



Cyprus
University of
Technology

Faculty of Geotechnical
Sciences and
Environmental
Management

Doctoral Dissertation

Biodiversity of wild bees in Cyprus: Species richness, land use effects and contribution to ecosystem services

Androulla Varnava

Limassol, December 2022

CYPRUS UNIVERSITY OF TECHNOLOGY
FACULTY OF GEOTECHNICAL SCIENCES AND ENVIRONMENTAL
MANAGEMENT
DEPARTMENT OF AGRICULTURAL SCIENCES, BIOTECHNOLOGY
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Presented by

Androulla Varnava

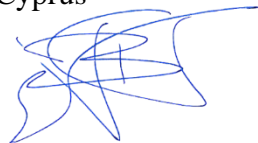
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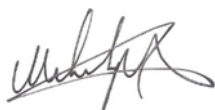
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The approval of the dissertation by the Department of Agricultural Sciences, Biotechnology and Food Science does not imply necessarily the approval by the Department of the views of the writer.

Declaration

The data presented in this PhD dissertation are the results of an original research work conducted by the author at the Cyprus University of Technology (CUT), unless otherwise indicated. The work contained herein has not been submitted, in whole or in part, to obtain any other degree or professional qualification in this or any other academic institution. Data from this study (Chapter 2) have been published in one peer-reviewed journal and other data (Chapter 4) are under revision in an international journal. In addition, part of the data of the current dissertation have been presented orally by Androulla Varnava in a conference, held under the auspices of The 7th European Conference of Apidology, 7-9 September 2016, Cluj-Napoca, Romania.

Scientific publications in referred journals

1. Varnava AI, Roberts S, Michez D, Ascher JS, Petanidou T, Dimitriou S, Devalez J, Pittara M, Stavriniades MC (2020) The wild bees (Hymenoptera, Apoidea) of the island of Cyprus. *ZooKeys* 924: 1–114. <https://doi.org/10.3897/zookeys.924.38328>
2. Varnava AI, Manganaris GA, Stavriniades MC (2022) Assessing the biodiversity and the impact of pollinators on carob production – under Revision in PLOS ONE.

Oral presentations

1. Varnava Androulla, Stavroulla Louka, Athanasia Mandoulaki and Stavriniades C. Menelaos 2016. Biodiversity of wild bees of Cyprus: past, present and future. 7th European Conference of Apidology, 7-9 September 2016, Cluj-Napoca, Romania.

Acknowledgements

I would like to express my sincere gratitude to my advisor Associate Professor Menelaos C. Stavrinides for his support during my PhD studies, for his endless patience and continuous motivation, and knowledge he conveyed to me. I could not have imagined a better help during the writing phases of the current dissertation. Besides my advisor, I would like to express my gratitude to the other members of my Advisory Committee: Professor Denis Michez of the Faculty of Science, Laboratory of Zoology of the University of UMons for his essential guidance and assistance in various aspects of the research. In addition, I acknowledge Associate Professor George Manganaris for his insightful comments and support.

My sincere thanks and gratitude also go to Stuart Roberts, Freelance Entomologist and Ecological Consultant who guided me at my very first steps as a Bee expert. Without his precious support, it would have been impossible to conduct the current study. I would also like to acknowledge all the taxonomists who provided help in species identification: Thomas Wood, Gerard Le Goff, Stuart Roberts, Andreas Müller and Christophe Praz, Jessica Litman, Max Kasperek, Michael Mikat, Achik Dorchin, Erwin Scheuchl, Bogdan Tomozei, Michael Kuhlmann, Alain Pauly, Pierre Rasmont, Göran Holmström, Holger Dathe, Jan Smit and Maud Mignot. I want to acknowledge Christian Schmid-Egger, Martin Jenner, Sophie Bagshaw, Nick Owens and John Varnava for their contribution in providing data and Ong Xin Rui for her recommendations in the purpose of the second Chapter and Kyriaki Varnava for her help on every single experiment. I should also thank the Department of Agriculture, Ministry of Agriculture, Rural Development and Environment of Cyprus for providing access to the Mavromoustakis collection and the Snow Entomological Museum Collection (Kansas, USA) who provided online digitised data of specimens collected by Mavromoustakis under a Creative Commons Attribution (CC-BY) 4.0 License.

I want to acknowledge for their help during the work for Chapter 3: Nicolas J. Vereecken for the R statistics guidance; Akrotiri Environmental Education and Information Centre and Joint Services Health Unit Cyprus BFC RAF Akrotiri for providing permits for sampling in Akrotiri region: Dr Angeliki Martinou (Head Entomologist), Dr Pantelis Charilaou (SBAA Environment and Conservation Officer), Dr Thomas Hadjikyriakou (Director of Akrotiri Environmental Education and Information Centre); Special thanks to

Kyriaki Varnava, for her help during every single experiment; Dr Elli Tzirkalli (Open University of Cyprus), Dr Athos Agapiou and Veroniki Kanellidou (Cyprus University of Technology, Department of Civil Engineering and Geomatics) for their help in map georeferencing work. Special thanks to Marios Mitas, Technical Engineer Photogrammetry in the Department of Lands and Surveys for the map provision. In addition, land owners in the Cherkes Chiftlik-Asomatos region who allowed me to work in their fields for the study. Special thanks are also extended to carob growers in Paphos, Limassol and Larnaca districts, for kindly providing their fields during this work. I am grateful to the Holy Transfiguration Monastery and the nuns in Avdellero (Larnaca region) who allowed us to carry out the experiments in their carob tree fields and especially to the nun fSigklitiki with whom we had frequent contact. I thank Dr. Achik Dorchin for his advice and suggestions at the beginning of this research and Dr. Ioannis Vogiatzakis for his help on the landscape characterization of our experimental regions. Finally, the Department of Environment for providing permits for sampling bees in Cyprus and special thanks to Elena Erotokritou who mediated this procedure.

Last but not the least, I would like to thank my precious parents Ioannis and Kyriaki for their support and their help in every single experiment all these years. Also, my partner Nicolas, for his essential support and help during the writing phases and all my friends and colleagues in Cyprus and abroad for their love and support all these years.

ΓΕΝΙΚΗ ΠΕΡΙΛΗΨΗ

Οι άγριες μέλισσες είναι βασικοί πάροχοι υπηρεσιών επικονίασης. Ογδόντα επτά από τις κύριες παγκόσμιες καλλιέργειες τροφίμων βασίζονται στην επικονίαση από ζώα, με περίπου το 35% της παγκόσμιας προσφοράς τροφίμων να στηρίζεται σε ζωικούς επικονιαστές. Έρευνες πολλών επιστημόνων κατέγραψαν ανησυχητικές μειώσεις των ειδών άγριων μελισσών σε πολλά μέρη του κόσμου, με την κλιματική αλλαγή και τη χρήση της γης, συμπεριλαμβανομένης της εντατικής γεωργίας, να αναδεικνύονται ως βασικοί λόγοι της μείωσης των ειδών. Οι στόχοι της παρούσας διατριβής ήταν να αποτιμηθεί η βιοποικιλότητα επικονιαστών στην Κύπρο, να ερευνηθεί η επίδραση του τύπου χρήσης γης στον πλούτο των ειδών χρησιμοποιώντας ιστορικά και πρόσφατα δεδομένα και να καταγραφεί η συνεισφορά συγκεκριμένων ειδών μελισσών στην επικοινωνία σημαντικών καλλιεργειών.

Στο **Κεφάλαιο 2** δημιουργήθηκε η πρώτη σύγχρονη λίστα των ειδών άγριων μελισσών της Κύπρου, βασισμένη σε προηγούμενες σχετικές δημοσιεύσεις, δείγματα από μουσεία και πρόσφατες συλλογές από το πεδίο. Συνολικά, 369 επαληθευμένα είδη μελισσών έχουν καταγραφεί στο νησί, με έντεκα είδη να αναφέρονται για πρώτη φορά στην Κύπρο. Το νησί φιλοξενεί και τις έξι από τις παγκοσμίως διαδεδομένες οικογένειες μελισσών, με την Apidae να εκπροσωπείται από 110 είδη, τη Megachilidae με 91, την Andrenidae με 76, τη Halictidae με 72, την Colletidae με 19 και τη Melittidae με 1 είδος. Είκοσι ένα από τα καταγεγραμμένα είδη είναι ενδημικά (ποσοστό ενδημισμού 5,7%) και η Κύπρος κατατάσσεται τρίτη μετά τη Λέσβο και τη Σικελία σε γνωστό πλούτο ειδών μελισσών μεταξύ των νησιών της Μεσογείου.

Στο **Κεφάλαιο 3** αναλύσαμε ιστορικές αλλαγές στον πλούτο των ειδών χρησιμοποιώντας ως βάση ένα μοναδικό σύνολο δεδομένων που συνέλεξε ο ταξινομιστής μελισσών Γεώργιος Μαυρομουστάκης, με έναρξη των δειγματοληψιών πριν ένα αιώνα και διάρκεια 30 ετών. Εστίασαμε σε δύο περιοχές με δύο διαφορετικούς τύπους χρήσης γης: στην περιοχή Τσερκές Τσιφτλίκ - Ασώματος όπου το τοπίο χαρακτηρίζεται ως κυρίως αγροτικό και στην περιοχή Ακρωτηρίου με κυρίως ημιφυσικό τοπίο. Έγιναν συλλογές μελισσών και στις δύο περιοχές ανά δύο εβδομάδες για περίοδο δύο ετών. Οι αλλαγές στις χρήσεις γης ήταν ελάχιστες μεταξύ της ιστορικής και της σημερινής περιόδου. Ωστόσο, η περιοχή Τσερκές Τσιφτλίκ - Ασώματος γνώρισε δραστικές αλλαγές, με αύξηση της χρήσης

εντατικών γεωργικών μεθόδων, ιδιαίτερα συνθετικών εντομοκτόνων, συμπεριλαμβανομένου του DDT, περίπου από το 1945 και έπειτα. Επιπρόσθετα, η περιοχή Τσερκέζ Τσιφτλίκ – Ασώματος έχει διάσπαρτη οικιστική ανάπτυξη σε σχέση με το Ακρωτήρι όπου η ανάπτυξη είναι πιο συγκεντρωμένη. Εντοπίσαμε σημαντικές αλλαγές στη σύνθεση των ειδών, με 43 είδη να έχουν αναφερθεί μόνο στα ιστορικά δείγματα, 77 μόνο στα πρόσφατα δείγματα, ενώ 42 εντοπίστηκαν και στις δύο περιόδους. Ο Μαυρομουστάκης ανέφερε 50 είδη από το Ακρωτήρι και 80 από την περιοχή Τσερκέζ Τσιφτλίκ - Ασώματος, από τα οποία τα 26 ήταν κοινά και στις δύο περιοχές. Στις πρόσφατες δειγματοληψίες συγκεντρώσαμε 110 είδη από το Ακρωτήρι και 68 από την περιοχή Τσερκέζ Τσιφτλίκ - Ασώματος, περιλαμβανομένων 53 κοινών ειδών. Η διαφορά στη συχνότητα εξαφανίσεων ειδών ήταν στατιστικά σημαντική, με την περιοχή Τσερκέζ Τσιφτλίκ - Ασώματος να χάνει είδη με διπλάσιο ρυθμό από το Ακρωτήρι, περίπου στο 75 και 35% αντίστοιχα. Ο πλούτος των ειδών φυτών από τα οποία συλλέχθηκαν μέλισσες ήταν υψηλότερος στο Ακρωτήρι, με στατιστικά σημαντική σχέση μεταξύ του φυτικού πλούτου και του πλούτου των μελισσών. Υποθέτουμε ότι οι κύριοι παράγοντες για την εξαφάνιση των ειδών είναι η εντατική χρήση συνθετικών γεωργικών φαρμάκων και η απώλεια κατάλληλων οικοτόπων και φυτικών ειδών λόγω της εφαρμογής εντατικών γεωργικών μεθόδων και οικιστικής ανάπτυξης. Ως αποτέλεσμα της εργασίας, αναφέρονται δεκατρία νέα είδη μελισσών στην Κύπρο, καθώς και τρία νέα είδη για την επιστήμη.

Το **Κεφάλαιο 4** αξιολόγησε την ποικιλότητα των άγριων μελισσών και άλλων επικονιαστών που βασίζονται στα άνθη της χαρουπιάς, καθώς και τη συμβολή της ζωικής επικοινωνίας στην παραγωγή χαρουπιών. Τα άνθη χαρουπιών υποβλήθηκαν σε δύο μεταχειρίσεις: Ανοιχτή επικονίαση, όπου οι ταξιανθίες έμειναν ως είχαν, και κλειστή επικονίαση, όπου οι ταξιανθίες εγκλωβίστηκαν σε δίχτυ κατά τη διάρκεια της ανθοφορίας. Οι εβδομαδιαίες παρατηρήσεις κατά τη διάρκεια της ανθοφορίας έδειξαν ότι το *Apis mellifera* ήταν ο πιο συχνός επισκέπτης των λουλουδιών ακολουθούμενη από είδη άγριων μελισσών και σφηκών. Τα άνθη χαρουπιών επισκέφθηκαν τουλάχιστον 10 διαφορετικά είδη άγριων μελισσών. Τα άνθη με ανοιχτή επικονίαση παρήγαγαν σημαντικά περισσότερους καρπούς, με το όφελος να κυμαίνεται από 4 έως 20 φορές υψηλότερη παραγωγή, ανάλογα με την περιοχή. Η ανοιχτή επικονίαση οδήγησε σε καρπούς με μεγαλύτερο βάρος, μήκος και αριθμό σπόρων σε σύγκριση με τους καρπούς που προέρχονταν από την κλειστή επικονίαση. Τα αποτελέσματα της παρούσας μελέτης

υπογραμμίζουν τη σημασία της ζωικής επικοινωνίας για την παραγωγή χαρουπιών, καθώς και τη σημασία των χαρουπιών για τη διατήρηση των άγριων μελισσών.

Τα ευρήματά της παρούσας διατριβής αναδεικνύουν τη σημασία τόσο των ιστορικών δεδομένων, όσο και σύγχρονων δειγματοληψιών για την κατανόηση της ποικιλότητας των μελισσών και την ανάγκη θέσπισης ενός μακροπρόθεσμου προγράμματος παρακολούθησης και δράσεων διατήρησης για τα είδη των αγρίων μελισσών της Κύπρου.

GENERAL ABSTRACT

Wild bees are key providers of pollination services. Eighty-seven of the leading global food crops rely on animal pollination, with ca. 35% of global food supply depended on the service. Seminal work by multiple authors documented alarming declines in wild bee species in several parts of the world, with climate change and land use change, including intensive agriculture, emerging as key drivers of species declines. The goals of the current Dissertation were to evaluate wild bee diversity in Cyprus, investigate the effect of land use on species richness using historical and contemporary data, and document the contribution of specific species to pollination services.

In **Chapter 2** the first modern checklist of the wild bees of Cyprus was created, based on a compilation of previous publications, museum specimens and recent collections. Overall, 369 verified bee species have been recorded on the island, with eleven species reported from Cyprus for the first time. The island hosts all six of the globally widespread bee families, with Apidae represented by 110 species, Megachilidae with 91, Andrenidae with 76, Halictidae with 72, Colletidae with 19, and Melittidae with 1. Twenty-one of the recorded bee species are endemic (i.e., 5.7 % endemism rate) and Cyprus ranks third after Lesvos and Sicily in known bee species richness among the Mediterranean islands.

In **Chapter 3** we relied on a unique data set collected by the bee taxonomist George Mavromoustakis covering a 30-year period beginning 100 years ago, and recent biweekly samplings over two years to analyze changes in species richness. We focused on two areas with contrasting land use patterns: Cherkas Chiftlik - Asomatos (CC_Asomatos) with a mainly agricultural and Akrotiri with a mainly seminatural land use profile. Changes in landscape use categories were mild and relatively similar in the two areas, with urban development more scattered in CC_Asomatos. In addition, CC_Asomatos experienced drastic changes in land use intensity, with an increase in the use of high-input agricultural methods, including synthetic insecticides, beginning with DDT from around 1945. We detected a substantial species turnover, with 43 species collected only in historical samples, 77 only in recent samples, while 42 persisted in both periods. Mavromoustakis reported 50 species from Akrotiri and 80 from CC_Asomatos, out of which 26 were common. We collected 110 species from Akrotiri, and 68 from CC_Asomatos with 53 common. There was a statistically significant difference in the frequency of species extinctions, with

CC_Asomatos losing species at twice the rate of Akrotiri, at ca. 75 and 35% respectively. The richness of plants visited by bees was higher in Akrotiri, with a significant relationship between plant species richness and bee species richness. We hypothesize that the main drivers for species extinctions are the intensive use of synthetic pesticides, and the loss of habitat and floral diversity because of the expansion of agriculture and urban development. Thirteen species new to Cyprus, as well as three species new to science are reported as part of the current work.

