. Process of labrum roughly square, slightly wider than long. Pilosity and ocelloccipital distance as in the female, antennae uniformly dark, segment 3 shorter than 4 + 5.

Mesosoma. Scutum and scutellum strongly shagreened, weakly shining, shallowly and unevenly punctured, punctures with slightly raised rims, separated by 1–2 puncture diameters. Episternum and propodeal sculpturing, mesosomal pilosity, and pronotal carination as in the female. Legs dark, apical tarsal segments slightly lightened. Wings hyaline, venation dark brown, nervulus slightly antefurcal.

Metasoma. As in the female, T1 and T2–5 apically smooth and shiny, without shagreenation, contrasting with the basally shagreened and dull parts (Figure 28). Pubescence as in the female. Genitalia long and slim, gonocoxites with weak rounded teeth, penis valve narrow, and gonostyli parallel sided, slightly wider at their apex than in their middle (Figure 29).

Diagnosis. *Andrena cedricola* morphologically resembles members of the subgenus *Poecilandrena* based on the criteria outlined by Pisanty et al. (2018), specifically *A. stenofovea* Scheuchl & Pisanty, 2018. However, this subgenus has been treated as a ‘wastebasket’ for species lacking apomorphies, and is strongly paraphyletic (Pisanty et al. 2020). As such, we do not formally place *A. cedricola* into a subgenus at this time, but it can be grouped with the *Poecilandrena* more generally for species recognition and identification purposes.

In the female sex it is most similar to *A. stenofovea* because of the aberrant small and triangular labral process (Figure 24). However, the tergites are completely



Figures 22–29. *Andrena* (*incertae sedis*) *cedricola* **n. sp. 22**, Female profile; **23**, female face; **24**, female labrum; **25**, female tergites; **26**, male profile; **27**, male face; **28**, male tergites; **29**, male genitalia.

different, with wide and shiny marginal areas (Figure 25), whereas in *A. stenofovea* the tergites are uniformly shagreened, with the margins barely differentiated and difficult to see. Though they do narrow below, the facial foveae are also wider than the width of an antenna above, whereas they are narrower than the width of an antenna throughout their entire length in *A. stenofovea*.

The male genitalia are simple (Figure 29) and closest to species like *A. sedumella* Scheuchl & Pisanty, 2018 and *A. limassolica* Mavromoustais, 1948, but are unique amongst Levantine species by the combination of gonocoxal teeth and uncurved gonostyli that broaden slightly at their apex, as well as by the unique sculpturing of the tergal margins as in the female.

Modifying the key of Pisanty et al. (2018), the female of *A. cedricola* keys to couplet 3 at which point it meets some of the characters of *A. stenofovea* (triangular labrum), but not others (facial fovea extremely narrow and elongate) but also does not agree with the alternative (facial fovea uniformly broad, labral process trapezoidal to rectangular). The male of *A. cedricola* keys to couplet 5 at which point it does not agree with either pathway (gonocoxites have a dorsal lobe, but the clypeus is not yellow marked). Both sexes can therefore be easily separated from other similar Levantine *Andrena*.

Distribution. Known from high altitude sites in central and northern Lebanon and the Golan Heights, Syria.

Floral preferences. One female and two males were collected from Brassicaceae. A different female specimen (N Lebanon, Hadath El Jebbe, border of the Cedar forest, 1618 m, 5.V.2017) with no floral visitation data had a scopa full of pollen. Pollen analysis of this load showed that it contained pure Brassicaceae pollen (18 μm in diameter, *Thlaspi*-type). More study is required before any firm conclusions can be drawn for this species.

Etymology. The name *cedri* (Cedar, *Cedrus*, genus of Old World trees) + *cola* (inhabiting, living in a place) was chosen because Lebanese specimens were collected from high altitude sites characterised by stands of *Cedrus libani* (Pinaceae), the national emblem of Lebanon.

Andrena (*Rufandrena*) *parvispinae* Wood, n. sp.

http://www.zoobank.org/urn:lsid:zoobank.org:pub:DACFB7F0-5A14-4E86-A8C9-25CB79428CB8

Type material. Holotype: ♂, SYRIA, Latakia, Qaranjah, 750 m [probably 35.783°N 35.900°E], 3.IV.1988, leg. L. Blank. Deposited at the OÖLM.

Paratypes: SYRIA: Latakia, Qaranjah, 750 m, 3.IV.1988, 4♂, leg. L. Blank; Tartus, Safita, 10 km E, 300 m [probably Alhulu west forests], 1♂, leg. L. Blank. Paratypes are deposited at the OÖLM with one retained in the personal collection of TJW.

Female. Unknown.

Description of male. Body length 5 mm (Figure 30).

Head. Black, clearly wider than long (Figure 33). Clypeus arched, weakly shagreened basally and laterally, centre weakly shiny, entire surface yellow with coloration extending onto the lower paraocular areas. Clypeus surface weakly and shallowly punctured, centrally with punctures separated by 3–4 puncture diameters, laterally by 2–3 puncture diameters. Process of labrum weakly trapezoidal, twice as broad as long. Face, gena, vertex, and scape with white hairs, these not exceeding the length of the scape. Antennae black, antennal segments slightly lightened orange-brown below from segment 5 onwards, segment 3 slightly exceeding 4 + 5 in length, shorter than 4 + 5 + 6. Ocelloccipital distance short, at most ½ width of posterior ocellus.

Mesosoma. Scutum and scutellum strongly shagreened but weakly shining, sparsely, shallowly, and subtly punctured, punctures separated by 2–3 puncture diameters. Pronotum non-carinate. Episternum shagreened, weakly shining. Propodeal triangle slightly marked by a weakly raised external carina, centrally with weak rugosity. Mesosoma with white hairs, these densest and longest on the episternum, the longest hairs equalling the length of the scape. Legs dark, lightened to dark red-orange at the apex of the tarsi, pubescence white. Wings hyaline, venation amber, nervulus clearly postfurcal.

Metasoma. Tergites dark, apical margins lightened yellow to amber, hyaline (Figure 32). Tergal integument shagreened, the strength of the shagreenation decreasing from the T1 to T5, therefore becoming shinier. T1 almost impunctate, with the density of punctures increasing across tergites, T5 therefore moderately but very shallowly punctate, punctures separated by 2 puncture diameters. Tergites laterally with small patches of white hairs, very widely interrupted, these most pronounced on T2–4. S7 widely emarginate, S8 widened and flattened, mallet shaped, laterally with two short but clearly projecting spines (Figure 31). Genitalia long, gonocoxa with moderately pronounced and rounded teeth, gonostyli curved with a thin, hyaline outer margin (Figure 34). Penis valve centrally with two lateral translucent semicircular projections.

Diagnosis. *Andrena parvispinae* can be instantly recognised as a member of the subgenus *Rufandrena* because of the characteristic structure of sternite 8 in the male sex which is strongly widened, and which possesses a clear spine on each side that clearly projects through surrounding hairs (Figures 30, 31). This character is so clear and distinctive that it is actually the first couplet in Warncke's (1968) key to West Palearctic *Andrena* subgenera. Only two species have been placed into the *Rufandrena, A. rufiventris* Lepeletier, 1841 (Morocco to Libya) and *A. orbitalis* Morawitz, 1871 (north-western Africa, Iberia, France, and Italy, Gusenleitner & Schwarz 2002). As well as being separable simply by their much larger size (10–11 mm in the male sex against 5 mm in *A. parvispinae*), both *A. rufiventris* and *A. orbitalis* have quite different genitalia with a marked emargination in the apical part of the gonostyli (Figures 34, 37, 40). The three species share a similar broader than long head shape, and similar

Figures 30–40. *Andrena* (*Rufandrena*). **30–34**, *A.* (*R.*) *parvispinae* **n. sp.: 30**, male profile; **31**, male sternite eight; **32**, male tergites; **33**, male face; **34**, male genitalia; **35–37**, *A.* (*R.*) *orbitalis* Morawitz, 1871: **35**, male tergites; **36**, male face; **37**, male genitalia; **38–40**, *A.* (*R.*) *rufiventris* Lepeletier, 1841: **38**, male tergites; **39**, male face; **40**, male genitalia.

white facial markings, though those in *A. parvispinae* are more extensive (Figures 33, 36, 39).

Distribution. Known only from Syria from Tartus to Latakia. The locality labels suggest inland locations in wooded districts. The species may be in northern Lebanon and south-eastern Turkey as both localities are within 20 km of the respective borders, but these areas must be searched.

Floral preferences. None recorded. Its relative *Andrena orbitalis* may be a specialist of *Plantago* (Plantaginaceae, TJW unpublished data), and so *Plantago* species could be searched in the spring. Nothing is known of the floral preferences of *A. rufiventris*.

Etymology. The name *parvi* (small) + *spinae* (spines) was chosen to describe the two tiny spines in the sides of sternite eight that place this bee in the subgenus *Rufandrena*. The name can also have a double meaning, referring to the small body size of the species itself relative to the other two members of this subgenus (i.e. the small bee in the group of *Andrena* with spines on sternite eight).

Figures 41–46. *Andrena* (*incertae sedis*) *prodigiosa* **n. sp. 41**, Male profile; **42**, male face; **43**, male tergites; **44**, male genitalia; **45**, male genitalia in profile; **46**, male genitalia in reverse view, view of bifurcate penis valve.

***Andrena* (*incertae sedis*) *prodigiosa* Wood, n. sp.**

http://www.zoobank.org/urn:lsid:zoobank.org:pub:F7A264EC-C11D-4009-B6E7-1C1683AA9C9F

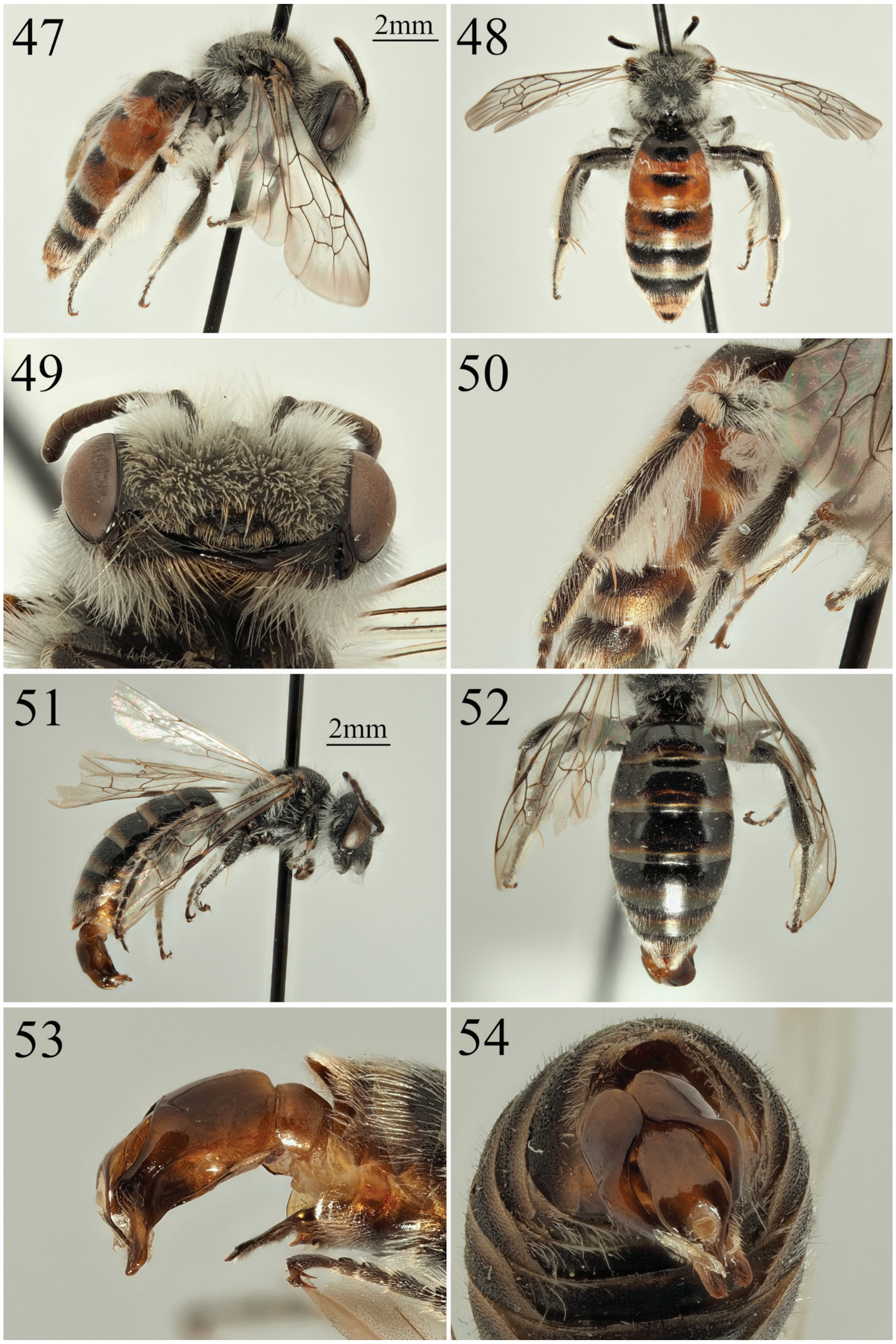
Type material. Holotype: ♂, LEBANON, Beka'a, Qaraoun Lake [33°33'57"N 35°42'28"E, Figure 1, location 6], 24.III.2013, leg. M. Kasparek. Deposited at the OÖLM.

Female. Unknown.

Description of male. Body length 8 mm (Figure 41).

Head. Black, clearly broader than long (Figure 42). Clypeus arched, apically truncate. Underlying surface very weakly shagreened in the apical half and shiny, strongly shagreened basally and laterally, dull. Shiny areas of clypeus sparsely punctured, punctures separated by 2–3 puncture diameters, dull areas of clypeus densely punctate, punctures separated by 0.5–1 puncture diameters. Process of labrum rectangular, three times wider than long, weakly shining. Face, gena, vertex, and scape with whitish to yellowish hairs, some of these exceeding the length of the scape. Antennal segments 1–3 entirely dark, segments 4–13 orange below. Segment 3 equals segments 4 + 5. Ocelloccipital distance equalling width of posterior ocellus.

Mesosoma. Scutum and scutellum densely shagreened, dull, with irregular shallow punctures with clearly raised rims, punctures separated by 0.5–2 puncture diameters. Pronotum non-carinate. Episternum strongly shagreened, dull, with dense shallow punctures without rim, punctures separated by 0.5–1 puncture diameters. Propodeum shagreened and reticulate, dull, propodeal triangle smooth, therefore indicated by this lack of reticulation. Episternum, propodeum, scutum, and scutellum with long whitish to yellowish hairs, these exceeding the length of the scape. Legs dark, tarsal segments 3–5 lightened



Figures 47–54. *Andrena* (*Pallandrena*) *christineae* Dubitzky, 2006. **47**, Female profile; **48**, female tergites; **49**, female labrum; **50**, female scopa; **51**, male profile; **52**, male tergites; **53**, male genitalia in profile; **54**, male genitalia.

orange-red, pubescence whitish to yellowish. Wings hyaline, venation amber, nervulus interstitial.

Metasoma. Tergites dark, shagreened, weakly shining, apical margins lightened yellow-brown (Figure 43). Tergal margins laterally with loose fringes of whitish yellow hairs. Sternite 8 arched (Figure 45), covered in golden hairs (Figure 46). Genitalia abnormal (Figure 44), gonocoxites with strong apical teeth, ground colour brown transitioning into translucent yellow as the gonocoxites meet the gonostyli which are flattened and shovel shaped, coming to an apical point that is covered in yellow hairs (Figure 44). Penis valve apically strongly bifurcate apically (Figure 46).

Diagnosis. The genitalia of this specimen are unlike any West Palearctic *Andrena* species, and even placing it into a subgenus is difficult, as its combination of characters does not fit any of the current subgeneric concepts. Structurally, the specimen is unremarkable except for the extraordinary genitalia (Figures 44–46) that has hugely enlarged and flattened gonostyli with apical hair tufts, and a penis valve that is apically bifurcate (Figure 37). Sternite 8 is centrally arched and covered in projecting golden hairs (Figures 45, 46). The genitalia are reminiscent of *Parandrenella* with strong gonocoxites leading to partially flattened gonostyli with hair tufts on their internal margin in combination with a penis valve that forms a triangle basally. The subgenus also often has sternite 8 ornamented with elaborate hair patterns (e.g. *Andrena nisoria* Warncke, 1969, see Scheuchl et al. 2011 for good illustrations), but the gonostyli are never this flattened, the penis valve is never bifurcate, and the male clypeus is always yellow in all species described to date. We would hesitantly associate this species with *Parandrenella* on the basis of the overall shape of the genital construction, but we feel that placement in this subgenus before a female can be located would be presumptive.

Distribution. Known only from the *locus typicus* in eastern Lebanon.

Etymology. The name *prodigiosa* (bizarre, prodigious, amazing) was chosen because of the remarkable male genitalia.

Andrena *species of Lebanon*

***Andrena* (*Aenandrena*) *bisulcata* Morawitz, 1877**

Distribution. Central Europe eastwards to the Caucasus, Turkey, and the Near East (Gusenleitner & Schwarz 2002).

Literature. Grace (2010): Lebanon.

Material examined. JORDAN: Pella env. [Tabaqat Fahl], −80 m, 29.IV.2006, 1♀, leg. K. Deneš, OÖLM; North Shuna environs, 29.IV.1996, 1♀, leg. Mi. Halada, OÖLM; South of Irbid, 13.IV.2009, 1♂, leg. M. Snižek, OÖLM; 10 km N, NE of Jarash [Jerash], 20.IV.2002, 1♀, leg. M. Snižek, OÖLM; LEBANON: Mount Lebanon, Fidar, 25.IV.2017, 1♀, leg. Z. Mahfouz, USEK; Jubayl [Byblos], 5.IV.2017, 1♂, leg. T. Iskandar, USEK; SYRIA: Tartus, St. Georg-Kloster, 250 m, 3.IV.1988, 1♂, leg. L. Blank, MSC.

Notes. This species is reported as new for Jordan and Syria.

***Andrena* (*Brachyandrena*) *colletiformis* Morawitz, 1874**

Distribution. Southern Europe and North Africa to the Near East and Central Asia (Gusenleitner & Schwarz 2002).

Literature. Grace (2010): Lebanon.

Material examined. JORDAN: Pella env. [Tabaqat Fahl], −80 m, 29.IV.2006, 1♀, leg. K. Deneš, OÖLM; 30 km WWN of Aljun, 30.IV.2006, 1♀, leg. F. Kantner, OÖLM; LEBANON: Mount Lebanon, Chamis, Wadi Cheber, 372 m, 26.IV.2019, 1♀, leg. P. Rasmont, UMONS, *Chaetosciadium trichospermum*; N Lebanon, Kfar Hay, Monastere St. Youhanna Maroun, 327 m, 3.V.2017, 1♀, leg. Boustani, TCFNR.

Notes. This species is reported as new for Jordan.

***Andrena* (*Chlorandrena*) *exquisita* Warncke, 1975 ***

Distribution. Bulgaria, Turkey and Israel (Gusenleitner & Schwarz 2002; Pisanty et al. 2018).

Material examined. JORDAN: Aljoun, 28.IV.2012, 1♀, leg. M. Kafka, OÖLM; Aljun environs, 1.V.2006, 1♀, leg. K. Deneš, OÖLM; 15 km W Jerash, Dibbin, 2.V.2006, 4♀, leg. K. Deneš, OÖLM; LEBANON: Bekaa, Kefraya, Horch El Kaser, 992 m, 9.IV.2019, 1♂, 3♀, leg. Boustani, TCFNR, *Crepis sancta*; Bekaa, West Bekaa, Ammiq, 871 m, 27.IV.2019, 1♀, leg. Boustani, TCFNR, *Sonchus oleraceus*; N Lebanon, Tannourine El Tahta, Wadi Ain Al Raha, 900 m, 27.III.2017, 2♂, 2♀; 11.IV.2017, 1♂; 18.IV.2017, 3♀; 3.V.2017, 2♀, all leg. Boustani, TCFNR; N Lebanon, Tannourine El Tahta, Al Mahbase, 893 m, 5.V.2019, 1♂, leg. Boustani, TCFNR; N Lebanon, Fehta, El Biara, 1664 m, 11.V.2019, 1♀, leg. Boustani, TCFNR, *Crepis sancta*; N Lebanon, Arz Tannourine, Gate, 1796 m, 11.V.2019, 1♂, leg. Boustani, TCFNR; N Lebanon, Ehden, Horch, Trail 1, 1534 m, 2.V.2017, 2♀, leg. Boustani, TCFNR; SYRIA: Latakia, Qaranjah, 750 m, 3.IV.1988, 11♂, leg. L. Blank, MSC; Tartus, St. Georg-Kloster, 250 m, 3.IV.1988, 1♀, leg. L. Blank, TJW; Aleppo, 500 m, Simeons-Kloster, 19.IV.1988, 1♀, leg. L. Blank, MSC.

Notes. This species is reported as new for Jordan and Syria. It was only recently reported from Israel for the first time (Pisanty et al. 2018), so it is clearly quite widespread but previously unnoticed in the Levant.

***Andrena* (*Chlorandrena*) *humabilis* Warncke, 1965 ***

Distribution. Balkans, Turkey and Israel (Gusenleitner & Schwarz 2002)

Material examined. JORDAN: 15 km W Jerash, Dibbin, 2.V.2006, 1♀, leg. K. Deneš, OÖLM; LEBANON: S Lebanon, Saidoun, El Mrouj, 26.III.2017, 1♀, leg. A. Baghdadi, SOILS; Saidoun, 10-11.II.2018, 1♂, 2♀, leg A. Baghdadi, SOILS/TJW; SYRIA: Tartus, St. Georg-Kloster, 250 m, 3.IV.1988, 1♀, leg. L. Blank, MSC.

Notes. This species is reported as new for Jordan and Syria.

Andrena (*Chlorandrena*) *humilis* Imhoff, 1832 *

Distribution. Europe, north-western Africa, Turkey, and eastwards into Russia and the Caucasus (Gusenleitner & Schwarz 2002; Hazir et al. 2014).

Material examined. LEBANON: N Lebanon, Fehta, El Biara, 1664 m, 24.IV.2018, 1♂, leg. Boustani, TJW, *Crepis* spp.; 11.V.2019, 2♂, leg. Boustani, TCFNR, *Crepis sancta*; N Lebanon, Arz Tannourine, Tannourine Forest Reserve Outskirts, 1794 m, 6.V.2017, 5♂, leg. Boustani, TCFNR, *Geranium* spp.; N Lebanon, Ehden, Jord, 1983 m, 7.V.2019, 1♂, leg. Boustani, TCFNR, *Medicago* spp.; N Lebanon, Arz Bcharre, Forest of the Cedars of God, Forest Limit, 1873 m, 6.V.2019, 2♀, leg. Boustani, TCFRN/TJW, *Crepis* spp.

Notes. The taxonomic situation surrounding *A. humilis* is complicated. It is the most widespread of the West Palearctic members of the *Chlorandrena* and indeed is the only species of this subgenus found in northern Europe, where it is easily identified due to a unique combination of characters. However, in southern Europe the situation is complicated by the presence of many similar species, and also by *A. humilis* itself which is variable. The usually consistently yellow male clypeus can show a reduced yellow marking, or be entirely black (e.g. Switzerland, Amiet et al. 2010). Because of this variation, Warncke (1975a, 1975b) described several subspecies including *Andrena humilis indigena* Warncke, 1975 and *Andrena humilis prunella* Warncke, 1975 from central and south-eastern Turkey respectively. Gusenleitner (1998) re-examined the later form and elevated it to species rank as *Andrena tadauchii* Gusenleitner, 1998 based on the clearly divergent male genitalia.

Examination of material collected from high elevation sites in Lebanon is difficult to immediately assign to a species as whilst the male genitalia conform, they also have entirely black clypei whereas the yellow marking is reduced but present in subspecies such as *A. h. indigena*. Given the variation in clypeal coloration across the range of *A. humilis*, Lebanese specimens were assigned to this taxon because of the strong similarity in genital construction. True *A. humilis* is widespread in Turkey (Hazir et al. 2014), and the seeming restriction of Lebanese specimens to high elevation sites would be consistent with the idea that the species is on the very edge of its southern range. *Andrena tadauchii* is known from lower elevation sites Turkey, Syria, and Israel (Gusenleitner & Schwarz 2002) and may well be present in Lebanon, but this must be confirmed.

Andrena (*Chlorandrena*) *orientana* Warncke, 1965 *

Distribution. South-eastern Europe and Ukraine to the Near East (Schwenninger et al. 2015).

Material examined. LEBANON: Bekaa, Kefraya, 1009 m, 27.IV.2019, 2♀, leg. Boustani, TCFNR/TJW, *Crepis* spp.

Andrena (*Chlorandrena*) *panurgimorpha* Mavromoustakis, 1957

Distribution. Greece, Turkey and the Caucasus, Cyprus, Ukraine and Israel (Gusenleitner & Schwarz 2002).

Literature. Grace (2010): Lebanon.

Material examined. JORDAN: Pella env. [Tabaqat Fahl], −80 m, 4.V.1995, 1♀; 29.IV.2006, 1♀, both leg. K. Deneš, OÖLM; North Shuna environs, 29–30.IV.1996, 1♂, leg. Mi. Halada, OÖLM; 20 km N of Karak, 1000 m, 27.IV.2006, 1♂, leg. K. Deneš, OÖLM; NW of Ajlun, 850 m, 20.V.2007, 4♀, leg. Z. Kevjal, OÖLM; Ajlun, 30 km W Jarash, 2.VI.2006, 2♀, leg. Z. Kevjal, OÖLM; Aljun environs, 1.V.2006, 2♂, 2♀, leg. F. Kantner, OÖLM; Aljun environs, 5.V.1995, 1♀, leg. K. Deneš, OÖLM; Ajlun env [Aljoun], 840 m, 1.V.2006, 5♂, 3♀, leg. K. Deneš, OÖLM; Irbid, Saham village, 19–25. IV.2003, 1♂, 2♀, leg. I. Pljushtch, OÖLM; 10 km W Jarash, 1.V.1996, 1♀, leg. Ma. Halada, OÖLM; 15 km W Jerash, Dibbin, 2.V.2006, 2♀, leg. K. Deneš, OÖLM; 10 km N, NE of Jarash [Jerash], 20.IV.2002, 1♀, leg. M. Snižek, OÖLM; 20 km NW of Amman, 420 m, 5.V.2006, 1♀, leg. K. Deneš, OÖLM; LEBANON: N Lebanon, Arz Tannourine, Tannourine Forest Reserve Outskirts, 1739 m, 6.V.2017, 1♂, leg. Boustani, TJW; N Lebanon, Jairoun, 29.V.2012, 2♀, leg. M. Kasparek, TCFNR; SYRIA: Aleppo, 500 m, Simeons-Kloster, 19.IV.1988, 1♂, leg. L. Blank, TJW; 60 km S Damascus, Khahab, 14.V.1996, 1♀, leg. Ma. Halada, OÖLM.

Notes. This species is reported as new for Jordan and Syria.

Andrena (*Chlorandrena*) *pinkeunia* Warncke, 1969 *

Distribution. Israel (Gusenleitner & Schwarz 2002).

Material examined. JORDAN: Pella env. [Tabaqat Fahl], −80 m, 29.IV.2006, 1♀, leg. K. Deneš, TJW; Aljoun, 28. IV.2012, 1♀, leg. M. Kafka, OÖLM; LEBANON: S Lebanon, Saidoun, 8.V.2018, 1♀, leg. A. Baghdadi, SOILS.

Notes. This species is reported as new for Jordan.

Andrena (*Chrysandrena*) *hesperia* Smith, 1853

Distribution. Circum-Mediterranean to Central Asia (Gusenleitner & Schwarz 2002).

Literature. Grace (2010): Lebanon.

Material examined. JORDAN: Pella env. [Tabaqat Fahl], −80 m, 29.IV.2006, 1♀, leg. K. Deneš, OÖLM; Aljoun, 28.IV.2012, 1♀, leg. M. Kafka, OÖLM; Aljun environs, 1.V.2006, 2♀, leg. K. Deneš, OÖLM; Irbid, Saham village, 19–25.IV.2003, 4♂, 2♀, leg. I. Pljushtch, OÖLM; 15 km W Jerash, Dibbin, 2.V.2006, 8♀, leg. K. Deneš, OÖLM; LEBANON: Mount Lebanon, Ksaibe, 518 m, 18.IV.2019, 1♂, leg. Boustani, TCFNR, *Sonchus* spp.; Mount Lebaon, Bentael, 369 m, 23.IV.2019, 1♀, leg. Bous, Rasm, Neme, TCFNR, *Crepis* spp.; N Lebanon, Tannourine El Tahta, Wadi Ain aA Raha, 900 m, 3. V.2017, 1♀, leg. Boustani, TCFNR; N Lebanon, Fehta, El Biara, 1664 m, 11.V.2019, 1♀, leg. Boustani, TCFNR, *Trifolium resupinatum*; N Lebanon, Harissa: Chir El Ribez, 1730 m, 31.V.2017, 2♀, leg. Boustani, TCFNR, *Crepis reuteriana*; N Lebanon, Horch Ehden, Nabeh Jouit, 1410 m, 20.V.2019, 1♂, 1♀, leg. Boustani, TCFNR, *Crepis* spp.; N Lebanon, Bcharre, Dahr el Adib, 2585 m, 27.V.2017, 2♂, leg. P. Rasmont & Boustani, TCFNR; SYRIA: Latakia, Qaranjah, 750 m, 3.IV.1988, 1♂, leg. L. Blank, MSC.

Notes. This species is reported as new for Jordan and Syria.

Andrena (*Chrysandrena*) *merula* Warncke, 1969 *

Distribution. Greece, Turkey and Israel (Gusenleitner & Schwarz 2002).

Material examined. JORDAN: NW of Ajlun, 850 m, 20. V.2007, 1♀, leg. Z. Kevjal, OÖLM; Aljoun, 27.IV.2012, 1♀, leg. M. Kafka, OÖLM; Irbid, Saham village, 19–25. IV.2003, 1♂, 2♀, leg. I. Pljushtch, OÖLM; 15 km W Jerash, Dibbin, 2.V.2006, 2♀, leg. K. Deneš, OÖLM; 10 km N, NE of Jarash [Jerash], 20.IV.2002, 2♀, leg. M. Snižek, OÖLM; LEBANON: Mount Lebanon, Barja, Marj Barja Daher, 350 m, 7.III.2017, 1♂, leg. Boustani, TCFNR; N Lebanon, Tannourine el Tahta, Al Mahbase, 893 m, 25.IV.2019, 1♂, leg. Boustani, TCFNR; SYRIA: 40 km SW Hama, Masyat [Masyaf], 1.V.2000, 1♂, leg. F. Kantner, OÖLM.

Notes. Very similar to *A. hesperia* but without orange coloured legs and with slightly finer tergal sculpturing. This species is reported as new for Jordan and Syria.

Andrena (*Cordandrena*) *torda* Warncke, 1965

Distribution. Greece, Turkey and Israel (Gusenleitner & Schwarz 2002).

Literature. Grace (2010): Lebanon.

Material examined. JORDAN: North Shuna environs, 29.IV.1996, 1♀, leg. Mi. Halada, OÖLM; S of At Tafila, 27–30.III.2013, 1♀, leg. M. Snižek, OÖLM; 20 km N of Karak, 1000 m, 27.IV.2006, 1♀, leg. K. Deneš, OÖLM; LEBANON: Bekaa, Quaraoun, 24.III.2013, 1♀, leg. M. Kasparek, TJW; N Lebanon, South of Jairoun, 23.V.2012, 1♀, leg. M. Kasparek, TCFNR; SYRIA: Aleppo, SW, 700 m, 7.IV.1988, 1♀, leg. L. Blank, TJW.

Notes. This species is reported as new for Jordan and Syria.

Andrena (*Cryptandrena*) *aruana* Warncke, 1967 *

Distribution. Israel and probably Syria (Warncke 1967; Gusenleitner & Schwarz 2002).

Material examined. LEBANON: Bekaa, Quaraoun, 24. III.2013, 1♂, leg. M. Kasparek, TJW.

Notes. Extremely similar to *A. monacha* (below) in the female sex, this species is best separated using the clearly different male genitalia.

Andrena (*Cryptandrena*) *brumanensis* Friese, 1899

Distribution. Southern Europe to Turkey and the Near East (Gusenleitner & Schwarz 2002).

Literature. Friese (1899): Mount Lebanon, Brumana [Broummana, close to Beirut], 30.IV.1899, leg. F. Morice. Friese listed the country as Syria, but the actual location is in modern day Lebanon; Grace (2010): Lebanon.

Material examined. JORDAN: North Shuna environs, 29.IV.1996, 1♀, leg. Mi. Halada, OÖLM.

Notes. This species is reported as new for Jordan.

Andrena (*Cryptandrena*) *monacha* Warncke, 1965

Distribution. Greece, Turkey and Cyprus (Gusenleitner & Schwarz 2002).

Literature. Grace (2010): Lebanon.

Material examined. LEBANON: Mount Lebanon, Khaldah [Khalde], 18.IV.1973, 1♂, (no collector information), TCFNR; SYRIA: Tartus, Safita, 10 km E, 300 m, 3.IV.1988, 1♂, leg. L. Blank, MSC.

Notes. This species has not yet been reported from Israel or Jordan, and so it may be on the edge of its southern range in Lebanon, and is reported as new for Syria.

Andrena* (*Cryptandrena*) *ventricosa **Dours, 1873**

Literature. Grace (2010): Lebanon.

Material examined. LEBANON: N Lebanon, Jairoun, 29.V.2012, 1♀, leg. M. Kasparek, TCFNR.

Andrena* (*Euandrena*) *bicolor **Fabricius, 1775 ***

Distribution. Europe, north-western Africa, Turkey, the Near East, and eastward to Central Asia (Gusenleitner & Schwarz 2002)

Material examined. LEBANON: N Lebanon, Hadath El Jebbe, Al Fouar, 1529 m, 12.IV.2019, 1♀, leg. Boustani, TCFNR, *Galium* spp.