Chapter 4 assessed the diversity of wild bees and other pollinators relying on carob flowers, as well as the contribution of animal pollination to carob production. Carob flowers were subjected to two treatments: Open pollination, where inflorescences were left untreated, and wind pollination, where inflorescences were bagged in a mesh during blooming. Weekly observations during blooming showed that *Apis mellifera* was the most frequent floral visitor followed by wild bees and wasps. Carob flowers were visited by at least 10 different wild bee species. Open-pollinated flowers produced significantly more pods, with the benefit ranging from 4 to 20 times higher production, depending on the region. Open pollination led to pods with greater weight, length and number of seeds compared to pods derived from wind pollination. The results of the study highlight the importance of animal pollination to carob production, as well as the significance of carob trees to wild bee conservation.

The findings of the current dissertation highlight the importance of historical data in understanding bee diversity and the need for establishing a long-term monitoring program and conservation actions for the bee species of Cyprus.

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LIST OF ABBREVIATIONS

CUT	CYPRUS UNIVERSITY OF TECHNOLOGY
e.g	For example
ha	hectare
mya	Million years ago
ml	Milliliter
m	Meters
ca.	Approximately
km ²	Square kilometre
et al.	And others
i.e	In other words
km	Kilometres
EU	European Union
NW_C	North-West Coast
SP	South Plateau
SC	South Coast

CHAPTER 1

1 Chapter 1: General Introduction

Wild bees and other pollinators are indispensable for ecosystem structure and function. Many wild and cultivated plants rely on pollinators, and especially bees for reproduction (Potts et al. 2010; Klein et al., 2007; van der Sluijs and Vaage, 2016). Eighty-seven of the leading global food crops rely on animal pollination, with ca. 35% of global food supply depended on the service (Klein et al. 2007). The annual global value of pollination is estimated at US\$195 to ~US\$387 billion annually (Porto et al., 2020). A total of 20,555 species of bees have been recorded worldwide, with more than 2,500 of them in Europe (Nieto et al., 2014; Orr et al., 2021). In recent years, the global decrease in *Apis mellifera* populations (Schlueter and Stewart, 2015) led to the recognition of the importance of the conservation of wild bee species to secure the uninterrupted provision of pollination services.

Wild bees act as alternative or complementary providers of pollination services (Blitzer et al., 2016) in crops like sunflower, coffee, almonds, apples and cucurbits (Winfree et al., 2008; Mandelik and Roll, 2009). Many plants need sonication for their pollination, for which honey bees are not effective as those flowers are only “buzz-pollinated” by wild bees such as *Xylocopa* and *Bombus* (Kline and Joshi, 2020). Wild bees act as a buffer in the decline of pollination services in areas where honeybee pollination drops because of climate change (Rader et al., 2013).

Pollinators including bees face several threats that jeopardize their existence. Land-use change, urbanization (habitat loss, degradation, and fragmentation), climate change, intensive agricultural management and pesticides, environmental pollution, genetically modified crops, pathogens, and invasive alien species are among key threats (Brown and Paxton, 2009; Carvalheiro et al., 2013; Cariveau and Winfree, 2015; Potts et al., 2016; IPBES, 2016; Baldock, 2020). The variety of threats to pollinators poses a contingent risk to peoples’ livelihoods. In the IPBES (Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services) assessment on pollinators, pollination, and food production for Europe, 9% of bee species are reported as threatened and populations are declining for 37% of bees, excluding data deficient species, which includes 57 per cent of bees (Potts et al. 2016). Where national Red List assessments are available, they show that often more than 40% of bee species may be threatened.

Pesticide use negatively affects bee assemblages. A combination of insecticides, like neonicotinoids and pyrethroids used as a seed coating can cause serious consequences for wild bees, such as reduction of bee density, nesting (*Osmia* species) and colony growth and reproduction (bumblebees) (Rundlöf et al., 2015, Woodcock et al., 2017). Interestingly, Brittain et al. (2010) found that wild bee species richness declined in vineyards after insecticide use but not in maize or uncultivated fields. Several species of wild bees are ground-nesting, consequently land-use changes affect bees due to floral resource and nesting site disturbance (Kremen et al., 2007).

In addition to pesticide use, other forms of intensive agricultural management pose major threats to pollinators with smaller bees more sensitive as larger bees can forage over longer distances (Kline and Joshi, 2020). Natural habitats host higher bee diversity than agricultural landscapes (Senapathi et al., 2017). The degradation of natural habitats and the large monocultures with intensive management systems decrease the availability of nesting sites and floral resources for wild bees (Kline and Joshi, 2020). Wild bees prefer to have several floral resources near nesting sites to avoid spending time away from their nests. Natural habitats without plenty of floral resources are not attractive to bees (Kline and Joshi, 2020). Another major threat driving bee decline is urbanization which leads to habitat loss, which can be partly offset by green spaces and areas with floral resources that help bees to prosper (Normandin et al., 2017). Green areas can contribute to wild bee conservation due to the high percentage of nesting and foraging habitats (Hausmann et al., 2015).

Conservation is an anthropocentric pursuit (Hall and Martins, 2020). Documenting biodiversity with continuous monitoring to link with potential drivers of decline should be the first step to conserving wild bee populations (Vereecken et al., 2021). As taxonomists are in decline, it is very important to train scientists in alpha taxonomy to be able to manipulate the data that will be collected. DNA barcoding can help the morphological taxonomy and those two methods are very important for bee research (Brown and Paxton, 2009). In addition, citizen science programs and education for awareness will enhance the collection of long-term data and help conservation action plans (Drossart and Gérard, 2020, Harvey et al., 2020, Flaminio et al., 2021). Conservation actions beneficial to bees include increasing crop diversity, mass flowering crops, regional farm diversity, creating ecological infrastructures, habitat restoration,

reduction of pesticides and land plowing, increasing the land cover heterogeneity, and using environmentally friendly practices such as organic farming, using fewer toxic pesticides and crop rotations (Kremen et al., 2007, Nieto et al., 2014, Potts et al., 2016, IPBES, 2016, Fortel et al., 2016, Senapathi et al., 2017).

Understanding the pressures threatening wild bees in a specific region requires the development of a knowledge base of the species present, understanding the effect of different stressors on their abundance, and developing a better documentation of their importance as pollination service providers. The current thesis aims at addressing all three study areas, focusing on the Mediterranean island of Cyprus.

Cyprus is the third largest island in the Mediterranean, located in the eastern part of the basin, with a land surface area of 9,251 km², of which 42 % is covered with forest/shrubland, and 23 % is devoted to agriculture (Vogiatzakis et al. 2016). The island is very rich in plant diversity with more than 1,900 plant species, of which 141 are endemic (Christofides 2017). A global biodiversity hotspot (Myers et al. 2000), the island is characterised by high rates of plant endemism (Christofides 2017) and constitutes an ideal place for the study of wild bees (Hymenoptera: Apoidea). There is a wealth of past information on the richness of wild bee species on the island, a result of the remarkable work of George Mavromoustakis, a world-renowned bee taxonomist native to the island. Mavromoustakis collected bees on the island for close to 50 years and compiled his work in a series of eight papers which included 237 currently valid species (Mavromoustakis 1949 [“1948”], 1951, 1952, 1953, 1954, 1955, 1957a, 1958 [“1957”]). Recent work on selected genera of wild bees in Cyprus was carried out by Ebmer (2014). Ascher and Pickering’s (2018) online compilation lists 335 species of wild bees on the island, while Kuhlmann et al. (2015) reported 305 species. Yet, there is no modern updated checklist where one can find information on the bee species present on the island. Such a checklist forms the basis for the development of further work on wild bee conservation, as it highlights knowledge gaps for specific areas and species. Checklists provide information on species presence in the study region and help in the knowledge of species distribution and taxonomic classification. Also, the information that they provide, helps in the establishment of long-term monitoring programs (Kilpatrick et al., 2020).

The activity of wild bees in Cyprus peaks in spring and summer, but some species are active throughout the year. Bees have been reported from the coasts of the island up to

the highest altitudes on the Troodos and Pentadactylos mountain ranges. Wild bees visit many different species of plants, both cultivated and wild, such as *Polygonum equisetiforme*, *Foeniculum piperitum*, *Pulicaria dysenterica*, *Statice virgata*, *Alyssum troodi*, *Ammi majus*, *Calendula persica*, *Sinapis alba*, *Echium sericeum*, *Thymus capitatus* (Mavromoustakis 1949 [“1948”], 1951, 1952, 1953, 1954, 1955, 1957a, 1958 [“1957”]). *Calendula persica*, *Sinapis alba*, *Echium sericeum*, *Rubus ulmifolius anatolicus*, *Centaurea hyalolepis*, *Teucrium polium micropodioides*, *Limonium spp.*, *Eryngium creticum* and *Mentha longifolia* are among the most visited plants by wild bees in Cyprus (Edwards et al. 2016). Habitats present on the island like, mediterranean shrublands with thorny phrygana shrubs, *Sarcopoterium sp.* *Cistus spp.*, *Onosma fruticosa* and *Teucrium micropodioides* are visited by large bee communities, as those plants provide nectar and pollen (Grace, 2010, Vogiatzakis et al., 2016). In addition in those habitats tall shrublands like *Ceratonia siliqua* can be a very important food source for bees. Wild bee assemblages benefit from nesting sites in agricultural fields. Bare soil or sparsely vegetated ground open to the sun offer suitable locations for nests for mining bees (Grace, 2010; Edwards et al. 2016). Habitats in agricultural environments play an important ecological role by optimizing microclimate and soil condition, and providing habitat for insects. High Nature Value farmland types, which include vineyards, traditional olive, carob and almond groves, farming mosaics and grazing lands are important for biodiversity in general (Vogiatzakis et al., 2016).

Some of the areas where Mavromoustakis carried out his sampling remained largely unchanged, whereas some other areas changed drastically because of urbanization and other land-use changes. By comparing changes in bee diversity in unchanged vs changed areas we can evaluate the effects of land use change and/or intensity on wild bee abundance and diversity. Most of the work investigating historical changes in bee diversity focused on northern latitudes (e.g. Rasmussen et al. 2022; Grixti and Packer, 2006; Bartomeus et al., 2013; Mathiasson and Rehan, 2019; Graham et al., 2021; Cameron et al, 2011) because of the availability of past historical data. Data on past species presence at southern latitudes are not readily available, probably a result of the concentration of sampling efforts around the areas where bee taxonomists worked or resided in the past. Mavromoustakis was probably the only major wild bee taxonomist residing and actively collecting bees at southern latitudes before the 1950’s. Still, data

collected by Mavromoustakis almost a century ago have never been used in a historical analysis to identify changes in bee species richness and link them to potential land use changes or management practices.

Although managed *Apis* species, such as *A. mellifera*, are considered the leading pollination providers (Klein et al., 2007) wild bees act as alternative or complementary providers of pollination services (e.g. Mallinger and Gratton, 2015; Blitzer et al., 2016). Wild bees contribute to the pollination of many crops, such as coffee, melon, tomato, sunflower, canola, blueberries, apple, and almonds, among many others (Mandelik and Roll, 2009; Nieto et al., 2014). According to Maclnnis and Forrest (2019), strawberries pollinated by wild bees were heavier than those pollinated by honeybees, while Klatt et al., 2014 reported fruits with fewer malformations, greater weight and longer shelf-life, resulting in higher commercial value. Similar results have also been reported for other fresh fruits, such as sweet cherry (Holzschuh et al., 2012). In addition, a higher diversity and abundance of wild bees resulted in enhanced fruit set in apple orchards (Blitzer et al., 2016). The use of managed solitary bees like *Osmia* can increase fruit set in almond orchards, where a small population ensured effective pollination even though social bees were 10 times more abundant (Koh et al., 2018; Bosch et al., 2021).

In Cyprus, the annual value of pollination services for crops is close to €60 million (Agricultural Statistics, 2015). The main perennial crops of Cyprus that rely on bees for pollination are apples, pears, walnuts, peaches, cherries, almonds, kiwi fruit and oranges. Although the carob tree (*Ceratonia siliqua* L.) is one of the most traditional cultures on the island, little is known about the pollination of the crop on the island or elsewhere (Dafni et al. 2012). Cyprus is the sixth producer of carobs in the world (FAO, 2014) with 9.295 tonnes from an area of 1.047 ha (Agricultural Statistics, 2015).

Although the carob tree is an underutilized crop with descending trends regarding production volumes, it represents an excellent model of a heat- and drought-resistant crop, grown in dry areas with practically no inputs (Davies, 1970; Eshghi et al., 2018). Carob cultivation is linked to the culture and traditions of Cyprus; in the past, the crop has had substantial importance to the rural economy (Davies, 1970). The carob tree is an entomophilous species, mainly pollinated by bees, flies, and wasps but is also wind-pollinated, depending on the habitat (Dafni et al., 2012; Tous, 2013; USDA, 2017). Diurnal and nocturnal entomophilous pollinators visit carob flowers (Dafni et al., 2012).

However, scarce information exists on the contribution of wild bee species to carob pollination, as well as on the importance of carob flowers to wild bee species.

The aims of the current Thesis were to a) generate an updated checklist of the bees of Cyprus to fill the gap in our knowledge and provide a clearer picture of bee distribution on the island, b) compare historic changes in bee richness between two areas with contrasting land use patterns to assess changes in species richness between past and present, develop plant-pollinator networks and explore the effects of land use on bee diversity, and c) quantify the impact of animal pollination on carob production.

In the **second Chapter** of the Dissertation, an updated checklist on the bee fauna of the island was generated through a compilation of previous publications, museum specimens and authors' recent collections. In **Chapter 3** the extensive historical record of bee species made by Mavromoustakis was studied and combined with recent intensive sampling data aiming to (a) document historic changes in bee richness between two areas with a mostly semi-natural and a mostly agricultural land use history (b) use networks to obtain estimates of specialization within plant-pollinator networks from recent samplings in the two regions, (c) explore the effects of land use on bee diversity. This is the first work comparing historical patterns in bee richness at a southern latitude, as previous work focused on northern areas. The **fourth Chapter** of the current Dissertation documented the diversity and measured the impact of bees and other insects on carob pollination on the island. The study assessed wild bee biodiversity in each carob grove, as well as the contribution of animal pollination to carob yield quantity and quality.

The current Dissertation came to cover the gap in knowledge of wild bees on the island and enhance the study effort, providing a baseline for future studies of wild bee diversity on the island of Cyprus and elsewhere.

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CHAPTER 2

2 Chapter 2: The wild bees (Hymenoptera, Apoidea) of the island of Cyprus

2.1 Abstract

Cyprus, the third largest island in the Mediterranean, constitutes a biodiversity hotspot with high rates of plant endemism. The wild bees of the island were studied extensively by the native George Mavromoustakis, a world-renowned bee taxonomist, who collected extensively on the island from 1916 to 1957 and summarised his results in a series of eight Cyprus-specific papers published from 1949 [“1948”] to 1957. The current work represents the first modern checklist of the wild bees of Cyprus, based on a compilation of previous publications, museum specimens and authors’ recent collections. Overall, 369 verified wild bee species have been recorded on the island, with eleven species reported from Cyprus for the first time. The island hosts all six of the globally widespread bee families, with Apidae represented by 110 species, Megachilidae with 91, Andrenidae with 76, Halictidae with 72, Colletidae with 19, and Melittidae with 1. Twenty-one of the recorded bee species are endemic (i.e., 5.7% endemism rate) and Cyprus ranks third after Lesvos and Sicily in known bee species richness among the Mediterranean islands. Previously unpublished records from various locations on Cyprus for 156 previously reported bee species are also provided in the study. The current work provides a baseline for future studies of wild bee diversity on the island of Cyprus and neighbouring regions.

Keywords: Bee species richness, biodiversity conservation, pollination, wild bees

2.2 Introduction

Cyprus, the third largest island in the Mediterranean, is situated in the eastern part of the basin, in the active tectonic zone between the African and the Eurasian plates. The island is a global biodiversity hotspot (Myers et al. 2000) characterised by high rates of plant endemism (Christofides 2017). Cyprus is an ideal place for the study of wild bees, because there is a wealth of past information on the diversity of species, a result of the considerable work of George Mavromoustakis, a world-renowned bee taxonomist native to the island.

The first list of the bee fauna of Cyprus was published by Pittioni (1950) who reported the results of a 1939 general scientific expedition on the island by Harald Lindberg, one of the most distinguished botanists in Finland in the 20th century, and his two sons, Hakan and Par Harald. The most detailed records on the bee fauna of the island were compiled by Mavromoustakis in a series of eight papers that summarised his Cyprus records which included 237 currently valid species (Mavromoustakis 1949 [“1948”], 1951, 1952, 1953, 1954, 1955, 1957a, 1958 [“1957”]). The first paper in the series is commonly cited according to its imprint date of 1948, but its date of publication as established for nomenclatural purposes by Evenhuis (2003) is 14 January 1949. Some other Mavromoustakis papers also have ICZN dates postdating their imprint dates as notes. Mavromoustakis’ data included in his eight Cyprus-specific papers are currently available in an accessible online database (Varnava and Stavrínides 2015), which includes data on the location, month and plant species on which bees were collected. The wild bee species had been reported by Mavromoustakis to visit 177 different species of plants, of which 13 are endemic (Varnava and Stavrínides 2015). Georghiou (1977) listed all the bees reported on the island by Pittioni (1950), as well as some species in the collections of the Department of Agriculture, virtually all of which were collected and identified by Mavromoustakis.

Recent work on selected genera of wild bees of Cyprus was carried out by Ebmer (2014). Ascher and Pickering’s (2018) online compilation lists 335 species of wild bees on the island, while Kuhlmann et al. (2015) report 305 species. The aim of the current work is to provide the first comprehensive checklist of the bees of Cyprus, including all past

information on authors' reports for each species, enriched with lists of new records and species collected by the authors of the current study.

2.3 Materials and methods

2.3.1 Study area

The geological history of Cyprus comprises a series of complex geological processes that started approximately 90 million years ago (mya), when the subduction of the African plate beneath the Eurasian created new oceanic crust; this was later cut off and uplifted to create the Troodos range, in the centre of the island, with a peak at 1,951 m (Wagstaffe 2016). The uplifting of limestone depositions created the Pentadaktylos range in the north of the country, with a maximum elevation of 1,024 m. The current form of the island took shape approximately two mya.

Pollen evidence suggests that early Holocene Cyprus was covered by dense stands of typical Mediterranean trees and shrubs, such as *Ceratonia siliqua*, *Quercus coccifera*, *Quercus infectoria*, *Laurus nobilis*, *Olea europaea*, *Cupressus sempervirens* and species in the genus *Juniperus* (Delipetrou et al. 2008). Noteworthy extinct species of animals that lived on the island during the Pleistocene until around 11,000 years BP include the Cyprus dwarf elephant (*Elephas cypriotes*) and Cyprus pygmy hippopotamus (*Phanourios minutus*), which probably arrived on the island by swimming from the mainland (Nicolaou et al. 2016).

The current land surface area of Cyprus is 9,251 km², of which 42% is covered with forest/shrubland, and 23% is devoted to agriculture (Vogiatzakis et al. 2016). There are 52 different habitat types listed in the EU Habitats Directive (92/43/EC), with five of them being exclusive to the island. The island is very rich in plant diversity with more than 1,900 plant species, of which 130 are endemic (Christofides 2017). Most of the endemic species of plants occur on the Troodos and Pentadaktylos mountain ranges.

There are 29 species of terrestrial mammals recorded on Cyprus, with bats represented by 19 species (Nicolaou et al. 2016). There are nine species of snakes, 11 species of lizards (one endemic species) (Sparrow and Baier 2016a), three species of native turtles (Sparrow and Baier 2016a), and three species of amphibians (one endemic) (Sparrow and Baier 2016b). Among the 412 bird species that have been recorded on Cyprus, 57 are resident

breeders with two endemic species that breed nowhere else: the Cyprus wheatear (*Oenanthe cypriaca*) and the Cyprus warbler (*Sylvia melanothorax*), with an additional of four endemic subspecies (Charalambidou et al. 2016).

Insects in Cyprus represent a highly diverse group with more than 5,000 recorded species according to Fauna Europaea (2012), with the number of species per order varying in more recent accounts. Coleoptera is the most species-rich order, followed by Hymenoptera and Lepidoptera. Well-studied groups include Odonata with 37 species (Sparrow et al. 2016), Orthoptera with 71 species of which 12 are endemic (Siedle et al. 2016), and butterflies with 49 species of which three are endemic (John 2016).

2.3.2 Methodology

The updated checklist was based on published records of wild bees and species present in authors' personal collections and in those of numerous correspondents. The earliest published descriptions based on Cyprus specimens date to 1870 (Dours, 1870) and 1910 (Cockerell, 1910), however these include specimens collected earlier, as it was very common for ornithologists or sometimes palaeontologists working for European museums to collect different taxa during their expeditions and provide them to experts for identification.

We used as a starting point for this survey a compilation of species occurrence records available for the island by J.S Ascher, accessible online through the website Discover Life (Ascher and Pickering 2018) some of which had associated specimens records captured through the project on the collaborative databasing of North American bee collections within a global informatics network (Ascher 2016). Each species in this initial list was evaluated by the experts, and species were retained in the checklist only if a primary paper based on examined specimens confirmed the presence of the species on the island. In addition, we retained in the checklist species for which a reference to a specific museum specimen was available.

Furthermore, a review of the literature known to the authors to cover Cyprus wild bee species was made to identify additional species recorded from the island. In general, we avoided redundant citation of distributional listings in global or regional compilations

(e.g. Ascher and Pickering 2018, Kuhlmann et al. 2015) or other secondary sources, such as Gusenleitner and Schwarz (2002) and Müller (2018). However, for some species for which no records for Cyprus existed in primary sources and which the authors of the study considered valid for Cyprus, we cited secondary sources.

Published works covering the wild bees of Cyprus as known to the authors were listed in chronological order under each species referenced. Georghiou (1977) was used as a reference only for species that were collected/examined in the Mavromoustakis collection during the Georghiou survey, but not for species whose presence in Cyprus was based on other published works (notably Pittioni, 1950).

Experts' samplings were carried out at different sites on the island (Fig. 1) by hand-netting and pan trapping. Sampling locations were concentrated on the southern part of the island, where the Republic of Cyprus exercises effective control (see Fig. 1 and Fig. 2A for an example of a sampling location). Hand-netting focused on collecting specimens during their visits to flowering plants (e.g. Fig 2B-D). For each species from the personal collection of authors we provide information on the collector (leg.), expert who identified the specimen (det.), locality, collection day, number of individuals of each sex and the collection specific number (museum collections/authors collections) when available. A list of museum acronyms is available in Table S1.

For species for which Cyprus is the type locality, we provide details on the type locality, status, repository, and collection event information (i.e., collector and date of collection), when available, extracted from a compilation of type data for world bees (J. S. Ascher, unpublished). For taxa described from Cyprus, we note the name under which the specimen was described from the island, to highlight the potentially interesting variation within the taxon. In addition, collection localities are provided for all specimens from the Mavromoustakis collection. Virtually all GPS coordinates for type specimens and specimens from the Mavromoustakis collection represent the centre of the administrative region of the village / city from where samples were collected, as no GPS data were available at the time of collection. For the unpublished records, the horizontal distance (30 m) from the given decimal latitude and decimal longitude describe the smallest circle containing the whole of the location.

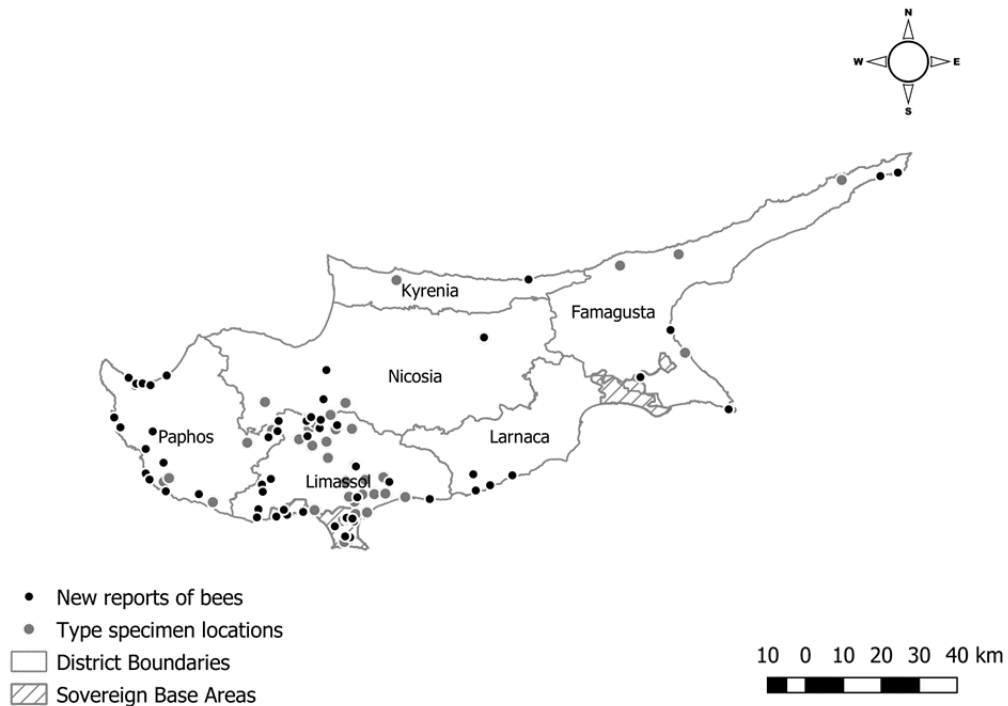


Figure 1. Map of Cyprus indicating locations of type specimens (for both valid and synonymised taxa) and unpublished records. See Suppl. material 1, Table S3, S4 for the geographic coordinates. The new reports of bees are shown with black dots and type specimen locations with grey dots.

The global distribution of each species is reported based on IUCN (2019) with additional data from Ascher and Pickering (2018) in cases where IUCN data did not list all continents from which a species was reported. Ascher and Pickering (2018) data were used to include additional continents in the distribution but not to amend the distribution data at country level for continents reported in IUCN (2019). We recognise that species distribution is dynamic, and therefore there might be differences between the actual distribution and the one described in the current study. Countries are grouped into geographic regions based on a United Nations categorisation (United Nations 2017 - ST/ESA/SER.A/408 - see Table S2). Specific countries are listed when the species is present in less than four countries within the geographic region. The nomenclature in the present work follows Nieto et al. (2014) for species names, Michener (2007) for most supra-specific taxa, and Dorchin et al. (2018) for the tribe Eucerini.

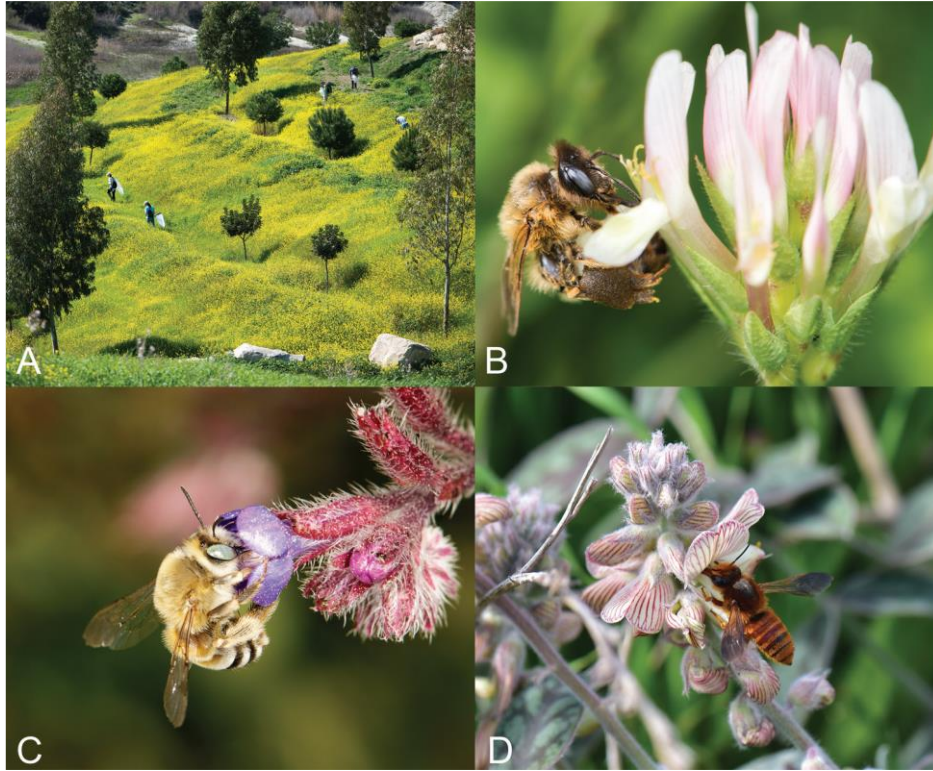


Figure 2. A Landscape with diverse bee fauna in Cyprus (Yermasoyia Dam area). B *Melitturga syriaca* foraging on *Trifolium clypeatum* C *Eucera dimidiata* foraging on *Anchusa undulata* subsp. *hybrida* D *Megachile cypricola* foraging on *Onobrychis venosa*. Pictures provided by Nicolas J. Vereecken (A, B, C) and Androulla Varnava (D).

2.4 Results

The present checklist for the Cyprus wild bee fauna includes a total of 369 species with confirmed records, 21 of which are endemic to Cyprus. Eleven species are reported for the first time from the island: *Andrena* (*Taeniandrena*) *leucopsis* Warncke, 1967, *A.* (*Chlorandrena*) *gordia* Warncke, 1975, *Anthophora* (*Pyganthophora*) *dalmatica* Pérez, 1902, *Colletes creticus* Noskiewicz, 1936, *Eucera* (*Hetereucera*) *aequata* Vachal, 1907, *E.* (*Eucera*) *palaestinae* Friese, 1922, *E.* (*Eucera*) *sulamita* Vachal, 1907, *Megachile* (*Eutricharaea*) *inexpectata* Rebmann, 1968, *Thyreus picaron* Lieftinck, 1968, *Sphecodes ephippius* (Linnaeus, 1767) and *S. pseudofasciatus* Blüthgen, 1925.

Additionally, unpublished records for 156 species of bees previously reported on the island are provided. The 369 wild bee species are classified into six families as follows: Apidae 110, Megachilidae 91, Andrenidae 76, Halictidae 72, Colletidae 19, and

Melittidae 1 species. Most of the 21 endemic species belong to the Andrenidae and Apidae families. We also provide a list of 29 additional species (see relevant section of Supplementary Material) for which there is high uncertainty for their presence on the island, even though they had been reported as present in Cyprus in the past.

A total of 101 species or subspecies were described from Cyprus (80 of which by G. Mavromoustakis) from 44 distinct locations (Fig. 1). Currently, 46 are valid at the species, and 18 at the subspecies level (Table S3). Most type locations are concentrated on the southern part of the island, in the District of Limassol, where Mavromoustakis resided and recent collections were carried out. Most of the type insects from Cyprus (52) are located at the Department of Agriculture collection in Nicosia (Cyprus Department of Agriculture, 1989).

2.4.1 Updated checklist of the bees of Cyprus

MELITTIDAE

DASYPODAINI

Genus *Dasypoda* LATREILLE, 1802

1 species.

Dasypoda (Megadasypoda) suripes (Christ, 1791)

References. Michez et al. (2004).

Distribution. Cyprus, Western Europe (Austria), Southern Europe (Albania, Italy), Northern Europe (Lithuania), Eastern Europe, Western Asia (Turkey, Armenia).

Notes. *D. suripes* has been considered by some authors to be a nomen dubium and therefore the species has been cited in some sources as *D. aurata* Rudow, 1881.

ANDRENIDAE

ANDRENINI

Genus *Andrena* FABRICIUS, 1775

73 species.

***Andrena (Aciandrena) aciculata* Morawitz, 1886**

References. Scheuchl and Willner (2016).