Notes. The *Andrena bicolor*-group, as well as the rest of the subgenus *Euandrena*, are badly in need of an in-depth revision across the Mediterranean region (Pisanty et al. 2018; Praz et al. 2019). There are several probably undescribed *Euandrena* species present in Lebanon (see Discussion), so here we only present one record of a specimen that can be confidently placed as *A. bicolor*. The status of *Euandrena* in the Mediterranean basin is likely to change dramatically in coming years.

Andrena* (*Euandrena*) *rufitibialis limosa **Warncke, 1969**

Distribution. Jordan, Israel, Syria and Turkey (Gusenleitner & Schwarz 2002).

Material examined. JORDAN: 15 km W Jerash, Dibbin, 750 m, 2.V.2006, 6♀, leg. K. Deneš, OÖLM/TJW; 20 km N of Karak, 1000 m, 27.IV.2006, 1♂, leg. K. Deneš, OÖLM; Ajlun S of Anjara, 27.IV.2002, 2♀, leg. M. Snižek, OÖLM; Aljoun, 28.IV.2012, 1♂, 1♀, leg. M. Kafka, TJW; Aljun environs, 5.V.1995, 1♀, leg. K. Deneš, OÖLM; Aljun environs, 840 m, 1.V.2006, 2♂, 1♀, leg. K. Deneš & F. Kantner, OÖLM; Aljun Hills env, 29.IV–1.V.2006, 1♀, leg. K. Deneš, OÖLM; Irbid, Saham village, 25.IV.2003, 1♀, leg. I. Pljushtch, OÖLM/TJW; LEBANON: Donnieh, 1600 m, 23.V.2012, 1♀, leg. M. Kasparek, TJW; Donnieh, Wadi Cehennem oberth. Quemmamine, 1393 m, 23.V.2012, 2♀, leg. M. Kasparek, TJW; south of Jairoun, 1648 m, 23.V.2012, 1♀, leg. M. Kasparek, TJW.

Notes. *A. rufitibialis* was originally described from Jericho, in the modern-day West Bank, though the type locality is listed as [Jordan] by Gusenleitner and Schwarz (2002), so it is not actually clear if it has been previously reported from Jordan or not. As its name suggests, one of its defining characters are the red-coloured hind tibiae and tarsi. Warncke later described the subspecies *limosa* with type material from Turkey, Jordan and Israel (Warncke 1969a). This bee is darker, lacking the red-coloured legs of the nominate type, but shares the shiny clypeus, densely and clearly punctate tergites, and clear hair fringes on the tergites. All examined material from Jordan and Lebanon conformed to *A. r. limosa*, with no specimens displaying red-coloured legs or tergites. *Andrena r. limosa* is considered a valid taxon by some authors (Rasmont et al. 2017), and further investigation into *A. rufitibialis* is needed to clarify the relationship between these different colour forms.

Andrena* (*Euandrena*) *rufula **Schmiedeknecht, 1883 ***

Distribution. Southern Europe from France and Spain eastwards to Ukraine and with a patchy distribution south into Greece and Turkey (Gusenleitner & Schwarz 2002).

Material examined. LEBANON: N Lebanon, Horch Ehden, Nabeh Jouit, 13.IV.2019, 1410 m, 1♀, leg. Boustani, TCFNR, *Crataegus* cf *monogyna*; N Lebanon, Horch Ehden, Nabeh Jouit, 24.IV.2019, 1337 m, 1♀, leg. P. Rasmont, TCFNR, *Salix libani*; N Lebanon, Arz Bcharre, Forest of the Cedars of God, 1913 m, 9. V.2017, 2♀, leg. Boustani, TCFNR, *Cotoneaster* spp.

Notes. *Andrena rufula* was reported from the western Taurus mountains of Turkey between Akseki and Beyşehir at 1300 m (Warncke 1975a). Its presence in Lebanon whilst unexpected is not unprecedented, and the high altitude Lebanese sites are ecologically and climatically comparable to the Taurus mountains. *Andrena rufula* is a univoltine polylectic species that flies in the spring (Amiet et al. 2010), and the flower records here would suggest that it forages from flowering broadleaved trees. *Andrena rufula* can be an abundant visitor to flowering apple trees in eastern France, collecting pure loads of Rosaceae pollen (TJW, *unpublished data*), so these observations are consistent with this picture. This is the first record of this species from the Levant, but it may also be present at high altitude sites in Syria and Israel.

Andrena* (*Fuscandrena*) *stenofovea **Scheuchl & Pisanty, 2018 ***

Distribution. Israel (Pisanty et al. 2018).

Material examined. LEBANON: Mount Lebanon, Barja, Marj Barja Daher, 350 m, 7.III.2017, 2♂, leg. Boustani, TCFNR; Bekaa, Quaraoun, 24.III.2013, 1♀, leg. M. Kasparek, TCFNR; N Lebanon, Tannourine El Tahta, Wadi Ain El Raha, 900 m, 27.III.2017, 1♀, leg. Boustani, TJW; SYRIA: Tartus, St. Georg-Kloster, 250 m, 3.IV.1988, 2♀, leg. L. Blank, MSC.

Notes. Originally placed in the *Poecilandrena*, this species is better placed in the *Fuscandrena* (Pisanty et al. 2020). This species is reported as new for Syria.

Andrena (*Holandrena*) *forsterella* Osytchnjuk, 1978

Distribution. The exact distribution of *A. forsterella* is unclear because its putative first generation was split off as a distinct species *A. wilhelmi* Schuberth, 1995. The two taxa have a similar distribution (Schuberth 1995) and *A. forsterella* is probably distributed from Italy, through the Balkans, to Turkey and further eastwards. True *A. forsterella* has not been recorded from Israel, where records conform to *A. wilhelmi* (Pisanty et al. 2018). See Notes.

Literature. Grace (2010): Lebanon.

Material examined. LEBANON: Bekaa, Der el Ahmar, 989 m, 3.VII.2019, 1♀, leg. Boustani, TJW.

Notes. *Andrena wilhelmi* is a spring-flying species, on the wing in March to June, whereas true *A. forsterella* flies between June and August (Schuberth 1995). This record represents the most southerly extent of its range, as re-examination of specimens reported as *A. forsterella* by Warncke (1969) collected in March and April confirm their identity as *A. wilhelmi* (Pisanty et al. 2018). Both taxa are likely to be present in Lebanon.

Andrena (*Holandrena*) *labialis* (Kirby, 1802) *

Distribution. Europe and north-western Africa eastwards to Turkey and Central Asia, south to Israel (Gusenleitner & Schwarz 2002; Pisanty et al. 2018).

Material examined. LEBANON: Mount Lebanon, Horch el Barouk, Chouf Biosphere Reserve, 1678 m, 2. VII.2019, 1♀, X. van Achter, VXA, *Medicago* spp.; N Lebanon, Hadath El Jebbeh, Chemin Wadi Ain El Raha, 1519 m, 29.VI.2017, 1♂, 1♀, leg. Boustani, TCFNR, *Ononis natrix*; N Lebanon, Harissa: Al Jawar, 1738 m, 28.VI.2017, 1♂, leg. Boustani, TCFNR; N Lebanon, Arz Tannourine Gate area, 1754 m, 23.VI.2018, 1♂, 1♀, leg. Boustani, TCFNR, *Allium phanerantherum*; N Lebanon, Hadath El Jebbe, Border of the Cedar forest, 1632 m, 5. VII.2019, 1♀, leg. Boustani, TCFNR, *Stachys cretica*; N Lebanon, Tannourine Reserve Trail 4, 6.VII.2017, 1747 m, 1♂, leg. Boustani, TCFNR, *Campanula stricta*; N Lebanon, Horch Ehden, Nabeh Jouit, 1410 m, 27. VI.2019, 1♀, leg. Boustani, TCFNR, *Stachys cretica*; Arz Bcharre, Forest of the Cedars of God, 22.VI.2017, 1815 m, 22.VI.2017, 1♀, leg. Boustani, TCFNR, *Vicia tenuifolia*; Arz Bcharre, Bcharre Reforestation Area, 1993 m, 22.VI.2017, 1♂, 2♀, leg. Boustani, TCFNR, *Medicago* spp.; 2.VII.2019, 1♂, leg. G. Ghisbain, UMONS; N Lebanon, Bcharre, 2042 m, 12.VII.2019, 1♀, leg. X. van Achter, XVA, *Vicia* spp.; Bekaa, Ainata, 1556 m, 30.V.2017, 5♂, leg. P. Rasmont, TCFNR.

Notes. *Andrena labialis* was recently reported from Israel for the first time from Mount Hermon at comparable altitudes (1600–1650 m, Pisanty et al. 2018) to the Lebanese sites reported here.

Andrena (*Holandrena*) *variabilis* Smith, 1853

Distribution. LEBANON: Southern Europe and north-western Africa eastwards to Turkey, the Near East, and into Central Asia (Gusenleitner & Schwarz 2002).

Literature. Grace (2010): Lebanon.

Material examined. Mount Lebanon, Laqlouq, 1752 m, 30.VI.2019, 1♀, leg. G. Ghisbain, UMONS.

Andrena (*Hoplandrena*) *trimmerana* (Kirby, 1802) *

Distribution. The true distribution of *A. trimmerana* is obscured by long-standing taxonomic confusion with another member of the *Hoplandrena* that has been referred to as *A. carantonica* Pérez, 1902, but it appears to be distributed across Europe into north-western Africa, Turkey and Israel (Gusenleitner & Schwarz 2002; Pisanty et al. 2018).

Material examined. LEBANON: N Lebanon, Arz Bcharre, Forest of the Cedars of God, 1913 m, 9.V.2017, 1♂, leg. Boustani, TCFNR; Bekaa, Donnieh, Wadi Cehennem, (no date), 1♀, leg. M. Kasparek, TCFNR; Bekaa, Ras Baalbeck, 5.V.2018, 1♂, leg. E. Harran, USEK.

Notes. True *A. trimmerana* is best and most confidently identified from spring males which have unidentate mandibles (lacking an internal mandibular tooth) and also possess a genal spine.

Andrena (*Lepidandrena*) *statusa* Gusenleitner, 1998 *

Distribution. Israel and Turkey (Gusenleitner & Schwarz 2002).

Material examined. LEBANON: N Lebanon, Tannourine El Tahta, Wadi Ain El Raha, 936 m, 11. IV.2017, 1♂, leg. Boustani, TJW.

Notes. Both *A. statusa* and *A. elisaria* Gusenleitner, 1998 (Turkey) were described in the same publication and from the same type locality and date. They differ mostly by the colour of the integument. Pisanty et al. (2018) argue that they likely represent variation within a single species, as both forms can be found together in Israel. For now, only one specimen has been found in Lebanon so we can make no comment as to the validity of this conclusion.

***Andrena* (*Margandrena*) *krausiella* Gusenleitner, 1998**

Distribution. Israel and Jordan (Gusenleitner & Schwarz 2002; Al-Ghzawi et al. 2006).

Literature. Grace (2010): Lebanon.

Material examined. LEBANON: S Lebanon, Saidoun, 20.I.2018, 2♀, leg. A. Baghdadi, SOILS/TJW.

***Andrena* (*Melanapis*) *fuscosa* Spinola, 1838 ***

Distribution. Circum-Mediterranean to Central Asia (Gusenleitner & Schwarz 2002).

Material examined. LEBANON: Bekaa, American University of Beirut farm, 15.IV.1962, 1♂, leg. K. Bedirian, AUB; 12.V.1962, 1♀, leg. S. Khan, AUB; SYRIA: Aleppo, 500 m, Simeons-Kloster, 19.IV.1988, 3♂, leg. L. Blank, MSC.

Notes. Seemingly not previously reported from Syria.

***Andrena* (*Melandrena*) *albopunctata* (Rossi, 1792) ***

Distribution. Circum-Mediterranean to Central Asia (Gusenleitner & Schwarz 2002).

Material examined. LEBANON: S Lebanon, Sidon [Saida], 25.V.1981, 1♀, (no collector information), TCFNR; Mount Lebanon, Chhim, Khallat Chiim, 25.IV.1981, 1♂, (no collector information), AUB; Bekaa, American University of Beirut farm, 19.IV.1962, 1♀, leg. N Samman; 27.IV.1962, 1♀, leg. K. Bedirian; 26.V.1962, 1♀, leg. Z. Rafii; 20.IV.1964, 1♀, leg. G. Siddloul, all AUB; Bekaa, Baalbeck, Hoch Sneid, 21.V.1964, 1♀, leg. B. Ayyash, AUB.

***Andrena* (*Melandrena*) *elmaria* Gusenleitner, 1998**

Distribution. Cyprus, Israel, Syria, and Turkey (Gusenleitner & Schwarz 2002).

Literature. Grace (2010): Lebanon.

Material examined. LEBANON: N Lebanon, Tannourine El Tahta, Al Mahbase, 893 m, 12.IV.2019, 1♀, leg. Boustani, TJW; 5.V.2019, 1♀, leg. Boustani, TCFNR; N Lebanon, Arz Tannourine Gate area, 1754 m, 2.IV.2018, 1♂, leg. Boustani, TCFNR; N Lebanon, Ehden, Nabeh Jouit, 1336 m, 24.IV.2019, 1♀, leg. P. Rasmont, UMONS, *Salix* cf *libani*.

***Andrena* (*Melandrena*) *limata* Smith, 1853 ***

Distribution. Europe and north-western Africa to the Near East, Turkey, and Central Asia (Gusenleitner & Schwarz 2002).

Material examined. LEBANON: Mount Lebanon, Falougha, 17.VII.1975, 1♂, (no collector information), AUB; Bekaa, American University of Beirut farm, 2.IV.1963, 1♀, leg. Babikir; 10.VI.1971, 1♂, leg. Anwar; 11.IV.1980, 1♀, leg. A. Fakher, all AUB.

***Andrena* (*Melandrena*) *morio* Brullé, 1832**

Distribution. Europe, North Africa, the Middle East, and into Central Asia (Gusenleitner & Schwarz 2002).

Literature. Mavromoustakis (1962): N Lebanon, Near Becharré [Bcharre], 19.VI.1960, 1♀; Focke, 20.VI.1960, 2♀; N Lebanon, Kadisha river, 20.VI.1960, 1♀; Grace (2010): Lebanon.

***Andrena* (*Melandrena*) *nigroaenea* (Kirby, 1802)**

Distribution. Europe, Mediterranean, Turkey, the Near East, and into Central Asia (Gusenleitner & Schwarz 2002).

Literature. Mavromoustakis (1962): N Lebanon, Near Becharré [Bcharre], 27.VI.1960, 1♀; N Lebanon, Kadisha river, 21-26.VI.1960, 6♀; Grace (2010): Lebanon.

Material examined. LEBANON: N Lebanon, Bcharre, 1900 m, 14.VII.2019, 1♀, leg. X. van Achter, XVA; Mount Lebanon, Hboub, 29.III.2017, 1♀, leg. E. Harran, USEK; N Lebanon, Tannourine El Tahta, Wadi Ain El Raha, 900 m, 1♂, leg. Boustani, TCFNR; N Lebanon, Hadath El JEbbEh, Road to Wadi Al Fouar, 1553 m, 28.VI.2018, 1♀, leg. Boustani, TCFNR; N Lebanon, Hadath el Jebbe, Al Fouar, 1529 m, 12.VI.2019, 1♂, leg. Boustani, TCFNR; N Lebanon, Tannourine Reserve, Trail 4, 1781 m, 3.VI.2019, 1♀, leg. Boustani, TCFNR; N Lebanon, Jairoun, 29.V.2012, 1♀, leg. M. Kasparek, TCFNR.

***Andrena* (*Melandrena*) *pyropygia* Kriechbaumer, 1873**

Distribution. Eastern Mediterranean to Ukraine and into Central Asia (Gusenleitner & Schwarz 2002).

Literature. Mavromoustakis (1962): Mount Lebanon, Baabdate, 24–25.V.1953, 2♂, 1♀; S Lebanon, Djezzine [Jezzine], 20.V.1953, 1♂; Grace (2010): Lebanon.

***Andrena* (*Melandrena*) *thoracica* (Fabricius, 1775)**

Distribution. Europe, North Africa, the Near East, and into Central Asia (Gusenleitner & Schwarz 2002).

Literature. Mavromoustakis (1962) (as *A. t. kotschyi* Mavromoustakis, 1953): N Lebanon, Near Becharré [Bcharre], 19–20.VI.1960, 3♀; N Lebanon, Kadisha river, 25.VI.1960, 1♀; N Lebanon, Cedars [Arz Bcharre], 4.VII.1960, 1♀; Grace (2010): Lebanon.

Material examined (*A. t. kotschyi*). LEBANON: Mount Lebanon, Berbara, 10.IV.1961, 1♀, leg. H. Nasr, AUB; Bekaa, American University of Beirut farm, 10.V.1961, 1♀, leg. R. Hajj, AUB; (*A. thoracica* sensu strictu)

Bekaa, American University of Beirut farm, 29.III.1964, 1♀, leg. Taylor, AUB.

Notes. There are outstanding taxonomic issues surrounding *A. thoracica* and its described subspecies. In typical nominate *A. thoracica* from northern Europe, the hind tibial spurs are black, but in Mediterranean forms such as *A. t. kotschyi* the hind tibial spurs are light red or amber, similar to *A. limata*. Specimens from the same site in Lebanon (Bekaa, American University of Beirut farm) produced specimens with both colour forms. *Andrena thoracica* could benefit from molecular investigation across its range.

Andrena (*Melittoides*) *melittoides* Friese, 1899 *

Distribution. Israel and Turkey (Gusenleitner & Schwarz 2002).

Literature. Friese (1899) described this species from Jerusalem, but also listed below this "Syria". It is not clear exactly what he meant by this as he did not detail specific specimens, and in the same paper he made reference to "Jaffa (Syria)" (p. 343) which today is in modern Israel. However, we can definitively report that the species is present in Lebanon based on contemporary material.

Material examined. LEBANON: Mount Lebanon, Wadi Chahrour, 22.V.2009, 1♂, leg. N Nemer, USEK.

Andrena (*Micrandrena*) *alfkenella* Perkins, 1914 *

Distribution. Morocco and Europe to Turkey (Gusenleitner & Schwarz 2002).

Material examined. LEBANON: Mount Lebanon, Chouf Biosphere Reserve, Barouk Gate, 1428 m, 16.V.2019, 1♀, leg. Boustani, TCFNR, *Peltaria angustifolia*; N Lebanon, Tannourine Reserve, Trail 4, 1781 m, 30.VI.2019, 1♀, leg. Boustani, TCFNR, *Euphorbia* spp.; N Lebanon, Arz Tannourine, Main gate, 1796 m, 4.VII.2019, 14♀, leg. Boustani, X. van Achter, & G. Ghisbain, TCFNR/TJW/UMONS/XVA, *Chaerophyllum aurantiacum*; N Lebanon, Arz Tannourine, reserve entrance, 1797 m, 12.VII.2019, 3♀, leg. X. van Achter, VXA, *Chaerophyllum aurantiacum*; N Lebanon, Horch Ehden, Nabeh Jouit, 1336 m, 24.IV.2019, 2♀, leg. Boustani, TCFNR; N Lebanon, Ehden, Horch Ehden, 1567 m, 1♀, leg. Boustani & W. Yammine, TCFNR.

Notes. *Andrena alfkenella* is widespread throughout Europe, extending to mountains in Turkey including the Taurus Mountains. The species is bivoltine, though the second generation is much more abundant and easier to find, showing a strong preference for Apiaceae pollen (TJW, unpublished data). Its presence at altitude in northern Lebanon is consistent with the trend shown in other species more typically found in Europe.

Andrena (*Micrandrena*) *alfkenelloides* Warncke, 1965 *

Distribution. Balkans to Turkey and the Near East (Gusenleitner & Schwarz 2002).

Material examined. LEBANON: N Lebanon, Tannourine El Tahta, Wadi Ain El Raha, 900 m, 24–27.III.2017, 4♀, leg. Boustani, TCFNR/TJW.

Andrena (*Micrandrena*) *lindbergella* Pittioni, 1950

Literature. Grace (2010): Lebanon.

Material examined. LEBANON: N Lebanon, Bcharre, Dahr El Adib, 2585 m, 27.V.2017, 3♂, leg. P. Rasmont & Boustani, TCFNR/TJW; N Lebanon, Bcharre, Dahr El Adib, 2437 m, 8.VI.2017, 2♀, leg. Boustani, TCFNR/TJW; N Lebanon, Arz Bcharre, Forest of the Cedars of God, Forest Limit, 1897 m, 20.V.2019, 1♂, leg. Boustani, TCFNR, *Alyssum* spp.; N Lebanon, Tannourine, Jabal Al Mnaitra, 2469 m, 28.V.2017, 1♂, leg. P. Rasmont & Boustani, TCFNR, *Ranunculus demissus*.

Notes. Recently recorded from Israel for the first time from Mount Hermon, also at altitude (1950–2200 m, Pisanty et al. 2018). With a *locus typicus* in the Troodos mountains in Cyprus, this is clearly an alpine species.

Andrena (*Micrandrena*) *magunta* Warncke, 1965 *

Distribution. Eastern Europe through the Balkans to Turkey and Israel (Gusenleitner & Schwarz 2002; Pisanty et al. 2018).

Material examined. LEBANON: Mount Lebanon, Jamhour, 2.IV.1973, 1♀, (no collector information), TCFNR; Bekaa, Quaraoun, 24.III.2013, 1♀, leg. M. Kasparek, TCFNR; N Lebanon, Tannourine El Tahta, Wadi Ain El Raha, 900 m, 5.V.2017, 1♀, leg. Boustani, TJW; 11.V.2017, 2♂, leg. Boustani, TCFNR/TJW, *Carduus argentatus*.

Andrena (*Micrandrena*) *minutula* (Kirby, 1802) *

Distribution. North-western Africa, through Europe to Cyprus and Turkey (Gusenleitner & Schwarz 2002).

Material examined. LEBANON: N Lebanon, Hadath El Jebbe, Al Fouar, 1529 m, 12.IV.2019, 1♀, leg. Boustani, TJW.

Notes. Another more typically 'European' species found at altitude.

Andrena (*Micrandrena*) *minutuloides* Perkins, 1914 *

Distribution. Morocco and Europe to Turkey and the Caucasus (Gusenleitner & Schwarz 2002).

Material examined. LEBANON: N Lebanon, Ehden, Ain El Naasa, 1598 m, 22.V.2019, 1♀, leg. Boustani, TJW.

Notes. Another more typically 'European' species found at altitude.

Andrena (*Micrandrena*) *oedicnema* Warncke, 1975 *

Distribution. Greece and Turkey to Israel (Gusenleitner & Schwarz 2002; Pisanty et al. 2018).

Material examined. JORDAN: Irbid, Saham villiage, 19–25.IV.2003, 3♀, leg. I. Pljushtch, OÖLM/TJW; LEBANON: Mount Lebanon, Barja, Marj Barja Daher, 350 m, 7.III.2017, 1♂, leg. Boustani, TCFNR; Mount Lebanon, Marej Barja, Kaleet El Besten, 358 m, 26. IV.2019, 1♀, leg. Boustani, TCFNR; N Lebanon, Tannourine El Tahta, Wadi Ain El Raha, 900 m, 24. III.2017, 1♂, leg. Boustani, TCFNR; SYRIA: Tartus, St. Georg-Kloster, 250 m, 3.IV.1988, 1♂, leg. L. Blank, TJW; Latakia, Saladinburg [Citadel of Saladin], 900 m, 4.IV.1988, 1♂, leg. L. Blank, TJW.

Notes. Recently reported from Israel for the first time (Pisanty et al. 2018), this species is reported as new to Jordan and Syria.

Andrena (*Micrandrena*) *rugothorace* Warncke, 1965 *

Distribution. Italy and the Balkans to Turkey and Israel (Gusenleitner & Schwarz 2002; Pisanty et al. 2018).

Material examined. LEBANON: N Lebanon, Tannourine El Tahta, Wadi Ain El Raha, 900 m, 11–18.IV.2017, 1♂, 1♀, leg. Boustani, TCFNR; N Lebanon, Tannourine El Tahta, Al Mahbase, 893 m, 25.IV–5.V.2019, 4♀, leg. Boustani, TCFNR/TJW.

Notes. Predominantly found at altitude, as is the case in Israel (Mount Hermon 1500 m, Pisanty et al. 2018).

Andrena (*Micrandrena*) *simontornyella corpana* Warncke, 1965

Distribution. Southern Europe and north-western Africa to Turkey and the Near East. The south-eastern form found in Greece, Turkey, and the Levant is smaller and was described as *A. corpana* (Warncke 1965).

Literature. Grace (2010): Lebanon.

Material examined. LEBANON: Bekaa, Qaraoun Lake, 24.III.2013, 1♀, leg. M. Kasparek, TJW.

Andrena (*Micrandrena*) *spreta* Pérez, 1895 aggregate

Distribution. The *Andrena spreta* complex is taxonomically challenging and controversial. In a broad sense, the species is found around the Mediterranean, and north into central and northern Europe (Gusenleitner & Schwarz 2002).

Literature. Grace (2010): Lebanon.

Material examined. LEBANON: N Lebanon, Tannourine El Tahta, Wadi Ain El Raha, 934 m, 11. V.2017, 1♂, leg. Boustani, TCFNR.

Notes. The taxonomic status of *A. spreta* and its subspecies is unclear. It is currently in the process of being revised and is likely to be broken up into multiple species in the future. The form likely to be present in Lebanon was described as *A. s. scirpacea* Warncke, 1975 from Turkey.

Andrena (*Micrandrena*) *tiaretta* Warncke, 1974

Distribution. North Africa to Israel and Syria (Gusenleitner & Schwarz 2002).

Literature. Grace (2010): Lebanon.

Material examined. LEBANON: N Lebanon, Tannourine El Tahta, Wadi Ain El Raha, 901 m, 11.IV.2017, 1♀, leg. Boustani, TCFNR; N Lebanon, Tannourine El Tahta, Wadi Ain El Raha, 878 m, 18.IV.2017, 1♀, leg. Boustani, TJW; N Lebanon, Tannourine El Tahta, Al Mahbase, 893 m, 5. V.2019, 1♀, leg. Boustani, TCFNR.

Notes. *Andrena tiaretta* can be differentiated from other Near Eastern *Micrandrena* by the sculpturing of the scutum, and by the male genitalia. Kratochwil (2015) revised the *A. tiaretta* group, describing *A. orientalis* Kratochwil, 2015 from Israel and Syria. We do not follow this interpretation as the characters described for separating the putative taxa are extremely slight, and we take the position that these constitute acceptable variation within a single species concept.

Andrena (*Micrandrena*) *tringa* Warncke, 1973 *

Distribution. Eastern Europe to Turkey and Israel (Gusenleitner & Schwarz 2002; Pisanty et al. 2018).

Material examined. LEBANON: Mount Lebanon, Chouf Biosphere Reserve, Maaser El Chouf Gate, 1726 m, 16. V.2019, 1♀, leg. Boustani, TCFNR; Mount Lebanon, Chouf Biosphere Reserve, Barouk Gate, 1428 m, 16. V.2019, 1♀, leg. Boustani, TCFNR; Mount Lebanon, Barouk, Chouf Biosphere Reserve, 1690 m, 4.VII.2019, 1♀, leg. X. van Achter, VXA; N Lebanon, Tannourine El Tahta, Al Mahbase, 893 m, 12.IV.2019, 1♀, leg. Boustani, TJW; N Lebanon, Harissa, Al Jawar, 1758 m, 11.V.2019, 1♂, 2♀, leg. Boustani, TCFNR; N Lebanon, Hadath El Jebbeh, Road to Wadi Al Fouar, 1553 m, 6.VI.2018, 1♀, leg. Boustani, TCFNR; N Lebanon, Tannourine Reserve, Trail 4, 1781 m, 13.V.2019, 1♀, leg. Boustani, TCFNR; N

Lebanon, Arz Tannourine Gate area, 1754 m, 2.IV.2018, 2♀, leg. Boustani, TCFNR; N Lebanon Arz Bcharre, Forest of the Cedars of God, Forest Limit, 1897 m, 20.V.2019, 4♂, 5♀, leg. Boustani, TCFNR/TJW; N Lebanon, Arz Bcharre, Forest of the Cedars of God Reforestation Area, 1933 m, 18.IV.2018, 1♀, leg. Boustani, TCFNR.

Notes. Predominantly found at altitude, as is the case in Israel (Mount Hermon 1300 m, Mount Meron 1000 m, Pisanty et al. 2018).

Andrena (*Nobandrena*) *anatolica* Alfken, 1935

Literature. Grace (2010): Lebanon.

Distribution. Greece, Turkey, and the Near East to Russia and the Caucasus (Gusenleitner & Schwarz 2002; Pisanty et al. 2018).

Material examined. LEBANON: N Lebanon, Arz Bcharre, Forest of the Cedars of God, 1883 m, 27.V.2018, 3♀, leg. Boustani, TCFNR, *Vicia tenuifolia*; N Lebanon, Arz Bcharre, Forest of the Cedars of God, Forest Limit, 1897 m, 2♂, 2♀, leg. Boustani, TCFNR, *Erysimum* spp.

Notes. This species was collected in association with *Erysimum* (Brassicaceae), a likely pollen host as some members of the *Nobandrena* are known to be specialised on Brassicaceae (Amiet et al. 2010; TJW unpublished data). This species was recently reported from Israel for the first time, also at a high altitude site (Mount Hermon 1500 m, Pisanty et al. 2018).

Andrena (*Nobandrena*) *asiatica* Friese, 1921

Distribution. Turkey and Lebanon (Schuberth et al. 2001); Grace (2010) Lebanon.

Literature. Schuberth et al. (2001): N Lebanon, Cedars [Arz Bcharre], 10–23.VI.1962, 1♀, Sw, 1♂, Coll. Schmiedeknecht, Zoological Museum Berlin.

Andrena (*Notandrena*) *ungeri* Mavromoustakis, 1952 *

Distribution. The map presented by Gusenleitner and Schwarz (2002) presents incorrect data. *Andrena ungeri* is found from south-eastern Europe through the Balkans and Turkey to Israel and Syria (Warncke 1969a; Hazir et al. 2014).

Material examined. JORDAN: Kerak, Mazra'a, −390 m, 19.III.1988, 18♀, MSC; LEBANON: Mount Lebanon, Arz Al Barouk, 19.V.1972, 1♀, (no collector information), AUB; Mount Lebanon, Dahr El Baïdar, 8.III.1973, 1♀, leg. E. Baram, AUB; Bekaa, Bawarij, 10.V.1975, 1♀, (no collector information), AUB; Bekaa, Anjar, 27.IV.2016, 1♀, leg. Boustani, Y. Zgheib, TCFNR.

Notes. This species is reported as new for Jordan.

Andrena (*Opandrena*) *schencki* Morawitz, 1866

Distribution. Europe to Turkey, the Near East, and Central Asia (Gusenleitner & Schwarz 2002).

Literature. Grace (2010): Lebanon.

Material examined. LEBANON: Beyrouth [Beirut], 1.V.1979, 1♀, leg. Japrin, TCFNR.

Andrena (*Orandrena*) *gallinula* Warncke, 1975 *

Distribution. Turkey and Armenia (Gusenleitner & Schwarz 2002).

Material examined. LEBANON: N Lebanon, Horch Ehden, Nabeh Jouit, 1410 m, 20.V.2019, 1♀, leg. Boustani, TJW, *Diplotaxis* spp.; N Lebanon, Horch Ehden, Ain El Naasa, 1560 m, 22.V.2019, 2♀, leg. Boustani, TCFNR, *Diplotaxis* spp.; SYRIA: 400 m NN Homs E 20 km, 1.IV.1988, 1♀, leg. S.M. Blank, TJW.

Notes. Close to *A. oralis* Morawitz, 1876 but smaller. Most similar to *A. acrana* Warncke, 1967 but can be separated by the more densely shagreened scutum. This species is reported as new for Syria.

Andrena (*Orandrena*) *garrula lomvia* Warncke, 1969 *

Distribution. Turkey and Israel (Gusenleitner & Schwarz 2002).

Material examined. JORDAN: Aljoun, 28.IV.2012, 1♀, leg. M. Kafka, OÖLM; LEBANON: Mount Lebanon, Barja, Marj Barja Daher, 350 m, 31.I.2016, 2♂, leg. Boustani, Y. Zgheib, TCFNR; N Lebanon, Tannourine El Tahta, Wadi Ain al Raha, 900 m, 24.III.2017, 4♀, leg. Boustani, TCFNR/TJW; SYRIA: Tartus, St. Georg-Kloster, 250 m, 3.IV.1988, 4♀, leg. L. Blank, MSC/TJW.

Notes. This taxon is reported as new for Jordan and Syria.

Andrena (*Pallandrena*) *christineae* Dubitzky, 2006 *

Distribution. Turkey (Ağrı; Hakkâri) and Iran (Kermanshahan, Dubitzky 2006).

Material examined. LEBANON: N Lebanon, Arz Bcharre Forest of the Cedars of God Reforestation Area, 1933 m, 18.IV.2018, 2♂, 2♀, leg. Boustani, TCFNR/TJW, *Geranium libanoticum*; Arz Bcharre, Forest of the Cedars of God, Forest Limit, 1897 m, 20.V.2019, 1♂, leg. Boustani. Allotype male deposited at the OÖLM.

Description of male. Body length 11 mm (Figure 51).

Head. Black, clearly wider than long. Clypeus black, broad, strongly domed, evenly reticulate with reticulation forming weak lateral carinae, underlying surface impunctate, weakly shining. Process of labrum twice as broad as long, only very shallowly raised above the rest of the labrum but smooth and shiny and therefore well differentiated from the clearly punctured remaining surface area. Face, gena, vertex, and scape with long white hairs, those on the lower part of the gena clearly exceeding the length of the scape. Gena slightly wider than the width of the compound eye. Antennae uniformly dark, segment 3 equalling 4 + 5. Ocelloccipital distance wide, twice width of posterior ocellus.

Mesosoma. Scutum and scutellum weakly shagreened, weakly shining, moderately but very shallowly punctate, punctures separated by 1–2 puncture diameters. Pronotum non-carinate. Episternum and propodeum shagreened with raised moderately strong reticulation, propodeal triangle clearly differentiated from the rest of the propodeum by a change in surface sculpture from moderate to shallow reticulation. Legs dark, only tarsal claws slightly lightened to red, pubescence white. Wings hyaline, venation dark brown to amber apically, nervulus interfurcal.