Material examined. Limassol District: Polemidia, 34.71178°N, 33.004775°E, 8.III.2017, (1♀); Sovereign Base Area, Akrotiri, Bishop's Pool, 34.597305°N, 32.984521°E, 10.III.2017, (1♀); Sovereign Base Area, Akrotiri, 34.600657°N, 32.971419°E, 10.III.2017, (2♀); Anogyra to Pachna Road km 4, 34.764269°N, 32.757736°E, 5.V.2015, (1♀), all records S.P.M Roberts leg., B. Tomozei det.

Distribution. Cyprus, Western Europe (Austria), Southern Europe (North Macedonia, Greece), Eastern Europe, Western Asia (Turkey), Southern Asia (Iran).

***Andrena (Suandrena) aegypticola* Friese, 1922**

References. Mavromoustakis (1954); Warncke (1967).

Mavromoustakis localities. Famagusta, Larnaca.

Distribution. Cyprus, Northern Africa (Libya), Western Asia.

Notes. Described from Cyprus as *Andrena larnacensis* Mavromoustakis 1954, from Famagusta: 35.125°N, 33.941667°E, 15.II.1951, G.A. Mavromoustakis leg., G.A. Mavromoustakis det. ♀, (DAAN).

***Andrena (Aenandrena) aeneiventris* Morawitz, 1872**

References. Mavromoustakis (1949 [“1948”]); Pittioni (1950); Mavromoustakis (1951, 1952, 1957a, b); Georghiou (1977); Scheuchl and Willner (2016).

Mavromoustakis localities. Limassol, Polemedia Hills, Zakaki, Asomatos, Fassouri, Yermasoyia river, Salamis, Near Pano Kivides, Kaloiri Hills near Yermasoyia River, Morphou.

Distribution. Cyprus, Western Europe (France, Switzerland, Austria), Southern Europe, Eastern Europe, Northern Africa, Central Asia, Western Asia.

Andrena (Melandrena) albopunctata (Rossi, 1792)

References. Gusenleitner and Schwarz (2002).

Distribution. Cyprus, Western Europe (France), Southern Europe, Eastern Europe, Northern Africa, Western Asia, Central Asia, Southern Asia (Iran, Afghanistan, Pakistan).

Andrena (Micrandrena) alfkenelloides Warncke, 1965

References. Gusenleitner and Schwarz (2002).

Material examined. Limassol District: 1 km E of Pissouri, 34.677579°N, 32.722066°E, 27.IV.2015, (3♀, 1♂), collecting pollen on Brassicaceae; 0.5 km E of Vasa, 34.831384°N, 32.79744°E, 29.IV.2015, (1♀), visiting Apiaceae; Anogyra to Avdimou Road km 2, 34.723986°N 32.736892°E, 3.V.2015, (21♀), collecting pollen and visiting Apiaceae; 0.7 km N of Anogyra, 34.745537°N, 32.73385°E, 3.V.2015, (14♀, 1♂), collecting pollen and visiting Apiaceae; Anogyra to Pachna Road km 4, 34.764269°N, 32.757736°E, 5.V.2015, (3♀), collecting pollen at Apiaceae, all records S.P.M. Roberts leg., B. Tomozei det.

Distribution. Cyprus, Southern Europe (Greece), Eastern Europe (Bulgaria), Western Asia (Turkey).

Andrena (Chlorandrena) astica Warncke, 1967

References. Gusenleitner and Schwarz (2002); Schwenninger (2015).

Distribution. Cyprus, Southern Europe (Greece), Western Asia (Turkey).

Andrena (Euandrena) bicolor Fabricius, 1775

References. Warncke (1965, 1975); Scheuchl & Willner (2016).

Material examined. Limassol District: Chionistra, 34.9317°N, 32.8664°E, 14.V.2012, 16.V.2012, S. Dimitriou leg., E. Scheuchl det. (1♂, 1♀), pan trap (UAEG).

Distribution. Cyprus, Widespread in Europe, Northern Africa (Morocco, Algeria, Tunisia), Western Asia (Turkey, Israel), Central Asia (Kazakhstan), Southern Asia (Iran), Eastern Asia (China).

Notes. Described from Cyprus as *Andrena bicolor* ssp. *apricaria* Warncke 1975, from Limassol: 34.66839°N, 33.03252°E, II.1939, K. Warncke leg./det. ♀, (OLML).

***Andrena (Cryptandrena) brumanensis* Friese, 1899**

References. Mavromoustakis (1949 [“1948”]); Pittioni (1950); Mavromoustakis (1951, 1952).

Material examined. Limassol District: 0.7 km N of Anogyra, 34.745537°N, 32.73385°E, 3.V.2015, (1♀), collecting pollen on Apiaceae; Yermasoyia Dam, 34.755799°N, 33.096194°E, 7.III.2017, all records S.P.M. Roberts leg., B. Tomozei det. (10♀).

Distribution. Cyprus, Western Europe (France), Southern Europe, Eastern Europe (Hungary, Romania, Slovakia), Western Asia (Turkey).

***Andrena (Truncandrena) canae* Strand, 1915**

References. Pittioni (1950); Mavromoustakis (1953, 1957a); Warncke (1967).

Mavromoustakis localities. Limassol, Amathus, Yerasa, Polemedia, Famagusta.

Distribution. Cyprus, Southern Europe (Greece), Western Asia (Turkey).

Notes. Described from Cyprus as *Andrena mavromoustakisi* Pittioni, 1950, from Geroskipou, E of Paphos: 34.76666°N, 32.46666°E, 8.V.1946, G.A. Mavromoustakis leg., B. Pittioni det., (MZHF).

***Andrena (Micrandrena) cervina* Warncke, 1975**

Type locality-country. Cyprus, Limassol: 34.66839°N, 33.03252°E, 10.IV.1967, G.A. Mavromoustakis leg., K. Warncke det. ♀, (OLML).

References. Warncke (1975).

Material examined. Limassol District: 2 km N of Anogyra, 34.748126°N, 32.732248°E, 1.V.2015, (1♀); Famagusta District: Cape Greco, 34.963264°N, 34.066211°E, 15.III.2017, (3♂), all records S.P.M. Roberts leg., B. Tomozei det.

Distribution. Cyprus. ENDEMIC.

***Andrena (Aenandrena) chaetogastra* Pittioni, 1950**

Type locality-country. Cyprus, Mt. Troodos, Chionistra: 34.9364°N, 32.8636°E, 17.VI.1939, H. Lindberg leg., B. Pittioni det. ♀, (MZHF).

References. Pittioni (1950).

Distribution. Cyprus, Western Asia (Israel).

***Andrena (Chlorandrena) cinereophila* Warncke, 1965**

References. Warncke (1965).

Distribution. Cyprus, Southern Europe (North Macedonia, Greece), Eastern Europe (Romania, Bulgaria), Western Asia (Israel), Southern Asia (Afghanistan).

***Andrena (Brachyandrena) colletiformis* Morawitz, 1874**

References. Mavromoustakis (1949 [“1948”]); Pittioni (1950); Mavromoustakis (1952, 1957a); Warncke (1967).

Mavromoustakis localities. Limassol, Cherkes, Yermasoyia River, Amathus, Salamis, Larnaca.

Distribution. Cyprus, Western Europe (France), Southern Europe, Eastern Europe, Northern Africa (Morocco, Tunisia, Algeria), Western Asia (Turkey, Israel), Central Asia (Turkmenistan, Kazakhstan), Southern Asia (Iran).

Notes. Described from Cyprus as *Andrena colletiformis insulana* Pittioni, 1950, from Kouklia: 34.6978°N, 32.592°E, 26.VI.1939, H. Lindberg leg., B. Pittioni det., (MZHF).

***Andrena (Simandrena) combinata* (Christ, 1791)**

References. Mavromoustakis (1949 ["1948"], 1951, 1952, 1954, 1958 ["1957"]); Scheuchl and Willner (2016).

Mavromoustakis localities. Limassol, Cherkes, Yermasoyia River, Amathus, Yerasa, Lania, Near Paramytha, Northern Mountains Kantara, Kellaki, Morphou (West Mesaoria plains), Larnaca.

Material examined. Limassol District: Makria Kontarka, 34.9095°N, 32.8971°E, 31.V.2012, 2.VI.2012 (1♀), pan trap (UAEG), all records S. Dimitriou leg., E. Scheuchl det.

Distribution. Cyprus, Widespread in Europe, Northern Africa (Algeria), Western Asia, Central Asia, Southern Asia (Iran), Eastern Asia (China).

***Andrena (Chlorandrena) crepidis* Schwenninger, 2015**

Type locality-country. Cyprus, Limassol District, 4 km SW Kaminaria: 34.904°N, 32.761°E, 24.III.2013, H.R. Schwenninger leg., H.R. Schwenninger det. ♂, (SMNS).

References. Schwenninger (2015).

Material examined. Limassol District: Kaminaria, 34.93°N, 32.78°E, 22.III.2013, (1♂); Kaminaria, 34.93°N, 32.78°E, 24.III.2013, (1♂); 4 km SW Kaminaria, 24.III.2013, (1♂); 5 km SW Kaminaria, 24.III.2013, (1♀, 1♂); Kaminaria, 34.93°N, 32.78°E, 2.IV.2009 (2♂); Amiantos, 34.918°N, 32.9472°E, 5-7.IV.2012 (1♂), pan trap (UAEG); Nicosia District: Kakopetria, 34.992°N, 32.9082°E, 5-7.IV.2012, (3♂), pan trap (UAEG); Kakopetria, 34.992°N, 32.9082°E, 25-27.IV.2012, (1♀), pan trap (UAEG), all Kaminaria records H.R. Schwenninger leg., H.R. Schwenninger det., all Amiantos records S. Dimitriou leg., E. Scheuchl det., all Kakopetria records S. Dimitriou leg., E. Scheuchl and J. Devalez det.

Distribution. Cyprus. ENDEMIC.

***Andrena (Notandrena) curvana* Warncke, 1965**

References. Scheuchl and Willner (2016).

Distribution. Cyprus, Western Europe (Austria), Southern Europe, Eastern Europe.

***Andrena (Cordandrena) cypria* Pittioni, 1950**

Type locality-country. Cyprus, Mt. Troodos, Chionistra: 34.9364°N, 32.8636°E, 17.VI.1939, H. Lindberg leg., B. Pittioni det. ♀, (MZHF).

References. Pittioni (1950); Mavromoustakis (1953).

Mavromoustakis localities. Mt. Troodos.

Distribution. Cyprus, Western Asia, Southern Asia (Iran).

***Andrena (Plastandrena) cypricola* Mavromoustakis, 1952**

Type locality-country. Cyprus, Kato Amiandos, 762-914m: 34.9059°N, 32.9431°E, 4.IV.1946, G.A. Mavromoustakis leg., G.A. Mavromoustakis det. ♀, (DAAN).

References. Pittioni (1950); Mavromoustakis (1952, 1953, 1954); Warncke (1967).

Mavromoustakis localities. Pera Pedi, Yermasoyia River, Trimiklini, Yerasa, Saettas, Ayia Phyla, Amyrou Monastery-near Apsiou, Amathus, Rotsou spring-near Paramytha, Kato Amiandos, Mt. Troodos.

Material examined. Nicosia District: Linou, 35.0755°N, 32.9164°E, 5-7.IV.2012, (1♀), pan trap (UAEG); Kakopetria, 34.992°N, 32.9082°E, 5-7.IV.2012, (1♀), pan trap (UAEG), all records S. Dimitriou leg., E. Scheuchl det.

Distribution. Cyprus. ENDEMIC.

***Andrena (Micrandrena) dargia* Warncke, 1965**

References. Gusenleitner and Schwarz (2002).

Distribution. Cyprus, Southern Europe (Greece), Western Asia (Turkey).

***Andrena (Holandrena) decipiens* Schenck, 1861**

References. Mavromoustakis (1949 [“1948”]); Warncke (1965); Scheuchl and Willner (2016).

Mavromoustakis localities. Limassol, Fassouri, Amathus, Akrounda, Nicosia.

Distribution. Cyprus, Western Europe, Southern Europe, Eastern Europe, Northern Africa, Western Asia (Turkey), Southern Asia (Iran).

***Andrena (Melandrena) elmaria* Gusenleitner, 1998**

References. Gusenleitner (1998).

Material examined. Limassol District: Yermasoyia Dam, 34.755799°N, 33.096194°E, 7.III.2017, (1♂); Sovereign Base Area Akrotiri, Bishop's Pool, 34.597305°N, 32.984521°E, 10.III.2017, (1♀, 1♂); Famagusta District: Cape Greco, 34.963264°N, 34.066211°E, 15.III.2017, (1♀), all records S.P.M. Roberts leg., B. Tomozei det.

Distribution. Cyprus, Western Asia, Southern Asia (Iran).

***Andrena (Parandrenella) figurata* Morawitz, 1866**

References. Gusenleitner and Schwarz (2002).

Distribution. Cyprus, Southern Europe, Eastern Europe, Western Asia (Turkey, Georgia, Azerbaijan), Southern Asia (Iran).

***Andrena flavilabris* Schenck, 1874**

References. Scheuchl and Willner (2016).

Distribution. Cyprus, Western Europe (France, Switzerland, Germany), Southern Europe (Spain), Eastern Europe (Ukraine), Western Asia.

***Andrena (Zonandrena) flavipes* Panzer, 1799**

References. Mavromoustakis (1949 [“1948”]); Pittioni (1950); Mavromoustakis (1951, 1952, 1953, 1954, 1957a); Georghiou (1977); Scheuchl and Willner (2016).

Mavromoustakis localities. Limassol, Polemedia Hills, Cherkes, Zakaki, Fassouri, Trimiklini, Eftagonia, Pissouri, Yerasa, Lania, Platania Forest Station, Fasoulla, Northern Mountains Kantara, Larnaca, Sand dunes near Amathus.

Material examined. Nicosia District: Kakopetria, 34.992°N, 32.9082°E, 5-7.IV.2012, (3♂, 2♀), pan trap (UAEG); Kakopetria, 34.992°N, 32.9082°E, 14-16.V.2012, (2♀), pan trap (UAEG); Kakopetria, 34.992°N, 32.9082°E, 31.V.2012, 2.VI.2012, (1♀), pan trap (UAEG); Limassol District: Amiantos, 34.918°N, 32.9472°E, 5-7.IV.2012, (12♂, 3♀), pan trap (UAEG); Amiantos, 34.918°N, 32.9472°E, 14-16.V.2012, (1♂, 1♀), pan trap (UAEG); Amiantos, 34.918°N, 32.9472°E, 31.V.2012, 2.VI.2012, (1♀), pan trap (UAEG); Makria Kontarka, 34.9095°N, 32.8971°E, 14-16.V.2012, (31♂, 3♀), pan trap (UAEG); Makria Kontarka, 34.9095°N, 32.8971°E, 31.V.2012, 2.VI.2012 (4♂, 17♀), pan trap (UAEG); Almirolivado, 34.9333°N, 32.9004°E, 14-16.V.2012, (58♂, 13♀), pan trap (UAEG); Almirolivado, 34.9333°N, 32.9004°E, 31.V.2012, 2.VI.2012, (1♂, 12♀), pan trap (UAEG); Troodos, Chionistra, 34.9317°N, 32.8664°E, 14-16.V.2012, (77♂, 1♀), pan trap (UAEG); Troodos, Chionistra, 34.9317°N, 32.8664°E, 31.V.2012, 2.VI.2012, (8♂, 40♀), pan trap (UAEG); Anogyra to Pachna Road km 4, 34.764269°N, 32.757736°E, 5.V.2015, (1♀); Yermasoyia Dam, 34.755799°N, 33.096194°E, 7.III.2017, (1♀, 1♂); Paphos District: Nr Arminou Reservoir, 34.883435°N, 32.750988°E, 29.IV.2015, (3♀), collecting pollen on Brassicaceae; 2.7 km SW of Acheleia, Potamos tis Ezouzas, 34.729004°N, 32.457544°E, 30.IV.2015, (1♀, 1♂), all Kakopetria, Amiantos, Makria Kontarka, Almirolivado and Troodos-Chionistra records S. Dimitriou leg., J. Devalez det., all Anogyra, Yermasoyia Dam and Paphos district records S.P.M. Roberts leg., B. Tomozei det.

Distribution. Cyprus, Widespread in Europe, Northern Africa, Western Asia, Central Asia, Southern Asia (India, Nepal), Eastern Asia (China).

***Andrena (Holandrena) forsterella* Osytshnjuk, 1978**

References. Schönitzer et al (1995); Gusenleitner and Schwarz (2002).

Distribution. Cyprus, Southern Europe, Eastern Europe (Bulgaria), Western Asia, Southern Asia (Iran).

Notes. In older literature often not separated from *A. variabilis*.

***Andrena (Melanapis) fuscata* Erichson, 1835**

References. Cockerell (1910); Mavromoustakis (1951, 1952, 1954); Warncke (1967); Scheuchl and Willner (2016).

Mavromoustakis localities. Episkopi, Zakaki, Cherkas, Fassouri, Famagusta, Larnaca.

Material examined. Famagusta District: Cape Greco, 34.963264°N, 34.066211°E, 15.III.2017, S.P.M. Roberts leg., B. Tomozei det. (7♂).

Distribution. Cyprus, Widespread in Europe, Northern Africa, Western Asia, Central Asia Southern Asia (India).

Notes. Described from Cyprus as *Andrena cyprica* Cockerell 1910, from Nicosia: 35.166667°N, 33.366667°E, 17.III, C. Glaszner leg., T.D.A. Cockerell det. ♂, (NHMUK).

***Andrena (Ptilandrena) glidia* Warncke, 1965**

References. Warncke (1974); Gusenleitner and Schwarz (2002).

Material examined. Nicosia District: Kakopetria, 34.992°N, 32.9082°E, 5-7.IV.2012, (1♀), pan trap (UAEG); Limassol District: Almirolivado, 34.9333°N, 32.9004°E, 14-16.V.2012, (2♀), pan trap (UAEG); Troodos, Chionistra, 34.9317°N, 32.8664°E, 14-16.V.2012, (3♀), pan trap (UAEG); Troodos, Chionistra, 34.9317°N, 32.8664°E, 31.V.2012, 2.VI.2012, (3♀), pan trap (UAEG), all records S. Dimitriou leg., E. Scheuchl det.

Distribution. Cyprus, Southern Europe (Greece), Western Asia (Turkey, Israel).

***Andrena (Chlorandrena) gordia* Warncke, 1975**

Material examined. Paphos District: Nr Arminou Reservoir, 34.883435°N, 32.750988°E, 29.IV.2015, (1♂), S.P.M. Roberts leg., B. Tomozei det.

Distribution. Cyprus, Western Asia (Turkey).

***Andrena (Melandrena) grandilabris* Pérez, 1903**

References. Warncke (1969, 1974).

Distribution. Cyprus, Western Asia.

***Andrena (Chrysandrena) hesperia* Smith, 1853**

References. Mavromoustakis (1949 [“1948”], 1951, 1952, 1953, 1957a); Scheuchl and Willner (2016).

Mavromoustakis localities. Limassol, Akrotiri Forest, Fassouri, Amathus, Yermasoyia River, Yerasa, Omodos, Trimiklini, Mesayitonia-Fasoulla, Amyrou Monastery (near Apsiou), Nicosia, Larnaca, Famagusta.

Material examined. Limassol District: Amiantos, 34.918°N, 32.9472°E, 25-27.IV.2012, (1♀), pan trap (UAEG); Sovereign Base Area, Akrotiri, 34.600657°N, 32.971419°E, 17.III.2017, (2♀), collecting pollen on *Crepis sancta* (Asteraceae); Sovereign Base Area, Avdimou Bay Cliffs, 34.656698°N, 32.773339°E, 13.III.2017, (1♀), all Amiantos records S. Dimitriou leg., E. Scheuchl det., all Akrotiri and Avdimou Bay records S.P.M. Roberts leg., B. Tomozei det.

Distribution. Cyprus, Widespread in Europe, Northern Africa, Western Asia (Turkey, Israel), Central Asia.

***Andrena (Margandrena) hyacinthina* Mavromoustakis, 1958**

Type locality-country. Cyprus, Yermasoyia River plain: 34.7182°N, 33.08788°E, 3.III.1952, G.A. Mavromoustakis leg., G.A. Mavromoustakis det. ♀, (DAAN).

References. Pittioni (1950); Mavromoustakis (1958); Warncke (1967).

Material examined. Limassol District: Yermasoyia Dam, 34.755799°N, 33.096194°E, 7.III.2017, S.P.M. Roberts leg., B. Tomozei det. (1♀).

Distribution. Cyprus, Western Asia (Turkey, Israel, Lebanon).

***Andrena (Ptilandrena) kornosica* Mavromoustakis, 1954**

Type locality-country. Cyprus, Mt. Kornos (Northern Mountains), 762m: 35.1379°N, 33.1379°E, 3.III.1936, G.A. Mavromoustakis leg., G.A. Mavromoustakis det. ♀, (NHMUK).

References. Pittioni (1950); Mavromoustakis (1954, 1957a); Warncke (1967).

Mavromoustakis localities. Mt. Kornos, Lania, Near Trooditissa.

Distribution. Cyprus. ENDEMIC.

***Andrena (Aciandrena) lamiana* Warncke, 1965**

References. Warncke (1965).

Material examined. Limassol District: Anogyra, 34.741952°N, 32.734845°E, 3.V.2015, S.P.M. Roberts leg., B. Tomozei det. (1♀), collecting pollen on Brassicaceae.

Distribution. Cyprus, Southern Europe (North Macedonia, Greece), Eastern Europe (Bulgaria), Western Asia (Turkey, Syria), Southern Asia (Iran).

***Andrena (Simandrena) lepida* Schenck, 1861**

References. Warncke (1965); Scheuchl and Willner (2016).

Distribution. Cyprus, Widespread in Europe, Northern Africa, Western Asia (Turkey, Israel, Syria), Southern Asia (Iran).

***Andrena (Taeniandrena) leucopsis* Warncke, 1967**

Material examined. Limassol District: Almirolivado, 34.9333°N, 32.9004°E, 14-16.V.2012, S. Dimitriou leg., E. Scheuchl det. (2♀), pan trap (UAEG).

Distribution. Cyprus, Southern Europe (North Macedonia, Greece), Eastern Europe (Romania, Bulgaria), Western Asia (Turkey, Lebanon), Southern Asia (Iran).

***Andrena (Poecilandrena) limassolica* Mavromoustakis, 1949**

Type locality-country. Cyprus, Limassol: 34.66839°N, 33.03252°E, 19.I.1936, G.A. Mavromoustakis leg., G.A. Mavromoustakis det. ♀, (DAAN).

References. Mavromoustakis (1949 [“1948”], 1952); Warncke (1967).

Mavromoustakis localities. Limassol, Polemedia Hills.

Distribution. Cyprus, Western Asia (Jordan).

***Andrena (Melandrena) limata* Smith, 1853**

References. Cockerell (1910, 1914); Mavromoustakis (1953, 1954, 1957a); Warncke (1967); Scheuchl and Willner (2016).

Mavromoustakis localities. Limassol, Zakaki, Pera Pedi.

Material examined. Limassol District: Sovereign Base Area Akrotiri, Bishop's Pool, 34.597305°N, 32.984521°E, 10.III.2017, (2♀, 1♂); Sovereign Base Area, Akrotiri, 34.600657°N, 32.971419°E, 10.III.2017, (1♀), collecting pollen on Asteraceae, all records S.P.M. Roberts leg., B. Tomozei det.

Distribution. Cyprus, Western Europe, Southern Europe, Eastern Europe, Northern Africa, Western Asia, Central Asia, Southern Asia (Iran).

Notes. Described from Cyprus as *Andrena batesiae* Cockerell, 1910, from Nicosia: 35.166667°N, 33.366667°E, D.M.A. Bate leg., T.D.A. Cockerell det. ♀, (NHMUK).

***Andrena (Micrandrena) lindbergella* Pittioni, 1950**

Type locality-country. Cyprus, Mt. Troodos, Chionistra: 34.9364°N, 32.8636°E, 17.VI.1939, H. Lindberg leg., B. Pittioni det. ♀, (MZHF).

References. Pittioni (1950); Warncke (1967).

Distribution. Cyprus, Western Asia (Israel, Lebanon).

***Andrena (Truncandrena) medeninensis* Pérez, 1895**

References. Warncke (1967, 1974).

Distribution. Cyprus, Southern Europe (Spain, Greece), Northern Africa, Western Europe (Turkey).

Notes. Records pertain to subspecies *usura* Warncke, 1967.

***Andrena (Simandrena) mehelyi* Alfken, 1936**

References. Scheuchl and Willner (2016).

Distribution. Cyprus, Western Europe (Austria), Southern Europe, Eastern Europe, Western Asia (Turkey), Southern Asia (Iran).

***Andrena (Chrysandrena) merula* Warncke, 1969**

Type locality-country. Cyprus, Ayia Eirini: 34.9816°N, 32.9712°E, 20.IV.1939, G.A. Mavromoustakis leg., K. Warncke det. ♂, (OLML).

References. Warncke (1969).

Distribution. Cyprus, Southern Europe (Greece), Western Asia (Turkey, Israel), Southern Asia (Afghanistan).

***Andrena (Cryptandrena) monacha* Warncke, 1965**

References. Warncke (1965).

Material examined. Limassol District: Yermasoyia Dam, 34.755799°N, 33.096194°E, 7.III.2017, S.P.M. Roberts leg., B. Tomozei det. (1♂).

Distribution. Cyprus, Southern Europe (Greece), Western Europe (Turkey, Lebanon, Syria).

***Andrena (Melandrena) morio* Brullé, 1832**

References. Mavromoustakis (1949 [“1948”]); Pittioni (1950); Mavromoustakis (1951, 1953, 1954, 1957a); Warncke (1967); Georghiou (1977); Scheuchl and Willner (2016).

Mavromoustakis localities. Limassol, Pera Pedi, Trimiklini, Lania, Moni, Polemedia, Zakaki, Cherkes, Fasoulla, Amathus, Potamitissa, Famagusta, Ayia Varvara (Stavrovouni).

Material examined. Nicosia District: Kakopetria, 34.992°N, 32.9082°E, 31.V.2012, 2.VI.2012, (1♀), pan trap (UAEG); Polemidia, 34.71178°N, 33.004775°E, 8.III.2017, (1♀); Famagusta District: Cape Greco, 34.963264°N, 34.066211°E, 15.III.2017, (7♂), all

Kakopetria records S. Dimitriou leg., J. Devalez det., all Polemidia and Cape Greco records S.P.M. Roberts leg., B. Tomozei det.

Distribution. Cyprus, Western Europe (France, Austria), Southern Europe, Eastern Europe, Northern Africa, Western Asia, Central Asia.

Notes. Described from Cyprus as *Andrena morio athalassae* Pittioni, 1950, from Limassol: 34.66839°N, 33.03252°E, 4-6.VI.1939, H. Lindberg leg., B. Pittioni det., (MZHF).

***Andrena (Ulandrena) neocypriaca* Mavromoustakis, 1956**

Type locality-country. Cyprus, Limassol: 34.66839°N, 33.03252°E, 16.IV.1949, G.A. Mavromoustakis leg., G.A. Mavromoustakis det. ♀, (DAAN).

References. Mavromoustakis (1956, 1957b); Warncke (1967).

Mavromoustakis localities. Near Limassol, Yermasoyia Hills.

Material examined. Limassol District: 2 km N of Anogyra, 34.748126°N, 32.732248°E, 1.V.2015, S.P.M. Roberts leg., B. Tomozei det. (1♀).

Distribution. Cyprus, Southern Europe (Greece), Western Asia (Turkey).

***Andrena (Melandrena) nigroaenea* (Kirby, 1802)**

References. Mavromoustakis (1949 [“1948”], 1951, 1952, 1954, 1956); Georghiou (1977); Scheuchl and Willner (2016).

Mavromoustakis localities. Limassol, Polemedia Hills, Zakaki, Mesayitonia, Apsiou, Yermasoyia River, Amathus, Pissouri, Potamitissa, Trimiklini, Lania, Kitromili near Polemedia, Famagusta, Near Kyperounta, Larnaca.

Material examined. Nicosia District: Kakopetria, 34.992°N, 32.9082°E, 5-7.IV.2012, (1♀), pan trap (UAEG); Kakopetria, 34.992°N, 32.9082°E, 14-16.V.2012, (8♀), pan trap (UAEG); Limassol District: Amiantos, 34.918°N, 32.9472°E, 14-16.V.2012, (3♀), pan trap (UAEG); Almirolivado, 34.9333°N, 32.9004°E, 14-16.V.2012, (3♀), pan trap (UAEG); Makria Kontarka, 34.9095°N, 32.8971°E, 14-16.V.2012, (5♀), pan trap (UAEG); Troodos, Chionistra, 34.9317°N, 32.8664°E, 14-16.V.2012, (3♀), pan trap

(UAEG); Almirolivado, 34.9333°N, 32.9004°E, 31.V.2012, 2.VI.2012, (5♀), pan trap (UAEG), all records S. Dimitriou leg., J. Devalez det.

Distribution. Cyprus, Widespread in Europe, Northern Africa, Western Asia, Southern Asia (Afghanistan, Iran).

***Andrena (Parandrenella) nisoria* Warncke, 1969**

References. Warncke (1974).

Material examined. Limassol District: Yermasoyia Dam, 34.755799°N, 33.096194°E, 7.III.2017, S.P.M. Roberts leg., B. Tomozei det. (1♂).

Distribution. Cyprus, Western Asia, Southern Asia (Iran).

***Andrena (Plastandrena) oligotricha* Mavromoustakis, 1952**

Type locality-country. Cyprus, Pera Pedi, 609m: 34.859444°N, 32.876111°E, 22.V.1929, G.A. Mavromoustakis leg., G.A. Mavromoustakis det. ♀, (DAAN).

References. Mavromoustakis (1949 [“1948”], 1952, 1953, 1954, 1957a); Warncke (1967).

Mavromoustakis localities. Limassol, Cherkes, Zakaki, Pera Pedi, Amathus, Lania, Kellaki, Ayia Varvara, Saettas, Potamitissa, Kato Amiantos, Ayios Kostantinos, Yerasa, Apsiou, Fasoula, Ayia Phyla, Amathus, Kykkos, Yermasoyia River.

Material examined. Paphos District: Nr Arminou Reservoir, 34.883435°N, 32.750988°E, 29.IV.2015, (2♀, 1♂), collecting pollen on Brassicaceae; Limassol District: 2 km N of Anogyra, 34.748126°N, 32.732248°E, 1.V.2015, (1♀), collecting pollen on Brassicaceae, all records S.P.M. Roberts leg., B. Tomozei det.

Distribution. Cyprus, Western Europe, Southern Europe, Northern Africa (Morocco, Algeria, Tunisia).

Notes. There has been considerable confusion over the true identity of this taxon. E. Scheuchl (2017, in litt.) regards *Andrena oligotricha* Mavromoustakis as a good species and that it replaces *Andrena bimaculata* in Cyprus. All previous records attributed to *A. bimaculata* are here treated as *A. oligotricha*.

***Andrena (Chlorandrena) orientana* Warncke, 1965**

References. Schwenninger (2015).

Material examined. Limassol District: 2 km N of Anogyra, 34.748126°N, 32.732248°E, 1.V.2015, (1♀), collecting pollen on Asteraceae; Sovereign Base Area, Akrotiri, 34.600657°N, 32.971419°E, 10.III.2017, (5♀), collecting pollen on Asteraceae, all records S.P.M. Roberts leg., B. Tomozei det.

Distribution. Cyprus, Southern Europe (North Macedonia, Greece), Eastern Europe (Bulgaria, Ukraine), Western Asia (Turkey, Israel).

***Andrena (Taeniandrena) ovatula* (Kirby, 1802)**

References. Mavromoustakis (1949 [“1948”], 1957b); Scheuchl and Willner (2016).

Mavromoustakis localities. Limassol, Amathus, Yermasoyia River.

Material examined. Limassol District: Yermasoyia Dam, 34.755799°N, 33.096194°E, 7.III.2017, S.P.M. Roberts leg., B. Tomozei det. (1♀, 1♂).

Distribution. Cyprus, Widespread in Europe, Northern Africa, Western Asia (Israel), Central Asia, Southern Asia (Iran, Afghanistan).

***Andrena (Chlorandrena) panurgimorpha* Mavromoustakis, 1957**

Type locality-country. Cyprus, Limassol: 34.66839°N, 33.03252°E, 16.IV.1949, G.A. Mavromoustakis leg., G.A. Mavromoustakis det. ♀, (DAAN).

References. Mavromoustakis (1957b, 1958).

Mavromoustakis localities. Yermasoyia Hills.