Metasoma. Tergites dark, margins lightened orange to yellow, clearly hyaline apically (Figure 52). Tergal integument very subtly shagreened, predominantly shining, weakly punctured throughout, punctures separated by 1–2 puncture diameters. S8 long and narrow, apically narrowly emarginate, therefore clearly forked. Genitalia long (Figure 53), generally reminiscent of members of the *Ulandrena* due to the widely parting gonocoxites and the large penis valve with an apical blister (Figure 54), though without apical gonocoxal teeth. Gonostyli narrow, forming projecting points that stand out in profile (Figure 53).

Notes. Described only from the female, *A. christineae* was known from high-elevation mountain sites in eastern Turkey and western Iran. Females can be easily recognised as *Pallandrena* because of the deep emargination in the labrum (Figure 49) and the plumose scopa (Figure 50). *Andrena christineae* females can be recognised easily because of the red coloration of the tergites (Figures 47, 48, Dubitzky 2006). Where altitudes were recorded, specimens were collected from 2050–2450 m (Turkey, Hakkari, Mt. Sat, 10.VI.1981), 1600 m (Turkey, Ağrı, 10 km N Tutak, 28.V.1980), and 1900–2000 m (Iran, Kermanshahan, Buchan, 19.V.1975, Dubitzky 2006). Sites in northern Lebanon are therefore at an ecologically consistent elevation. The bee may also be present in Turkish mountains closer to Lebanon, linking the populations together, and given this specialised ecological niche, the species is probably under-recorded.

Lebanese material represents the earliest recorded flight date of 18.IV for this species, but even this early in the season male material shows extensive wing wear (Figure 51), perhaps explaining why males were not captured by previous collectors. *Andrena christineae*, as well as other *Pallandrena* species such as *A. byrsicola* Schmiedeknecht, 1900, are likely to be a specialised on *Geranium* or other member of the Geraniaceae, in part because of the extraordinary plumose scopa that defines the subgenus *Pallandrena* (Figure 50, TJW *unpublished data*). This scopa type is reminiscent of the plumose scopa of the specialist *A. hattorfiana* (Fabricius, 1775) that is presumably an adaptation to collecting the similarly large grains of *Knautia* (Dipsacaceae) that can reach 100 µm in diameter. The scopal hairs of specialised bees often reflect the characteristics of the particular pollen type that they specialise on, with long simple hairs in bees specialised on large grains from Onagraceae or Cucurbitaceae or dense plumose or branched hairs in bees specialised on small grains from Asteraceae (Linsley 1958; Thorp 1979; Portman & Tepedino 2017). To date, morphological adaptations to pollen harvesting in *Andrena* have received little attention, though see LaBerge (1987) and Dubitzky et al. (2010) for the subgenera *Scoliandrena* and *Hamandrena*, respectively.

Andrena (*Pallandrena*) *pallidicincta* Brullé, 1832 *

Distribution. From the Balkans to Turkey and Israel (Gusenleitner & Schwarz 2002).

Material examined. LEBANON: N Lebanon, Ehden, Horch Ehden, Gate area, 1424 m, 2.V.2017, 6♂, leg. Boustani, TCFNR/TJW, *Geranium* spp.; N Lebanon, Donnieh, 23.V.2012, 1♀, leg. M. Kasparek, TCFNR; SYRIA: 50 km NE Tartus, Banyas, 1.V.2000, 1♀, leg. F. Kantner, OÖLM.

Notes. Probably a specialist on *Geranium* like *A. christineae* based on the floral associations and the remarkable plumose scopa that are typical of the *Pallandrena*. Reported as new for Syria.

Andrena (*Plastandrena*) *pilipes* Fabricius, 1781

Distribution. Taking a broad interpretation, *A. pilipes* is found around the Mediterranean into Central Asia (Gusenleitner & Schwarz 2002).

Literature. Grace (2010): Lebanon.

Material examined. LEBANON: Bekaa, Der el Ahmar, 3.VII.2019, 1♂, leg. G. Ghisbain, UMONS.

Notes. *Andrena pilipes* may contain additional taxa such as *A. spectabilis* Smith, 1853 which was reported from

Jordan (Al-Ghzawi et al. 2006). For now, we take a broad approach for this taxon.

Andrena (*Poecilandrena*) *bytinskii* Warncke, 1969 *

Distribution. Israel and (unpublished) Turkey (Pisanty et al. 2018)

Material examined. JORDAN: Aljun environs, 1. V.2006, 1♀, leg. F. Kantner, OÖLM; Ajlun S of Anjara, 27.IV.2002, 1♀, leg. F. M. Snižek, OÖLM; 15 km W Jerash, Dibbin, 2.V.2006, 5♀, K. Deneš, OÖLM/TJW; LEBANON: N Lebanon, Fehta, El Biara, 1632 m, 24. IV.2018, 1♂, leg. Boustani, TJW.

Notes. Not restricted to high altitude sites in Israel (Pisanty et al. 2018) or Jordan, so the single Lebanese site is probably not representative of its ecological niche. Newly recorded for Jordan.

Andrena (*Poecilandrena*) *freidbergi* Pisanty & Scheuchl, 2018 *

Distribution. Previously known only from Israel (Mount Hermon, Pisanty et al. 2018).

Material examined. LEBANON: N Lebanon, Arz Bcharre, Forest of the Cedars of God, Forest Limit, 1873 m, 20. V.2019, 1♀, leg. Boustani, TJW, *Veronica polifolia*.

Notes. No previous flower records (Pisanty et al. 2018), but the association with *Veronica* would be consistent with the subgenus, many members of which are specialists or have strong association with this plant genus. The species seems to be restricted to high elevation sites in both Israel and Lebanon.

Andrena (*Poecilandrena*) *labiata regina* Friese, 1921 *

Distribution. This subspecies is known from Israel and Turkey (Pisanty et al. 2018).

Material examined. LEBANON: N Lebanon, Arz Tannourine Reserve Trail 4, 1800 m, 6.V.2017, 1♀, leg. Boustani, TCFNR; N Lebanon, Hadath El Jebbeh, Border of Cedar Forest, 1681 m, 19.IV.2018, leg. Boustani, 1♀, TCFNR, *Bellevalia flexuosa*; N Lebanon, Bcharre, Dahr El Adib, 2306 m, 27.V.2017, 1♂, 2♀, leg. Boustani, TCFNR, *Gagea* spp.; N Lebanon, Bcharre, Bcharre Reforestation Area, 2347 m, 27.VI.2017, Boustani, 1♀, TCFNR, *Veronica polifolia*.

Notes. The nominate subspecies of *A. labiata* is polylectic with no clear preferences (Wood & Roberts 2017), so this may also be true for this subspecies as well given the range of flower visits.

Andrena (*Poecilandrena*) *rusticola* Warncke, 1975 *

Distribution. Known from Israel and Turkey (Pisanty et al. 2018).

Material examined. JORDAN: Aljoun, 28.IV.2012, 2♀, leg. M. Kafka, OÖLM/TJW; LEBANON: N Lebanon, Horch Ehden, Nabeh Jouit, 1336 m, 24.IV.2019, 1♂, leg. Bous & Rasm, TJW, *Veronica syriaca*; SYRIA: Latakia, Qaranjah, 750 m, 3.IV.1988, 1♂, leg. L. Blank, MSC; Tartus, Safita, 10 km E, 300 m, 3.IV.1988, 1♀, leg. L. Blank, MSC.

Notes. The association with *Veronica* is consistent with data from Israel (*Veronica leiocarpa*, Pisanty et al. 2018). This species is reported as new for Jordan and Syria.

Andrena (*Poecilandrena*) *sphecodimorpha mediterranea* Scheuchl & Pisanty, 2016 *

Distribution. This subspecies is known from Israel (Pisanty et al. 2018).

Material examined. JORDAN: Ajlun env [Aljoun], 840 m, 1.V.2006, 1♀, leg. K. Deneš, OÖLM; LEBANON: N Lebanon, Tannourine Reserve, Trail 4, 1781 m, 13.V.2019, 1♂, leg. Boustani, TJW, *Thlaspi* spp.; N Lebanon, Horch Ehden, Nabeh Jouit, 1336 m, 24.IV.2019, 1♂, leg. Bous & Rasm, TJW, *Veronica syriaca*; N Lebanon, south of Jairoun, 23.V.2012, 1♀, leg. M. Kasparek, TCFNR; SYRIA: Crac des Chevaliers, 30.V.1995, 1♀, leg. K. Deneš, OÖLM.

Notes. Most of the records reported here occur a little later in the season than the February–April flight period reported by Pisanty et al. (2016, 2018). However, many do occur further north and at a higher altitude, possibly explaining this discrepancy. This species is reported as new for Jordan and Syria.

Andrena (*Poliandrena*) *unicincta* Friese, 1899 *

Distribution. Known from Israel (Gusenleitner & Schwarz 2002), but the identification of this group of red-marked *Poliandrena* has historically been difficult and confused, see comments on *Andrena unifasciata* below.

Material examined. ISRAEL: 10 km E of Kiryat Gat, 13.V.2019, 6♀, leg. M. Halada, OÖLM; Bet Shemesh, Britannia Park, 23.IV.2018, 13♀, leg. M. Halada, OÖLM; R70, 10 km NNE Nahariya, 28.IV.2018, 1♀, leg. M. Halada, OÖLM; Ramot Naftali, 10 km S of Kiryat Shmona, 27.IV.2018, 13♀, leg. M. Halada, OÖLM; JORDAN: 30 km NW Aljun, 600 m, 29.IV.2006, 1♀, leg. K. Deneš, OÖLM; 10 km W Jarash, 1.V.1996, 1♀, leg. Ma. Halada, OÖLM; Irbid, Alkfarat, 28–29.IV.2012, 1♀, leg. M. Kafka, OÖLM; 15 km W Jerash, Dibbin, 2.V.2006, 2♀, leg. K. Deneš, OÖLM; LEBANON: S Lebanon, Saidoun, 5.III.2018, 1♀, leg. A. Baghdadi, SOILS; 24.III.2019, 1♂, leg. A. Baghdadi, SOILS; N Lebanon, Tannourine El Tahta, Al Mahbase, 893 m, 5.V.2019, 1♀, leg. Boustani, TCFNR, *Sonchus oleraceus*.

Notes. See comments on *Andrena unifasciata*. This species is reported as new for Jordan.

Andrena (*Poliandrena*) *unifasciata* Friese, 1899 stat. rev.

Distribution. Jordan, Lebanon, and the West Bank.

Literature. Friese (1899): Beirut, 28.IV.1889, 1♂, 1♀, leg. F. Morice.

Material examined (*Andrena unifasciata*). WEST BANK: [specimen labelled 'Israel'] Wadi el Kelt [Wadi Qelt], 5.III.1954, 1♀, (no collector information), OÖLM; JORDAN: 15 km W Jerash, Dibbin, 2.V.2006, 4♀, leg. K. Deneš, OÖLM; (*Andrena caspica* Morawitz, 1886): ISRAEL: 10 km E of Kiryat Gat, 13.V.2019, 5♀, leg. M. Halada, OÖLM; JORDAN: 20 km S of North Shuna, Tall Al Arbatin, 19.IV.1996, 3♀, leg. Ma. Halada, OÖLM; Aljoun, 28.IV.2012, 1♂, leg. M. Kafka, OÖLM; SYRIA: Latakia, Saladinburg [Citadel of Saladin], 900 m, 4.IV.1988, 1♂, leg. L. Blank, MSC; Tartus, Safita, 10 km E, 300 m, 3.IV.1988, 1♂, leg. L. Blank, MSC.

Notes. The situation within Near Eastern *Poliandrena* is complex and has historically been greatly confused. As summarised in Gusenleitner & Schwarz (2002), there are six taxa (*A. basimacula* Alfken, 1929; *A. caspica* Morawitz, 1886; *A. kriechbaumeri* Schmiedeknecht, 1883; *A. polita* Smith, 1847; *A. unicincta*; and *A. westensis* Warncke, 1965) that form a group with the same genital construction. *Andrena basimacula* is found in Libya and can be easily separated due to its dark pubescence and *A. kriechbaumeri* (Balkans to Turkey) can also be separated because of the very strongly postfurcal position of the nervulus. This leaves four taxa occurring in the Eastern Mediterranean that have been dealt with confusingly and in various combinations with each other.

For example, *Andrena westensis* was originally described as a subspecies of *A. unicincta* from Greece (Warncke 1965a), then later he suggested that it was instead a subspecies of *A. caspica*, also including *A. unicincta* and *A. unifasciata* as junior synonyms (Warncke 1967). However, he later listed both *A. caspica* and *A. unicincta* as good species (Warncke 1969a), but then moved *A. westensis* and *A. caspica* into synonymy with *A. polita* (Warncke 1975a). As a result, the true distribution of all these data is unclear; the map presented in Gusenleitner and Schwarz (2002) is possibly the broadest possible interpretation of *A. polita* containing all six taxa.

Within a Lebanese context, it is best to identify the true taxa occurring in the Levant. Friese described two similar species from the Near East. *Andrena unicincta* from Jerusalem, 7–10.IV.1899, 2♂, 2♀, leg. F. Morice, and *Andrena unifasciata* Friese, 1899 from Beirut, 28.IV.1899, also leg. F. Morice. According to Friese, the two taxa are very similar but *A. unifasciata* differs in the female sex by the clearly shiny mesonotum ("sonst wie *unicincta* und nur an dem glänzenden, sparsam und tief punctirten Mesonotum", sculpturing clearly dull in *unicincta*) and the black clypeus in the male (yellow in *A. unicincta*).

Andrena unifasciata was synonymised with *A. caspica* by Warncke (1967) without any justification or written reasoning, as was often the case (e.g. Schmid-Egger & Doczkal 1995). It is noted by Gusenleitner and Schwarz (2002) that *A. caspica* are variable in size, sometimes containing smaller individuals (p. 164) and that sometimes the colour of the clypeus varies from yellow to black (p. 165). Examination of material from the Levant shows that the original position of Friese was correct, and *A. unifasciata* is a valid taxon that can be separated from other similar *Poliandrena* in the Levant in the female sex by the degree of shagreenation on the scutum, the shape of the labral process, the overall body size, and the position of the nervulus and additionally in the male sex by the coloration of the clypeus (Table 1). *Andrena kriechbaumeri* is not included in this determination table because it can be easily separated in both sexes by the position of the nervulus which is strongly postfurcal, and it is probably absent from the Levant. There are therefore three red-marked *Poliandrena* in the Levant, all of which probably have overlapping distributions. Museum material should be carefully re-examined to clarify their exact distributional ranges.

Grace (2010) reports *A. caspica* from Lebanon, but given the confusion over *A. caspica* and *A. unifasciata* this could refer to either taxon, and possibly refers simply to the type locality of *A. unifasciata*, and so the presence of true *A. caspica* in Lebanon is for now considered unproven. The true identity of Levantine material identified as *A. caspica* should be reviewed. For now, we consider that only *A. unicincta* and *A. unifasciata* are present in Lebanon.

Andrena (*Simandrena*) *thomsoni* Ducke, 1898 *

Distribution. Southern Europe from France to Turkey and Central Asia (Gusenleitner & Schwarz 2002).

Material examined. LEBANON: Bekaa, Kefraya, 1101 m, 27.IV.2019, 2♂, leg. Boustani, TCFNR; Bekaa, West Bekaa, Ammiq, 871 m, 27.IV.2019, 1♂, leg. Boustani, TJW, *Sonchus oleraceus*; N Lebanon,

Table 1. Determination table for *Poliandrena* that have historically been confused in the Near East region. Characters require direct comparison across different taxa.

	A. caspica Morawitz, 1886	*A. polita* Smith, 1847	*A. unicincta* Friese, 1899	*A. unifasciata* Friese, 1899	*A. westensis* Warncke, 1965
♀ labral process	Clearly and deeply emarginate	Rounded with tiny emargination	Rounded with tiny emargination	Slightly emarginate	Rounded with tiny emargination
♀ scutum structure	Slightly shiny	Slightly shiny	Dull	Shiny	Dull
♀ nervulus	Interfurcal	Postfurcal	Postfurcal	Interfurcal	Postfurcal
♀ size	Larger, 12–13 mm	Larger, 12–13 mm	Larger, 11–12 mm	Smaller, 10–11 mm	Larger, 12–13 mm
♀♂ abdomen colour	Partly red on tergal discs	Black, tergal margins lightened	Partly red on tergal discs	Partly red on tergal discs	Black, tergal margins lightened
♂ clypeus colour	Completely yellow, sometimes also with small yellow marks on lower paraocular area	Completely black	Yellow front margin, occupying 1/3 of the total clypeal area	Completely black	Completely yellow

Tannourine El Tahta, Wadi Ain El Raha, 900 m, 24.III.2017, 1♀, leg. Boustani, TJW; N Lebanon, Arz Tannourine, Tannourine Forest Reserve Outskirts, 1739 m, 25.V.2017, 1♂, leg. Boustani, TCFNR, *Crepis reuteriana*.

Notes. *Andrena thomsoni* was reported from the western and southern coasts of Turkey in high elevation areas such as the Taurus mountains (Warncke 1975a), making this a similar situation to that of *A. rufula*. Lebanese specimens conform closely to comparative *A. thomsoni* material from southern France. *Andrena gasparella* Patiny, 1998 was described from a single locality in western Turkey (Akşehir, Konya) and is similar to *A. thomsoni*, but Lebanese material have a scutellum that is dull, not shiny (Patiny 1998), in line with true *A. thomsoni*.

Andrena (*Simandrena*) *transitoria* Morawitz, 1871

Distribution. Central Europe and Italy eastwards to Turkey, the Near East, and Central Asia (Gusenleitner & Schwarz 2002).

Literature. Mavromoustakis (1962): Mount Lebanon, Hammana, 16.V.1953, 1♀; Mount Lebanon, Ein el Arar, 25.V.1953, 1♀.

Material examined. JORDAN: 30 km N Tafila [At-Tafilah], 2.V.1996, 1♀, leg. Ma. Halada, OÖLM; 16 km WWN Aljun [Aljoun], 600 m, 21.V.2007, 3♂, leg. Z. Kejval, OÖLM; LEBANON: Beirut, American University of Beirut, 1.V.1980, 1♀, leg. O.K. Rima, AUB.

Notes. This species is reported as new for Jordan.

Andrena (*Simandrena*) *vetula* Lepeletier, 1841

Distribution. Circum-Mediterranean to Central Asia (Gusenleitner & Schwarz 2002).

Literature. Mavromoustakis (1962): Mount Lebanon, Ein el Arar (near Baabdate), 25.V.1953, 1♀; S Lebanon Djezzine [Jezzine], 2.VI.1953, 1♀.

Material examined. LEBANON: S Lebanon, Saidoun, 15.IV.2018, 1♂, *Rapistrum rugosum*; 22.IV.2018, 1♀; 5.V.2018, 1♀, all leg. A. Baghdadi, SOILS; Mount Lebanon, Daichouniyé, Nahr Beirut Climbing Site, 133 m, 27.IV.2017, 3♂, 3♀, leg. Boustani, TCFNR.

Notes. Originally placed in the *Ptilandrena, A. vetula* clearly falls within with *Simandrena* (Pisanty et al. 2020).

Andrena (*Suandrena*) *cyanomicans mirna* Warncke, 1969 *

Distribution. Iberia, north-western Africa, and the Near East (Gusenleitner & Schwarz 2002).

Material examined. LEBANON: Mount Lebanon, Fanar, 11.III.1965, 1♀, (no collector information, from the R. Traboulsi Collection), USEK; Bekaa, American University of Beirut farm, 15.III.1965, 1♂, 2♀, leg. M. A. Sawsan, TCFNR.

Notes. The *Suandrena* are in need of revision. The subspecies *A. c. fratella* Warncke, 1968 (Morocco) is highly likely to be a valid species more closely related to the *Andrena maderensis* Cockerell, 1922 group (Kratochwil et al. 2014), and it is also likely that *A. c. mirna* is a valid species.

Andrena (*Taeniandrena*) *hova* Warncke, 1975 *

Distribution. Central and eastern Turkey (Gusenleitner & Schwarz 2002).

Material examined. LEBANON: N Lebanon, Fehta, El Biara, 1632 m, 25.V.2018, 1♀, leg. Boustani, TCFNR, *Vicia tenuifolia*; N Lebanon, Hadath El Jebbe, Al Fouar, 1529 m, 25.V.2018, 1♀, leg. Boustani, TCFNR, *Vicia tenuifolia*; N Lebanon, Arz Tannourine, Gate area, 1754 m, 29.VI–6.VII.2019, 1♀, leg. Boustani & G. Ghisbain, TCFNR, *Vicia tenuifolia*; N Lebanon, Arz Bcharre, Forest of the Cedars of God, 1883 m, 29.VI.2019, 2♂, 2♀, leg. Boustani & Jabbour, TCFNR, *Vicia tenuifolia* and *Vicia canescens*; N Lebanon, Arz Bcharre, Forest of the Cedars of God, Forest Limit, 1873 m, 5.VI.2019, 7♀, leg. Boustani, TCFNR, *Vicia tenuifolia*; N Lebanon, Arz Bcharre, Bcharre Reforestation Area, 1993 m, 27.VI.2017, 4♂, 3♀, leg. Boustani, TCFNR, *Vicia tenuifolia* and *Vicia canescens*; N Lebanon, Bcharre Reforestation Area, 2216 m, 2.VII.2019, 3♂, 5♀, leg. Boustani, TCFNR, *Vicia canescens*.

Notes. *Andrena hova* was described from central (Ankara, Madenşehri) and eastern (Erzurum) Turkey (Warncke 1975a, 1975b). Like other members of the *Taeniandrena, A. hova* is probably oligolectic on Fabaceae (Wood & Roberts 2017). All females were collected from *Vicia* species, so far the only confirmed pollen host.

Andrena (*Taeniandrena*) *ovatula* (Kirby, 1802) aggregate *

Distribution. Following a broad interpretation, *A. ovatula* is a circum-Mediterranean species extending eastwards into Central Asia (Gusenleitner & Schwarz 2002).

Material examined. LEBANON: N Lebanon, Horch Ehden, Ain Al Bayada Gate, 1597 m, 5.VII.2019, 3♀, leg. Boustani & G. Ghisbain, TJW, *Medicago* spp. & *Coronilla varia*; N Lebanon, Arz Bcharre, Forest of the Cedars of God, Forest Limit, 1897 m, 2.VII.2019, 1♂, leg. Boustani, TJW, *Anarrhinum orientale*.

Notes. This taxon contains several cryptic species that are identifiable using COI barcoding throughout the Western Palearctic, even in well-studied regions such as central and western Europe, and the group therefore requires a deep revision (Praz & Wood, in prep.). It is not at all clear which name should be applied to Lebanese material, and so these specimens are reported as *A. ovatula* in the broadest possible sense (e.g. Warncke 1969a records from Israel) as *A. ovatula* sensu stricto, a western taxon with a strong Atlantic distribution (Praz & Wood, in prep.), is almost certainly not found in the Eastern Mediterranean.

Andrena (*Taeniandrena*) *similis* Smith, 1849

Distribution. There is currently some taxonomic uncertainty surrounding animals from North Africa; we favour a single circum-Mediterranean taxon. *Andrena similis* is otherwise found across Europe to Turkey, the Caucasus, and the Near East (Gusenleitner & Schwarz 2002).

Literature. Grace (2010): Lebanon.

Material examined. JORDAN: North Shuna environs, 29–30.IV.1996, 1♂, leg. Mi. Halada, OÖLM; Ajlun S of Anjara, 27.IV.2002, 1♀, leg. M. Snižek, OÖLM; 15 km W of Jerash, 2.V.2006, 1♀, leg. K. Deneš, OÖLM; South of Irbid, 13.IV.2009, 1♂, leg. M. Snižek, OÖLM; LEBANON: S Lebanon, Sidon [Saida], 14.III.1973, 1♀, (no collector information), AUB; Mount Lebanon, Ksaibe, 518 m, 18.IV.2018, 1♂, leg. Boustani, TCFNR, *Sonchus* spp.; Mount Lebanon, Bhamdoun, 1.V.1975, 1♀, (no collector information), AUB; Mount Lebanon, Bentael, 337 m, 23.IV.2019, 1♀, leg. Bous, Rasm, Neme, TCFNR, *Trifolium* spp.; N Lebanon, Tannourine El Tahta, Wadi Ain El Raha, 900 m, 27.III.2017, 1♀, leg. Boustani, TCFNR; N Lebanon, Tannourine El Tahta, Wadi El Fouar, 1187 m, 19.IV.2018, 1♂, leg. Boustani, TCFNR, *Anchusa hybrida*; N Lebanon, Tannourine El Tahta, Mar Boutrous, 1207 m, 25.IV.2019, 1♀, leg. Boustani, TCFNR, *Hymenocarpos circinnatus*; N Lebanon, Hadath El Jebbeh, Chemin Wadi Ain El Raha, 1519 m, 29.VI.2017, 2♀, leg. Boustani, TCFNR, *Ononis natrix*; N Lebanon, Arz Tannourine, Tannourine Forest Reserve Outskirts, 1766 m, 6.V.2017, 1♂, leg. Boustani, TCFNR; N Lebanon, Arz Tannourine Reserve Trail 4, 1800 m, 6.V.2017, 1♀, leg. Boustani, TCFNR; N Lebanon, Ehden, Jord, 1983 m, 5.VII.2019, 1♀, leg. G. Ghisbain, UMONS, *Onobrychis cornuta*; N Lebanon, Tannourine, Jord Tannourine, 2296 m, 30.VI.2019, 1♀, leg. A. Gekiere, UMONS, *Onobrychis cornuta*; Arz Bcharre, Forest of the Cedars of God, Forest Limit, 1897 m, 5.VI.2019, 3♀, leg. Boustani, TCFNR, *Onobrychis cornuta*; N Lebanon, south of Jairoun, 23.V.2012, 1♀, leg. M. Kasparek, TCFNR.

Notes. This species is reported as new for Jordan.

Andrena (*Truncandrena*) *doursana mizorhina* Warncke, 1975 *

Distribution. *Andrena doursana s.l.* is found from Morocco across North Africa and north to south-east Turkey (Gusenleitner & Schwarz 2002). The subspecies *A. d. mizorhina* is found in Adana, Turkey (Warncke 1975a) and probably Israel (Warncke 1969a, see Notes for explanation).

Material examined. LEBANON: Bekaa, Kefraya, 27. IV.2019, 1♂, 1♀, leg. Boustani, TCFNR.

Notes. *Andrena doursana* is a highly variable species, with many described subspecies, several of which may be valid taxa. The form occurring in the Levant was originally called *A. doursana derbentina* Morawitz, 1886 (Warncke 1969a) after they were synonymised by Warncke (1967). *Andrena derbentina* was described from the Caucasus whereas *A. doursana* is a Mediterranean taxon. Writing later, Warncke (1975b) described the form in south-eastern Turkey as *A. d. mizorhina*, writing that this was the bee formerly referred to as *A. d. derbentina* (presumably referring to his 1969 publication) and that *A. derbentina* was a different, and valid, species. *Andrena d. mizorhina* has a male clypeus that is entirely dark, in contrast with North African and Iberian forms of *A. doursana*, and examination of paratype males of *A. derbentina* show that they have a yellow tip to the end of the clypeus, at least in some specimens (Gusenleitner & Schwarz 2002). The Lebanese specimen has an entirely dark clypeus, and we therefore take the position that this material is consistent with *A. d. mizorhina* sensu Warncke (1975b).

Andrena (*Truncandrena*) *fuligula* Warncke, 1965 *

Distribution. Israel and Turkey (Gusenleitner & Schwarz 2002).

Material examined. LEBANON: Beka'a [Bekaa], Qaraoun Lake, 24.III.2013, 1♂, 1♀, leg. M. Kasparek, TJW; SYRIA: 8 km N of Shaykh Miskin [Al Sheikh Maskin], 28.III.1994, 1♂, leg. S. Becvar, OÖLM; An Nasrah [Al-Nasrah], 8-13.IV.2005, 1♂, leg. S. Jaki, OÖLM.

Notes. This species is reported as new for Syria.

Andrena (*Truncandrena*) *medeninensis usura* Warncke, 1967 *

Distribution. Iberia, North Africa, Cyprus, and Turkey (Gusenleitner & Schwarz 2002). The subspecies *A. m. usura* is found in Cyprus and Turkey.

Material examined. LEBANON: Mount Lebanon, Chouf Biosphere Reserve, Barouk Trails crossing, 1772 m, 16. V.2019, 1♂, leg. Boustani, TCFNR, *Thlaspi* spp.; N Lebanon, Tannourine Reserve, Trail 4, 1781 m, 13. V.2019, 2♀, leg. Boustani, TCFNR/TJW, *Thlaspi* spp.; N Lebanon, Arz Tannourine, Gate, 1796 m, 11.V.2019, 1♀, leg. Boustani, TCFNR; Mount Lebanon, Mazraat al Daher, 529 m, 19.VI.2019, 1♀, leg. Boustani, TCFNR.

Notes. Another *Truncandrena* species that shows a huge degree of variation over its range. This taxon and *Truncandrena* species in general would benefit from molecular investigation.

Andrena (*Truncandrena*) *optata* Warncke, 1975

Distribution. The exact distribution of *A. optata* is slightly unclear because it was originally described from Greece as a subspecies of *A. rufomaculata* (below). It is probably found in Eastern Europe, the Balkans, and Turkey, but the southern limit of its range is unclear (see Gusenleitner & Schwarz 2002 for combined map).

Literature. Grace (2010): Lebanon.

Material examined. LEBANON: Mount Lebanon, Chouf Biosphere Reserve, Barouk-Maaser dirt road, 1769 m, 16. V.2019, 1♂, leg. Boustani, TCFNR, *Cynoglossum nebrodense*; N Lebanon, Tannourine El Tahta, Mar Boutrous, 1207 m, 1♂, leg. Boustani, TJW.

Notes. Subsequent authors have accepted *A. optata* as a valid species from *A. rufomaculata* as it is larger, has significantly longer mouthparts, and there are consistent differences in the male genitalia. The species is widespread in Turkey (Hazir et al. 2014).

Andrena (*Truncandrena*) *rotundilabris rila* Warncke, 1969

Literature. Warncke (1969a): N Lebanon, Cedars near Bscharré [Bcharre], 1900 m, 12-19.VI.1931, leg. W. Zerny (paratype); Grace (2010): Lebanon.

Distribution. Turkey and the Caucasus to Lebanon and Israel (Gusenleitner & Schwarz 2002).

Andrena (*Truncandrena*) *rufomaculata* Friese, 1921

Distribution. For the same reasons as *A. optata*, the true distribution of *A. rufomaculata* is unclear. It is probably found in Turkey and the Levant (Gusenleitner & Schwarz 2002; Hazir et al. 2014).

Literature. Grace (2010): Lebanon.

Material examined. LEBANON: S Lebanon, Hilaliyah, 8.IV.1975, 1♂, (no collector information, from the R. Traboulsi Collection), AUB; Beyrouth, (no date), 1♂, leg. E. Baram, AUB; S Lebanon, Saidoun, 18.III.2018, 1♂, leg. A. Baghdadi, TJW; 3.IV.2018, 1♂, leg. A. Baghdadi, SOILS; Mount Lebanon, Bchetfîne, 6.V.1995, 1♂, leg. A. Fayad, AUB; Mount Lebanon, Fanar, 15. III.1965, 1♂, (no collector information), USEK; Mount Lebanon, Daichouniyé, Nahr Beirut Climbing Site, 133 m, 3.IV.2017, 2♂, 1♀, leg. Boustani, TCFNR/TJW; Mount Lebanon, Jubayl [Byblos], 17.IV.2017, 1♂, leg. O. Murr, M. Fakhry, USEK; N Lebanon, Tannourine El Tahta, Wadi Ain El Raha, 900 m, 27.III.2017, 1♂, leg. Boustani, TCFNR; Bekaa, American University of Beirut farm, 17.IV.1961, 1♂, (no collector information), AUB.

***Andrena* (*Truncandrena*) *serraticornis* Warncke, 1965 ***

Distribution. Greece, Turkey and Israel (Gusenleitner & Schwarz 2002).

Material examined. JORDAN: Jarash environs, 1. V.1996, 1♀, leg. Ma. Halada, OÖLM; 15 km W Jerash, Dibbin, 2.V.2006, 1♀, leg. K. Deneš, OÖLM; LEBANON: Mount Lebanon, Chammis, Wadi Cheber, 377 m, 5.IV.2019, 1♂, 2♀, leg. Boustani, TCFNR/TJW, *Sonchus tenerrimus*; Mount Lebanon, Falougha, Cedar woods, 1480 m, 27.IV.2019, 3♀, leg. Boustani, TCFNR, *Myagrum perfoliatum*; SYRIA: Tartus, St. Georg-Kloster, 250 m, 3.IV.1988, 1♂, leg. L. Blank, TJW.

Notes. This species is reported as new for Jordan and Syria.

***Andrena* (*Truncandrena*) *tscheki tritica* Warncke, 1965 ***

Distribution. Central Europe to Turkey and the Near East. Subspecies *tritica* is found in the Eastern Mediterranean (Gusenleitner & Schwarz 2002).

Material examined. LEBANON: S Lebanon, Saidoun, 18. III.2018, 1♀; 24.III.2019, 1♀; 15.IV.2019, 1♀, all leg. A. Baghdadi, SOILS/TJW; S Lebanon, Saidoun, Joura, 25. III.2018, 1♂, 1♀, leg. A. Baghdadi, SOILS, *Raphanus raphanistrum*; N Lebanon, Tannourine El Tahta, Wadi Ain El Raha, 900 m, 24–27.III.2017, 2♀, leg. Boustani, TCFNR.

***Andrena* (*Ulandrena*) *dauma* Warncke, 1969 ***

Distribution. Israel and Turkey (Gusenleitner & Schwarz 2002).

Material examined. JORDAN: 20 km N of Karak, 1000 m, 27.IV.2006, 1♀, leg. K. Deneš, OÖLM; NW of Ajlun, 850 m, 20.V.2007, 4♀, leg. Z. Kejval, OÖLM; Ajlun S of Anjara, 27.IV.2002, 1♀, leg. M. Snižek, OÖLM; 17 km SW of Amman, 23.IV.2006, 2♀, leg. F. Kantner, OÖLM; LEBANON: N Lebanon, Arz Tannourine, Tannourine Forest Reserve Outskirts, 1739 m, 6.V.2017, 1♂, 1♀, leg. Boustani, TCFNR/TJW; N Lebanon, Arz Lubnan, Bcharre Reforestation Area, 1967 m, 12.V.2017, 1♀, leg. Boustani, TCFNR; SYRIA: 25 km W Damascus, Burqush environs [near Baddoûaa], 5.V.2000, 1♀, leg. F. Kantner, OÖLM.

Notes. This species is reported as new for Jordan and Syria.

***Andrena* (*Ulandrena*) *fulvitarsis* Brullé, 1832 ***

Distribution. Italy, Ukraine, and the Balkans to Turkey and Israel (Gusenleitner & Schwarz 2002).

Material examined. JORDAN: 20 km S of North Shuna, Tall Al Arbatin, 19.IV.1996, 2♀, leg. Ma. Halada, OÖLM/TJW; LEBANON: Arz Bcharre, Forest of the Cedars of God, Forest Limit, 1873 m, 20.V.2019, 1♀, leg. Boustani, TJW.

Notes. This species is reported as new for Jordan.

***Andrena* (*Ulandrena*) *isabellina* Warncke, 1969 ***

Distribution. Israel and Turkey (Gusenleitner & Schwarz 2002).

Material examined. JORDAN: Pella env. [Tabaqat Fahl], −80 m, 29.IV.2006, 1♀, leg. K. Deneš, OÖLM; 30 km NW Aljun, 600 m, 29.IV.2006, 1♀, leg. K. Deneš, OÖLM; 30 km WWN of Aljun, 30.IV.2006, 1♀, leg. K. Deneš, OÖLM; Aljoun, 28.IV.2012, 1♀, leg. M. Kafka, OÖLM; Aljun environs, 1.V.2006, 4♀, leg. K. Deneš, OÖLM; Irbid, Saham village, 19–25.IV.2003, 1♂, 1♀, leg. I. Pljushtch, OÖLM; Aman environs., Hisban villiage, 9.IV.2003, 1♀, leg. I. Pljushtch, OÖLM; 15 km W Jerash, Dibbin, 2. V.1996, 1♀, leg. K. Deneš, OÖLM; 10 km N, NE of Jarash [Jerash], 20.IV.2002, 1♂, 2♀, leg. M. Snižek, OÖLM/TJW; LEBANON: Bekaa, Kefraya, 1009 m, 27. IV.2019, 2♀, leg. Boustani, TCFNR/TJW, *Crepis* spp.; N Lebanon, Hadath El Jebbe, Border of the Cedar forest, 1646 m, 13.V.2019, 2♀, leg. Boustani, TCFNR, *Crepis* cf *sancta*; SYRIA: Tartus, St. Georg-Kloster, 250 m, 3. IV.1988, 1♂, leg. L. Blank, TJW; Tartus, Safita, 10 km E, 300 m, 1♂, leg. L. Blank, MSC; 60 km S Damascus, 14. V.1996, 1♀, leg. Ma. Halada, OÖLM.

Notes. This species is reported as new for Jordan and Syria.

***Andrena* (*Zonandrena*) *flavipes* Panzer, 1799**

Distribution. The most widespread taxon in the West Palearctic, found throughout Europe, North Africa, the Middle East, and into Central Asia (Gusenleitner & Schwarz 2002).

Literature. Mavromoustakis (1962) S Lebanon, Djezzine [Jezzine], 2.VI.1952, 4♀; Mount Lebanon, Hammana, 16. V.1953, 1♀; Mount Lebanon, Ein el Arar, 25.VI.1953, 1♀; Kadisha river, 21.VI.1960, 1♀.

Material examined and notes. LEBANON: 4♂ and 29♀ constituting 23 records between 1975 and 2019 from across Lebanon, this taxon is common and widespread.

***Andrena* (*Zonandrena*) *sigiella* Gusenleitner, 1998 ***

Distribution. Israel (Gusenleitner & Schwarz 2002).

Material examined. JORDAN: Pella env. [Tabaqat Fahl], −80 m, 29.IV.2006, 1♀, leg. K. Deneš, OÖLM; S of At Tafila, 27–30.III.2013, 1♀, leg. M. Snižek, OÖLM; Al Karak env [Kerak], 6.IV.2013, 1♀, leg. M. Snižek, OÖLM; 20 km NNW Al Karak, 1–30.IV.2006, 1♀, leg. F. Kantner, OÖLM; LEBANON: Mount Lebanon, Barja, Terbe, 326 m, 17.IV.2017, 2♀, leg. Boustani, TCFNR; Bekaa, American University of Beirut farm, 13.IV.1962, 1♀, leg. C. Christian; 2.VI.1962, 1♀, leg. Z. Rafii, both AUB; SYRIA: Salkhad, 6.V.1996, 1♀, leg. Ma. Halada, OÖLM.

Notes. This species is reported as new for Jordan and Syria.

Discussion

Altogether, the critical review of the literature and museum specimens combined with contemporary survey efforts have produced a total of 86 *Andrena* species from Lebanon, with 53 species reported for the first time (including newly described species), as well as 25 and 23 species reported for the first time from Jordan and Syria, respectively. In-depth studies of other insect groups are scarce for Lebanon, but the revisionary works that have been compiled follow the same trend; high diversity with several new records for Lebanon, and new species for science described from mountainous areas (Larsen 1974; Németh 2019).

Discussion of the biogeography of Lebanese *Andrena* species is difficult because most of the knowledge of their distribution in neighbouring areas comes from Israel and Turkey, and what we know about their faunas themselves continues to change, with 35 species newly reported for Israel very recently, a faunal richness increase of around 20% (Pisanty et al. 2018). The knowledge of the faunas of Jordan and Syria is also highly incomplete, as evidenced by the new records presented here. That said, three interesting groups of species can be identified in the Lebanese *Andrena* fauna presented here.

The largest is the surprising collection of species more typically found in temperate Europe, specifically *A. alfkenella* (average site 1618 m above sea level), *A. humilis* (1789 m), *A. labialis* (1728 m), *A. minutula* (1529 m), *A. minutuloides* (1598 m), *A. rufula* (1553 m), and *A. thomsoni* (1152 m) which were all found at altitude. Altogether, these species were found at an average of 1567 m above sea level, illustrating their isolation. In this regard, the mountains of northern Lebanon show a strong affinity with the Taurus mountains in south-east Turkey where these species can also be found at what was thought to be their south-eastern range limit (Warncke 1975a). This broadly mirrors the situation in bumble bees (*Bombus*) where *B. melanurus* Lepeletier, 1836 and *B. niveatus* Kriechbaumer, 1870 show isolated populations at altitude in the Lebanese mountains, with the latter only extending further south to mountains in northern Israel (Rasmont & Iserbyt 2014; Boustani et al. 2020).

The second group is more Levantine in nature, and contains species previously endemic to Israel, specifically *A. aruana, A. freidbergi, A. pinkeunia, A. sigiella, A. sphecodimorpha mediterranea*, and *A. stenofovea*. This group is particularly rich in *Poecilandrena*, and the Lebanese has gone from zero to five confirmed species of *Poecilandrena*, including two species or subspecies (*A. friedburgi* and *A. sphecodimorpha mediterranea*) described since 2016. Because of the small geographic area of the countries of the Levant, it was highly likely that *Poecilandrena* species known only from Israel would be found more widely when the opportunity for scientific study became available (Pisanty et al. 2018). Finally, the smallest group is for species previously restricted to mountains in Turkey and Armenia, specifically *A. gallinula* and *A. hova*, and in the case of *A. christineae*, mountains in Iran as well. The smaller number of more typically ‘Turkish’ species suggests that the relationship between the montane faunas of Lebanon and Turkey may be relatively weak. However, as evidenced by these new discoveries the level of sampling in this region is low and it is difficult to draw strong conclusions at the present time.

This problem is further illustrated by the limitations placed on the program of sampling underlying the current work, as little to no material was available for study from the most southerly or northerly parts of Lebanon (Figure 1), specifically the governorates of Akkar, Nabatieh, and South governorate, as these areas are difficult to access safely and have not been the subject of historical collections. These governorates contain some of the most low-lying parts of the country with the most extensive areas of thermomediterranean and eumediterranean habitat (Abi-Saleh & Safi 1988), suggesting that additional sampling here is likely to detect many of the typical faunal elements from low-lying parts of the Near East such as *A. iliaca* Warncke, 1969, *A. nisoria* Warncke, 1969, *A. toelgiana* Friese, 1921, and *A. venerabilis* Alfken, 1935, as well as more recently described species to date known only from Mediterranean Israel (Pisanty et al. 2016, 2018).

There remains substantial uncertainty over several East Mediterranean *Andrena* groups, most notably in *Carandrena, Euandrena*, and *Micrandrena* (Pisanty et al. 2018; Praz et al. 2019). There are at least four additional possibly undescribed *Euandrena* species in Lebanon that are not listed here and which are the subject of molecular investigation, including some of the cryptic members of the *Andrena bicolor* complex in southern Europe identified by Praz et al. (2019), as well as several *Micrandrena* species that cannot yet be confidently assigned a name. Combined with the high species richness of *Andrena* in neighbouring countries in the Levant, the large number of unconfirmed species records for the country (online supplementary material), and the need for increased study in undersampled areas, it is highly likely that the true number of *Andrena* species in Lebanon will be well over 100. The new species described here, combined with other recent work (Pisanty et al. 2016, 2018), support the position that studies of *Andrena* in the Levant are far from complete.

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Supplementary material

The supplemental data for this article can be accessed here.

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Conservation Biology

Contributed Paper

Global effects of extreme temperatures on wild bumblebees

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Abstract: Climate plays a key role in shaping population trends and determining the geographic distribution of species because of limits in species' thermal tolerance. An evaluation of species tolerance to temperature change can therefore help predict their potential spatial shifts and population trends triggered by ongoing global warming. We assessed inter- and intraspecific variations in heat resistance in relation to body mass, local mean temperatures, and evolutionary relationships in 39 bumblebee species, a major group of pollinators in temperate and cold ecosystems, across 3 continents, 6 biomes, and 20 regions (2386 male specimens). Based on experimental bioassays, we measured the time before heat stupor of bumblebee males at a heatwave temperature of 40 °C. Interspecific variability was significant, in contrast to interpopulational variability, which was consistent with heat resistance being a species-specific trait. Moreover, cold-adapted species are much more sensitive to heat stress than temperate and Mediterranean species. Relative to their sensitivity to extreme temperatures, our results help explain recent population declines and range shifts in bumblebees following climate change.

Keywords: climate change, extreme events, pollinator decline, heat resistance, inter- and intraspecific variability

Efectos Globales de las Temperaturas Extremas sobre Abejorros Silvestres

Resumen: El clima juega un papel importante en la configuración de las tendencias poblacionales y en la determinación de la distribución geográfica de las especies debido a los límites de la tolerancia térmica y al agua que tiene cada especie. Por lo tanto, una evaluación de la tolerancia de las especies al cambio térmico puede ayudar a predecir los potenciales cambios espaciales y las tendencias poblacionales detonadas por el calentamiento global en curso. Evaluamos las variaciones inter- e intraespecíficas de la resistencia al calor en relación con la masa corporal, temperaturas locales promedio y las relaciones evolutivas para 39 especies de abejorros, un grupo primordial de polinizadores en ecosistemas templados y fríos, en tres continentes, seis biomas y 20 regiones (2,386 especímenes machos). Con base en bioanálisis experimentales, medimos el tiempo previo al letargo por calor de los abejorros machos a temperaturas de 40 °C, típicas de una ola de calor. La variabilidad interespecífica fue significativa, en contraste con la variabilidad interpoblacional, lo cual fue consistente con el hecho de que la resistencia al calor sea una característica específica de la especie. Además, las especies adaptadas al frío son mucho más sensibles al estrés por calor que las especies de clima templado o Mediterráneo. En relación con

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la sensibilidad a las temperaturas extremas, nuestros resultados ayudan a explicar las recientes declinaciones poblacionales y cambios en la distribución de los abejorros posteriores al cambio climático.

Palabras Clave: cambio climático, declinación de polinizadores, eventos extremos, resistencia al calor, variabilidad inter- e intraespecífica

Introduction

Since the turn of the 20th century, human activities have triggered global warming, resulting in an average temperature increase of 0.85 °C (Hance et al. 2007). According to most scenarios of the Intergovernmental Panel on Climate Change, this situation is expected to worsen by the end of the 21st century (i.e., up to 6 °C in the worst-case scenario), especially in arctoalpine regions (Fronzek et al. 2012; IPCC 2014). The consequences of global warming are 2-fold: gradual modifications of main climatic parameters (e.g., humidity, temperature) and an increase in the frequency and intensity of extreme and localized weather events, such as heat waves (Easterling et al. 2000; Meehl & Tebaldi 2004). A heat wave corresponds to a period of 2 consecutive days with the temperature higher than 40.6 °C (Robinson 2001; Meehl & Tebaldi 2004). Cold and temperate areas are equally likely to experience heat waves, whereas extreme events are very rare in tropical biomes (Meehl & Tebladi 2004).

Current global warming is affecting ecosystems by displacing local populations, a situation that will eventually lead to extinctions (e.g., Walther et al. 2002; Parmesan 2006; Sunday et al. 2012). Although most studies to date have focused on the consequences of gradual climatic modifications, higher intensity and frequency of extreme events of temperature variation could be a more serious threat than the gradual increase in average temperatures (Hance et al. 2007; Kingsolver & Buckley 2017). Hyperthermic stress, notably induced by heat waves, is associated with physiological perturbations (Parmesan et al. 2000; Hance et al. 2007; Kingsolver & Buckley 2017), mortality (Neven 2000; Parmesan 2006; Kingsolver et al. 2013), and behavioral changes (i.e., stupor, characterized by a critical decrease in motor function and inability to escape from conditions) (Perez & Aron 2020).

We focused on bumblebees (Hymenoptera: *Bombus*), a diversified group of crucial pollinators in temperate and cold areas (Williams 1998). Bumblebees are eusocial insects, having evolutionary origins in cold climates but comprising derived clades in Mediterranean and tropical areas (Hines 2008; Williams et al. 2017). Bumblebee distributions and declines are affected by the interaction between climate and food availability, the effects of which have resulted in negative population trends where populations are distant from their climatic optimum, especially in warmer areas (Williams 1986; Williams et al. 2007). These endoheterothermic bees display several adaptations to cold climates but few to high temperatures (Heinrich 2005; Pimsler et al. 2020). Over the last decades, strong shifts have been reported in bumblebee populations worldwide (Goulson et al. 2004), at least partially triggered by climate change (Kerr et al. 2015).

Recent research shows that bumblebees exhibit spatial variability in their response to climate change; patterns are heterogeneous among species (Kerr et al. 2015). Bumblebees are more likely to decline where significant warming has occurred; populations living on the margins of their historical distribution are especially affected (Kerr et al. 2015). Although maximum critical temperature seems species specific (Oyen et al. 2016), high temperatures near 40 °C can trigger thermal distress (Heinrich 2005). Until now, studies on bumblebee thermal tolerance have focused on measuring maximum and minimum critical temperatures through examination of a single-species model (Oyen & Dillon 2018) or have explored the effect of elevation on these thermal limits for only 3 species (Oyen et al. 2016). Researchers used temperature-ramping methods with experimental devices set in a central location to which the specimens would be taken after field collection. These highly standardized protocols allow for precise measurements of species thermal limits but have undoubtedly restrained the number of model species and replicates that could be tested, as well as the geographical range from which the specimens can be collected. Moreover, it appears that critical thermal limits depend on ramping rates for dynamic methods (e.g., Overgaard et al. 2006; Oyen et al. 2016). The relationships between heat stress sensitivity in bumblebees, population trends, and species' range are still generally unknown. However, such information could help predict which species and communities are the most exposed to thermal stress under climate change (Ayrinhac et al. 2004; Rezende et al. 2011). Using a portable device, we evaluated the variation in heat resistance (with a static heatwave temperature of 40 °C) of a large set of bumblebee species that live in different habitats at different latitudinal and longitudinal scales and investigated the relationship between heat resistance, body mass, climatic variables, and population trends.

Methods

Sampling Sites and Species

The sampling strategy was to maximize the number of biomes, regions, species, and specimens tested to consider interindividual variability. We tested 39 bumblebee species (2386 males) across 20 regions in 6 biomes (Fig. 2) between 2013 and 2019. When necessary, we used genetic barcoding (cytochrome oxidase I *[COI]* mitochondrial sequences) or cephalic labial gland secretions or both to identify the collected specimens (Martinet et al. 2019; Valterová et al. 2019). Moreover, we tested the interpopulation heat-resistance variability of 6 widespread species for which we were able to study multiple allopatric populations: *B. cryptarum*, *B. jonellus*, *B. lapponicus*, *B. lucorum*, *B. polaris*, and *B. terrestris*. We separated specimens among 6 biotopes based on the climate of sampled stations (Mauser 2004): polar or tundra ($n = 544$), subpolar ($n = 384$), boreal ($n = 266$), mountainous ($n = 352$), temperate ($n = 679$), and Mediterranean ($n = 161$). All information about collecting sites and specimens is in Appendix S1.

We used only males because they display a constant hormonal state. Females have a changing hormonal cycle that can influence their physiology (Heinrich 2005). Males are also more exposed during their flight period (May to September depending on the species) to high air temperatures of extreme climatic events while collecting nectar and conducting their nuptial behavior in sunlight areas (Heinrich 2005). Moreover, they cannot take shelter in thermoregulated underground nests as the females do (Heinrich 2005). However, for some late summer species males may not be exposed to as warm of temperatures (depending on phenology), contrary to workers of these species.

Assessment of Hyperthermic Stress Resistance and Related Factors

Following the protocol established by Martinet et al. (2015), specimens were placed in controlled and constant conditions in an incubator (Herp Nursery II, Lucky Reptile, Waldkirch, Germany) at 40 °C and humidity of 50–60%. The temperature of 40 °C was chosen to simulate a realistic, average heatwave temperature, as recorded in natural environments across more than 90 countries (Russo et al. 2015; Ragone et al. 2018). Moreover, 40 °C is below the CT_{max} (maximum critical temperature) for species in the *Bombus* genus (e.g., mean [SD] = 45 °C [1] for *B. huntii*; 44 °C [0] for *B. bifarius*, and 40 °C [4] for *B. sylvicola* [Oyen et al. 2016]).

The time before heat stupor (THS) was measured for each specimen with a chronometer as an estimator of the heat stress resistance (10 individual tubes at the same time to minimize thermal load effect). The THS corresponds to the time from the insertion in the incubator after an initiation period of 5 min until the heat stupor. When the specimen was unable to return to normal position even after the vial was turned, it was assumed to be in heat stupor. Once in heat stupor, THS was recorded and the insect was removed from the enclosure to recover at room temperature. We additionally recorded mortality after the experiment. We also tested whether body mass influenced THS because it could be an important predictor associated with heat tolerance. Given that larger individuals could be expected to be more prone to overheating (Heinrich 1975, 2005), we measured both fresh mass (i.e., mass of the living specimen) and dry mass (i.e., mass of the specimen after complete dehydration) (Hagen & Dupont 2013). All technical details and experimental limitations associated with the methods are in Appendix S2.

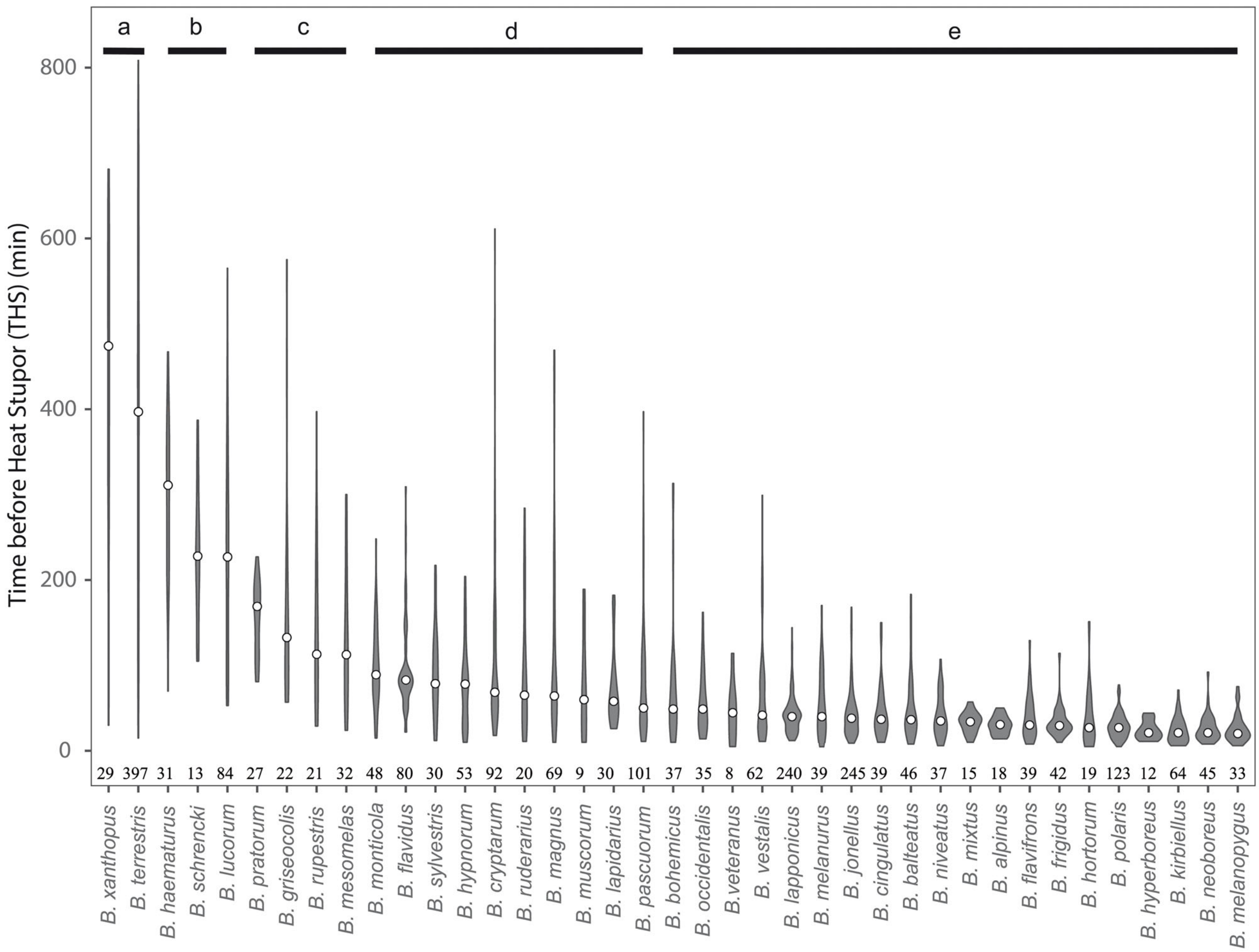
Evolutionary Patterns and Phylogenetic Signals Underlying Heat Stress Resistance

We used a Bayesian approach to investigate the phylogenetic signal associated with THS measures averaged for each species. We started from the Bayesian phylogenetic analysis performed by Cameron et al. (2007) on the *Bombus* genus. We sampled 1000 post-burn-in trees from 3 independent posterior distributions inferred by Cameron et al. (2007). We then used the R package phytools to estimate Blomberg's K statistic, which measures the phylogenetic signal of a trait by comparing the observed signal of this trait with the signal under a Brownian motion model of trait evolution on a phylogeny (Blomberg et al. 2003; Revell 2012). For each tree sampled from posterior distributions, we estimated 2 K values: the K value based on the original mean thermal resistance values and the K value based on mean thermal resistance values permuted among species producing a posterior ($K_{\text{posterior}}$) and a null distribution (K_{null}) of K values, respectively. The statistical support associated with the posterior distribution of K was evaluated by comparing it with its corresponding null of distribution and formalized by approximating a Bayes factor (BF) value. The BF support associated with K was approximated by the posterior odds that $K_{\text{posterior}} > K_{\text{null}}$ divided by the equivalent prior odds (the prior probability for $K_{\text{posterior}} > K_{\text{null}}$ is 0.5):

$$BF_K = \frac{\left(\frac{p_K}{1-p_K}\right)}{\left(\frac{0.5}{1-0.5}\right)}, \tag{1}$$

where p_K is the posterior probability that $K_{\text{posterior}} > K_{\text{null}}$ (i.e., the frequency at which $K_{\text{posterior}} > K_{\text{null}}$ in the samples from the posterior distribution). The prior odds are 1 because we assumed an equal prior expectation for $K_{\text{posterior}}$ and K_{null} (Suchard et al. 2005; Dellicour et al. 2017). For the visualization, the maximum clade

(a) Interspecific variability in THS



(b) Intraspecific variability in THS

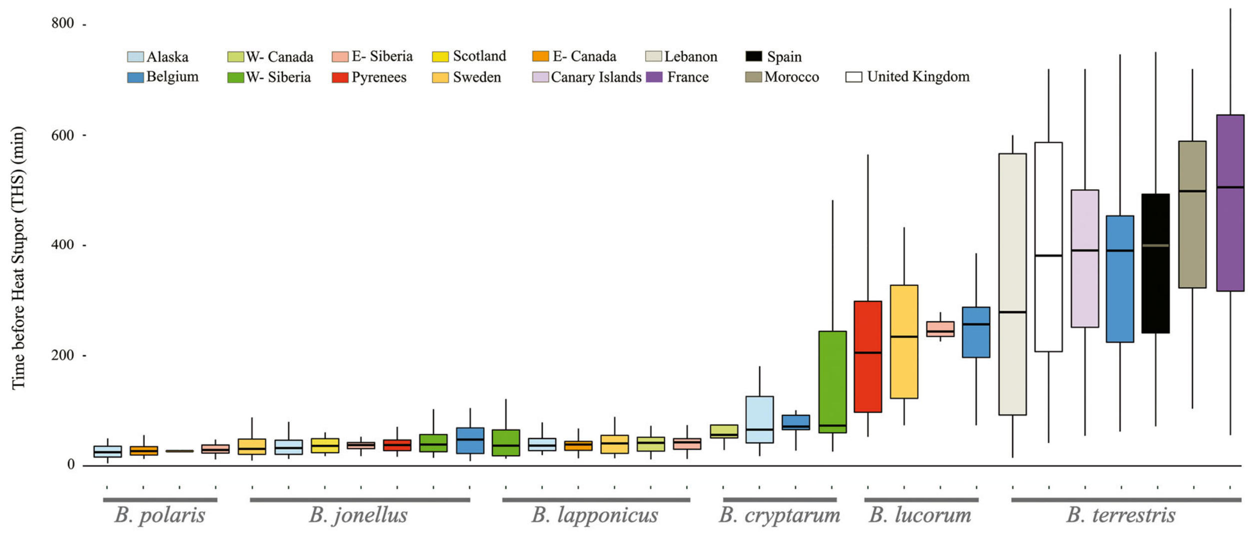


Figure 1. Interspecific variability of heat stress resistance (a) among 39 bumblebee species (letters a, b, c, d, and e, species group supported by a post hoc multiple comparison test [Kruskal–Wallis, p < 0.05]; numbers above x-axis line, number of specimens per species; white circles, median) and (b) among 6 bumblebee species at different sampling sites (horizontal lines in boxes, median values; whiskers, minimum, first quartile, third quartile, and maximum).

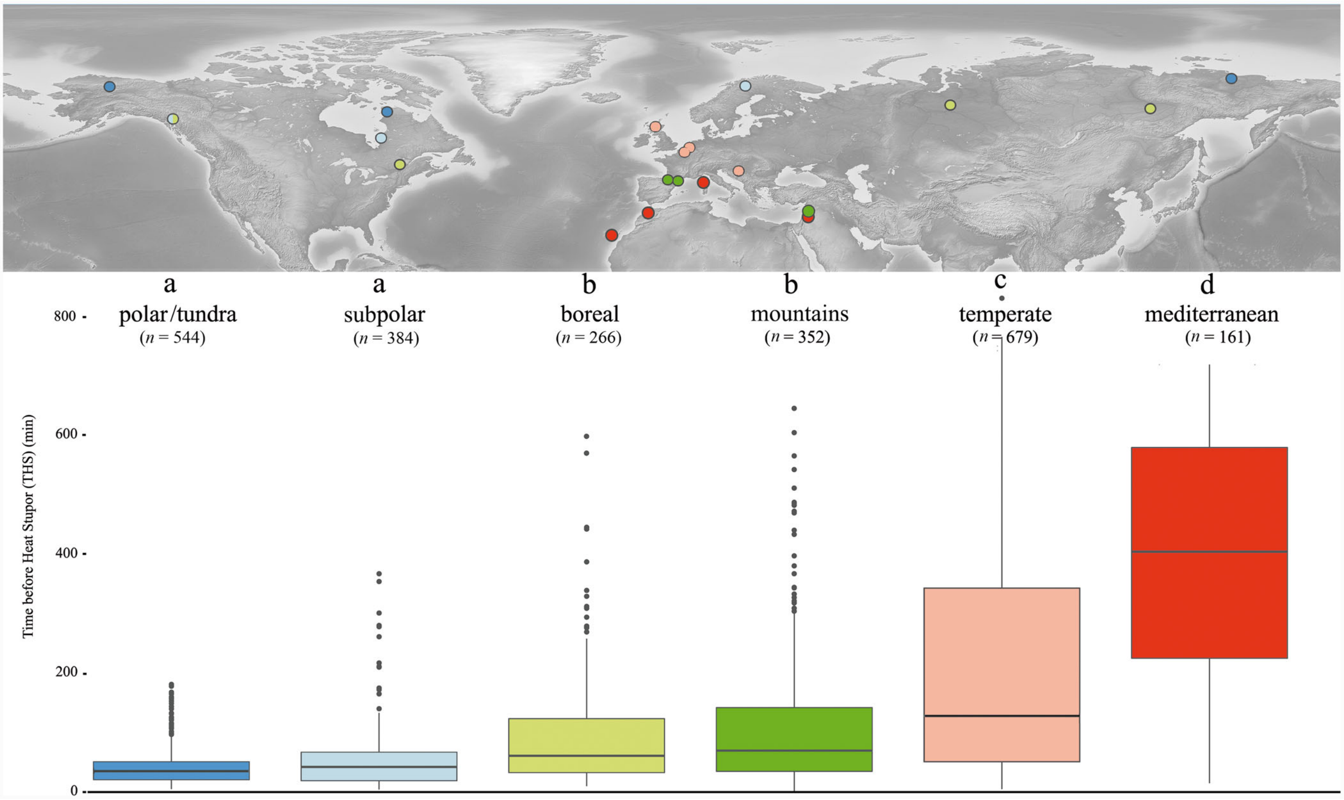


Figure 2. Variation of heat stress resistance in bumblebee individuals across biotopes: polar or tundra (dark blue), subpolar (light blue), boreal (light green), mountains (dark green), temperate (light red), and Mediterranean (dark red). Letters a, b, c, and d represent groups supported by a post hoc multiple comparison test (Kruskal–Wallis, $p < 0.05$).

credibility tree was obtained with TreeAnnotator 1.10 (Rambaut & Drummond 2020).

Statistical Analyses

We performed Kruskal–Wallis tests to compare THS among species and biotopes (pgirmess R package [R Development Core Team 4.0.3 2020]). We then tested the correlation between THS and different response variables: mean annual temperature (mean T°), mean temperature of the warmest quarter (mTWQ), mean temperature of the coolest quarter (mTCQ) at collecting sites, dry weight of specimens, and fresh weight of specimens. We extracted the climatic variables from the WorldClim 2 database (Fick & Hijmans 2017). We first performed a visual exploration of these correlations with a principal component analysis (PCA) and then formally investigated these correlations by performing a linear regression (LR) coupled with a commonality analysis (CA). The LR–CA approach allowed us to estimate both the unique and combined contributions of predictors to the explained variance in the response variable. Unique and combined effects, respectively, represent the amount of explained variance in the response variable (i.e., here THS). Finally, to investigate the relation between THS and the conservation status of the analyzed species (Nieto et al. 2014), we used the population trend estimation proposed by the International Union for Conservation of Nature (IUCN) to sort sampled species according to their IUCN population trend categories: unknown, decreasing, stable, and increasing.

Results

Variability in Heat Stress Resistance of Bumblebees

We measured THS for 2386 bumblebee males belonging to 39 species (Fig. 1; Appendix S1). In each species, heat stress caused mortality in approximately 50% of the specimens after experimentation. The THS differed significantly among species ($p < 0.01$) (Fig. 1). Five groups exhibited decreasing THS (post hoc Kruskal–Wallis multiple comparison test) (Fig. 1a): *Bombus xanthopus* and *B. terrestris* ($p < 0.01$); *B. haematurus*, *B. schrencki*, and *B. lucorum* ($p < 0.01$); *B. pratorum*, *B. griseocollis*, *B. rupestris*, and *B. mesomelas* ($p < 0.01$); *B. monticola*, *B. flavidus*, *B. sylvestris*, *B. hypnorum*, *B. cryptarum*, *B. ruderarius*, *B. magnus*, *B. muscorum*, and *B. lapidarius* ($p < 0.01$); and all other species ($p < 0.01$). The species with a distribution range centered on Mediterranean areas, such as *B. terrestris* (median = 397 min), or restricted to this region, such as *B. xanthopus* (median = 474 min), had the highest heat resistance among sampled species. Arctoalpine species, such as *B. polaris* (median = 27 min), *B. hyperboreus* (median = 21 min), and *B. frigidus* (median = 30 min), had the lowest heat resistance, including values up to 10 times lower than *B. terrestris*.

More resistant species also exhibited higher variation in their THS (Fig. 1b). However, none of the 6 tested species showed a significant interpopulation difference ($p > 0.05$) in THS (Kruskal–Wallis test): *B. cryptarum* ($p = 0.1$), *B. jonellus* ($p = 0.25$), *B. lapponicus* ($p = 0.82$), *B. lucorum* ($p = 0.71$), *B. polaris* ($p = 0.39$), and *B. terrestris* ($p = 0.06$). In other words, despite living in different ecoclimates, conspecific populations did not differ from each other in their THS (Fig. 1b).