Material examined. Limassol District: Anogyra to Pachna Road km 4, 34.764269°N, 32.757736°E, 5.V.2015, S.P.M. Roberts leg., B. Tomozei det. (1♀, 2♂).

Distribution. Cyprus, Southern Europe (Italy, Greece), Eastern Europe (Ukraine), Western Asia (Turkey, Israel), Southern Asia (Iran).

***Andrena (Truncandrena) pareklisiae* Mavromoustakis, 1957**

Type locality-country. Cyprus, Lania: 34.82444°N, 32.920833°E, 11.IV.1953, G.A. Mavromoustakis leg., G.A. Mavromoustakis det. ♀, (DAAN).

References. Mavromoustakis (1957b); Warncke (1967).

Distribution. Cyprus. ENDEMIC.

***Andrena (Ulandrena) polemediana* Mavromoustakis, 1956**

Type locality-country. Cyprus, Ayia Eirini (near Paramytha): 34.9816°N, 32.9712°E, 12.IV.1939, G.A. Mavromoustakis leg., G.A. Mavromoustakis det. ♀, (DAAN).

References. Mavromoustakis (1956, 1957b).

Mavromoustakis localities. Near Limassol.

Material examined. Limassol District: Anogyra, 34.741952°N, 32.734845°E, 3.V.2015, S.P.M. Roberts leg., B. Tomozei det. (1♀), visiting Asteraceae.

Distribution. Cyprus. ENDEMIC.

***Andrena (Melandrena) pyropygia* Kriechbaumer, 1873**

References. Mavromoustakis (1949 [“1948”], 1951, 1952).

Mavromoustakis localities. Limassol, Polemedia Hills, Cherkes, Episkopi, Pano Kivides, Eleousa Monastery, Karpasian Peninsula, Apostolos Varnavas (near Famagusta).

Distribution. Cyprus, Southern Europe (Greece), Eastern Europe (Ukraine), Western Asia (Turkey, Israel), Southern Asia (Iran).

***Andrena (Poliandrena) pyrozonata* Friese, 1921**

References. Mavromoustakis (1958); Warncke (1967).

Distribution. Cyprus, Western Asia (Turkey).

Notes. Described from Cyprus as *Andrena perapedica* Mavromoustakis, 1958, from Pera Pedi, 609 m: 34.859444°N, 32.876111°E, G.A. Mavromoustakis leg., G.A. Mavromoustakis det. ♀, (DAAN).

***Andrena (Truncandrena) paramythensis* Mavromoustakis, 1957**

References. Mavromoustakis (1957a); Warncke (1967).

Mavromoustakis localities. Near Paramytha, Yerasa, Apsiou, Fasoulla, Lania, Pera Pedi, Kellaki, Trimiklini.

Distribution. Cyprus, Western Asia (Turkey).

Notes. The subspecies described from Cyprus is *Andrena rufomaculata paramythensis* Mavromoustakis, 1957, from Paramytha vicinity (Vrisi tou Rotsou): 34.757°N, 32.972°E, 11.III.1944, G.A. Mavromoustakis leg., G.A. Mavromoustakis det. ♀, (DAAN).

***Andrena (Troandrena) saettana* Warncke, 1975**

Type locality-country. Cyprus, Saittas: 34.8708333°N, 32.9166667°E, 2.V.1961, G.A. Mavromoustakis leg., K. Warncke det. ♀, (OLML).

References. Warncke (1975).

Distribution. Cyprus, Southern Europe (Greece), Western Asia (Turkey, Jordan).

***Andrena (Margandrena) sibthorpi* Mavromoustakis, 1952**

Type locality-country. Cyprus, Polemedia Hills: 34.7134°N, 32.9812°E, 9.XII.1949, G.A. Mavromoustakis leg., G.A. Mavromoustakis det. ♀, (DAAN).

References. Mavromoustakis (1952); Warncke (1967).

Mavromoustakis localities. Polemedia Hills.

Distribution. Cyprus. ENDEMIC.

***Andrena (Taeniandrena) similis* Smith, 1849**

References. Warncke (1975); Scheuchl and Willner (2016).

Material examined. Paphos District: Nr Arminou Reservoir, 34.883435°N, 32.750988°E, 29.IV.2015, (1♀); Limassol District: 0.5 km E of Vasa, 34.831384°N, 32.79744°E, 29.IV.2015, (1♀), visiting Asteraceae; Yermasoyia Dam, 34.755799°N, 33.096194°E, 7.III.2017, (1♀), all records S.P.M. Roberts leg., B. Tomozei det.

Distribution. Cyprus, Widespread in Europe, Western Asia, Central Asia, Southern Asia (Iran, Afghanistan), Eastern Asia (China).

Notes. Described from Cyprus as *Andrena ocreata* ssp. *cyprisina* Warncke 1975, from Limassol: 34.66839°N, 33.03252°E, 8.III.1959, G.A. Mavromoustakis leg., K. Warncke det. ♀, (KW).

***Andrena (Micrandrena) spreta* Pérez, 1895**

References. Warncke (1974, 1975).

Distribution. Cyprus, Western Europe, Southern Europe, Northern Africa, Western Asia, Southern Asia (Iran, Afghanistan).

Notes. Cyprus records pertain to subspecies *scirpacea* Warncke, 1975 (type locality: Turkey).

***Andrena (Aciandrena) tenuiformis* Pittioni, 1950**

Type locality-country. Cyprus, Mt. Troodos, 1200-1952 m: 34.9364°N, 32.8636°E, 16-22.VI.1939, H. Lindberg leg., B. Pittioni det. ♀, (MZHF).

References. Pittioni (1950); Warncke (1967).

Distribution. Cyprus, Western Asia (Turkey, Israel).

***Andrena (Simandrena) thomsonii* Ducke, 1898**

References. Gusenleitner and Schwarz (2002).

Distribution. Cyprus, Western Europe (France), Southern Europe, Western Asia (Turkey), Southern Asia (Iran).

***Andrena (Melandrena) thoracica* (Fabricius, 1775)**

References. Mavromoustakis (1949 [“1948”], 1953, 1954, 1957a, b); Georghiou (1977); Scheuchl and Willner (2016).

Mavromoustakis localities. Limassol, Zakaki, Episkopi, Yermasoyia River, Famagusta.

Distribution. Cyprus, Widespread in Europe, Northern Africa (Morocco, Algeria, Tunisia), Western Asia, Central Asia, Southern Asia (Iran, Afghanistan), Eastern Asia (China, Korea).

Notes. Described from Cyprus as *Andrena thoracica* ssp. *kotschyi* Mavromoustakis 1953, from Limassol: 34.66839°N, 33.03252°E, 12.V.1930, G.A. Mavromoustakis leg./det. ♀, (DAAN).

***Andrena (Cordandrena) torda* Warncke, 1965**

References. Warncke (1965).

Material examined. Famagusta District: Cape Greco, 34.963264°N, 34.066211°E, 15.III.2017, S.P.M. Roberts leg., B. Tomozei det. (1♀).

Distribution. Cyprus, Southern Europe (Greece), Western Asia.

***Andrena (Simandrena) transitoria* Morawitz, 1871**

References. Mavromoustakis (1949 [“1948”], 1951, 1952, 1953, 1954, 1957a).

Mavromoustakis localities. Limassol, Cherkes, Episkopi, Yermasoyia River, Ayia Phyla, Apsiou, Amathus, Pissouri, Potamitissa, Kato Amiandos, Fasoulla, Yerasa, Moni, Trimiklini, Kellaki, Phinikaria River, Platania Forest.

Distribution. Cyprus, Southern Europe (North Macedonia, Greece), Eastern Europe, Western Asia, Central Asia (Kyrgyzstan, Tajikistan, Turkmenistan), Southern Asia (Afghanistan).

***Andrena (Troandrena) troodica* Warncke, 1975**

References. Pittioni (1950).

Distribution. Cyprus, Western Asia (Turkey).

***Andrena (Truncandrena) truncatilabris* Morawitz, 1877**

References. Mavromoustakis (1949 [“1948”], 1951, 1952, 1953, 1957a, b).

Mavromoustakis localities. Limassol, Cherkes, Apsiou, Fassouri, Yermasoyia River, Amathus, Pissouri, Yerasa, Near Paramytha, Trimiklini, Morphou, Near Famagusta.

Material examined. Limassol District: Yermasoyia Dam, 34.755799°N, 33.096194°E, 7.III.2017, (1♂, 2♀); Polemidia, 34.71178°N, 33.004775°E, 8.III.2017, (1♂, 1♀); Sovereign Base Area, Akrotiri, Bishop's Pool, 34.597305°N, 32.984521°E, 10.III.2017, (1♀); Paphos District: Nr Arminou Reservoir, 34.883435°N, 32.750988°E, 29.IV.2015, (1♂, 2♀), collecting pollen on *Sinapis* (Brassicaceae), all records S.P.M. Roberts leg., B. Tomozei det.

Distribution. Cyprus, Western Europe (France), Southern Europe, Eastern Europe, Northern Africa (Algeria, Libya), Western Asia (Israel, Lebanon, Syria), Central Asia (Kazakhstan, Turkmenistan), Southern Asia (Iran).

***Andrena (Notandrena) ungeri* Mavromoustakis, 1952**

Type locality-country. Cyprus, Zakaki: 34.663951°N, 32.999785°E, 18.I.1949 [“1948”], G.A. Mavromoustakis leg., G.A. Mavromoustakis det. ♂, (DAAN).

References. Pittioni (1950); Mavromoustakis (1952).

Distribution. Cyprus, Southern Europe (North Macedonia, Greece), Eastern Europe (Hungary, Romania, Bulgaria), Northern Africa (Morocco), Western Asia (Turkey).

***Andrena (Notandrena) urdula* Warncke, 1965**

References. Gusenleitner and Schwarz (2002).

Distribution. Cyprus, Southern Europe (Spain - only in the west, Greece), Eastern Europe (Romania, Bulgaria), Northern Africa (South Morocco), Western Asia.

***Andrena (Holandrena) variabilis* Smith, 1853**

References. Mavromoustakis (1949 ["1948"], 1951).

Mavromoustakis localities. Limassol, Cherkes, Yermasoyia River, Near Zakaki, Near Enkomi of Famagusta.

Material examined. Limassol District: Almirolivado, 34.9333°N, 32.9004°E, 31.V.2012, 2.VI.2012, S. Dimitriou leg., E. Scheuchl det. (1♂), pan trap (UAEG); Anogyra to Pachna Road km 4, 34.764269°N, 32.757736°E, 5.V.2015, S.P.M. Roberts leg., B. Tomozei det. (1♀).

Distribution. Cyprus, Widespread in Europe, Northern Africa (Morocco, Algeria, Tunisia), Western Asia, Central Asia (Kazakhstan, west Turkmenistan), Southern Asia (Iran).

***Andrena (Cryptandrena) ventricosa* Dours, 1873**

References. Mavromoustakis (1949 ["1948"], 1951, 1957a); Warncke (1975).

Mavromoustakis localities. Cherkes, Amathus, Pissouri, Pyrgos, Ayia Phyla, Paramytha.

Distribution. Cyprus, Western Europe (France, Austria), Southern Europe, Eastern Europe, Northern Africa (Morocco, Tunisia), Western Asia, Central Asia.

Notes. Described from Cyprus as *Andrena ventricosa ridibundus* Warncke 1975, from Cherkes: 34.65°N, 32.975°E, 11.III.1951, G.A. Mavromoustakis leg., K. Warncke det. ♀, (KW).

***Andrena (Ptilandrena) vetula* Lepeletier, 1841**

References. Mavromoustakis (1949 ["1948"], 1951, 1954, 1958 ["1957"]); Georghiou (1977).

Mavromoustakis localities. Limassol, Fassouri, Yermasoyia River, Pera Pedi, Amathus, Near Famagusta.

Material examined. Limassol District: Anogyra, 34.73663°N, 32.732715°E, 26.IV.2015, (1♂, 1♀), collecting pollen on *Sinapis* (Brassicaceae); Anogyra, 34.741952°N, 32.734845°E, 3.V.2015, (3♀), collecting pollen on *Sinapis* (Brassicaceae); Anogyra to Avdimou Road km 2, 34.723986°N, 32.736892°E, 3.V.2015, (1♀), collecting pollen on *Sinapis* (Brassicaceae); Anogyra to Pachna Road km 4, 34.764269°N, 32.757736°E, 5.V.2015, (1♀), collecting pollen on Brassicaceae; Sovereign Base Area, Paramali Bay, 34.661805°N, 32.804261°E, 10.III.2017, (1♂), visiting *Sinapis alba* (Brassicaceae); Paphos District: Nr Arminou Reservoir, 34.883435°N, 32.750988°E, 29.IV.2015, (1♂, 5♀), collecting pollen on *Sinapis* (Brassicaceae); Famagusta District: Cape Greco, 34.963264°N, 34.066211°E, 15.III.2017, (2♂), all records S.P.M. Roberts leg., B. Tomozei det.

Distribution. Cyprus, Western Europe (France), Southern Europe (Portugal, Spain, Italy), Northern Africa, Western Asia, Central Asia (Turkmenistan), Southern Asia (Iran).

***Andrena (Holandrena) wilhelmi* Schubert, 1995**

References. Schubert (1995).

Distribution. Cyprus, Southern Europe (North Macedonia, Italy, Greece), Eastern Europe (Ukraine), Western Asia (Turkey, Israel).

The only known Cyprus records are listed as Paratypes in Schubert (1995): Limassol, III.1932, 1m J. Schubert det.; Salamis (north of Famagusta), 23.III.1971, K.M. Guichard leg., J. Schubert det.

***Andrena (Taeniandrena) wilkella* (Kirby, 1802)**

References. Warncke (1965); Scheuchl and Willner (2016).

Distribution. Cyprus, Widespread in Europe, Western Asia, Central Asia, Southern Asia (India), Eastern Asia (China).

MELITTURGINI

Genus *Melitturga* LATREILLE, 1809

1 species.

***Melitturga (Melitturga) syriaca* Friese, 1899**

References. Mavromoustakis (1949 [“1948”], 1951, 1957a).

Mavromoustakis localities. Near Limassol, Mesayitonia, Near Palodia.

Material examined. Limassol District: Yermasoyia Dam, 34.755799°N, 33.096194°E, 7.III.2017, (5♀); Paphos District: N of Elia Bridge, 34.900977°N, 32.776759°E, 29.IV.2015, (3♂), all records S.P.M. Roberts leg./det.

Distribution. Cyprus, Eastern Europe (Bulgaria), Western Asia.

PANURGINI

Genus *Panurginus* NYLANDER, 1848

2 species.

***Panurginus lactipennis* Friese, 1897**

References. Pittioni (1950); Mavromoustakis (1952).

Mavromoustakis localities. Mt. Troodos.

Distribution. Cyprus, Southern Europe (Greece), Eastern Europe (Romania), Western Asia (Turkey).

***Panurginus turcomanicus* Popov, 1936**

References. Warncke (1972b).

Distribution. Cyprus, Eastern Europe (Ukraine), Western Asia (Turkey, Israel, Azerbaijan), Central Asia.

HALICTIDAE

HALICTINI

Genus *Halictus* LATREILLE, 1804

14 species.

Halictus (Halictus) asperulus Pérez, 1895

References. Mavromoustakis (1949 [“1948”]); Pittioni (1950); Mavromoustakis (1951, 1952, 1953, 1957a); Ebmer (2014).

Mavromoustakis localities. Pera Pedi, Mt. Troodos, Platania Forest Station, Ayia Varvara (Stavrovouni), Eftagonia, Trimiklini, Pyrga, Xerokolimbi Stream near Trooditissa, Platres.

Material examined. Paphos District: 15 km SE Paphos, Kouklia, 34.72°N, 32.55°E, 20.VI.2013, C. Schmid-Egger leg., A.W. Ebmer det. (1♀).

Distribution. Cyprus, Western Europe (France, Austria), Southern Europe (Spain, Italy, Albania), Eastern Europe, Western Asia (Israel), Southern Asia (Iran).

Halictus (Halictus) brunnescens (Eversmann, 1852)

References. Mavromoustakis (1949 [“1948”]); Pittioni (1950); Mavromoustakis (1951, 1952, 1957a,b); Ebmer (2014).

Mavromoustakis localities. Limassol, Polemedia Hills, Akrotiri village, Cherkes, Episkopi, Yermasoyia River, Fassouri, Near Zakaki, Ayios Athanasios, Amathus, Eftagonia, Trimiklini, Mt. Troodos Kannoures Springs, Younaros of Zakaki, Pyrga (Larnaca), Near Ayios Theodoros (Pitsillia), Larnaca.

Material examined. Nicosia District: Linou, 35.0755°N, 32.9164°E, 5-7.IV.2012, (1♀), pan trap (UAEG); Kakopetria, 34.992°N, 32.9082°E, 5-7.IV.2012, (3♀), pan trap (UAEG); Kakopetria, 34.992°N, 32.9082°E, 25-27.IV.2012, (1♀), pan trap (UAEG); Limassol District: Amiantos, 34.918°N, 32.9472°E, 31.V.2012, 2.VI.2012, (2♀), pan trap (UAEG); Almirolivado, 34.9333°N, 32.9004°E, 16-18.IX.2011, (1♀), pan trap (UAEG); SBA, 8 km S Limassol, Akrotiri (near Airbase), 34.60°N, 32.97°E, 20.VI.2013, (4♂);

Paphos District: 15 km SE Paphos, Kouklia, 34.72°N, 32.55°E, 20.VI.2013, (10♂); 20 km NNW Paphos, Lara Beach, 34.94°N, 32.31°E, 20.VI.2013, (1♀, 5♂), all Linou, Kakopetria, Amiantos and Almirolivado records S. Dimitriou leg., J. Devalez det., all Akrotiri and Paphos district records C. Schmid-Egger leg., A.W. Ebmer det.

Distribution. Cyprus, Western Europe (Austria), Southern Europe (Spain, Greece), Eastern Europe, Northern Africa, Western Asia (Turkey), Central Asia, Southern Asia.

***Halictus (Seladonia) cephalicus* Morawitz, 1874**

References. Mavromoustakis (1949 [“1948”]); Mavromoustakis (1951, 1952, 1957a); Ebmer (2014).

Mavromoustakis localities. Limassol, Polemedia Hills, Cherkes, Akrotiri Bay, Moni, Yermasoyia River, Kathikas, Amathus, Near Eftagonia.

Material examined. Paphos District: 15 km SE Paphos, Kouklia, 34.72°N, 32.55°E, 20.VI.2013, (20♀, 1♂); 20 km N Paphos, Kathikas, 34.90°N, 32.42°E, 20.VI.2013, (3♀); 6 km NE Polis, beach, 35.06°N, 32.46°E, 20.VI.2013, (2♀); 6 km W Polis, botanical garden, 35.03°N, 32.37°E, 20.VI.2013, (1♀); Polis, 35.053539°N, 32.351197°E, 30.X.2016, (9♂), visiting *Dittrichia viscosa* (Asteraceae); 8 km N Paphos, Mavrokolympos Reservoir, 34.85°N, 32.40°E, 20.VI.2013, (5♀, 1♂); Limassol District: Troodos, Mt. Olympos, 34.93°N, 32.86°E, 20.VI.2013, (1♀); 1 km E of Pissouri, 34.677579°N, 32.722066°E, 27.IV.2015, (1♀), visiting Brassicaceae; Anogyra to Pachna Road km 4, 34.764269°N, 32.757736°E, 5.V.2015, (2♀), collecting pollen on Brassicaceae; Sovereign Base Area, Akrotiri, 34.628771°N, 32.941031°E, 29.X.2016, (1♂, 1♀), visiting *Dittrichia viscosa* (Asteraceae), all Kouklia, Kathikas, NE Polis, Polis botanical garden, Mavrokolympos Reservoir and Troodos, Mt. Olympos records C. Schmid-Egger leg., A.W. Ebmer det., all Polis, Pissouri, Anogyra, and Akrotiri records S.P.M. Roberts leg., A. Pauly det.

Distribution. Cyprus, Southern Europe, Eastern Europe, Western Asia, Southern Asia (Iran).

***Halictus (Mucoreohalictus) cypricus* Blüthgen, 1937**

Type locality-country. Cyprus, Limassol: 34.66839°N, 33.03252°E, 7.III.1931, G.A. Mavromoustakis leg., P.A.V. Blüthgen det. ♀, (MFNB).

References. Blüthgen (1937); Mavromoustakis (1949 [“1948”]); Pittioni (1950); Mavromoustakis (1951, 1952); Georghiou (1977); Ebmer (2014).

Mavromoustakis localities. Limassol, Polemedia Hills, Cherkes, Zakaki, Episkopi, Pera Pedi, Akrotiri Bay, Pissouri, Near Zakaki, Famagusta.

Material examined. Paphos District: 15 km SE Paphos, Kouklia, 34.72°N, 32.55°E, 20.VI.2013, C. Schmid-Egger leg., A.W. Ebmer det. (1♂).

Distribution. Cyprus, Western Asia (Turkey, Israel), Southern Asia (Iran).

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

References. Ebmer (2014).

Distribution. Cyprus, Northern Africa (Egypt), Western Asia (Turkey, Israel, Syria).

***Halictus (Halictus) graecus* Blüthgen, 1933**

References. Pesenko (2005).

Distribution. Cyprus, Southern Europe (Greece, Croatia), Eastern Europe (Bulgaria, Ukraine), Western Asia (Turkey).

***Halictus (Halictus) nicosiae* Blüthgen, 1923**

Type locality-country. Cyprus, Nicosia: 35.166667°N, 33.366667°E, Staudinger leg., P. A.V. Blüthgen det.

References. Blüthgen (1923); Mavromoustakis (1949 [“1948”]); Pittioni (1950); Mavromoustakis (1951, 1952, 1953, 1954); Ebmer (2014).

Mavromoustakis localities. Polemedia Hills, Apsiou, Pera Pedi, Near Pano Kivides, Near Amathus, Trimiklini, Saettas, Platres, Fasoulla, Yerasa, Lania, Livadin of Cedars (Paphos Forest), Platania Forest Station, Karpasian Peninsula, Eleousa Monastery, Xerokolimbi Stream near Trooditissa, Kykkou Monastery.

Ebmer localities: Platres, Mochi, Lefkara, Coral Bay, Agios Nikolaos, Troodos-Pano Platres road, Moni Trooditissa, Caledonia Waterfall, Tripylos Cedar Valley, south of Mt. Olympus, Kannaviou, Arminou to Filousa, Agios Nikolaos to Mandria, Pano Panagia, Moni Trooditissa, north of Mt. Olympus, South of Kakopetria, East of Platania, 3 km north east Troodos, north of Platres.

Material examined. Paphos District: 15 km SE Paphos, Kouklia, 34.72°N, 32.55°E, 20.VI.2013, (2♀); 20 km N Paphos, Kathikas, 34.90°N, 32.42°E, 20.VI.2013, (1♀); 8 km N Paphos, Mavrokolympos Reservoir, 34.85°N, 32.40°E, 20.VI.2013, (2♀); Limassol District: Troodos, Mt. Olympos, 34.93°N, 32.86°E, 20.VI.2013, C. (2♀); 2 km N of Anogyra, 34.748126°N, 32.732248°E, 1.V.2015, (1♀); Anogyra to Avdimou Road km 2, 34.723986°N, 32.736892°E, 3.V.2015, (1♀), visiting Asteraceae; 0.7 km N of Anogyra, 34.745537°N, 32.73385°E, 3.V.2015, (1♀); Anogyra to Pachna Road km 4, 34.764269°N, 32.757736°E, 5.V.2015, (1♀), all Kouklia, Kathikas, Mavrokolympos Reservoir and Troodos Mt. Olympos records C. Schmid-Egger leg., A.W. Ebmer det., all Anogyra records S.P.M. Roberts leg., A. Pauly det.

Distribution. Cyprus. ENDEMIC.

***Halictus (Seladonia) phryganicus* (Pauly & Devalez, 2015)**

References. Mavromoustakis (1949 [“1948”]); Pittioni (1950); Mavromoustakis (1951, 1952, 1957a); Georghiou (1977); Ebmer (2014); Pauly (2015).

Mavromoustakis localities. Limassol, Polemedia Hills, Mt. Troodos Kannoures springs, Erimi, Chiflicoudia marshes, Amathus, Pissouri, Yermasoyia River/Hills, Moni, Pyrga, Near Mesayitonia, Alassa.

Material examined. Paphos District: 15 km SE Paphos, Kouklia, 34.72°N, 32.55°E, 20.VI.2013, (5♀); 6 km NE Polis, beach, 35.06°N, 32.46°E, 20.VI.2013, (4♀); 6 km W Polis, botanical garden, 35.03°N, 32.37°E, 20.VI.2013, (1♀); 8 km N Paphos, Mavrokolympos Reservoir, 34.85°N, 32.40°E, 20.VI.2013, (1♀, 1♂); Limassol District: SBA, 8 km S Limassol, Akrotiri (near Airbase), 34.60°N, 32.97°E, 20.VI.2013, (1♀, 1♂); Sovereign Base Area, Episkopi, Kensington Cliffs, 34.670772°N, 32.846923°E, 4.V.2015, (2♀), all Paphos district and 8 km S Limassol Akrotiri records C. Schmid-Egger leg., A. Pauly det., all Episkopi records S.P.M. Roberts leg., A. Pauly det.

Distribution. Cyprus, Southern Europe (Greece), Eastern Europe (Bulgaria), Western Asia (Turkey, Israel), Central Asia, Southern Asia (Iran).

Notes. All records of *Halictus smaragdulus* Vachal, 1895 from Cyprus are now attributable to this recently described species.

***Halictus (Mucoreohalictus) pollinosus* Sichel, 1860**

References. Blüthgen (1937); Mavromoustakis (1949 [“1948”], 1951, 1954, 1957a); Ebmer (2014).

Mavromoustakis localities. Limassol, Pera Pedi, Hills near Trimiklini, Amiandos, Moni, Mt. Troodos Kannoures Springs.

Material examined. Limassol District: Amiantos, 34.918°N, 32.9472°E, 31.V.2012, 2.VI.2012, (2♀), pan trap (UAEG); Anogyra to Pachna Road km 4, 34.764269°N, 32.757736°E, 5.V.2015, (2♀), visiting Asteraceae; Paphos District: 2.7 km SW of Acheleia, Potamos tis Ezouzas, 34.729004°N, 32.457544°E, 30.IV.2015, (1♀), collecting pollen at *Chrysanthemum* sp. (Asteraceae), all Amiantos records S. Dimitriou leg., J. Devalez and A. Pauly det., all Anogyra and Paphos district records S.P.M. Roberts leg., A. Pauly det.

Distribution. Cyprus, Western Europe (France, Germany, Austria), Southern Europe, Eastern Europe, Northern Africa, Western Asia (Turkey, Israel, Jordan), Central Asia, Southern Asia (Iran, Afghanistan, Pakistan).

Notes. The subspecies from Cyprus is *Halictus pollinosus limissicus* Blüthgen, 1937, from Limassol: 34.66839°N, 33.03252°E, 2.VI.1928, G.A. Mavromoustakis leg., P.A.V. Blüthgen det. ♂, (MFNB).

***Halictus (Vestitohalictus) pulvereus* Morawitz, 1874**

References. Ebmer (2014).

Material examined. Paphos District: 20 km N Paphos, Kathikas, 34.90°N, 32.42°E, 20.VI.2013, C. Schmid-Egger leg., A.W. Ebmer det. (2♀).

Distribution. Cyprus, Southern Europe (Greece), Eastern Europe (Ukraine), Western Asia (Turkey), Central Asia (Turkmenistan, Uzbekistan), Southern Asia (Iran, Afghanistan), Eastern Asia.

Halictus (Halictus) quadricinctus (Fabricius, 1776)

References. Georghiou (1977).

Material examined. Limassol District: 1 km E of Pissouri, 34.677579°N, 32.722066°E, 27.IV.2015, (1♀), visiting Asteraceae; 2 km N of Anogyra, 34.748126°N, 32.732248°E, 1.V.2015, (1♀), visiting Asteraceae, all records S.P.M. Roberts leg., A. Pauly det.

Distribution. Cyprus, Western Europe, Southern Europe, Eastern Europe, Northern Europe (Denmark, Finland), Western Asia, Central Asia, Southern Asia (Iran, Afghanistan), Eastern Asia (China, Mongolia).

Halictus (Halictus) resurgens Nurse, 1903

References. Blüthgen (1923); Mavromoustakis (1949 [“1948”], 1951, 1952, 1953, 1954, 1957a, b); Georghiou (1977); Ebmer (2014).

Mavromoustakis localities. Limassol, Mesayitonia, Chiflicoudia marshes, Moni, Yermasoyia River, Amathus, Lania, Pera Pedi, Famagusta, Nicosia, Livadin of Cedars (Paphos Forest), Near Zakaki, Near Amathus, Near Ayios Theodoros (Pitsillias).

Material examined. Paphos District: 20 km NNW Paphos, Lara Beach, 34.94°N, 32.31°E, 20.VI.2013, (2♀); 8 km N Paphos, Mavrokolympo Reservoir, 34.85°N, 32.40°E, 20.VI.2013, C. Schmid-Egger leg., A.W. Ebmer det. (2♀, 2♂); Limassol District: Anogyra, 34.73663°N, 32.732715°E, 26.IV.2015, (4♀), visiting *Chrysanthemum* (Asteraceae); Sovereign Base Area, Avdimou Bay Cliffs, 34.656698°N, 32.773339°E, 27.IV.2015, (1♀); Sovereign Base Area, Akrotiri, 34.628771°N, 32.941031°E, 29.X.2016, (3♂, 1♀), visiting *Dittrichia viscosa* (Asteraceae); 2 km N of Anogyra, 34.748126°N, 32.732248°E, 1.V.2015, (1♀); 0.7 km N of Anogyra, 34.745537°N, 32.73385°E, 3.V.2015, (1♀); Larnaca District: Zygi, 34.731233°N, 33.343487°E, 28.X.2016, (1♂), visiting *Dittrichia viscosa* (Asteraceae), all Paphos

district records C. Schmid-Egger leg., A.W. Ebmer det., all Limassol and Larnaca district records S.P.M. Roberts leg., A. Pauly det.

Distribution. Cyprus, Southern Europe, Eastern Europe, Northern Africa (Egypt), Western Asia (Turkey), Central Asia, Southern Asia, Eastern Asia (China).

***Halictus (Halictus) subsenilis* Blüthgen, 1955**

References. Ebmer (1975, 2014).

Distribution. Cyprus, Western Asia (Israel).

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

References. Mavromoustakis (1949 [“1948”]); Pittioni (1950); Mavromoustakis (1951, 1952, 1953); Ebmer (2014).

Mavromoustakis localities. Limassol, Cherkes, Moni, Yermasoyia River, Near Paramytha, Near Zakaki, Near Ayios Theodoros (Pitsilia), Larnaca.

Material examined. Paphos District: 15 km SE Paphos, Kouklia, 34.72°N, 32.55°E, 20.VI.2013, (13♀); 20 km N Paphos, Kathikas, 34.90°N, 32.42°E, 20.VI.2013, (2♀); 20 km NNW Paphos, Lara Beach, 34.94°N, 32.31°E, 20.VI.2013, (4♀); Limassol District: 1 km E of Pissouri, 34.677579°N, 32.722066°E, 27.IV.2015, (1♀), all Paphos district records C. Schmid-Egger leg., A.W. Ebmer det., all Limassol district records S.P.M. Roberts leg., A. Pauly det.

Distribution. Cyprus, Southern Europe (Greece), Eastern Europe (Ukraine, Moldova, Russian Federation), Western Asia (Turkey), Central Asia (Turkmenistan), Southern Asia (Iran).

Genus *Lasioglossum* CURTIS, 1833

37 species.

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

References. Mavromoustakis (1949 [“1948”]); Pittioni (1950); Mavromoustakis (1951, 1952, 1957a); Ebmer (2014).

Mavromoustakis localities. Limassol, Cherkes, Chiflicoudia marshes, Fassouri, Amathus, Moni, Yermasoyia Hills, Near Mesayitonia, Larnaca.

Material examined. Paphos District: 15 km SE Paphos, Kouklia, 34.72°N, 32.55°E, 20.VI.2013, C. Schmid-Egger leg., A.W. Ebmer det. (1♀).

Distribution. Cyprus, Southern Europe (Croatia, Greece), Eastern Europe (Bulgaria), Northern Africa (Libya, Egypt), Western Asia, Central Asia (Turkmenistan), Southern Asia (Iran), Eastern Asia (China).