Factors Related to the Variability of Heat Stress Resistance in Bumblebees

Analyses of aggregate data related to the biotopes showed some significant differences in THS ($p < 0.01$) (Fig. 2). Post hoc Kruskal–Wallis tests revealed 4 groups ($p < 0.05$) along a latitudinal and elevational gradient: specimens collected in polar and tundra and subpolar biotopes, specimens collected in boreal and mountain biotopes, specimens collected in temperate biotopes, and specimens collected in Mediterranean biotopes. Arctic and boreal species were characterized by a very low heat stress resistance; median THS was 20 and 40 min, respectively. Temperate and Mediterranean species had the highest heat resistance: THS median of 150 and 400 min, respectively (see Appendices S1 and S3 for the biotope of each specimen).

The phylogenetic signal associated with average THS values was supported only by an approximated Bayes factor of 6.81. According to the scale of interpretation, a Bayes factor >3 but <20 can only be interpreted as a positive but not as a strong statistical support (Appendix S4). Therefore, we concluded that there was at least a positive but poorly supported heat-resistance pattern related to phylogenetic relationships among tested species.

Fresh mass was measured for 1592 specimens before experiments and dry mass for 1276 specimens after experimentation (Appendix S1). Fresh body mass and dry mass varied significantly among species ($p < 0.01$) but not at the interpopulation level ($p = 0.19$). As highlighted by the PCA (Fig. 4), dry and fresh weights appeared to be poorly correlated with THS, contrary to the different temperature variables that appeared logically and notably correlated with each other. This trend was consistent with the results of the CA performed on the following linear regression (LR): THS ~ mTWQ + dry weight + fresh weight (global $R^2 = 0.47$, $p < 0.01$). Because the PCA confirmed that the 3 temperature variables (mean T°, mTWQ, and mTCQ) were highly correlated to each other, we only considered 1 of these measures in the LR–CA. We selected mTWQ because it corresponds to the average temperature occurring during the flying season of bumblebee males. For the different explanatory variables, we obtained the following unique (U) and combined (C) contributions to the global R^2: mTWQ, $U = 0.251$, $C = 0.161$; dry weight, $U = 0.001$, $C = 0.035$; and fresh weight, $U = 0.033$, $C = 0.158$. Therefore, among the tested predictive variables, only the mean temperature of the warmest quarter appeared to explain a significant part of the variability in THS.

Relationship Between Population Trends and THS

Analyses of aggregate data related to the Red List status (following IUCN criteria) showed significant differences between species displaying a positive population trend and species with a negative, stable, or unknown trend ($p < 0.01$) (Fig. 5). However, the category of species with positive population trends could have been heavily driven by *B. terrestris*. No significant difference was detected between declining, stable, and unknown categories ($p > 0.20$). Species associated with high THS values tended to increase their relative abundance and their geographical range, whereas species in regression were associated with low THS. There was no specific pattern for stable species, which showed a large range of THS (Fig. 5).

Discussion

At high temperatures, organisms lose neuromuscular function (i.e., heat stupor), making them sensitive to environmental challenge or unable to fill their biological functions (Huey & Kingsolver 1989; Goller & Esch 1990; Overgaard & MacMillan 2017). Although bumblebees may regularly experience extreme temperatures during heat waves when foraging outside (for workers) or during their nuptial behavior (for males), few researchers have evaluated resistance to heat stress to date (Martinet et al. 2015; Oyen et al. 2016). We found at large geographical scale a very high interspecific variability but a very limited interpopulational variability in heat stress resistance (Fig. 1). At the community level, heat waves could therefore be mostly detrimental for thermally sensitive bumblebee species by inducing strong disturbances due to hyperthermic stress.

Inter- and Intraspecific Variability of THS and Biotope Effect

Variability in heat stress resistance was high, ranging from 20 min for arctic species (e.g., *B. polaris*) to

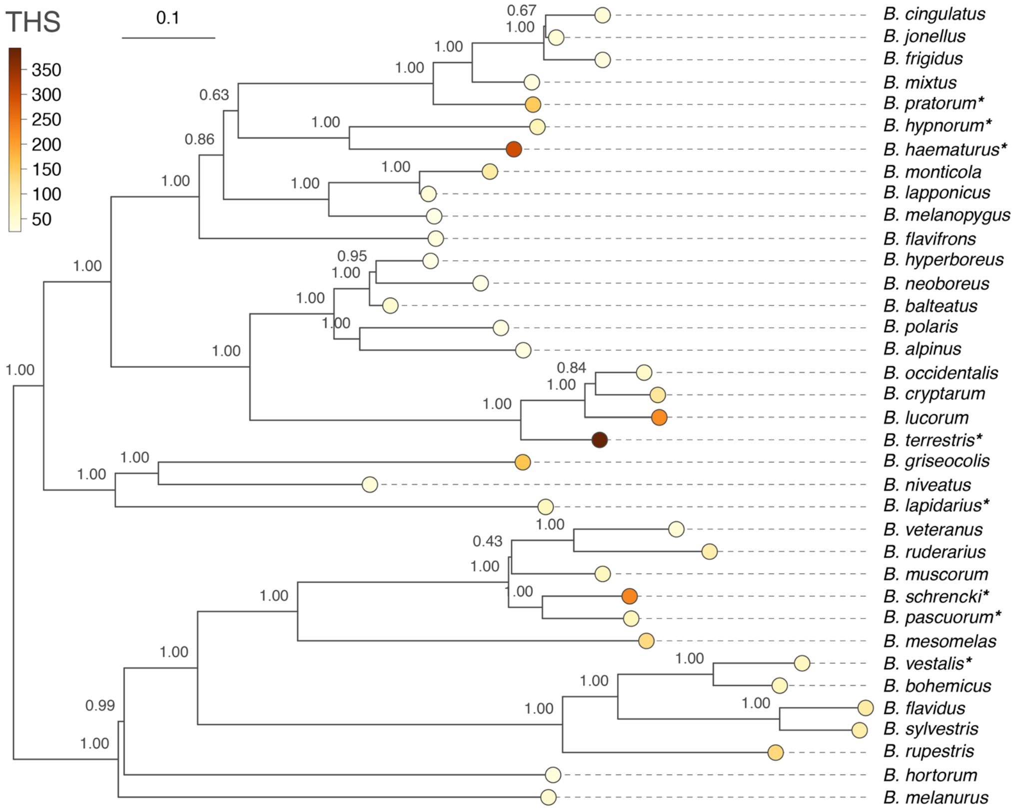


Figure 3. Bayesian phylogeny of target Bombus species. Maximum clade credibility (MCC) tree obtained from posterior trees inferred by Cameron et al. (2007) (see text for details). Tip nodes are colored according to the minimum thermal resistance (THS) averaged for each species. Posterior probabilities are reported for each internal node in the tree. An asterisk indicates species is associated with a positive population trend (as defined by the International Union for Conservation of Nature [Nieto et al. 2014]).

more than 10 h for Mediterranean ones (e.g., *B. terrestris*). Such a large interspecific variability in heat resistance has also been observed in other morphologically homogeneous groups of animals (e.g., Tomanek 2010; García-Robledo et al. 2016). Heat stress resistance variations could reflect the diversity of habitat and therefore the ecoclimatic constraints encountered in specific geographic distribution (Rasmont & Iserbyt 2012). Our results suggest that the more the geographic distribution of a species is restricted to the north or in high altitudes, the less resistance they have to hyperthermic stress. This could be explained based on simple selection mechanisms. Because high temperatures in the Arctic region constitute a recent climatic disruption, no specific selection for heat shock gene could have occurred there, in contrast with genes involved in resistance to the cold (Liu et al. 2020). Although genetic structure is known to occur among conspecific populations (Lecocq et al. 2017; Ghisbain et al. 2020), species with a wide distribution are exposed to more variable climatic parameters and may be less sensitive to modified ecoclimatic conditions (Kingsolver & Buckley 2017). Our results confirm this hypothesis. The widespread *B. terrestris* and *B. lucorum* (Rasmont et al. 2015) exhibited a lower heat sensitivity than spatially restricted species belonging to the phylogenetically close *B. magnus* or *B. cryptarum*. For *B. xanthopus*, although its distribution is insular (Corsica), the wide biotope diversity encountered in its geographical range could explain its especially high heat resistance (Rasmont & Adamski 1995). Overall, our results suggest that heat tolerance varies a lot among bumblebee species, a trend that can be associated with the extreme diversity in their habitats. Therefore, tolerance to extreme temperatures is likely a limiting factor in their distributions.

In contrast with the interspecific analysis (Fig. 1a), our results depicted a low variability in heat stress resistance among conspecific populations (Fig. 1b). Recently, Pimsler et al. (2020) described the same pattern in *Bombus vosnesenski*: no significant regional differentiation in gene expression at intraspecific level under high temperatures exposure (CTmax). However, for the most widespread species, *B. terrestris*, which lives in habitats ranging from warm to cool temperate climates, our results showed a statistical marginal significance, in contrast to the other studied taxa with a more restricted

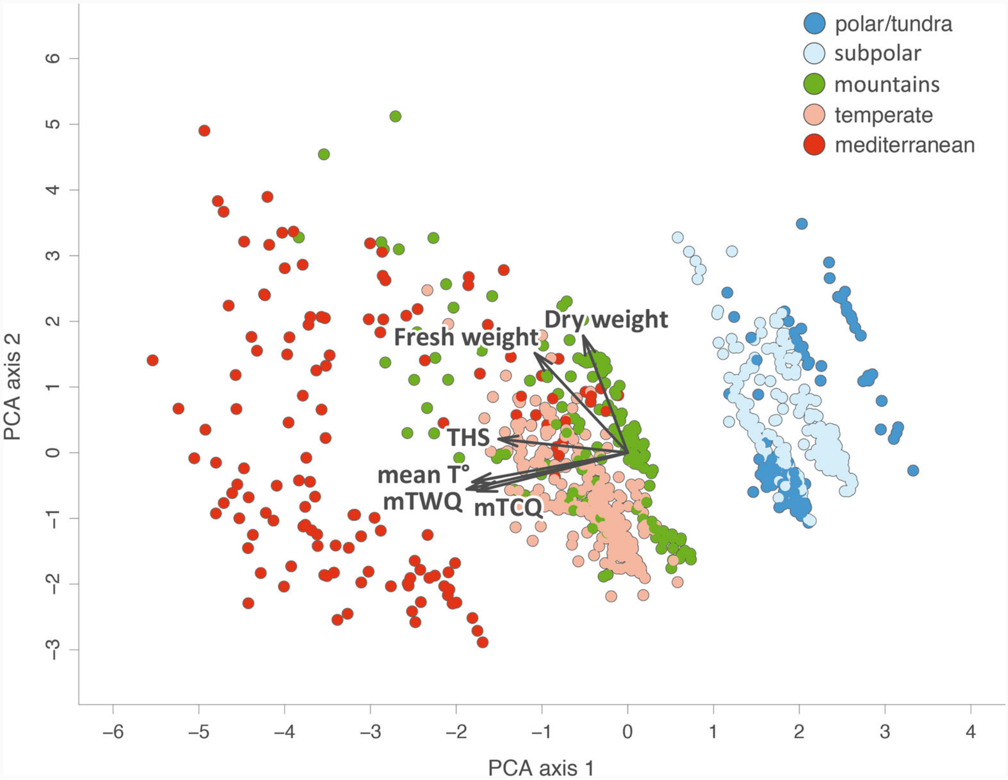


Figure 4. Principal component analysis (PCA) of the time before heat stupor (THS) and several covariables (mean T, mean annual temperature of collecting site; mTCQ, mean temperature of the coolest quarter; mTWQ, mean temperature of the warmest quarter; weight, tested specimen weight; colors, biotope where the specimen was collected; arrows, different variables in the PCA and their contribution to principal axes 1 and 2).

geographic range. Overall, these results underline that bumblebees are cold-adapted organisms with local adaptation probably more tuned on cold tolerance across a species range, whereas their ability to adapt to high temperatures seems to be more limited, which explains their high sensitivity to climate change.

At the interindividual level, differences in THS between biological units may reflect innate individual variation in heat resistance (Oyen & Dillon 2018). Thermal limits may also differ between individuals based on their own evolutionary or developmental histories (Berteaux et al. 2004). For some populations, previous selection (through recent extreme climatic events) of resistant individuals could explain the low interindividual variability. On the contrary, high interindividual variability in THS (e.g., observed in *B. terrestris* or *B. lucorum*) could be explained by a larger intrapopulational genetic diversity or a mechanism behind the ability of these species to occupy more diverse climatic zones.

Phylogenetic Signal in Heat Resistance

We did not find a strong phylogenetic signal associated with THS (Fig. 3; Appendix S4), suggesting evolutionary patterns that were independently acquired among species. The presence of a weakly supported phylogenetic signal could be influenced by groups of closely related species distributed within the same habitat (e.g., all *Alpinobombus* species limited to arctic areas and all displaying low THS) (Figs. 2 & 3), in contrast to other more widespread groups (e.g., *Pyrobombus*) in which closely related species are associated with very different THS values and different habitats. *Pyrobombus* and several other bumblebee lineages can drastically vary in their climate occupancy, with sister lineages separated by vicariance adaptations that could relate to climate adaptation (Hines 2008).

Heat Resistance and Body Mass

Given the biophysics of heat transfer and the relation of the insect's mass and heat resistance (Bergmann 1847; Heinrich & Heinrich 1983), larger organisms are generally expected to be less able to thermoregulate at high temperatures and should therefore be more sensitive to hyperthermic stress. Previous work on 3 bumblebee species suggests that only 1 species (*B. huntii*) shows a relationship between thermal limits and fresh body mass (Oyen et al. 2016). According to this study, CT_{max} increases with body mass but this relation is the opposite

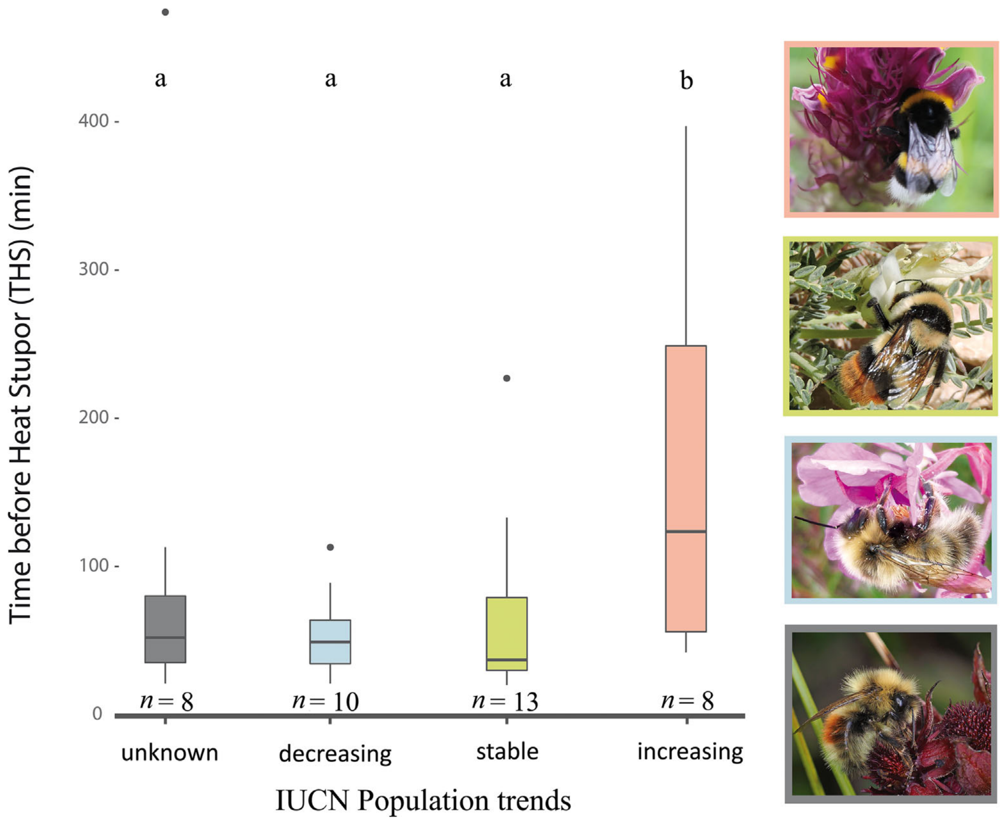


Figure 5. Relation between the heat resistance (THS) of bumblebee species and population trend status as defined by the International Union for Conservation of Nature (IUCN [Nieto et al. 2014]): decreasing, stable, increasing, or unknown evolution of population size (numbers above x-axis line, number of species per category; gray, Bombus lapponicus *[P. Rasmont, Chokurdakh, Russia]; blue,* Bombus polaris *[P. Rasmont, Toolik, Alaska, U.S.A.]; green,* Bombus niveatus *[M. Boustani, Lebanon]; red,* Bombus terrestris *[M. Folschweiller, Belgium]; letters above boxes, groups supported by a post hoc multiple comparison test [Kruskal–Wallis, $p < 0.05$]; horizontal lines in boxes, median; whiskers, minimum, first quartile, third quartile, and maximum values; dots, extreme values). Each sampled species is sorted by its International Union for Conservation of Nature status.*

to that of the heat transfer rule (Bergmann 1847; Heinrich & Heinrich 1983). In the same study, the low elevation species tolerate hotter temperatures than the high elevation species despite their body mass (Oyen et al. 2016). Our study at the continental scale did not confirm these preliminary results because our heat resistance estimator was consistent across bees varying in body mass. The THS variation was poorly related to dry mass considering all data gathered (Fig. 4). Interestingly, our linear model showed that fresh mass explained a larger part of the variance of THS than dry mass. Fresh mass reflects the hydration of organisms, and this parameter could have a significant effect on heat stress resistance, as observed in other groups (Leiva et al. 2019). In the field, bumblebees may regularly experience differences in the nutritional quality of their resources (Vanderplanck et al. 2014). Poor nutritional quality alters foraging activity (Pankiw et al. 2004) and influences physiological conditions (Stabler et al. 2015), whereas high-quality diets could have a buffering effect of heat stress on colonies (Vanderplanck, Martinet et al. 2019). In other insects such as fruit flies or beetles, feeding raises CT_{max} by increasing the body mass of the organism or by improving nutritional or hydration status (Nyamukondiwa & Terblanche 2009; Chidawanyika et al. 2017).

Heat Resistance and Population Trend

Our results highlight that expanding bumblebee species (Nieto et al. 2014; Rasmont et al. 2015), such as *B. haematurus* and *B. schrencki*, present a particularly high resistance to heat stress (Fig. 5). These species live in areas with a continental climate and are therefore naturally exposed to a large range of temperatures during their life cycle (Rasmont et al. 2015). Their recent expansion could be partially explained by an evolutionary selected ability to tolerate extreme temperature variations. Although our results emphasize only a significant relationship between heat stress resistance and positive population trend, the rarity or decline of species such as *B. polaris*, *B. jonellus*, and *B. hyperboreus* could at least be partially explained by their low THS. Following species-specific physiological characteristics, some species could naturally present a higher plasticity (e.g., activation of transcriptional cascade of heat shock response) and phenological or behavioral adaptations, which would reduce the deadly effect of heat stress (Valladares et al. 2014). This could explain the different responses to our thermal resistance test between species with a similarly widespread geographic distribution, including species living in diversified habitats. For some of the studied species (8 of 39), the available data to formally assess population trends are insufficient ("unknown" [Nieto et al. 2014]). Although the unknown category may not be included in formal analyses (Arbetman et al. 2017), we still applied this classification because our results showed that the majority of these taxa had a low THS, indicating the urgency of obtaining data for a monitoring and a safeguarding management of these key pollinators.

In the context of current and future climate change, a reaction through a physiological or biochemical response (i.e., resilience, acclimation capacity) to stressful environmental temperatures may facilitate species conservation in transformed ecoclimatic environments (Stillman 2003; Somero 2010; Gunderson et al. 2017). Interspecific differences in thermal tolerance could be a key factor in explaining and predicting climate-driven range shifts of pollinators. With our measurements of hyperthermic stress resistance in bumblebees across many populations and species, we have provided valuable insights into recent population declines and range shifts (Kerr et al. 2015). We suggest that shifts in the distribution of bumblebee species could be partly driven by their heat stress resistance during heat wave events. Our empirical results should be integrated in models facilitating mechanistic predictions of the climate change effects on future distributions of these vital pollinators. Limited local adaptations observed in bumblebees represent a critical factor in the physiological threshold that could make certain species very sensitive to environmental changes.

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Author Contributions

B.M., S.D., and P.R. conceived and designed the experiments. B.M., E.Z., M.B., and K.P. conducted the experiments. B.M. and S.D. analyzed the data. B.M., S.D., G.G., E.Z., K.P., T.L., M.B., R.B., D.M. and P.R. wrote the paper.

Supporting Information

Additional information is available online in the Supporting Information section at the end of the online article. The authors are solely responsible for the content and functionality of these materials. Queries (other than absence of the material) should be directed to the corresponding author.

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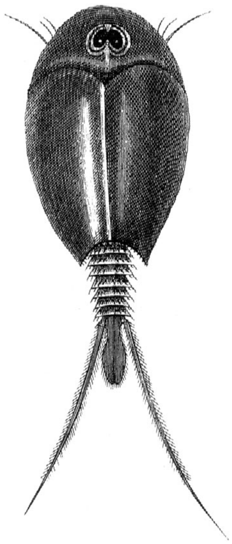

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RESEARCH ARTICLE

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Global patterns in bumble bee pollen collection show phylogenetic conservation of diet

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Abstract

1. Bumble bees (*Bombus*) are a group of eusocial bees with a strongly generalised feeding pattern, collecting pollen from many different botanical families. Though predominantly generalists, some bumble bee species seem to have restricted dietary choices. It is unclear whether restricted diets in bumble bees are inherent or a function of local conditions due to a lack of data for many species across different regions.
2. The objective of this study was to determine whether bumble bee species displayed specific patterns of pollen collection, and whether patterns were influenced by phylogenetic relatedness or tongue length, a trait known to be associated with structuring floral visitation.
3. Bumble bee pollen collection patterns were quantified from 4,132 pollen loads taken from 58 bumble bee species, representing 24% of the pollen-collecting diversity of this genus.
4. Phylogenetic trait mapping showed a conserved pattern of dietary dissimilarity across species, but not for dietary breadth. Dietary dissimilarity was driven by collection of Fabaceae, with the most similar species collecting around 50%–60% of their diet from this botanical family. The proportion of the diet collected from Fabaceae also showed a conserved phylogenetic signal. Greater collection of Fabaceae was associated with longer tongue lengths, with shorter tongued species focusing on alternative botanical families. However, this result was largely driven by phylogenetic relatedness, not tongue length per se.
5. These results demonstrate that, though generalists, bumble bees are still subject to dietary restrictions that constrain their foraging choices. These dietary constraints have implications for their persistence should their core resources decline in abundance.

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KEYWORDS
Bombus, dietary specialisation, Fabaceae, museum specimens, pollen analysis, tongue length

1 | INTRODUCTION

Herbivorous insects exhibit one of the most successful evolutionary strategies on Earth, comprising one in every three described eukaryotic species (Hardy et al., 2020). Though pronounced dietary generalists exist, the majority of insect herbivores are strongly specialised and using a limited number of host plants, typically within single botanical families (Forister et al., 2015; Jaenike, 1990). In addition to this use of specific host plants, phylogenetically conserved dietary patterns are commonly observed within clades of herbivores, with related insects feeding on related plants. This phenomenon has been most clearly studied in the Lepidoptera (Ehrlich & Raven, 1964; Janz & Nylin, 1998), but should apply equally across all groups as they are all subject to the same fundamental selective pressures that shape their dietary choices (Hardy et al., 2020; Hunter, 2016).

Against this context, bees (Hymenoptera: Anthophila) represent an ideal group in which to further investigate the phenomenon of conserved dietary specialisation. Bees are a diverse lineage that have long been the subject of scientific study because of their strong mutualism with flowering plants. As the single most important insect pollinators (Rader et al., 2016), bees drive the sexual reproduction of a large proportion of the nearly 90% of animal-pollinated flowering plant species (Ollerton et al., 2011) through pollination. This pollination occurs during the concurrent collection of the resources necessary to produce their own offspring. With very few exceptions, bees feed their developing larvae entirely on plant pollen, nectar, and in some cases, oils. Bees must therefore be classed as herbivorous insects, at least functionally if not strictly trophically (Steffan et al., 2019). Though bees are herbivores, they have not traditionally been used as models for understanding the evolution of herbivory in insects, this being much more extensively studied in the Lepidoptera (Ehrlich & Raven, 1964; Forister et al., 2015; Jaenike, 1990). Bee–plant interactions are predominantly studied in the context of pollination, which should be classified as a balanced mutual exploitation due to the potential for reduced plant fitness resulting from overharvesting of pollen (Westerkamp, 1996), and pollination syndromes that exploit bees (Dafni, 1984).

Specialised patterns of pollen collection by bees are well known and have been documented for almost a century (Robertson, 1925). It was classically suggested that bees have evolved towards pollen specialisation from generalist ancestors (Moldenke, 1979). However, the current consensus is that generalised species predominantly emerge from specialised clades which are characterised by the conservation of pollen specialisation, with occasional switches to novel hosts (Dellicour et al., 2014; Müller, 1996; Patiny et al., 2007; Sipes & Tepedino, 2005). Examples of the phylogenetic conservation of pollen collection suggest that physiological or neurological constraints exist that limit the ability of bee species and clades to break away from their ancestral floral hosts (Sedivy et al., 2008). To date, most studies involve bee lineages that are dominated by specialists that collect pollen from a single botanical family. From first principles, it would be expected that these constraints should also have an observable effect on lineages dominated by generalised species, as suggested within a lineage of megachilid bees (Haider et al., 2014). However, this has not been investigated elsewhere, in part because of the lack of robust empirical data quantifying pollen collection patterns in generalist bee species.

The bumble bees (*Bombus*, Apidae) are a moderately large genus of bees comprising around 265 species globally in 15 subgenera (Arbetman et al., 2017; Cameron & Sadd, 2020). The genus is relatively young, arising some 25–40 million years ago in the Palearctic (Dehon et al., 2019; Hines, 2008). Excluding the fraction (10%) of socially parasitic species, all species form eusocial colonies that persist for several months, or even across multiple years in tropical species. As is expected from this long activity period (Waser et al., 1996), most bumble bees are generalist foragers (polylectic) with species collecting pollen from many different botanical families (Kleijn & Raemakers, 2008; Wood et al., 2019), even if individuals can be spatially and temporally specialised (Leonhardt & Blüthgen, 2012). Though predominantly a genus of generalists, the species *Bombus gerstaeckeri* breaks this pattern, as it is known to be a specialist (oligolectic) on plants of the genus *Aconitum* (Ranunculaceae, Gosselin et al., 2013), this specialisation all the more notable because it occurs in a group of otherwise polylectic species. Bumble bees therefore represent an ideal generalised lineage in which to investigate whether conserved pollen collection patterns exist.

There has been a long-running debate over patterns of pollen collection in bumble bees, as to whether certain species have inherently narrower and less flexible diets, and how this relates to their persistence in the face of global change (Goulson et al., 2005; Kleijn & Raemakers, 2008; Rasmont, 1988; Williams, 1985; Williams et al., 2007; Wood et al., 2019). Empirical studies documenting variation in dietary breadth have been geographically and phylogenetically limited in scope, and therefore insufficient to answer fully whether bumble bees display conserved patterns of pollen collection. Moreover, there has also been a long-running debate over the importance of bumble bee tongue length (as used here specifically referring to the sum of the lengths of the glossa and prementum) as a mechanism shaping the flowers that they visit and therefore their diets through morphological exclusion, competition and niche partitioning (Goulson et al., 2005; Harder, 1985; Heinrich, 1976; Inoue & Yokoyama, 2006; Inouye, 1978; Miller-Struttmann et al., 2015). Bumble bee tongues show a high degree of interspecific variation, with short-tongued species in subgenera such as *Cullumanobombus* and *Pyrobombus* having average worker tongue lengths of 5–6 mm, and long-tongued species in subgenera such as *Megabombus* having average worker tongue lengths of 12–13 mm (Arbetman et al., 2017), this variation in tongue length being independent of overall body size. As tongue length is strongly phylogenetically conserved in bumble bees (Arbetman et al., 2017), it would be a prime candidate to explain any similarly conserved dietary patterns, should they exist.

We address the question of conserved pollen collection patterns in bumble bees directly using the most complete quantitative dataset on bumble bee pollen diets assembled to date, in combination with a robust phylogeny of the genus. We hypothesise that bumble bees will show a conserved pattern of pollen use as seen in other bee lineages despite their generalised nature. We additionally test whether bumble bee tongue length is associated with any pollen collection patterns, and hypothesise that it will be given its role in structuring flower visitation in this genus.

2 | MATERIALS AND METHODS

2.1 | Pollen diet quantification

Bumble bee pollen diets were quantified following established methodologies (Kleijn & Raemakers, 2008; Wood et al., 2019; see Supporting Information Methods). Briefly, dried pollen balls were removed from selected pinned bumble bee specimens taken from museum and private collections to achieve the greatest possible taxonomic representation. The use of museum material is necessary for species such as *Bombus cullumanus* that have declined to extinction across large parts of their range (Williams et al., 2013), and therefore cannot easily be studied in contemporary landscapes. These balls were rehydrated, stained with fuchsin jelly, and pollen grains were identified using light microscopy, predominantly to genus. The proportion of each plant taxon was assessed, with taxa representing <2%–5% excluded (depending on identifier) as these may have arisen from contamination (Müller, 1996). These proportions were weighted by the overall size of the pollen ball relative to a full load, and weightings were used to calculate final dietary proportions. A total of 4,136 pollen loads from 58 bumble bee species belonging to 13 subgenera (representing approximately 93% of subgenera and 24% of species that collect pollen, Dataset S1, Dataset S2) from 34 countries were analysed (Table S1), 1,743 of which were published previously (Kleijn & Raemakers, 2008; Wood et al., 2019). Specimens for which label dates were available (n = 4,089) were collected between 1874 and 2020 (median = 1992). Data of capture were not considered or controlled for in this study, as there is no evidence to suggest that bumble bee diets change meaningfully over time (Kleijn & Raemakers, 2008). The most important museums were the Laboratory of Zoology collection, University of Mons (1,221 specimens, Mons, Belgium), the Naturalis Biodiversity Center (552 specimens, Leiden, the Netherlands), the J.B. Wallis/R.E. Roughley Museum of Entomology (369 specimens, Winnipeg, Canada), the Royal Belgian Institute of Natural Sciences (341 specimens, Brussels, Belgium), the Bavarian State Collection of Zoology (323 specimens, Munich, Germany), the A.J. Cook Arthropod Research Collection (296 specimens, East Lansing, USA) and the Natural History Museum (239 specimens, London, UK). Full details are available in Dataset S2.

2.2 | Dietary metrics

Results were analysed at the botanical family level as this is the level at which most dietary specialisation occurs in insects (Forister et al., 2015), and to facilitate comparison between biogeographical regions where the same botanical families are present but are comprised of different constituent genera. Three major traits were investigated for a pattern of phylogenetic conservation: (a) dietary breadth, (b) diet dissimilarity and (c) collection from specific botanical families. To compare dietary breadth, results were standardised to produce a measure of the number of botanical families each species would be expected to collect in a sample size of 15 pollen loads (the smallest sample size, *B. haematurus*) using rarefaction. Rarefaction was conducted on pollen data (weighted percentage) after its transformation to complete pollen load equivalents (integer data) following Wood et al. (2019). The function *rarefy* from the VEGAN package (Oksanen et al., 2015) was used to calculate dietary breadth values based on the observed frequencies of collected botanical families, chosen at random without replacement 1,000 times. As this procedure is designed for integer data (e.g. the number of discrete visits to different flower species) and the pollen-load analysis data are non-integer (proportions of differently sized pollen loads), the pollen-load data were first transformed. The total number of pollen loads analysed for each species was multiplied by the proportion of each collected pollen. For example, across all samples, *B. fervidus* (n = 66) collected from 13 botanical families. In total, 63.8% of its pollen was collected from Fabaceae, giving 40.1 'complete' pollen-load equivalents, that is, in 66 unique *B. fervidus* foraging bouts for pollen, 40 would functionally have been to Fabaceae. This value was calculated for each botanical family collected by each bumble bee species, and then these values were all multiplied by 10 and rounded to the nearest whole number to give an integer equivalent used in the rarefaction procedure. For *B. fervidus*, when rarefied to a sample size of 15 pollen loads, this gives a comparable diet breadth of 10.513 botanical families.

For dietary dissimilarity, pairwise differences in dietary composition (Bray–Curtis dissimilarity, using the transformed integer dataset for rarefaction) were calculated between each species pair using the *vegdist* function in the (VEGAN package). Scores can range between '1' (= perfectly dissimilar) and '0' (= perfectly similar). The clearest example of dissimilarity can be seen with *B. gerstaeckeri*, which collected all of its pollen from Ranunculaceae. It therefore received a pairwise dissimilarity score of '1.000' with all bumble bee species that did not collect any Ranunculaceae. The greatest example of similarity can be seen between *B. armeniacus* and *B. distinguendus* that collected from relatively few botanical families with a high degree of overlap, Fabaceae plus Boraginaceae accounting for 75.9% of the diet of *B. armeniacus*, and 89.4% of the diet of *B. distinguendus*. This generated a pairwise dissimilarity score of '0.166', indicating high dietary similarity. These pairwise differences were averages for each species (57 comparisons per species) to produce an average dissimilarity score.

Collection from specific botanical families was calculated as a simple percentage across the entire diet, for example for Fabaceae, *B. affinis* collected 11.4% of its pollen from this botanical family, *B. alagesianus* collected 47.9% and so on. This was calculated for the top 10 most important botanical families as defined below.

2.3 | Data analysis

Dietary metrics were tested for phylogenetic signal. We used the R package PHYTOOLS (Revell, 2012) to estimate and assess the level of significance of the *K* statistic measuring the phylogenetic signal of chosen traits (standardised dietary breadth, averaged dissimilarity, percentage of specific botanical families collected) by comparing the observed signal in each trait to the signal under a Brownian motion model of trait evolution on a phylogeny (Blomberg et al., 2003). This estimation was based on the maximum clade credibility tree obtained from the most updated Bayesian phylogenetic analysis performed by Cameron et al. (2007) for the genus *Bombus*, including all but two of the species in our dataset (*B. cullumanus* and *B. bisiculus*, sequences not available).

The composition of bumble bee pollen diets was visualised using a non-metric multidimensional scaling (NMDS) plot with the *ordiplot* function from the VEGAN package (Bray–Curtis dissimilarity). The impact of subgenus was tested using permutational multivariate analysis of variance (PERMANOVA) tests with the function *adonis* (VEGAN package). Only subgenera with three or more representatives were included. Two analyses were run, with and without the highly aberrant *B. gerstaeckeri*. For the full dataset, the most important botanical families contributing to differences in pollen-load composition (dissimilarity) among individual species were identified using similarity percentage (SIMPER) analyses with the *simper* function (VEGAN package). Because the SIMPER analysis requires categorical groupings, bumble bee species were sorted by overall dissimilarity score, with half ($n = 29$) placed in a 'high dissimilarity' group, and half ($n = 29$) in a 'low dissimilarity' group. The top 10 botanical families contributing most to the difference in dissimilarity scores after SIMPER analysis were tested for phylogenetic signal. The relationship between bumble bee tongue length and dietary metrics was tested using linear models, or in the case of dietary dissimilarity, Spearman's rank correlation as the response variable could not be transformed to normality. Bumble bee tongue length values were taken from a literature compilation (Arbetman et al., 2017), with values available for 41 of the 58 species studied here. Phylogenetic least squares regression analyses were conducted using the package APE (Paradis & Schliep, 2019) to ensure that observed relationships with tongue length were not driven by phylogenetic proximity. To ensure that tongue length was not confounded by bumble bee body size, this was independently tested for phylogenetic signal and correlation with tongue length (see Supporting Information Methods). All analyses were conducted in R version 3.6.3.

3 | RESULTS

Studied bumble bee species were widely polylectic, collecting from 60 botanical families, with a typical bumble bee species collecting 9.9 ± 0.6 botanical families in 15 analysed pollen loads after standardisation. However, standardised dietary breadth showed no phylogenetic signal (Blomberg's $K = 0.248$, $p = 0.114$, Figure S1). Instead, dietary dissimilarity was associated with a phylogenetic signal ($K = 0.307$, $p = 0.028$), with the subgenera *Mendacibombus*, *Bombias* and *Thoracobombus* showing a conserved trend of similar diets with a high Fabaceae content (Figure 1).

Dietary composition showed structuring by subgenus, with *Thoracobombus* clearly collecting from a restricted subset of the botanical families used by the subgenus *Pyrobombus*, which occupied the widest variety of dietary niches (PERMANOVA, $F_{6,41} = 2.19$, $p = 0.001$, Figure S2). All other subgenera were intermediate between the two. Including the aberrant *B. gerstaeckeri*, which is a specialist of *Aconitum* (Ranunculaceae), did not change the overall relationship, but greatly distorted the overall pattern ($F_{6,42} = 2.14$, $p = 0.003$, Figure S3). SIMPER analysis between the high and low dissimilarity groups showed that Fabaceae explained the largest proportion of variation between the groups (39.7%), with members of the low dissimilarity group collecting on average twice as much Fabaceae as the high dissimilarity group (Table 1). The next highest contributor, Asteraceae, explained just 7.1% of variation. When these top 10 botanical families contributing most to overall variation between the two groups were tested individually, the percentage of pollen collected from Fabaceae ($K = 0.440$, $p < 0.001$), Lamiaceae ($K = 0.327$, $p = 0.022$), Rosaceae ($K = 0.380$, $p = 0.019$) and Hypericaceae ($K = 0.350$, $p = 0.014$) were all associated with a phylogenetic signal (full results Table S2).

Collection of Fabaceae explained much of the overall variation in dietary dissimilarity scores among individual species ($R^2 = 0.682$), with the next highest, Ranunculaceae ($R^2 = 0.227$), explaining substantially less and showing no phylogenetic signal ($K = 0.217$, $p = 0.488$, full results Table S2). In contrast, Lamiaceae ($R^2 = 0.003$), Rosaceae ($R^2 = 0.022$) and Hypericaceae ($R^2 = 0.003$) explain very little to none of this variation despite their phylogenetic signal. The use of Fabaceae pollen therefore largely determines overall dietary dissimilarity, with species with the lowest dissimilarity scores preferentially using this family, and species with the greatest dissimilarity scores favouring a wide range of different botanical families (Table 2).

There was no relationship between tongue length and dietary breadth (LM, $t_{1,39} = 1.252$, $p = 0.218$, $R^2 = 0.039$, Figure 2a), but both a lower dietary dissimilarity score (Spearman's Rho = 0.602, $p < 0.001$, $R^2 = 0.209$, Figure 2b) and higher collection of pollen from Fabaceae (LM, $t_{1,39} = 3.121$, $p = 0.003$, $R^2 = 0.200$, Figure 2c) were associated with longer tongue length. However, both the results for

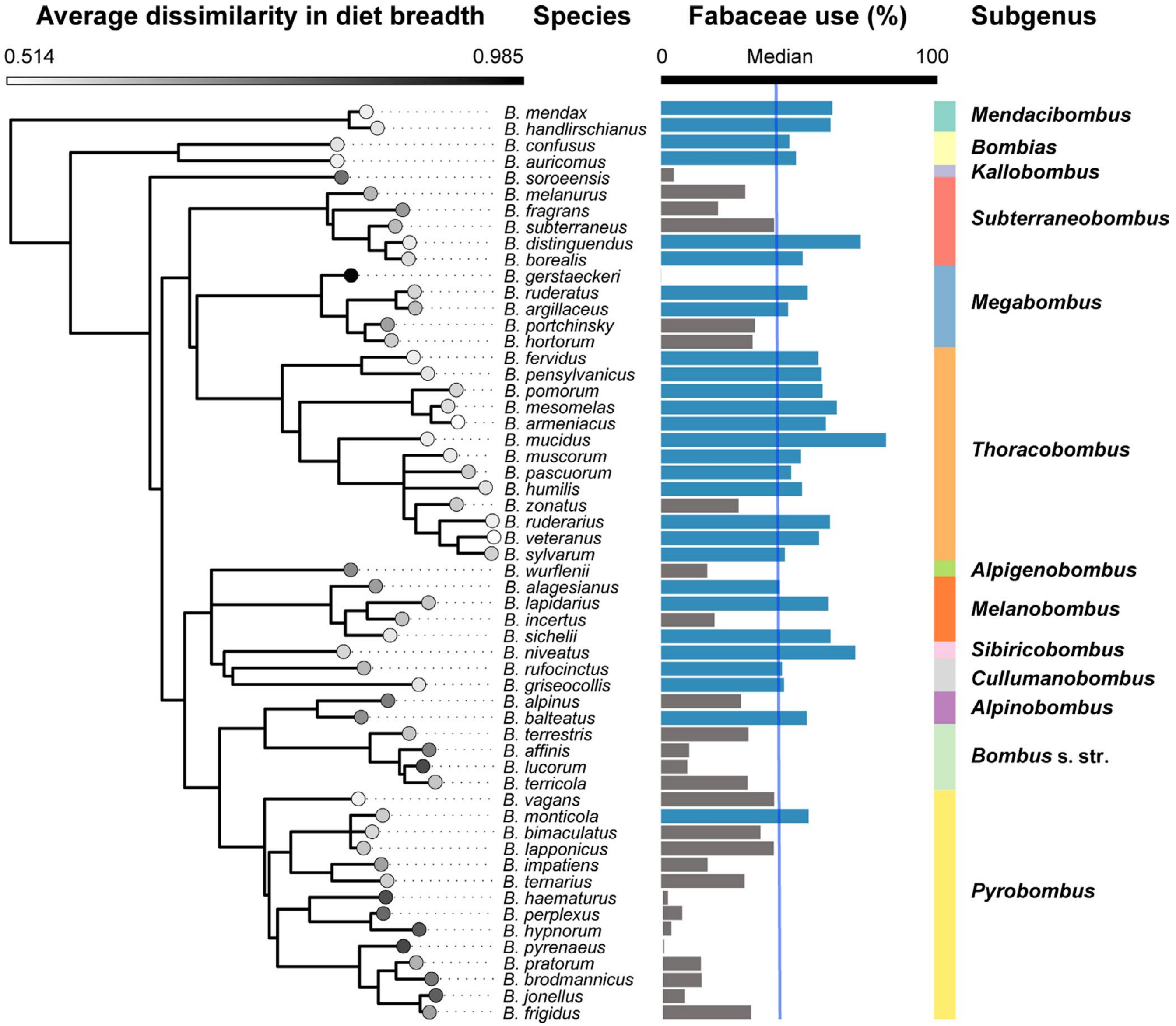

FIGURE 1 Average pollen diet composition dissimilarity (Bray–Curtis dissimilarity, relative to diets of other bumble bee species, 0 = completely similar, 1 = completely dissimilar) mapped onto the bumble bee phylogeny. For each species, the percentage of the diet composed of Fabaceae is also indicated

dietary dissimilarity (PGLS, $t_{1,39} = 1.357$, $p = 0.183$) and collection of Fabaceae (PGLS, $t_{1,39} = 0.859$, $p = 0.395$) were non-significant after phylogenetic correction. Body size showed a weak positive correlation with tongue length, but no phylogenetic signal and no association with any of the dietary metrics (see Supporting Information Results).

4 | DISCUSSION

Bumble bees show a phylogenetically conserved pattern of pollen collection, not in the overall breadth of their diet, but in the composition of collected botanical families. This is most clearly expressed in the *Mendacibombus*, *Bombias* and *Thoracobombus* lineages, these all displaying a strong association with pollen from the Fabaceae which dominates their diets. Although bumble bees are some of the most hyper-generalised of all insect herbivores, regularly collecting from more than 10 botanical families (Forister et al., 2015), these conserved patterns show that they are still subject to dietary restrictions that constrain their foraging choices as seen in solitary and more specialised bee lineages (Dellicour et al., 2014; Haider et al., 2014; Müller, 1996; Patiny et al., 2007; Sedivy et al., 2008; Sipes & Tepedino, 2005).

The conservation of the pollen diet shown by these solitary bee lineages (*Melitta*, *Osmia* subgenus *Osmia*, Anthidiini, Rophitinae, *Chelostoma*, *Didasia*, respectively) differs from that seen in bumble bees by its much greater incidence of specialisation and host switching. Though clusters of related species feeding on the same host family make for a clear pattern, when host switching occurs it can be abrupt. For example, three closely related specialists *Melitta*

TABLE 1 Similarity percentage (SIMPER) analysis comparing the composition of pollen loads collected by high ($n = 29$) and low dissimilarity ($n = 29$) bumble bee species. Only the top 10 botanical families contributing the most to overall variation are included

Botanical family	Use by high dissimilarity group (%)	Use by low dissimilarity group (%)	Average differential (% points)	Contribution to overall variation (%)
Fabaceae	28.9	58.7	29.8	39.7
Asteraceae	9.9	5.7	4.2	7.1
Lamiaceae	8.4	7.0	1.4	6.8
Ericaceae	8.1	2.9	5.1	6.3
Rosaceae	6.3	4.4	2.0	5.6
Boraginaceae	6.0	4.6	1.4	5.2
Orobanchaceae	5.6	3.9	1.7	4.9
Campanulaceae	7.2	0.6	6.7	4.5
Ranunculaceae	2.1	0.9	1.2	2.2
Hypericaceae	1.5	1.9	0.4	2.1

TABLE 2 Dominant botanical family in collected pollen (% of the diet) for the top 10 bumble bee species with the (a) most and (b) least dissimilar dietary scores (Bray–Curtis dissimilarity, 0 = perfectly similar, 1 = perfectly dissimilar)

Species	Subgenus	Dissimilarity score	Dominant botanical family	Percentage dominance
(a)				
B. gerstaeckeri	*Megabombus*	0.985	Ranunculaceae	100.0
B. pyrenaeus	*Pyrobombus*	0.845	Campanulaceae	38.4
B. lucorum	*Bombus* s. str.	0.844	Apiaceae	31.4
B. haematurus	*Pyrobombus*	0.831	Lamiaceae	41.7
B. hypnorum	*Pyrobombus*	0.803	Rosaceae	36.2
B. jonellus	*Pyrobombus*	0.795	Ericaceae	62.2
B. perplexus	*Pyrobombus*	0.775	Rosaceae	27.8
B. soroeensis	*Kallobombus*	0.763	Campanulaceae	47.2
B. cullumanus	*Cullumanobombus*	0.754	Asteraceae	45.2
B. brodmannicus	*Pyrobombus*	0.750	Boraginaceae	36.9
(b)				
B. armeniacus	*Thoracobombus*	0.514	Fabaceae	66.5
B. veteranus	*Thoracobombus*	0.516	Fabaceae	63.9
B. mendax	*Mendacibombus*	0.537	Fabaceae	69.2
B. auricomus	*Bombias*	0.537	Fabaceae	54.6
B. ruderarius	*Thoracobombus*	0.538	Fabaceae	68.2
B. vagans	*Pyrobombus*	0.538	Fabaceae	45.5
B. fervidus	*Thoracobombus*	0.539	Fabaceae	63.8
B. muscorum	*Thoracobombus*	0.544	Fabaceae	56.6
B. distinguendus	*Subterraneobombus*	0.545	Fabaceae	80.6
B. bisiculus	*Melanobombus*	0.547	Fabaceae	73.0

leporina, *M. tricincta* and *M. nigricans* specialise on unrelated flowers with divergent morphology, namely Fabaceae (zygomorphic), *Odontites* (Orobanchaceae, sympetalous) and *Lythrum* (Lythraceae, actinomorphic, Vanderplanck et al., 2017). In contrast, the generalist nature of bumble bees means that major hosts like Fabaceae are usually still present in the diets of clades that have moved onto other resources, such as the *Pyrobombus* which still collect an average of 23.7% of their pollen from this family despite clearly having a low overall affinity with it. Bumble bees most clearly differ from these previously studied lineages by their sociality and flight period length, the two going hand in hand as the production of a worker caste necessitates an extended period of activity. This long flight period means that specialising on a single resource is not a viable strategy (Waser et al., 1996), unless said resource has an extremely long flowering period, and even then it may be necessary to skip the worker generation to reduce overall flight period length as seen in *B. gerstaeckeri* (Ponchau et al., 2006). This long flight period may be the reason that when bumble bee clades move away from Fabaceae,

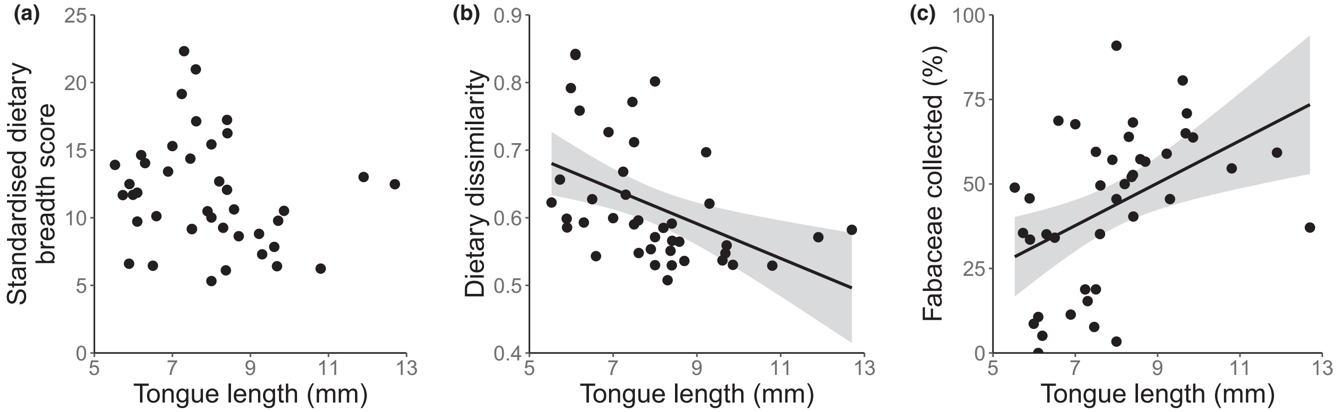

FIGURE 2 Relationship between average worker tongue length (mm) and (a) standardised dietary breadth score, (b) dietary dissimilarity score and (c) average percentage of Fabaceae collected. Lines represent significant relationships with 95% confidence intervals, indicated by grey shaded areas

they do so less abruptly, and this reduced collection remains visible in their pollen collection patterns.

While overall constrained pollen collection patterns in bumble bees are apparent, the specific mechanisms governing their existence require discussion, most clearly the phylogenetically conserved trait of tongue length (Arbetman et al., 2017). Though well established, much of the work on tongue length driving bumble bee dietary niches has focused on the collection of nectar (Harder, 1985; Heinrich, 1976; Inouye, 1978), and not pollen, as the tongue itself is not directly involved in pollen removal (as opposed to adaptations present in other bee lineages, e.g. Müller, 2006). Why then should tongue length shape pollen collection? Bumble bees have high energetic (calorific) needs and are sensitive to floral nectar rewards, making foraging decisions based on the profitability of different plant species (Heinrich, 1979; Inouye, 1978), which, in turn, is affected by flower handling efficiency that is strongly influenced by tongue length (Harder, 1983). It has consequently been argued that, as long-tongued bumble bees collect pollen while nectar foraging, they out-compete short-tongued bees on flowers with deep corollae and force these species to visit plants with short corollae instead (Heinrich, 1976). The concurrent collection of pollen and nectar therefore provides a mechanistic explanation as to how tongue length could determine pollen foraging patterns in bumble bees. However, the lack of a relationship between tongue length and foraging patterns after correction for evolutionary distance suggests that these relationships are being driven by phylogenetic relatedness rather than tongue length per se.

A question remains, however, why is the botanical family Fabaceae so important? The Fabaceae itself is a hyper-diverse plant lineage with almost 20,000 species, the third largest botanical family this metric, and they occur in almost all habitats worldwide from tropical forests to Mediterranean, desert and temperate regions, and to high latitudes and altitudes (Legume Phylogeny Working Group (LPWG), 2017). Bumble bees evolved some 25–40 million years ago in the Palearctic during a period of rapid global cooling (Dehon et al., 2019; Hines, 2008), and as such all major botanical lineages including Fabaceae would nominally have been available to them (Wikström et al., 2001). The large majority of bumble bee species are found in areas with distinct seasons that render year-round colony development impossible. This comparatively short season may have favoured the use of the most rewarding pollen sources with high protein content such as members of the Fabaceae (Hanley et al., 2008), or a high protein to lipid ratio (Vaudo et al., 2016) to achieve the fastest possible colony growth (Moerman et al., 2016). Though plausible, this idea forms at most a hypothesis (Smith, 2016), as it is ultimately not possible to demonstrate why bumble bees became strongly associated with Fabaceae as opposed to any other botanical family available to them during their evolution. Alternative hypotheses may be that Fabaceae was favoured due to its abundance in cold environments and because they have high and reliable provision of both pollen and nectar. It should be noted that though the family itself is very diverse, bumble bees do not show an association with most Fabaceae lineages, instead specifically favouring those with a symmetrical (zygomorphic) flower structure, these being found predominantly within the Papilionoideae (Legume Phylogeny Working Group (LPWG), 2017). This flower shape necessitates animal pollination (e.g. the explosive mechanism used by *Desmodium*, Alemán et al., 2014) and may be involved with the link between this lineage and bumble bees, but more direct evidence is lacking. Future experimental work conducted on conserved bumble bee linages may allow for hypotheses arising from these ideas to be tested more robustly, as to date most manipulative studies have been conducted on the derived lineages *Bombus* s. str. and *Pyrobombus* that show no meaningful association with Fabaceae (Figure 1).

The restricted pollen foraging choices of bumble bees have implications for their continued persistence and successful conservation. A global change affecting the availability of a particular resource will collectively affect any phylogenetically related group constrained to using that resource. Inversely, a phylogenetically related group that lacks a conserved dietary pattern means that it is less likely to be collectively affected because members pursue an inherently wider variety of strategies. In bumble bees, these two patterns are, respectively, well illustrated by the subgenera *Thoracobombus* (all 13 studied species favouring Fabaceae) and *Pyrobombus* (the

14 studied species individually favouring seven different botanical families), and these two subgenera were identified as being the most and least over-represented subgenera for declining species globally (*Thoracobombus*, 64% declining, *Pyrobombus*, 6% declining; Arbetman et al., 2017).

Bumble bees sharing a conserved niche may not be more likely to decline per se, and dietary niche may not be the principal predictor of decline, as this is not seen in global analyses (Arbetman et al., 2017). Indeed, bumble bees face other major threats to their populations such as global warming and pathogens (Cameron & Sadd, 2020; Rasmont et al., 2015). However, the fact that meaningful constraints exist has implications for species dependent on specific resources. The loss of preferred host plants is a key driver of bee species decline (Scheper et al., 2014), and the impact of such a loss cannot be avoided by species lacking dietary flexibility. The inflexible strategy pursued by lineages such as the *Thoracobombus* is therefore more likely to result in a more uniform decline should their preferred host rapidly decrease in abundance, as occurred to Fabaceae during the 20th century in Europe and North America (Goulson et al., 2005; Rasmont, 1988; Scheper et al., 2014; Wood et al., 2019). Fabaceae are a botanical family of enormous commercial value, leading to the movement of species around the world. Industrial Fabaceae cultivation in North America relied heavily on the use of non-native species from the Palearctic, many of which are now invasive. The role that non-native species play in forming and shaping the dietary niches and ranges of North American bumble bees should be further investigated. In contrast to the patterns seen in these seemingly inflexible bumblebee lineages, the evolutionary shift demonstrated here from Fabaceae onto a wider range of host families may have preadapted members of derived bumble bee clades like *Pyrobombus* to the environmental changes caused by the Anthropocene, and made it less likely for them to be collectively affected by the decline of any particular resource.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

AUTHORS' CONTRIBUTIONS

T.J.W. and G.G. conceived the study; all authors provided the specimens; T.J.W., D.K. and M.K. carried out pollen identification and quantification; T.J.W. and G.G. ran the analyses and T.J.W. led writing of the manuscript; all authors contributed critically to the writing process.

DATA AVAILABILITY STATEMENT

Data available from the Dryad Digital Repository https://doi.org/10.5061/dryad.63xsj3v2g (Wood et al., 2021).

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section.

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Raising awareness on the wild bees of Lebanon through social media

By BOUSTANI Mira, RASMONT Pierre, NEMER Nabil

This section presents a selection of content prepared for the Tannourine Cedar Nature Reserve, and for the NGO “Lebanese Wildlife”, Lebanon. This content aims to raise awareness on the local bee’s biodiversity and to highlight their importance. The information is based on the findings of the Bees of Lebanon, that we believe should be made accessible to wider audiences. This is mainly done through social media platforms, namely Facebook and Instagram, in order to reach a maximum audience. We benefit from the traction created by the recent interest of the public in the outdoors and wildlife observation to disseminate this information. Indeed, wild bees have been historically largely neglected in Lebanon both in scientific work and environment protection initiatives. The large popularity of the domesticated honeybee (*Apis mellifera*) and its recurrent introduction in environmental initiatives as a tool for rural development also participates in dimming the knowledge around native bees.

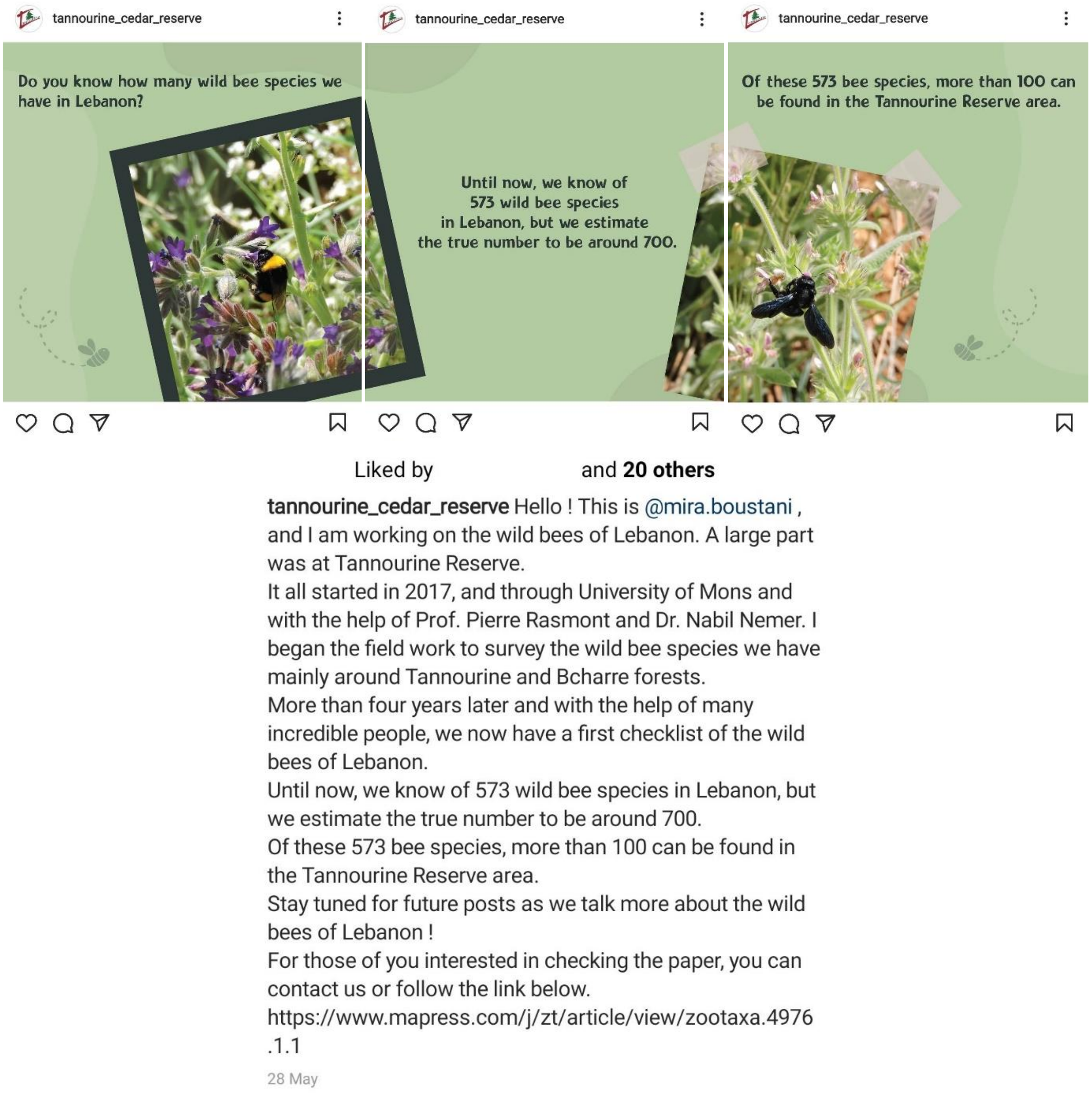
Below is a presentation of the two entities we had the opportunity to collaborate with to create and disseminate the content about the wild bees of Lebanon, and a selection of content prepared for each.

I- Tannourine Cedar Forest Nature Reserve (TCFNR) - Lebanon

“The Tannourine Cedar Forest Nature Reserve created by virtue of Law No. 9 on February 25, 1999. The reserve is managed by a committee in cooperation with the Ministry of Environment. The reserve protects the largest and most dense cedar forest of cedar in Lebanon (625 ha). The cedars accounts for more than 80% of the total number of trees […]”

The TCFNR co-funded this thesis, and the reserve premises and surroundings were one of the focus areas of the sampling. Therefore, with the information available until now TCFNR is a good starting point for the dissemination of information on the local wild bees.

Instagram page link: https://www.instagram.com/tannourine_cedar_reserve/



Do you know how many wild bee species we have in Lebanon?

Until now, we know of 573 wild bee species in Lebanon, but we estimate the true number to be around 700.

Of these 573 bee species, more than 100 can be found in the Tannourine Reserve area.

Liked by and **20 others**

tannourine_cedar_reserve Hello ! This is @mira.boustani , and I am working on the wild bees of Lebanon. A large part was at Tannourine Reserve.
It all started in 2017, and through University of Mons and with the help of Prof. Pierre Rasmont and Dr. Nabil Nemer. I began the field work to survey the wild bee species we have mainly around Tannourine and Bcharre forests.
More than four years later and with the help of many incredible people, we now have a first checklist of the wild bees of Lebanon.
Until now, we know of 573 wild bee species in Lebanon, but we estimate the true number to be around 700.
Of these 573 bee species, more than 100 can be found in the Tannourine Reserve area.
Stay tuned for future posts as we talk more about the wild bees of Lebanon !
For those of you interested in checking the paper, you can contact us or follow the link below.
https://www.mapress.com/j/zt/article/view/zootaxa.4976.1.1

28 May

Figure 1: A series of three consecutive Instagram posts on the number of recorded bee species of Lebanon in general and Tannourine in particular. Picture credits: Mira Boustani. Graphic designer: Loulia Tarabay.

UMONS
Université de Mons

Wild Bees of North Lebanon

annourine

What is a bee?
A bee is a flying insect from the order Hymenoptera that has two pairs of wings. **There are over 20,000 species of bees around the world**; the most known is the honeybee (*Apis mellifera*) which is domesticated.

Do all bees make honey?
Most wild bees prepare food for their larvae from pollen and nectar that they shape like a dough. Some wild bees like the Bumblebees also make honey, but they stock very small amounts that cannot be collected. Only honeybees make large amounts of honey that can be harvested.

So why are they important?
The most important service they provide is pollination. They are pollinators of most of our fruits and vegetables. Furthermore, they are necessary for the reproduction of large numbers of wild plants, making them a vital element in nature.

Do all bees sting?
No. Only females of larger species have painful stings, and only when provoked. There are also smaller bees that have non painful stings, and many species do not sting at all.

What do they eat?
Bees are florivores, which means they feed on flowers. Males and females forage to eat nectar whereas females also collect pollen to feed their larvae. They have a specialized pollen collecting brush that can be located on their hind legs or lower abdomen.

Where and when to find them?
Bees can often be found flying between flowers, especially on sunny days. They are most frequent in spring and early summer. In Lebanon, there are also species that fly during fall and winter.

And how long do they live?
Most wild bees are short lived. The adult life span is a few weeks during which the female spends most of her time building nests and preparing food reserves for her larvae. After metamorphosis and a more or less prolonged resting period, the young adults emerge, mate, and the cycle restarts.

Are all bees social?
No. Most bees are solitary, some are social like Bumblebees who live in colonies comparable to honeybees. Others are parasitic and lay their eggs in other bee nests.

How can I protect them?
Wild bees are great guests to have in your garden. To encourage them we can use less pesticides and provide nesting places such as unturned soil, wall cavities, or man-made insect hotels. Lebanon is famous for high wild flowers diversity, allowing wild flowers to grow undisturbed is a simple and effective way of conserving wild bees and honeybees. In fact, wild bees and honeybees share most of their food plants.

Qu'est-ce qu'une Abeille?
Une abeille est un insecte volant qui possède deux paires d'ailes. **Il existe plus de 20,000 espèces d'abeilles dans le monde;** la plus connue est l'abeille mellifère qui est domestiquée.

Est-ce que toutes les abeilles font du miel?
La majorité des abeilles sauvages préparent de la nourriture pour leurs larves à partir de pollen et de nectar appelé pain de pollen. Quelques abeilles sauvages comme les Bourdons font du miel mais en stockent de très petites quantités qui ne sont pas collectées. Les abeilles mellifères sont les seules à fabriquer assez de miel pour la récolte.

Alors pourquoi sont-elles importantes?
Le service le plus important que les abeilles fournissent est la pollinisation. Elles pollinisent nos fruits et légumes ainsi qu'une grande partie des plantes sauvages. Ceci fait d'elles un élément important pour les milieux naturels.

Est-ce que toutes les abeilles piquent?
Non. Uniquement les femelles des espèces les plus larges ont des piqûres douloureuses, et ne piquent que lorsqu'elles sont provoquées. D'autres petites abeilles ont des piqûres peu douloureuses, et beaucoup sont incapables de piquer.

Que mangent-elles?
Les abeilles sont des florivores, c'est-à-dire qu'elles se nourrissent des ressources florales. Les mâles butinent le nectar pour se nourrir tandis que les femelles collectent également le pollen pour leurs larves. Elles possèdent des brosses à pollen à la face inférieure de l'abdomen ou aux pattes arrière.

Ou et quand les retrouver?
On peut souvent retrouver les abeilles butinant de fleur en fleur, surtout pendant les jours ensoleillés. Elles sont très fréquentes au printemps et au début de l'été. Au Liban, il y a également des espèces qui volent en automne et en hiver.

Combien de temps vivent-elles?
La majorité des abeilles sauvages ont une durée de vie courte. La vie des adultes s'étend sur quelques semaines durant lesquelles les femelles passent une grande partie de leur temps à construire les nids et à préparer les réserves de nourriture pour leurs larves. Après la métamorphose et une période de repos de longueur variable, les jeunes adultes émergent, s'accouplent, et le cycle redémarre.

Les abeilles sont-elles toutes sociales?
Non. La majorité des abeilles sont solitaires. Certaines comme les bourdons vivent dans des colonies comme les abeilles mellifères, d'autres sont parasites et pondent leurs œufs dans le nid d'autres espèces.

Comment les proteger?
Les abeilles sauvages sont des visiteurs bénéfiques à votre jardin. Afin d'encourager leurs visites, on peut utiliser moins de pesticides, et prévoir des endroits où elles peuvent nidifier comme un sol non labouré, des trous dans les murs ou un hôtel à insectes. Au Liban, la diversité des plantes à fleurs sauvages est très élevée. Laisser pousser ces plantes dans le jardin est un moyen simple et efficace de participer à la conservation des abeilles sauvages et domestiques. En effet, les abeilles sauvages et domestiques partagent une grande partie de leurs ressources florales.

Melecta obscura (M)
شطرنجية داكنة
Mélècte noire
Black mourning bee
↑ 1-1.8 ↓

Nomada lucidula
الدبورية اللماعة
Nomade brillante
Bright Nomad bee
↑ 0.3-1.6 ↓

Bombus argillaceus (F)
الطنانة الطينية
Bourdon argilleux
Clay bumblebee
↑ 0.9-2.8 ↓

]

Bombus terrestris (F)

الطنانة الأرضية
Bourdon terrestre
Buff-tailed bumblebee

↑↓ 0.9-2.8

Amegilla albigena (F)

الزنانة السريعة بيضاء الخدود
Amégille à joues blanches
White-cheeked banded bee

↑↓ 0.8-2.4

Andrena sp. (F)

الرملية
Andrène
Mining bee

↑↓ 0.8-1.7

Anthidium sp. (F)

الشوكية
Anthidie
Wool carder bee

↑↓ 0.6-1.9

Anthophora aestivalis (F)

الزنانة الصيفية
Anthophore estivale
Summer flower bee

↑↓ 1-1.9

Anthophora atroalba (M)

زنانة القتاد
Anthophore de L'Astragale
Milkvetch flower bee

↑↓ 1-1.9

Chalicodoma parietina (F)

قاردة الجدران
Mégachile des murailles
Black Mud Dauber Bee

↑↓ 1.1-2

Eucera sp. (M)

القرناء
Eucère
Long-horned Bee

↑↓ 0.8-1.7

Habropoda hakkariensis (M)

زنانة هكاري
Habropode d'Hakkari
Hakkari digger bee

↑↓ 1-1.8

Habropoda tarsata (F)

زنانة عريضة الأرجل
Habropode à gros tarses
Large-legged digger bee

↑↓ 1-1.8

Habropoda zonatula (M)

زنانة مقلمة
Habropode bandée
Banded digger bee

↑↓ 1-1.8

Megachile sp. (M)

القارضة
Mégachile
Leaf cutter bee

↑↓ 0.9-1.7

Osmia sp.

أوسميا
Osmie
Mason bee

↑↓ 0.8-1.6

Xylocopa olivieri (M)

نقار أوليفيه
Xylocope d'Olivier
Olivier's carpenter bee

↑↓ 1.6-2

Xylocopa parviceps (M)

نقار صغير الرأس
Xylocope à petite tête
Small-headed carpenter bee

↑↓ 1.4-1.7

Acknowledgements
This poster has been realised in the context of studies on the bees of North Lebanon by Mira Boustani, under the direction of Professors Pierre Rasmont (University of Mons, Belgium) and Nabil Nemer (Holy Spirit University of Kaslik, Lebanon).
We thank Eng. Challitah Tanios Tannourine Cedar Forest Nature Reserve Director, Mrs Sandra Saba Horch Ehden Reserve Director, The Committee of Cedar Forest Friends and Secretary Eng. Charbel Tauk for their kind help and facilitation of field work.
We also thank all the people who contributed to the material of this poster.
All bee pictures taken by Pierre Rasmont.

Xylocopa valga (M)
نقار معكوس الأرجل
Xylocope panarde
Splayfooted carpenter bee
2-2.7

LEGEND

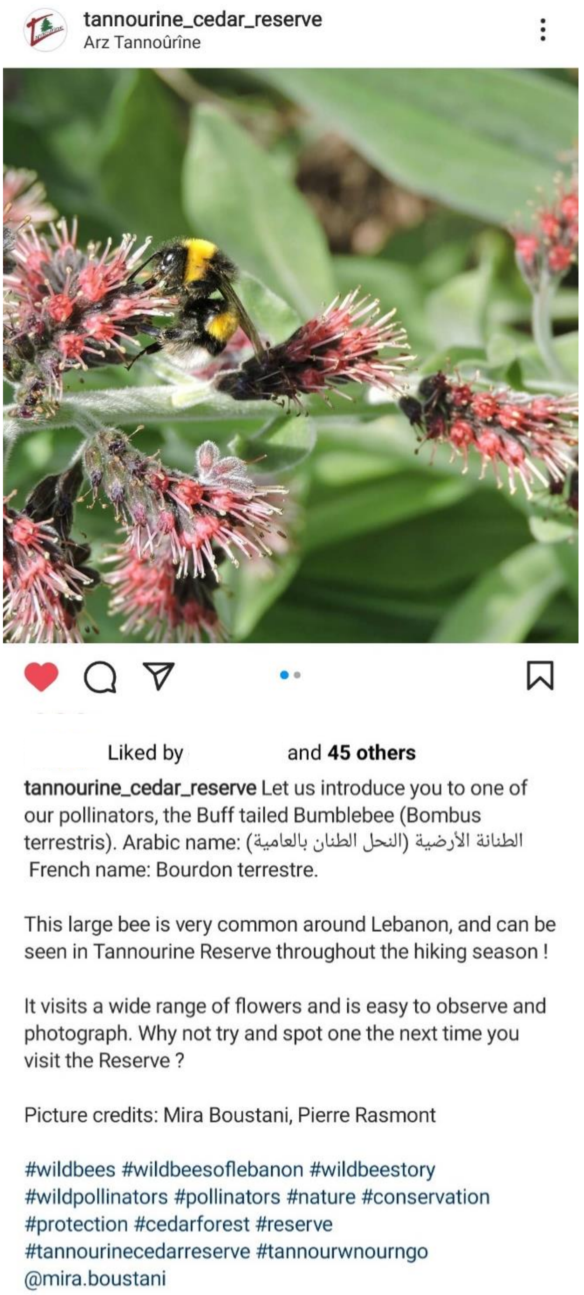
SOCIALITY
Parasitic
Social
Solitary

POLLEN LOAD
Hind leg Lower half
Full hind leg
Lower abdomen

SEX
M Male
F Female

SIZE
Length (cm)

Figure 2: A poster prepared for TCFNR and the other nature reserved of North Lebanon that introduces wild bees in French and English. We focus on some wild bee species and their main traits and give their Arabic, French and English common names. Picture credits: Pierre Rasmont. Graphic Designer: Joelle Abboud.



tannourine_cedar_reserve
Arz Tannoûrîne

Liked by and **45 others**

tannourine_cedar_reserve Let us introduce you to one of our pollinators, the Buff tailed Bumblebee (Bombus terrestris). Arabic name: (الطنانة الأرضية (النحل الطنان بالعامية
French name: Bourdon terrestre.

This large bee is very common around Lebanon, and can be seen in Tannourine Reserve throughout the hiking season !

It visits a wide range of flowers and is easy to observe and photograph. Why not try and spot one the next time you visit the Reserve ?

Picture credits: Mira Boustani, Pierre Rasmont

#wildbees #wildbeesoflebanon #wildbeestory #wildpollinators #pollinators #nature #conservation #protection #cedarforest #reserve #tannourinecedarreserve #tannourwnourngo @mira.boustani

Figure 3: Introduction to *Bombus terrestris* and common names. Credit of the photo displayed above: Mira Boustani.

tannourine_cedar_reserve
محمية ارز تنورين

Liked by and **60 others**

tannourine_cedar_reserve Let's have a little insight on these wild bees! 🐝👇🏻

- **Andrena** bees are among the most diverse wild bee groups, especially in the Mediterranean region

- These bees are solitary, nest in the soil and forage on a wide range of wild and cultivated flowers

- They are most abundant in spring, and can be found almost anywhere with flowers !

- A recent study has revised the **Andrena** bees of Lebanon, and introduced four new species for science from Lebanon

- Many of the 86 species of **Andrena** bees in Lebanon are present in Tannourine Forest Nature Reserve and surrounding areas.

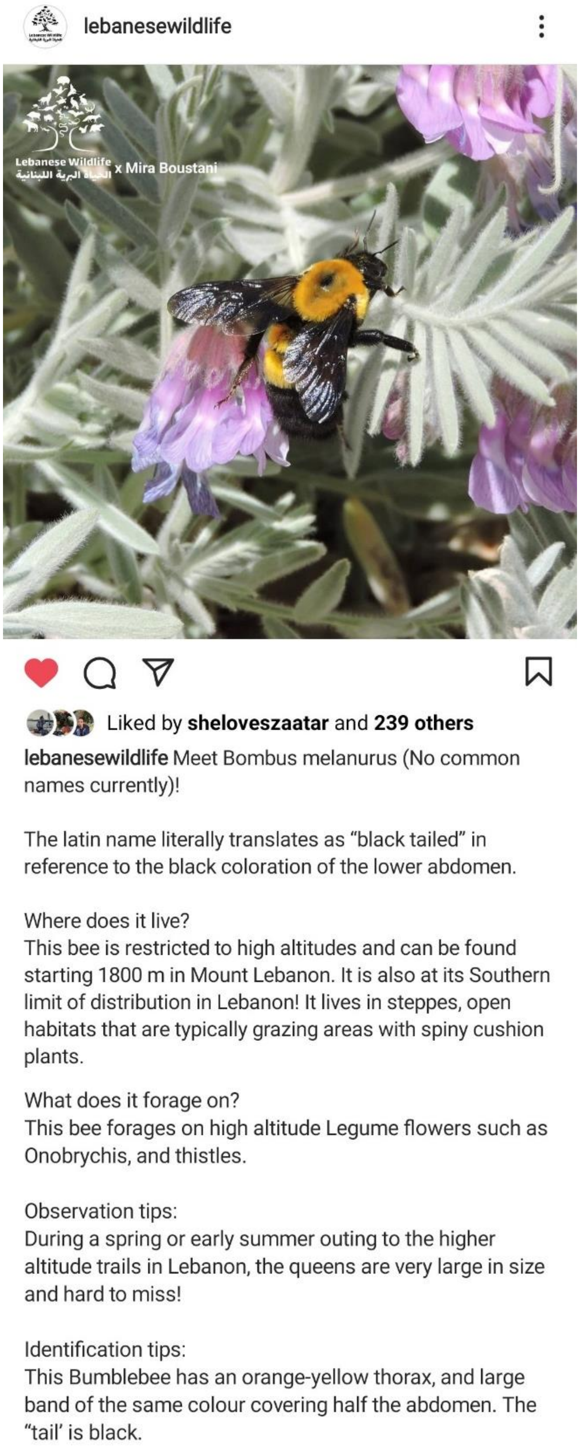
1st 📸: *Andrena flavipes* (female)
2nd 📸: *Andrena colletiformis* (male)

Figure 4: Introduction to *Andrena* of Lebanon in light of the study of Wood *et al*. (2020), see Annex 1. Photo credit: Pierre Rasmont.

II- Lebanese Wildlife NGO – Lebanon

"Lebanese Wildlife is an environmental conservation non-governmental organization (NGO) that initially began as an initiative in September 2018 and was established as an NGO in June 2020; registration number is #651. Lebanese Wildlife treats injured or orphaned local wildlife and returns them to their natural habitat upon full recovery. We continuously strive to improve the quality of local wildlife care and foster compassion within the community"

Instagram page link: https://www.instagram.com/lebanesewildlife/



Liked by **sheloveszaatar** and **239 others**

lebanesewildlife Meet Bombus melanurus (No common names currently)!

The latin name literally translates as "black tailed" in reference to the black coloration of the lower abdomen.

Where does it live?
This bee is restricted to high altitudes and can be found starting 1800 m in Mount Lebanon. It is also at its Southern limit of distribution in Lebanon! It lives in steppes, open habitats that are typically grazing areas with spiny cushion plants.

What does it forage on?
This bee forages on high altitude Legume flowers such as Onobrychis, and thistles.

Observation tips:
During a spring or early summer outing to the higher altitude trails in Lebanon, the queens are very large in size and hard to miss!

Identification tips:
This Bumblebee has an orange-yellow thorax, and large band of the same colour covering half the abdomen. The "tail' is black.

Figure 5: Brief introduction to *Bombus melanurus*. Photo credit: Mira Boustani.

Liked by **gboustani** and **263 others**

lebanesewildlife Bee or Fly?

Known as Hoverfly or Flower Fly, these bee mimicking flies belong to the family Syrphidae and are common throughout Lebanon.

So how to recognize them as flies?
(1) Look at those eyes! Fly eyes occupy a very large part of their head, even touching in the middle.
(2) Tiny antennae. Fly antennae are short and club shaped, both protruding from the same point in the middle of the face.
(3) A closer look at the wings. Contrary to bees that have two pairs of wings, flies only have one pair. Additionally, these two wings always form a triangle shape when the fly is at rest.

Apart from looking like bees, are they pollinators as well? Yes! These flies are very important pollinators, but their awesomeness doesn't stop here! The larvae are known to feed on plant pests such as aphids, making them welcome guests in gardens and orchards.

📷 @mira.boustani

.

Figure 6: Brief introduction to Syrphid flies and their resemblance to bees. Photo credit: Mira Boustani.

Arabic names for the Middle East and North Africa wild bees

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This section presents the context and methodology behind the creation of Arabic common names for the bees of the Middle East and North Africa (MENA) countries, some of which were used in vulgarisation and social media content. This is a work in progress choosing our Lebanon and Morocco as starting points. Both countries have highly diverse bee faunas that include many taxa from the MENA countries, allowing us to target a long species list that be useful between eastern and western Mediterranean Arabic speakers.

General context

Scientific names of all living organisms are in Latin. One of the most common ways of producing common names in re-adapting or translating the Latin name. This results in familiar sounds and easy to use names in countries where the first language has a Latin root such as French or many Latin words such as English. However, to Arabic speakers, Latin names sound alien, do not resemble familiar sounds, or hold any meaning.

Therefore, one of the most important steps in communication around wild bees for Arabic speakers would be producing Arabic common names for the local bees. This communication includes vulgarisation for the general public, communication through media, and introduction of bee species protection laws in legal text. One way of producing common names in re-adapting or translating the Latin name. This results in familiar sounds and easy to use names in countries where the first language has a Latin root such as French or many Latin words such as English. However, to Arabic speakers, Latin names sound alien, do not resemble familiar sounds, or hold any meaning.

Therefore, one of the most important steps in communication around wild bees for Arabic speakers would be producing Arabic common names for the local bees. This communication includes vulgarisation for the general public, communication through media, and introduction of bee species protection laws in legal text.

Methodology

We produced genera names, imitating the scientific name system in order to facilitate binomial designation of the species. We then produced Arabic names for the bee families as these were absent from literature to our knowledge using the most common genus in each family. Finally, we produced the species names by combining a unique species common name to the genus. The name explanation and justification are given in every case along with the common names in French and English. Furthermore, because French is widely spoken in the MENA countries, the work will be presented in both French and English.

We used several sources to create the common names for both genera and species:

- **Pre-existing common names**: In case it was already named and accurately referred to as a bee (*Xylocopa* for example are referred to as large Coleoptera in Lebanon), we listed the existing name. For example, for the genus *Bombus* الطنانة "*Al Tannana*" was already used in literature.

- **A literal translation or Arabization of the scientific or common names from other languages:** We used كوليتا "*Koulita*" for the genus *Colletes*, which is an arabisation of the Latin name and does not have a meaning but sounds like an Arabic word.

- **A name relative to a morphological trait:** For example, we suggest the name القرناء "*Al Karnaa*" for the genus *Eucera*, referring to the long antennae of the males.

- **A name relative to the habitat:** For the genus *Andrena*, we suggest the name رملية "*Ramliyya*", in reference to nesting in sandy soil.

Names validation

The suggested names are then reviewed for validation.

i) Validation by taxonomists to ensure that the names are relevant from a taxonomic or ecological point of view. This step is also important to produce names for the more challenging taxa with subtle differences where a good knowledge of the species is necessary to choose the most relevant criteria for the common names.

ii) Validation by a linguist to ensure that the linguistic base is correct. This step is also where better sounding synonyms can be chosen, or where the names can be shortened as Arabic is particularly challenging for producing compact names.

Examples

We present here the list of families and most important genera that were validated by Prof. Pierre Rasmont (University of Mons-Belgium), and Prof. Deniz Michez (University of Mons-Belgium), and some species examples from families Apidae which were validated by Prof. Pierre Rasmont (University of Mons-Belgium), and family Andrenidae validated by Dr.

Thomas Wood (University of Mons-Belgium). The names are being reviewed by Prof. Najwa Hamaoui (University of Mons-Belgium) for linguistic validation.

Table 1: List of suggested Arabic names for the main wild bee families

Family	**French**	**English**	**Arabic**	**Arabic in Latin script**	**Name Explantation**	**Name Justification**
Apidae	Apides	Apids	النحليات	*Al Nahliyyat*	Variation of the plural word of "*Nahel*" (*Apis*)	In reference to the genus *Apis* that includes honeybees (*Apis mellifera*) and which is the best known in this family.
Andrenidae	Andrenides	Andrenids	الرمليات	*Al Ramliyyat*	Plural of the genus name chosen for *Andrena* "*Al Ramliyya*", meaning the sandy, in reference to nesting in the sand	In reference to the genus with the most species in the family: *Andrena*
Megachilidae	Megachilides	Megachilids	القاردات	*Al Karidat*	Plural of genus name chosen for *Megachile* "*Al Karida*" meaning the "cutter"	In reference to the leaf-cutting behaviour for use in nest-building
Colletidae	Colletides	Colletids	الكوليتات	*Al Coulitat*	Plural of genus name chosen for *Colletes* "*Koulita*" which is an Arabisation of the Latin name	In reference to the genus with the most species in the family: *Colletes*
Halictidae	Halictides	Halictids	المفلوقات / مقوسات العرق	*Al Mafloukat*	Plural of the genus names of *Halictus* and *Lasioglossum*, meaning "split"	In reference to the smooth band of cuticle on the bottom of the female abdomen of *Halictus* and *Lasioglossum*
Mellitidae	Mellitides	Mellitids	المسرولات	*Al Mousarwalat*	Plural of the genus name chosen for *Dasypoda* "*Mousarwala*" meaning "wearing pants"	In reference to the scopa of the female *Dasypoda* that resembles pants

Table 2: List of suggested Arabic names for the main wild bee genera

Genus	**Family**	**French**	**English**	**Arabic**	**Arabic in latin script**	**Name Explantation**	**Name Justification**
Andrena sp.	Andrenidae	Andrène	Mining Bee	رملية	*Ramliyya*	Meaning “Sandy”	In reference to nesting in the sand "*Ramel*" (رمل)
Anthophora sp.	Apidae	Anthophore	Flower Bee	زنانة	*Zannana*	Meaning “talkative” in a noisy way	In reference to the noisy flight of *Anthophora*
Apis sp.	Apidae	Abeille mellifère	Honeybee	نحل العسل	*Nahel al Aasal*	Meaning honeybee	Name in literature
Bombus sp.	Apidae	Bourdon	Bumblebee	الطنانة	*Al Tannana*	Meaning “which bumbles”	Name in literature
Eucera sp.	Apidae	Eucère	Long-horned Bee	القرناء	*Al Karnaa*	Meaning “with horns”	In reference to the long antennae of the males
Melecta sp.	Apidae	Mélècte	Mourning Bee	شطرنجية	*Shataranjiyya*	A variation of the word شطرنج “*Shataranj*”, meaning chess board	In reference to the black and white pattern of *Melecta* resembling a chess board
Nomada sp.	Apidae	Nomade	Nomad	الدبورية	*Al Dabbouriyya*	A variation of the word دبور “*Dabbour*”, meaning a wasp	In reference to the wasp-like aspect of *Nomada*
Xylocopa sp.	Apidae	Xylocope / Perce-bois	Large Carpenter Bee	نقارة	*Nakkar*	Meaning “piercer”	In reference to wood nesting

Colletes sp.	Colletidae	Collète	Plasterer Bee	كوليتا	*Koulita*	"*Koulita*" is the Arabisation of the Latin name and holds no meaning in Arabic	
Hylaeus sp.	Colletidae	Hylée	Yellow-face Bees	المقنعة	*Al Moukannaa*	Meaning "the masked"	In reference to the mask-like aspect of the *Hylaeus* face coloration
Halictus sp. *Lasioglossum* sp.	Halictidae	Halicte	End-banded Furrow Bee	المفلوقة	*Al Maflouka*	Meaning "the split"	In reference to the smooth band of cuticle on the bottom of the female abdomen
Sphecodes sp.	Halictidae	Sphécode	Blood Bee	المفلوقة الطفيلية	*Al Maflouka al Toufayliyya*	Meaning "the split parasite" with المفلوقة "*Al Maflouka*": the split and طفيلية "*Toufayliyya*": parasite	Combining the name given to *Halictus* and *Lasioglossum* and parasite in reference to the parasitic genus
Anthidium sp.	Megachilidae	Anthidie	Banded Carder	الشوكية	*Al Shawkiyya*	Meaning "the thorny"	In reference to the spines at the bottom of the male abdomen
Hoplitis sp.	Megachilidae	Osmie	Mason Bee	بناءة	*Banna'a*	Meaning "the builder"	In reference to the nest built with mud and pebbles
Lithurgus sp.	Megachilidae	Lithurge	Forehead Bee	بارزة الجبين	*Barizat Al Jabin*	Meaning "with a protruding brow", with بارزة "*Bariza*": protruding and جبين "*Jabin*": brow	In reference to the protruding ridge between the eyes
Megachile sp.	Megachilidae	Mégachile	Leaf-cutter Bee	القارضة	*Al Karida*	Meaning "the cutter"	In reference to the leaf-cutting behaviour for use in nest-building

Table 3: List of suggested Arabic names for some *Bombus* species

Species	**French Name**	**English Name**	**Arabic Name**	**Arabic in latin script**	**Name Explanation**	**Name Justification**
Bombus terrestris	Bourdon terrestre	Buff-tailed Bumblebee	الطنانة الأرضية	*Al Tannana Al Ardiyya*	Meaning the "earthy bumblebee" with الطنانة "*Al Tannana*": "bumbles" and الأرضية "*Al Ardiyya*": of the Earth	Name in literature
Bombus argillaceus	Bourdon argilleux	Clay Bumblebee	الطنانة الطينية	*Al Tannana Al Tiniyya*	Meaning the "clay bumblebee" with الطنانة "*Al Tannana*": "bumbles" and طين "*Tin*": Clay	A translation on the Latin name
Bombus melanurus	Bourdon à queue noire	Oriental Black-tailed Bumblebee	الطنانة سوداء الذيل	*Al Tannana Sawdaa al Zayel*	Meaning the "black-tailed bumblebee" with الطنانة "*Al Tannana*": "bumbles", سوداء "*Sawda'a*": black, and ذيل "*Zayl*": Tail	A translation on the Latin name and common names and in reference to the black sternites at the end of the abdomen

Table 4: List of suggested Arabic names for some *Andrena* species

Species	**French Name**	**English Name**	**Arabic Name**	**Arabic in Latin script**	**Name Explanation**	**Name Justification**
Andrena albopunctata	Andrène à points blancs	White Spotted Mining Bee	رملية بيضاء النقاط	*Ramliyya Bayda'a Al Nikat*	Meaning "the sandy with white spots" with رملية "*Ramliyya*": sandy, بيضاء "*Bayda'a*": white, and نقاط "*Nikat*": spots	A literal transition of the Latin name
Andrena labialis	Andrène du Trèfle	Large Meadow Mining Bee	رملية النفل	*Ramliyyat Al Nafel*	Meaning "the sandy of the *Trifolium*" with رملية "*Ramliyya*": sandy and نفل "*Nafel*"; *Trifolium*	A literal transition of the French common name and in reference to a foraged flower preference
Andrena minapalumboi	Andrène de Minapalumbo	Dark-tailed Cabbage Mining Bee	رملية الكرنب سوداء الذيل	*Ramliyyat Al Karnab Sawda'a Al Zayel*	Meaning the "dark-tailed sandy of the Cabbage", with the *Trifolium*" with رملية "*Ramliyya*": sandy, كرنب "*Karnab*": cabbage, سوداء "*Sawda'a*": black, and لذيل "*Zayel*": tail	A literal transition of the English common name and in reference to a foraged flower preference and black sternites at the end of the abdomen

Supplementary material

View of the Wadi Ain El Raha valley form Tannourine Cedar Forest Nature Reserve. Picture by Xavier van Achter.

Supplementary material for Chapter 1, part 2

Boustani M., Yammine W., Nemer N., Abou Fakhr Hammad E., Michez D. & Rasmont P. (2020) Distribution and flower visitation records of bumblebees in Lebanon (Hymenoptera: Apidae). *Annales de la Société entomologique de France (N.S.)*. 56(2), 115–124. https://doi.org/10.1080/00379271.2020.1749885

Supporting Information Appendix S1

Male cephalic labial gland secretions analysis

In order to verify the morphological subspecies identification for *Bombus terrestris*, we used CLGS, an eco-chemical trait involved in bumblebee pre-mating recognition (Baer, 2003; Ayasse & Jarau, 2014). These secretions are complex mixtures of mainly aliphatic compounds synthesized by male cephalic labial glands (Coppée et al., 2008; Lecocq et al., 2011; Žacek et al., 2013) and are commonly used for resolving species differentiation issues, and have been successful in differentiating *B. terrestris* subspecies (Lecocq et al., 2015; Lecoq et al, 2016; Martinet et al, 2018).

We identified the main component as the compound that had the highest relative area (RA) among all compounds of CLGSs at least in one specimen of the taxon. We extracted the CLGS with 400 μL of n-hexane, according to De Meulemeester et al. (2011). Samples were stored at−20∘C prior to the analyses. We quantified the CLGS compounds with a gas chromatograph Shimadzu GC-2010 system (GC-FID) equipped with a nonpolar SLB-5ms capillary column [5% phenyl (methyl) polysiloxane stationary phase; column length 30m; inner diameter0.25 mm; film thickness 0.25 μm] and a flame ionization detector. We quantified the peak areas of compounds in GC solution postrun (Shimadzu Corporation) with automatic peak detection and noise measurement. The relative areas (RAs, expressed in %) of compounds in each sample were calculated by dividing the peak areas of compounds by the total area of all compounds. We excluded compounds for which RA were less than 0.1% for all specimens (De Meulemeester et al., 2011). The data matrix for each taxon was based (Appendix S2) on the alignment ofeach relative proportion of compound between all samples performed with GCA ligner 1.0 (Dellicour & Lecocq, 2013a,b).For GC-FID analyses, we injected 1 μL, using a splitless injection mode (injector temperature of 220∘C) and helium as carrier gas (1mL/min, constant velocity of 50 cm/s).The oven temperature (of the column) was programmed isothermally, starting at 70∘C for 2min and then rising from 70 to320∘C at a rate of 10∘C/min. The temperature was then held at320∘C for 5min.

In order to facilitate the alignment of compounds and their identification, before each sample injection, a standard (Kovats) was injected containing a mix of hydrocarbons (alkanes) fromC10 (decane) to C40 (tetracontane). Kovats indices were calculated with GC Kovats 1.0 according to the method described by Dellicour & Lecocq (2013 a,b).

We performed statistical comparative analyses of the CLGSs using R environment (R Development Core Team, 2013) to detect CLGS differentiations including the Lebanese *Bombus terrestris* specimens. We used a clustering method, computed with the unweighted pair-group method with average linkage (UPGMA) based on correlation distance matrices (RA of each compound) (R package ape; Legendre & Legendre, 2004; Paradis et al., 2004), to detect the divergence between taxa in the CLGS composition. We assessed CLGS differentiations of the 5 Lebanese specimens to the 9 Sicilian *Bombus terretris calabricus* of the same cluster using a multiple response permutation procedure (MRPP) (R-package vegan, Oksanen et al., 2011).

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Supplementary material for
Chapter 1, part 2

Boustani, M., Rasmont, P., Dathe, H.H., Ghisbain, G., Kasparek, M., Michez, D., Mueller, A., Pauly, A., Risch, S., Straka, J., Terzo, M., Van Achter, X., Wood, T.J. & Nemer, N. (2021) The bees of Lebanon (Hymenoptera: Apoidea: Anthophila). *Zootaxa*. 4976(1), 001–146. https://doi.org/10.11646/zootaxa.4976.1.1

ANNEX III. List of species of the Lebanese bee fauna with distribution category, the presence in literature or material examined, and the listing in annexes I and II.

Taxon	Endemic	Levant	East Mediterranean	West palearctic	Palearctic	New to Lebanon	Material Examined	Literature	ANNEX I	ANNEX II
Colletes cariniger			X			X	X			
Colletes caskanus				X		X	X			
Colletes mlokossewiczi					X	X	X			
Colletes nasutus				X		X	X			
Colletes similis					X		X	X		
Colletes tuberculatus					X	X	X			
Hylaeus armeniacus			X			X	X			
Hylaeus clypearis				X		X	X			
Hylaeus communis					X	X	X			
Hylaeus cornutus				X		X	X			
Hylaeus crispulus			X			X	X			
Hylaeus damascenus				X		X	X			
Hylaeus imparilis					X	X	X			
Hylaeus iranicus			X			X	X			
Hylaeus kahri				X		X	X			
Hylaeus kotschisus			X			X	X			
Hylaeus lineolatus				X		X	X			
Hylaeus longimacula				X		X	X			
Hylaeus meridionalis					X	X	X			
Hylaeus pictus				X		X	X			
Hylaeus punctulatissimus				X		X	X			
Hylaeus punctus				X		X	X			
Hylaeus rugicollis			X			X	X			
Hylaeus sidensis			X			X	X			

Hylaeus soror				X		X	X			
Hylaeus styriacus					X	X	X			
Hylaeus syriacus			X			X	X			
Hylaeus taeniolatus				X		X	X			
Hylaeus variegatus					X	X	X			
Andrena abruptifovea		X						X		
Andrena albopunctata					X			X		
Andrena alfkenella				X				X		
Andrena alfkenelloides				X				X		
Andrena anatolica				X				X		
Andrena aruana		X						X		
Andrena asiatica			X					X		
Andrena bicolor					X			X		
Andrena bisulcata				X				X		
Andrena brumanensis				X				X		
Andrena bytinskii			X					X		
Andrena cedricola		X						X		
Andrena christineae			X					X		
Andrena colletiformis					X			X		
Andrena cyanomicans				X				X		
Andrena dauma			X					X		
Andrena doursana				X				X		
Andrena elmaria			X					X		
Andrena exquisita			X					X		
Andrena flavipes					X			X		
Andrena forsterella				X				X		
Andrena freidbergi		X						X		
Andrena fuligula			X					X		
Andrena fulvitarsis				X				X		
Andrena fuscosa					X			X		

Andrena gallinula			X					X		
Andrena garrula			X					X		
Andrena hesperia					X			X		
Andrena hova			X					X		
Andrena humabilis		X						X		
Andrena humilis					X			X		
Andrena isabellina			X					X		
Andrena krausiella		X						X		
Andrena labialis					X			X		
Andrena labiata					X			X		
Andrena leucopsis				X		X	X			
Andrena limata					X			X		
Andrena lindbergella			X					X		
Andrena magunta				X				X		
Andrena medeninensis				X				X		
Andrena melittoides			X					X		
Andrena merula			X					X		
Andrena minutula				X				X		
Andrena minutuloides				X				X		
Andrena monacha			X					X		
Andrena morio					X			X		
Andrena nigroaenea					X			X		
Andrena oedicnema			X					X		
Andrena optata				X				X		
Andrena orientana				X				X		
Andrena ovatula aggregate				X				X		
Andrena pallidicincta			X					X		
Andrena panurgimorpha			X					X		
Andrena pilipes					X			X		
Andrena pinkeunia		X						X		

Andrena prodigiosa	X							X		
Andrena pyropygia					X			X		
Andrena rotundilabris			X					X		
Andrena rufitibialis			X					X		
Andrena rufomaculata			X					X		
Andrena rufula				X				X		
Andrena rugothorace				X				X		
Andrena rugulosa				X		X	X			
Andrena rusticola			X					X		
Andrena schencki					X			X		
Andrena scrophulariae	X							X		
Andrena serraticornis			X					X		
Andrena sigiella		X						X		
Andrena similis				X				X		
Andrena simontornyella				X				X		
Andrena sphecodimorpha				X				X		
Andrena spreta aggregate				X				X		
Andrena statusa			X					X		
Andrena stenofovea		X						X		
Andrena thomsoni				X				X		
Andrena thoracica					X			X		
Andrena tiaretta				X				X		
Andrena torda			X					X		
Andrena transitoria					X			X		
Andrena trimmerana				X				X		
Andrena tringa				X				X		
Andrena tscheki				X				X		
Andrena ungeri				X				X		
Andrena unicincta			X					X		
Andrena unifasciata		X						X		

Andrena variabilis					X			X		
Andrena ventricosa				X				X		
Andrena vetula					X			X		
Panurgus posticus			X				X	X		
Panurgus pyropygus			X					X		
Melitturga praestans				X				X		
Halictus aegypticola			X				X	X		
Halictus asperulus				X		X	X			
Halictus berlandi			X				X	X		
Halictus beytueschebapensis			X			X	X			
Halictus brunnescens					X	X	X			
Halictus fatsensis			X			X	X			
Halictus galilaeus					X	X	X			
Halictus hermon		X				X	X			
Halictus maculatus					X	X	X			
Halictus patellatus				X		X	X			
Halictus resurgens				X		X	X			
Halictus sexcinctus				X		X	X			
Halictus squamosus			X				X	X		
Halictus subalfkenellus			X				X	X		
Halictus tetrazonianellus				X			X	X		
Seladonia cephalica			X				X	X		
Seladonia phryganica			X			X	X			
Seladonia pollinosa					X	X	X			
Seladonia seladonia					X	X	X			
Seladonia subaurata				X			X	X		
Seladonia submediterranea				X		X	X			
Seladonia tuberculata			X				X	X		
Seladonia vestita				X		X	X			
Lasioglossum adaliae			X			X	X			

Lasioglossum aegyptiellum				X		X	X			
Lasioglossum algericolellum				X		X	X			
Lasioglossum algirum					X	X	X			
Lasioglossum anellum				X		X	X			
Lasioglossum angusticeps				X		X	X			
Lasioglossum annulipes					X	X	X			
Lasioglossum bluethgeni				X		X	X			
Lasioglossum brevicorne				X		X	X			
Lasioglossum caspicum					X	X	X			
Lasioglossum clypeare				X		X	X			
Lasioglossum clypeiferellum			X			X	X			
Lasioglossum convexiusculum				X		X	X			
Lasioglossum corvinum				X		X	X			
Lasioglossum costulatum				X		X	X			
Lasioglossum crassepunctatum				X		X	X			
Lasioglossum cristula				X		X	X			
Lasioglossum damascenum				X		X	X			
Lasioglossum discum				X		X	X			
Lasioglossum dolichocephalum				X		X	X			
Lasioglossum elatum			X			X	X			
Lasioglossum enslini		X					X	X		
Lasioglossum epipygiale				X		X	X			
Lasioglossum filipes					X	X	X			
Lasioglossum glabriusculum				X		X	X			
Lasioglossum griseolum				X		X	X			
Lasioglossum hethiticum				X		X	X			
Lasioglossum interruptum				X		X	X			
Lasioglossum iranicum			X			X	X			
Lasioglossum israelense			X			X	X			
Lasioglossum kussariense				X		X	X			

Lasioglossum laeve				X		X	X			
Lasioglossum laevidorsum				X		X	X			
Lasioglossum laevinode				X		X	X			
Lasioglossum laticeps				X		X	X			
Lasioglossum leucozonium					X	X	X			
Lasioglossum limbelloides			X				X	X		
Lasioglossum lineare				X		X	X			
Lasioglossum longirostre			X			X	X			
Lasioglossum lucidulum					X	X	X			
Lasioglossum malachurum				X		X	X			
Lasioglossum marginatum					X	X	X			
Lasioglossum mesosclerum				X		X	X			
Lasioglossum montifringillum			X			X	X			
Lasioglossum morio				X		X	X			
Lasioglossum nigripes				X		X	X			
Lasioglossum nitidiusculum				X		X	X			
Lasioglossum pallens				X		X	X			
Lasioglossum politum					X	X	X			
Lasioglossum pseudolittorale			X					X		
Lasioglossum pseudosphecodimorphum			X			X	X			
Lasioglossum punctatissimum				X		X	X			
Lasioglossum puncticolle				X		X	X			
Lasioglossum pygmaeum				X		X	X			
Lasioglossum semiaeneum					X	X	X			
Lasioglossum soror				X		X	X			
Lasioglossum subaenescens				X		X	X			
Lasioglossum subfasciatum				X		X	X			
Lasioglossum tadschicum					X	X	X			
Lasioglossum transitorium				X		X	X			

Lasioglossum truncaticolle				X		X	X			
Lasioglossum villosulum					X	X	X			
Lasioglossum xanthopus				X		X	X			
Thrincohalictus prognathus			X				X	X		
Sphecodes barbatus			X			X	X			
Sphecodes dusmeti					X	X	X			
Sphecodes gibbus					X	X	X			
Sphecodes monilicornis					X	X	X			
Sphecodes pellucidus					X	X	X			
Sphecodes puncticeps					X	X	X			
Sphecodes spinulosus					X	X	X			
Nomiapis diversipes					X	X	X			
Nomiapis equestris			X				X	X		
Pseudapis nilotica				X				X		
Nomioides minutissimus					X	X	X			
Dasypoda spinigera				X		X	X			
Lithurgus chrysurus				X				X		
Chelostoma aegaeicum			X			X	X			
Chelostoma bytinskii		X				X				
Chelostoma diodon			X			X	X			
Chelostoma comosum			X					X		
Chelostoma foveolatum				X		X	X			
Chelostoma lucens			X			X	X			
Chelostoma maidli			X			X	X			
Chelostoma mocsaryi					X	X	X			
Chelostoma schlettereri			X					X		
Chelostoma ventrale				X		X	X			
Heriades clavicornis					X			X		
Heriades punctulifera				X			X	X		
Heriades rubicola				X		X	X			

Heriades truncorum					X	X	X			
Stenoheriades levantica		X					X	X		
Hoplitis acuticornis					X	X	X			
Hoplitis annulata				X			X	X		
Hoplitis bisulca				X		X	X			
Hoplitis campanularis				X		X	X			
Hoplitis ciliaris				X		X	X			
Hoplitis daniana			X			X	X			
Hoplitis duckeana				X		X	X			
Hoplitis libanensis		X						X		
Hoplitis lysholmi		X						X		
Hoplitis obtusa				X			X	X		
Hoplitis pallicornis				X		X	X			
Hoplitis pici				X			X			
Hoplitis praestans				X		X	X			
Hoplitis lebanotica			X					X		
Hoplitis unispina			X			X	X			
Hoplitis yermasoyiae				X				X		
Osmia amathusica				X		X	X			
Osmia andrenoides				X		X	X			
Osmia aquila			X			X	X			
Osmia aurulenta				X			X	X		
Osmia avosetta			X				X	X		
Osmia bicornis				X		X	X			
Osmia bidentata				X		X	X			
Osmia breviata			X			X	X			
Osmia caerulescens				X		X	X			
Osmia cephalotes				X		X	X			
Osmia clypearis			X			X	X			
Osmia cornuta				X		X	X			

Osmia difficilis					X		X	X		
Osmia dilaticornis				X		X	X			
Osmia dimidiata				X			X	X		
Osmia distinguenda				X		X	X			
Osmia forticornis				X		X	X			
Osmia gutturalis			X			X	X			
Osmia kuznetzovi				X		X	X			
Osmia labialis				X		X	X			
Osmia melanogaster				X		X	X			
Osmia mirhiji			X					X		
Osmia moreensis				X		X	X			
Osmia mustelina				X			X	X		
Osmia nana				X			X	X		
Osmia nigrohirta				X		X	X			
Osmia niveata				X			X	X		
Osmia oramara				X		X	X			
Osmia rhodoensis				X			X	X		
Osmia rufohirta				X		X	X			
Osmia saxicola					X	X	X			
Osmia scutellaris				X		X	X			
Osmia signata				X		X	X			
Osmia spinigera				X				X		
Osmia subcornuta					X	X	X			
Osmia submicans				X			X	X		
Osmia sybarita				X		X	X			
Osmia teunisseni				X		X	X			
Osmia thoracica				X		X	X			
Osmia versicolor				X			X	X		
Protosmia glutinosa				X		X	X			
Protosmia longiceps			X				X	X		

Protosmia monstrosa				X			X	X		
Protosmia paradoxa			X					X		
Protosmia tiflensis				X		X	X			
Afranthidium lebanense			X					X		
Afranthidium pusillum					X		X	X		
Anthidiellum troodicum				X			X	X		
Anthidiellum strigatum				X			X	X		
Anthidium christianseni			X				X	X		
Anthidium syriacum		X					X	X		
Anthidium diadema				X		X	X			
Anthidium florentinum				X			X	X		
Anthidium gussakovskiji				X		X	X			
Anthidium loti				X			X	X		
Anthidium manicatum					X		X	X		
Anthidum venustum				X				X		
Anthidium rotundum			X				X	X		
Anthidium spiniventre					X	X	X	X		
Anthidium taeniatum				X		X	X			
Anthidium trispinosum				X		X	X			
Anthidium undulatiforme				X		X	X			
Anthidium undulatum				X			X	X		
Anthidium wuestneii				X			X	X		
Eoanthidium hoplostomum			X					X		
Eoanthidium insulare				X			X	X		
Eoanthidium judaeense			X				X	X		
Icteranthidium cimbiciforme				X		X	X	X		
Icteranthidium fedtschenkoi				X				X		
Icteranthidium grohmanni				X			X	X		
Pseudoanthidium aff. cribratum				X				X		
Pseudoanthidium melanurum				X				X		

Pseudoanthidium reticulatum				X			X	X		
Pseudoanthidium stigmaticorne				X		X	X			
Rhodanthidium aculeatum			X				X	X		
Rhodanthidium caturigense				X			X	X		
Rhodanthidium exsectum				X				X		
Rhodanthidium septemdentatum				X			X	X		
Stelis denticulata		X				X	X			
Stelis minuta				X				X		
Stelis nasuta				X				X		
Stelis ruficornis			X					X		
Stelis signata				X				X		
Trachusa verhoeffi			X					X		
Coelioxys argenteus				X		X	X			
Megachile albisecta				X		X	X			
Megachile albonotata					X	X	X			
Megachile apicalis				X		X	X			
Megachile burdigalensis				X		X	X			
Megachile inexspectata				X		X	X			
Megachile doriae			X				X	X		
Megachile ericetorum				X			X	X		
Megachile flabellipes				X		X	X			
Megachile foersteri				X			X	X		
Megachile giraudi					X	X	X			
Megachile hirsuta					X	X	X			
Megachile hungarica			X			X	X			
Megachile lagopoda					X			X		
Megachile monstrifica				X				X		
Megachile leucomalla				X		X	X			
Megachile manicata				X			X	X		

Megachile montenegrensis					X	X	X			
Megachile parietana				X			X	X		
Megachile pilicrus				X		X	X			
Megachile pilidens				X		X	X			
Megachile pyrenaica					X	X	X			
Megachile sanguinipes				X		X	X			
Megachile sicula				X		X	X			
Xylocopa iris					X		X	X		
Xylocopa olivieri				X		X	X			
Xylocopa parviceps					X	X	X			
Xylocopa pubescens				X		X	X			
Xylocopa rufa				X		X	X			
Xylocopa valga				X		X	X			
Xylocopa varentzowi					X	X	X			
Xylocopa violacea					X	X	X			
Ceratina acuta				X		X	X			
Ceratina bispinosa				X			X	X		
Ceratina chalcites				X		X	X			
Ceratina chalybea				X		X	X			
Ceratina cucurbitina				X			X	X		
Ceratina dallatorreana				X		X	X			
Ceratina denesi			X			X	X			
Ceratina dentiventris				X		X	X			
Ceratina mandibularis				X			X	X		
Ceratina moricei				X			X	X		
Ceratina nigroaenea				X		X	X			
Ceratina nigrolabiata				X		X	X			
Ceratina parvula				X		X	X			
Ceratina sakagamii				X		X	X			
Ceratina schwarzi				X		X	X			

Ceratina schwarziana			X			X	X			
Ceratina tibialis				X		X				
Exoneuridia libanensis		X					X	X		
Ancyla asiatica				X				X		
Ancyla stolli				X				X		
Nomada babiyi				X		X	X			
Nomada basalis				X		X	X	X		
Nomada bispinosa					X	X	X			
Nomada distinguenda				X		X	X			
Nomada fucata					X	X	X			
Nomada fuscipennis				X		X	X			
Nomada integra				X		X	X			
Nomada israelis		X				X	X			
Nomada lucidula			X			X	X			
Nomada nobilis				X		X	X			
Nomada pallispinosa				X		X	X			
Nomada propinqua				X		X	X			
Nomada radoszkowskii					X	X	X			
Nomada striata					X	X	X			
Nomada trispinosa					X	X	X			
Nomada yermasoyiae			X			X	X			
Ammobates latitarsis			X					X		
Ammobates oraniensis				X		X	X			
Ammobates punctatus				X		X	X			
Eucera aeolopus			X			X	X			
Eucera albofasciata				X		X	X			
Eucera alternans				X		X	X			
Eucera caerulescens			X				X	X		
Eucera cinnamomea		X				X	X			
Eucera clypeata				X		X	X			

Eucera cypria			X			X	X			
Eucera dalmatica				X		X	X			
Eucera ebmeri			X			X	X			
Eucera fasciata				X		X	X			
Eucera friesei			X			X	X			
Eucera gaullei			X			X	X			
Eucera helvola				X			X	X		
Eucera hermoni		X				X	X			
Eucera hungarica				X		X	X			
Eucera interrupta				X		X	X			
Eucera laxiscopa			X			X	X			
Eucera longicornis					X	X	X			
Eucera nigrifacies				X		X	X			
Eucera nigripes			X			X	X			
Eucera obsoleta				X		X	X			
Eucera palaestinae			X			X	X			
Eucera parnassia			X			X	X			
Eucera penicillata			X			X	X			
Eucera pici			X			X	X			
Eucera plumigera				X		X	X			
Eucera punctulata				X		X	X			
Eucera spinipes			X			X	X			
Eucera squamosa				X		X	X			
Eucera syriaca			X			X	X			
Eucera taurica					X	X	X			
Eucera vulpes				X		X	X			
Eucera wattsi		X					X	X		
Eucera zeta				X		X	X			
Tetralonia graja				X			X	X		
Tetralonia malvae					X	X	X			

Tetralonia nigriceps				X		X	X			
Tetralonia scabiosae				X		X	X			
Amegilla albigena					X	X	X			
Amegilla fasciata				X			X	X		
Amegilla garrula				X		X	X			
Amegilla montivaga				X		X	X			
Amegilla quadrifasciata				X		X	X			
Amegilla salviae				X		X	X			
Amegilla savignyi				X		X	X	X		
Amegilla velocissima					X	X	X			
Anthophora harmalae					X			X		
Anthophora aestivalis				X		X	X			
Anthophora affinis				X		X	X			
Anthophora agama				X		X	X			
Anthophora bifasciata				X		X	X			
Anthophora canescens				X		X	X			
Anthophora concinna			X					X		
Anthophora crinipes					X	X	X			
Anthophora dalmatica				X		X	X			
Anthophora dispar				X		X	X			
Anthophora dufourii				X		X				
Anthophora heliopolitensis		X						X		
Anthophora mucida				X		X	X			
Anthophora nigriceps				X			X	X		
Anthophora orientalis					X	X	X			
Anthophora pedata				X		X	X			
Anthophora plagiata					X	X	X			
Anthophora plumipes					X	X	X			
Anthophora ponomarevae				X		X	X			
Anthophora robusta					X		X	X		

Anthophora rogenhoferi				X			X	X		
Anthophora sagemehli					X	X	X			
Anthophora socia				X				X		
Habropoda hakkariensis			X			X	X			
Habropoda tarsata					X	X	X			
Habropoda zonatula				X		X	X			
Melecta aegyptiaca				X				X		
Melecta albifrons				X				X		
Melecta fulgida				X				X		
Melecta guichardi				X				X		
Melecta obscura				X		X	X			
Melecta transcaspica				X				X		
Melecta tuberculata				X				X		
Thyreus histrionicus				X				X		
Thyreus ramosus					X			X		
Bombus argillaceus					X		X	X		
Bombus melanurus					X		X	X		
Bombus niveatus vorticosus					X		X	X		
Bombus terrestris calabricus					X		X	X		
Apis mellifera					X					
Hylaeus angustatus				X				X	X	
Hylaeus brevicornis					X			X	X	
Hylaeus gredleri				X				X	X	
Hylaeus maculatus				X					X	
Hylaeus punctatus				X				X	X	
Hylaeus rubicola				X					X	
Hylaeus trifidus				X					X	
Andrena bassana			X						X	
Andrena canae			X						X	
Andrena combinata					X				X	

Andrena dorsata					X				X	
Andrena erythrocnemis				X					X	
Andrena falcinella			X						X	
Andrena grandilabris			X						X	
Andrena hyacinthina			X						X	
Andrena iliaca			X						X	
Andrena kilikiae			X						X	
Andrena lepida					X				X	
Andrena mucida				X					X	
Andrena nisoria			X						X	
Andrena nitidiuscula				X					X	
Andrena pandosa				X					X	
Andrena polita				X					X	
Andrena tadauchii				X					X	
Andrena toelgiana			X						X	
Andrena truncatilabris					X				X	
Andrena ulula			X						X	
Andrena urdula				X					X	
Andrena venerabilis			X						X	
Camptopoeum nigrotus					X				X	
Camptopoeum sacrum					X				X	
Camptopoeum variegatum					X				X	
Rophites algirus				X				X	X	
Dufourea cypria		X							X	
Lasioglossum calceatum				X				X	X	
Lasioglossum debilior				X					X	
Lasioglossum euboeense				X				X	X	
Lasioglossum ituraeum				X				X	X	
Lasioglossum vagans					X				X	
Seladonia gemmea				X				X	X	

Dasypoda pyriformis				X				X	X	
Chelostoma forcipatum			X						X	
Stenoheriades asiatica			X						X	
Hoplitis erythrogastra				X					X	
Hoplitis semirubra		X						X	X	
Osmia laticauda			X						X	
Osmia hellados				X					X	
Osmia signata				X					X	
Ochreriades fasciatus		X						X	X	
Anthidium tesselatum				X				X	X	
Icteranthidium ferrugineum				X					X	
Pseudoanthidium octodentatum				X					X	
Stelis annulata				X					X	
Stelis simillima				X				X	X	
Coelioxys aurolimbata				X				X	X	
Megachile communis				X					X	
Megachile lefebvrei				X					X	
Megachile schmiedeknechti				X					X	
Megachile rubrimana				X					X	
Nomada glaberrima				X				X	X	
Nomada caspia					X				X	
Nomada confinis				X				X	X	
Nomada fenestrata					X				X	
Epeolus bischoffi			X						X	
Ceratina bifida				X				X	X	
Ceratina zwakhalsi			X					X	X	
Ammobatoides abdominalis				X				X	X	
Eucera alfkeni			X						X	
Eucera baal		X						X	X	

Eucera bidentata				X					X	
Eucera nigrescens					X				X	
Eucera nigrita				X					X	
Amegilla punctifrons			X						X	
Anthophora atricilla				X			X		X	
Anthophora atroalba				X					X	
Anthophora biciliata				X					X	
Anthophora blanda				X					X	
Anthophora hispanica				X				X	X	
Melecta ashabadensis					X			X	X	
Melecta festiva				X				X	X	
Melecta luctuosa				X					X	
Panurgus cavannae										X
Halictus atrovirens										X
Protosmia asensioi										X
Xylocopa hottentotta										X

Supplementary material for
Annex I

Wood, T.J., **Boustani M.**, & Rasmont P. (2020) A revision of the *Andrena* (Hymenoptera: Andrenidae) of Lebanon with the description of six new species. *Annales de la Société entomologique de France (N.S.)*. 56(4), 279–312. https://doi.org/10.1080/00379271.2020.1794960

APPENDIX I. Site-specific details and geographic co-ordinates for localities reported in this study. Data marked in red was inferred based on label information and does not represent the precise position of the collecting locality

APPENDIX II. Unconfirmed Andrena species reported from Lebanon

APPENDIX I. Site-specific details and geographic co-ordinates for localities reported in this study. Data marked in red was inferred based on label information and does not represent the precise position of the collecting locality

				Decimal degrees (WSG84)			
Governorate	**Locality**	**Toponym**	**Altitude (meters above sea level)**	**Latitude N**	**Longitude E**	**Position in Fig. 1**	**Notes**
Beirut	Beirut	American University of Beirut	100	33.9005	35.4784		
Beirut	Beirut		100	33.8719	35.5097		
Bekaa	Ainata		1556	34.1008	36.0413		
Bekaa	Haouch Snaid	American Univeristy of Beirut Farm	1000	33.9267	36.0621		Located in Hoch Sneid (Bekaa)
Bekaa	Anjar		950	33.7258	35.9297		
Bekaa	Baalbeck	Hoch Sneid	1000	34.0000	36.2000		
Bekaa	Bawarij		1000	33.8167	35.8167		
Bekaa	Der El Ahmar		989	34.0662	36.1487		
Bekaa	Kefraya	Horch El Kaser	992	33.6595	35.7422		
Bekaa	Kefraya		1009	33.7134	35.7611		
Bekaa	Kefraya		1101	33.6786	35.7383		
Bekaa	Quaraoun		792	33.5669	35.7193	Location 6	'Quaraoun (Lake)
Bekaa	Ras Baalbeck		1000	34.3000	36.4167		
Bekaa	West Bekaa	Ammiq	871	33.7326	35.7834		
Mount Lebanon	Baabdate		1100	33.8911	35.6725		
Mount Lebanon	Barja	Marj Barja Daher	350	33.6513	35.4587		
Mount Lebanon	Barja	Terbe	326	33.6498	35.4605		
Mount Lebanon	Bentael		337	34.1378	35.6966		
Mount Lebanon	Bentael		369	34.1385	35.6939		
Mount Lebanon	Berbara		200	34.1952	35.6347		

Mount Lebanon	Bhamdoun		1100	33.7958	35.6497		
Mount Lebanon	Brumana [Broummana, close to Beirut]		800	33.8847	35.6333		
Mount Lebanon	Chammis	Wadi Cheber	372	33.6449	35.4646		
Mount Lebanon	Chammis	Wadi Cheber	377	33.6448	35.4624		
Mount Lebanon	Chhim	Khallat Chiim	700	33.6236	35.4836		
Mount Lebanon	Chouf Biosphere Reserve	Barouk Gate	1428	33.6984	35.6988	Location 5	
Mount Lebanon	Chouf Biosphere Reserve	Barouk Trails crossing	1772	33.6859	35.6987	Location 5	
Mount Lebanon	Chouf Biosphere Reserve	Barouk-Maaser dirt road	1769	33.6851	35.6984	Location 5	
Mount Lebanon	Chouf Biosphere Reserve	Maaser El Chouf Gate	1726	33.6751	35.6918	Location 5	
Mount Lebanon	Dahr el Baïdar		1000	33.8167	35.7667		
Mount Lebanon	Daichouniyé	Nahr Beirut Climbing Site	133	33.8394	35.5837		
Mount Lebanon	Ein el Arar (near Baabdate)		1100	33.8911	35.6725		Locality of Baabdate
Mount Lebanon	Falougha	Cedar woods	1480	33.8246	35.7522	Location 4	
Mount Lebanon	Falougha		1250	33.8275	35.7331		
Mount Lebanon	Fanar		250	33.8833	35.5833		
Mount Lebanon	Fidar		900	34.1000	35.6500		
Mount Lebanon	Hammana		1200	33.8275	35.7331		
Mount Lebanon	Hboub		250	34.1333	35.6667		
Mount Lebanon	Horch El Barouk	Shouf Biosphere Reserve	1678	33.6690	35.7020		
Mount Lebanon	Horch el Barouk	Shouf Biosphere Reserve	1690	33.6740	35.7053		
Mount Lebanon	Jamhour		350	33.8333	35.5667		
Mount Lebanon	Jubayl [Byblos]		0	34.1167	35.6500		
Mount Lebanon	Khaldah		30	33.7833	35.4833		
Mount Lebanon	Ksaibe		518	33.8627	35.6485		
Mount Lebanon	Laqlouq		1752	34.1374	35.8739	Location 3	
Mount Lebanon	Marej Barja	Kaleet El Besten	358	33.6503	35.4645		
Mount Lebanon	Mazraat al Daher		529	33.6033	35.5158		

Mount Lebanon	Wadi Chahrour		500	33.8204	35.5552		
North Lebanon	Jord Tannourine	Jabal Al Mnaitra	2469	34.1925	36.0176		
North Lebanon	Arz Al Barouk		1200	33.6833	35.6833		
North Lebanon	Arz Bcharre	Forest of the Cedars of God	1913	34.2438	36.0474	Location 1	
North Lebanon	Arz Bcharre	Forest of the Cedars of God Reforestation Area	1933	34.2409	36.0540	Location 1	
North Lebanon	Arz Bcharre	Forest of the Cedars of God	1815	34.2243	36.0473	Location 1	
North Lebanon	Arz Bcharre	Forest of the Cedars of God	1883	34.2446	36.0454	Location 1	
North Lebanon	Arz Lubnan	Bcharre Reforestation Area	1993	34.2404	36.0561	Location 1	
North Lebanon	Arz Lubnan	Bcharre Reforestation Area	1967	34.2394	36.0528	Location 1	
North Lebanon	Arz Tannourine	Arz Tannourine Gate area	1754	34.2079	35.9328	Location 2	
North Lebanon	Arz Tannourine	Gate	1796	34.2078	35.9325	Location 2	
North Lebanon	Arz Tannourine	Gate area	1754	34.2076	35.9326	Location 2	
North Lebanon	Arz Tannourine	Main gate	1796	34.2076	35.9326	Location 2	
North Lebanon	Arz Tannourine	Reserve Entrance	1797	34.2080	35.9327	Location 2	
North Lebanon	Arz Tannourine	Tannourine Forest Reserve Outskirts	1739	34.2078	35.9326	Location 2	
North Lebanon	Arz Tannourine	Tannourine Forest Reserve Outskirts	1766	34.2063	35.9318	Location 2	
North Lebanon	Arz Tannourine	Tannourine Forest Reserve Outskirts	1794	34.2058	35.9325	Location 2	
North Lebanon	Arz Tannourine	Tannourine Reserve Trail 4	1747	34.2021	35.9369	Location 2	
North Lebanon	Arz Tannourine	Tannourine Reserve Trail 4	1800	34.2061	35.9333	Location 2	
North Lebanon	Bcharre	Bcharre reforestation Area	2347	34.2248	36.0605		
North Lebanon	Bcharre	Dahr El Adib	2306	34.2252	36.0583		
North Lebanon	Bcharre	Dahr El Adib	2437	34.1839	36.0339		
North Lebanon	Bcharre	Dahr El Adib	2585	34.2111	36.0599		
North Lebanon	Bcharre	Reforestation area	2216	34.2258	36.0608		
North Lebanon	Bcharre		1900	34.2427	36.0481		
North Lebanon	Bcharre		2042	34.2458	36.0673		
Mount Lebanon	Bchetfine		470	33.7131	35.5517		
North Lebanon	Cedars [Arz Bcharre]		1800	34.2417	36.0487		

North Lebanon	Donnieh	Wadi Cehennem	924	34.4000	36.1333		
North Lebanon	Donnieh		900	34.4167	36.1167		
North Lebanon	Ehden	Ain El Naasa	1560	34.3078	35.9923		
North Lebanon	Ehden	Jord	1983	34.3167	35.9833		
North Lebanon	Fehta	El Biara	1632	34.1893	35.9159		
North Lebanon	Fehta	El Biara	1664	34.1894	35.9159		
North Lebanon	Forest of the Cedars of God	Forest Limit	1873	34.2445	36.0455	Location 1	
North Lebanon	Forest of the Cedars of God	Forest Limit	1897	34.2411	36.0545	Location 1	
North Lebanon	Hadath el Jebbe	Al Fouar	1529	34.2133	35.9253	Location 2	
North Lebanon	Hadath el Jebbe	Border of the Cedar forest	1618	34.2161	35.9356	Location 2	
North Lebanon	Hadath el Jebbe	Border of the Cedar forest	1632	34.2191	35.9361	Location 2	
North Lebanon	Hadath el Jebbe	Border of the Cedar forest	1646	34.2181	35.9381	Location 2	
North Lebanon	Hadath el Jebbe	Chemin Wadi Ain el Raha	1519	34.2134	35.9252	Location 2	
North Lebanon	Hadath el Jebbeh	Road to Wadi Al Fouar	1553	34.2133	35.9253	Location 2	
North Lebanon	Hadath el Jebbeh	Border of Cedar Forest	1681	34.2181	35.9381	Location 2	
North Lebanon	Harissa	Al Jawar	1738	34.1949	35.9258	Location 2	
North Lebanon	Harissa	Al Jawar	1758	34.1934	35.9239	Location 2	
North Lebanon	Harissa	Chir El Ribez	1730	34.2007	35.9195	Location 2	
North Lebanon	Horch Ehden	Ain Al Bayada Gate	1597	34.3033	35.9832	Location 2	
North Lebanon	Horch Ehden	Gate area	1424	34.3085	35.9841	Location 2	
North Lebanon	Horch Ehden	Nabeh Jouit	1337	34.3161	35.9827	Location 2	
North Lebanon	Horch Ehden	Nabeh Jouit	1410	34.3085	35.9828	Location 2	
North Lebanon	Horch Ehden	Trail 1	1534	34.3097	35.9894	Location 2	
North Lebanon	Jairoun		1000	34.4333	36.1000		
North Lebanon	Kadisha river		1000	34.2833	35.9167		
North Lebanon	Kfarhayy	Monastere St.Youhanna Maroun	327	34.2463	35.7513		
Mount Lebanon	Laqlouq	Matoube	1657	34.1211	35.8459		

North Lebanon	Near Becharré [Bcharre]		1500	34.2500	36.0167		Locality of Bcharre
North Lebanon	South of Jairoun		1648	34.3833	36.1167		
North Lebanon	Tannourine el Tahta	Wadi Ain el Raha	900	34.2128	35.8718		
North Lebanon	Tannourine	Jord Tannourine	2296	34.2082	36.0049		
North Lebanon	Tannourine el Tahta	Al Mahbase	893	34.2144	35.8747		
North Lebanon	Tannourine el Tahta	Mar Boutrous	1207	34.2097	35.9004		
North Lebanon	Tannourine el Tahta	Wadi Ain al Raha	900	34.2126	35.8723		
North Lebanon	Tannourine el Tahta	Wadi Ain Al Raha	936	34.2123	35.8751		
North Lebanon	Tannourine el Tahta	Wadi Ain El Raha	901	34.2121	35.8739		
North Lebanon	Tannourine el Tahta	Wadi Ain El Raha	934	34.2126	35.8723		
North Lebanon	Tannourine el Tahta	Wadi al Fouar	1187	34.2096	35.9003		
North Lebanon	Tannourine Reserve	Trail 4	1781	34.2065	35.9322		
South Lebanon	Djezzine [Jezzine]		950	33.5408	35.5831		
South Lebanon	Hilaliyah		450	33.5667	35.3833		
South Lebanon	Saidoun	El Mrouj	750	33.5222	35.5139		
South Lebanon	Saidoun	Joura	750	33.5225	35.5156		
South Lebanon	Saidoun		750	33.5217	35.5151		
South Lebanon	Sidon [Saida]		20	33.5631	35.3689		

APPENDIX II. Unconfirmed *Andrena* species reported from Lebanon

Grace (2010) published an overview of the bees of the Eastern Mediterranean, including country-level reports for *Andrena*. These include an additional 23 species of *Andrena* for Lebanon, many of which are widespread in the Eastern Mediterranean and are probably present but which for now we consider to be unconfirmed, as none of the underlying data supporting these statements were reported, and additionally some are also in a state of taxonomic flux and uncertainty over their exact status and distributions and so cannot be listed with confidence. All 25 species are listed here with some notes on their likely identity and validity.

***Andrena* (*Carandrena*) *falcinella* Warncke, 1969**
Present in neighbouring countries; probably present in Lebanon.

***Andrena* (*Chlorandrena*) *tadauchii* Gusenleitner, 1998**
See discussion under *A. humilis* in the main manuscript.

***Andrena* (*Didonia*) *mucida* Kriechbaumer, 1873**
Present in neighbouring countries; probably present in Lebanon.

***Andrena* (*Fumandrena*) *pandosa* Warncke, 1968**
Present in neighbouring countries; probably present in Lebanon.

***Andrena* (*Margandrena*) *hyacinthina* Mavromoustakis, 1958**
Present in neighbouring countries; probably present in Lebanon.

***Andrena* (*Melandrena*) *grandilabris* Pérez, 1903**
Present in neighbouring countries; probably present in Lebanon.

***Andrena* (*Nobandrena*) *iliaca* Warncke, 1969**
Widespread in Jordan, Israel, and Syria, this taxon is likely to be present in Lebanon.

***Andrena* (*Notandrena*) *erythrocnemis* Morawitz, 1870**
Present in neighbouring countries; probably present in Lebanon.

***Andrena* (*Notandrena*) *nitidiuscula* Schenck, 1853**
Grace (2010) reported material from Lebanon as *A. nitidiuscula nigellata* Pérez, 1895 which is a synonym of *A. fulvicornis* Schenck, 1853 (Wood et al. 2020). Examined material from Syria, Israel, Egypt, and Jordan conforms to *A. fulvicornis*.

***Andrena* (*Notandrena*) *urdula* Warncke, 1965**
Present in neighbouring countries; probably present in Lebanon.

***Andrena* (*Parandrenella*) *nisoria* Warncke, 1969**
Present in neighbouring countries; probably present in Lebanon.

***Andrena* (*Poecilandrena*) *kilikiae* Warncke, 1969**
Pisanty et al. (2018) note that Grace (2010) recorded *A. kilikiae* from Lebanon but also do not have access to any underlying data. We have seen material from Latakia in western Syria (TJW, *unpublished data*) and so the species is probably present in Lebanon, but this must be confirmed.

***Andrena* (*Poliandrena*) *polita* Smith, 1847**
This report is presumably based on the map of Warncke presented in Guseneleitner & Schwarz (2002) which shows many records of *A. polita* across the Levant and into Egypt and Libya (combining *A. basimacula* as *A.*

polita basimacula, see Warncke 1974). However, it is unclear which exact species concept Warncke was using when this map was created, and he probably included various combinations of *A. basimacula*, *A. polita*, *A. unicincta*, and *A. westensis*. For now, true *A. polita* is not considered to be present in the Levant.

***Andrena* (*Poliandrena*) *toelgiana* Friese, 1921**
Present in neighbouring countries; probably present in Lebanon.

***Andrena* (*Simandrena*) *combinata* (Christ, 1791)**
Pisanty et al. (2018) list *A. mehelyi* Alfken, 1936 from Israel. This taxon is considered to be a subspecies of *A. combinata* by some authorities (Gusenleitner & Schwarz 2002) but as a valid by others (Schmid-Egger & Scheuchl 1997).

***Andrena* (*Simandrena*) *dorsata* (Kirby, 1802)**
The taxonomic status of *Andrena propinqua* Schenck, 1853 is controversial and has been considered a synonym (Gusenleitner & Schwarz 2002) and a valid taxon (Schmid-Egger & Scheuchl 1997). We favour *A. propinqua* as a valid taxon favouring warmer conditions and one which therefore has a more Mediterranean distribution, and this is the taxon likely to be found in Lebanon.

***Andrena* (*Simandrena*) *lepida* Schenck, 1861**
Present and common in neighbouring countries; probably present in Lebanon.

***Andrena* (*Simandrena*) *venerabilis* Alfken, 1935**
Present in neighbouring countries; probably present in Lebanon.

***Andrena* (*Taeniandrena*) *leucopsis* Warncke, 1967**
The status of *Taeniandrena* taxa across the Western Palearctic requires a deep revision. Some western taxa are in the process of being revised (TJW and C. Praz, *in preparation*).

***Andrena* (*Truncandrena*) *bassana* Warncke, 1969**
Present in neighbouring countries; probably present in Lebanon.

***Andrena* (*Truncandrena*) *canae* Strand, 1915**
Present in neighbouring countries; probably present in Lebanon.

***Andrena* (*Truncandrena*) *truncatilabris* Morawitz, 1877**
Scheuchl & Hazir (2012) described *Andrena urfanella* Scheuchl & Hazir, 2012 from Turkey and Israel. It is very similar to *A. truncatilabris* and may actually replace it in the Levant, or alternatively it may simply be the form of *A. trunctilabris* present in this region as this taxon shows considerable variation across the West Palearctic.

***Andrena* (*Truncandrena*) *ulula* Warncke, 1969**
Present in neighbouring countries; probably present in Lebanon.