Lasioglossum (Dialictus) akroundicum (Blüthgen, 1937)

Type locality-country. Cyprus, Akrounda: 34.768889°N, 33.079444°E, 24.IV.1931, G.A. Mavromoustakis leg., P.A.V. Blüthgen det. ♀, (MFNB).

References. Blüthgen (1937); Mavromoustakis (1949 [“1948”]); Pittioni (1950); Mavromoustakis (1951, 1952); Ebmer (2014).

Mavromoustakis localities. Pyrgos, Near Paramytha, Akrounda, Near Eftagonia, Mt. Troodos, Listovounos.

Material examined. Limassol District: Troodos, Chionistra, 34.9317°N, 32.8664°E, 31.V.2012, 2.VI.2012, S. Dimitriou leg., A. Ebmer det. (1♀), pan trap (UAEG); Troodos, Mt. Olympos, 34.93°N, 32.86°E, 20.VI.2013, C. Schmid-Egger leg., A.W. Ebmer det. (3♀).

Distribution. Cyprus. ENDEMIC.

Lasioglossum (Sphecodogastra) anellum (Vachal, 1905)

References. Mavromoustakis (1949 [“1948”]); Pittioni (1950); Mavromoustakis (1957a); Ebmer (2014).

Mavromoustakis localities. Limassol, Pera Pedi, Mt. Troodos, Amiantos, Ayia Varvara (Stavrovouni).

Material examined. Paphos District: 15 km SE Paphos, Koukليا, 34.72°N, 32.55°E, 20.VI.2013, (1♀); 20 km NNW Paphos, Lara Beach, 34.94°N, 32.31°E, 20.VI.2013, (1♀); 6 km NE Polis, beach, 35.06°N, 32.46°E, 20.VI.2013, (1♀); 8 km N Paphos, Mavrokolympos Reservoir, 34.85°N, 32.40°E, 20.VI.2013, (1♀, 2♂); Nr Arminou Reservoir, 34.883435°N, 32.750988°E, 29.IV.2015, (1♀); Asprokremmos Dam, 34.720825°N, 32.551994°E, 30.IV.2015, (1♀), collecting pollen at *Sisymbrium* (Brassicaceae); Limassol District: 1 km E of Pissouri, 34.677579°N, 32.722066°E, 27.IV.2015, (1♀), collecting pollen at Brassicaceae; Pissouri 2 km S, 34.654385°N, 32.717924°E, 30.x.2016, (2♂), visiting *Ceratonia siliqua* (Fabaceae); Larnaca District: Zygi, 34.731233°N, 33.343487°E, 28.X.2016, (1♂), visiting *Ceratonia siliqua* (Fabaceae); Zygi, 34.746277°N, 33.384472°E, 28.X.2016, (1♂), visiting *Ceratonia siliqua* (Fabaceae), all Koukليا, Lara beach, Polis and Mavrokolympos Reservoir records C. Schmid-Egger leg., A.W. Ebmer det., all Arminou Reservoir, Asprokremmos Dam, Limassol and Larnaca district records S.P.M. Roberts leg., A. Pauly det.

Distribution. Cyprus, Southern Europe, Eastern Europe (Bulgaria), Western Asia, Southern Asia (Iran).

***Lasioglossum (Lasioglossum) aphrodite* Ebmer, 2014**

Type locality-country. Cyprus, Mt. Troodos, S of Troodos, Caledonia Waterfall, 1400-1500 m: 34.9045°N, 32.86849°E, 10.VII.1987, A.W. Ebmer leg., A.W. Ebmer det. ♂, (AWE).

References. Ebmer (2014).

Material examined. Limassol District: Troodos, Chionistra, 34.9317°N, 32.8664°E, 14-16.V.2012, (1♂, 2♀), pan trap (UAEG); Troodos, Chionistra, 34.9317°N, 32.8664°E, 31.V.2012, 2.VI.2012, (7♂, 34♀), pan trap (UAEG), all records S. Dimitriou leg., A. Ebmer det.

Distribution. Cyprus. ENDEMIC.

***Lasioglossum (Hemihalictus) clypeiferellum* (Strand, 1909)**

References. Mavromoustakis (1949 [“1948”]); Ebmer (2014).

Mavromoustakis localities. Limassol.

Distribution. Cyprus, Southern Europe (North Macedonia, Greece), Northern Africa (Egypt), Western Asia (Israel), Central Asia, Southern Asia (Iran, Afghanistan), Eastern Asia (Mongolia).

Lasioglossum (Hemihalictus) convexiusculum (Schenck, 1853)

References. Mavromoustakis (1949 [“1948”]); Ebmer (2014).

Mavromoustakis localities. Mt. Troodos.

Material examined. Limassol District: Troodos, Mt. Olympos, 34.93°N, 32.86°E, 20.VI.2013, C. Schmid-Egger leg., A.W. Ebmer det. (6♀).

Distribution. Cyprus, Western Europe, Southern Europe (Spain, Italy, Greece), Eastern Europe (Czech Republic, Poland, Ukraine), Northern Europe (Lithuania), Western Asia (Turkey), Central Asia (Tajikistan), Southern Asia (Iran).

Lasioglossum (Sphecodogastra) damascenum (Pérez, 1910)

References. Mavromoustakis (1954, 1957a); Ebmer (2014).

Mavromoustakis localities. Pera Pedi, Yerasa.

Material examined. Limassol District: Sovereign Base Area, Episkopi, Kensington Cliffs, 34.670772°N, 32.846923°E, 4.V.2015, S.P.M. Roberts leg., A. Pauly det. (1♂).

Distribution. Cyprus, Southern Europe, Eastern Europe (Hungary, Romania, Bulgaria), Western Asia (Turkey, Israel, Syria).

Lasioglossum (Hemihalictus) dolichocephalum (Blüthgen, 1923)

References. Mavromoustakis (1949 [“1948”]); Ebmer (2014).

Mavromoustakis localities. Ayios Athanasios.

Distribution. Cyprus, Southern Europe (North Macedonia, Croatia, Greece), Western Asia (Turkey, Israel, Lebanon).

Lasioglossum (Hemihalictus) elegans (Lepelletier, 1841)

References. Mavromoustakis (1949 [“1948”], 1951); Ebmer (2014).

Mavromoustakis localities. Apostolos Varnavas (near Famagusta), Ayios Athanasios, Evdhimou River.

Distribution. Cyprus, Western Europe (France, Switzerland, Austria), Southern Europe, Eastern Europe (Hungary, Romania), Northern Africa (Algeria), Western Asia (Turkey, Israel, Georgia), Central Asia, Southern Asia (Iran).

Lasioglossum (Sphecodogastra) epipygiale (Blüthgen, 1924)

References. Ebmer (2014).

Distribution. Cyprus, Western Asia (Turkey), Central Asia, Southern Asia.

Lasioglossum (Hemihalictus) erraticum (Blüthgen, 1931)

References. Mavromoustakis (1949 [“1948”]); Ebmer (2014).

Mavromoustakis localities. Ayios Athanasios.

Distribution. Cyprus, Southern Europe (Greece), Western Asia (Turkey, Armenia).

Lasioglossum (Hemihalictus) griseolum (Morawitz, 1872)

References. Mavromoustakis (1949 [“1948”], 1957a); Pittioni (1950); Ebmer (2014).

Mavromoustakis localities. Limassol, Cherkas.

Material examined. Paphos District: 20 km NNW Paphos, Lara Beach, 34.94°N, 32.31°E, 20.VI.2013, (3♀); 6 km NE Polis, beach, 35.06°N, 32.46°E, 20.VI.2013, (1♀), all records C. Schmid-Egger leg., A.W. Ebmer det.

Distribution. Cyprus, Western Europe, Southern Europe, Eastern Europe (Bulgaria), Northern Africa (Morocco, Tunisia), Western Asia, Central Asia, Southern Asia (Afghanistan).

***Lasioglossum (Sphecodogastra) imbecillum* Ebmer, 1974**

References. Ebmer (2014).

Distribution. Cyprus, Southern Europe (Greece), Eastern Europe (Bulgaria), Western Asia (Turkey, Jordan).

***Lasioglossum (Lasioglossum) kotschy* Ebmer, 1981**

Described from Cyprus as *Halictus eurasicus torquillus* Warncke, 1982, from Mt. Troodos: 34.9045°N, 32.86849°E, 7.VII.1935, A.W. Ebmer det. ♂.

References. Ebmer (1981); Warncke (1982); Pittioni (1950); Ebmer (2014).

Material examined. Limassol District: Troodos, Chionistra, 34.9317°N, 32.8664°E, 14-16.V.2012, (14♀), pan trap (UAEG); Troodos, Chionistra, 34.9317°N, 32.8664°E, 31.V.2012, 2.VI.2012, (1♀), pan trap (UAEG), all records S. Dimitriou leg., A. Ebmer det.

Distribution. Cyprus. ENDEMIC.

***Lasioglossum (Hemihalictus) laevidorsum* (Blüthgen, 1923)**

References. Blüthgen (1937); Mavromoustakis (1949 [“1948”], 1951); Warncke (1982); Ebmer (2014).

Mavromoustakis localities. Mt. Troodos Kannoures springs, Pera Pedi, Between Mozaras Station and Kato Aminados, Mt. Troodos Pasha Livadin.

Distribution. Cyprus, Western Europe (France, Switzerland, Austria), Southern Europe, Northern Africa (Egypt), Western Asia (Turkey, Israel), Southern Asia (Iran, India).

Notes. The subspecies described from Cyprus is *Lasioglossum laevidorsum troodicum* (Blüthgen, 1937), from Mt. Troodos: 34.9234°N, 32.8833°E, 19.VI.1935 G.A. Mavromoustakis leg., P.A.V. Blüthgen det. ♀, (KW).

***Lasioglossum (Sphecodogastra) laticeps* (Schenck, 1870)**

References. Pittioni (1950); Mavromoustakis (1957b); Ebmer (2014).

Mavromoustakis localities. Limassol, Apsiou, Moni River, Near Amathus, Kaloiri Hill, Morphou, Trimiklini, Kellaki, Monagroulli, Near Mesayitonia, Polemedia.

Distribution. Cyprus, Widespread in Europe, Western Asia (Turkey, Israel), Southern Asia (Iran).

Lasioglossum (Leuchalictus) leucozonium (Schrank, 1781)

References. Blüthgen (1937); Mavromoustakis (1949 [“1948”], 1951, 1952, 1953); Ebmer (2014).

Mavromoustakis localities. Limassol, Polemedia Hills, Yermasoyia River, Amathus, Trimiklini, Near Famagusta, Saettas, Kilani.

Material examined. Nicosia District: Linou, 35.0755°N, 32.9164°E, 5-7.IV.2012, (7♀), pan trap (UAEG); Linou, 35.0755°N, 32.9164°E, 25-27.IV.2012, (6♀), pan trap (UAEG); Linou, 35.0755°N, 32.9164°E, 14-16.V.2012, (1♀), pan trap (UAEG); Kakopetria, 34.992°N, 32.9082°E, 5-7.IV.2012, (1♀), pan trap (UAEG); Kakopetria, 34.992°N, 32.9082°E, 14-16.V.2012, (1♀), pan trap (UAEG); Limassol District: Amiantos, 34.918°N, 32.9472°E, 5-7.IV.2012, (2♀), pan trap (UAEG), all records S. Dimitriou leg., J. Devalez det.

Distribution. Cyprus, Widespread in Europe, Northern Africa, Western Asia, Central Asia, Southern Asia (Iran), Eastern Asia (Mongolia, China).

Lasioglossum (Hemihalictus) limbellum (Morawitz, 1876)

References. Ebmer (2014).

Distribution. Cyprus, Western Europe, Southern Europe, Eastern Europe, Northern Africa (Morocco, Algeria, Tunisia), Western Asia (Turkey, Israel), Central Asia, Southern Asia (Iran, Afghanistan), Eastern Asia (China).

Lasioglossum (Sphecodogastra) lineare (Schenck, 1870)

References. Mavromoustakis (1949 [“1948”], 1952, 1954); Ebmer (2014).

Mavromoustakis localities. Limassol, Akrotiri Forest, Polemedia Hills, Ayios Athanasios, Yermasoyia River, Pera Pedi.

Material examined. Limassol District: Troodos, Chionistra, 34.9317°N, 32.8664°E, 14-16.V.2012, S. Dimitriou leg., A. Ebmer det. (1♂), pan trap (UAEG); Paphos District: 2.7 km SW of Acheleia, Potamos tis Ezousas, 34.729004°N, 32.457544°E, 30.IV.2015, S.P.M. Roberts leg., A. Pauly det. (1♀).

Distribution. Cyprus, Western Europe, Southern Europe, Eastern Europe, Western Asia, Central Asia (Turkmenistan, Tajikistan, Uzbekistan), Southern Asia (Iran).

Lasioglossum (Hemihalictus) lucidulum (Schenck, 1861)

References. Ebmer (2014).

Material examined. Paphos District: 15 km SE Paphos, Kouklia, 34.72°N, 32.55°E, 20.VI.2013, C. Schmid-Egger leg., A.W. Ebmer det. (1♀).

Distribution. Cyprus, Widespread in Europe, Northern Africa, Western Asia (Turkey, Israel, Georgia), Central Asia, Southern Asia (Iran, Afghanistan, Pakistan), Eastern Asia.

Lasioglossum (Sphecodogastra) malachurum (Kirby, 1802)

References. Mavromoustakis (1949 [“1948”]); Pittioni (1950); Mavromoustakis (1951, 1952, 1953, 1954, 1957a, b); Georghiou (1977); Ebmer (2014).

Mavromoustakis localities. Limassol, Polemedia Hills, Yermasoyia, Cherkes, Episkopi, Chiflicoudia marshes, Famagusta.

Material examined. Paphos District: 15 km SE Paphos, Kouklia, 34.72°N, 32.55°E, 20.VI.2013, (1♂); 20 km NNW Paphos, Lara Beach, 34.94°N, 32.31°E, 20.VI.2013, (6♀); 2.7 km SW of Acheleia, Potamos tis Ezousas, 34.729004°N, 32.457544°E, 30.IV.2015, (1♀); Famagusta District: Rizokarpaso, 5 km E, 35.63°N, 34.50°E, 10.IV.2007, (1♂); Limassol District: Sovereign Base Area, Akrotiri, Bishop's Pool, 34.597305°N, 32.984521°E, 28.IV.2015, (1♀), all Kouklia, Lara Beach, and Rizokarpaso records C. Schmid-Egger leg., A.W. Ebmer det., all Potamos tis Ezousas and Akrotiri records S.P.M. Roberts leg., A. Pauly det.

Distribution. Cyprus, Widespread in Europe, Northern Africa, Western Asia, Central Asia (Turkmenistan), Southern Asia (Iran).

Lasioglossum (Dialictus) mandibulare (Morawitz, 1866)

References. Mavromoustakis (1949 [“1948”], 1952, 1957a); Ebmer (2014).

Mavromoustakis localities. Limassol, Cherkes, Pernera coast of Paralimni, Chiflicoudia marshes, Famagusta.

Distribution. Cyprus, Western Europe (Switzerland), Southern Europe (Spain, Bosnia and Herzegovina, Greece), Eastern Europe (Romania, Bulgaria, Russian Federation), Western Asia.

Lasioglossum (Evyllaesus) marginatum (Brullé, 1832)

References. Mavromoustakis (1949 [“1948”], 1951, 1952, 1953, 1954); Ebmer (2014).

Mavromoustakis localities. Polemedia Hills, Ayia Phyla, Pera Pedi, Amathus, Trimiklini, Kellaki, Lania, Platania Forest Station, Amyrou Monastery, Ayia Irini Station.

Material examined. Kyrenia District: 15 km E Kyrenia, 'Turtle Beach', 35.334413°N, 33.494187°E, 10.IV.2007, (1♀); Limassol District: Anogyra, 34.73663°N, 32.732715°E, 26.IV.2015, (1♀); Sovereign Base Area, Avdimou Bay Cliffs, 34.656698°N, 32.773339°E, 27.IV.2015, (1♀); 2 km N of Anogyra, 34.748126°N, 32.732248°E, 1.V.2015, (4♀); 0.7 km N of Anogyra, 34.745537°N, 32.73385°E, 3.V.2015, (1♀), visiting *Cistus creticus* (Cistaceae); Anogyra to Pachna Road km 4, 34.764269°N, 32.757736°E, 5.V.2015, (1♀), collecting pollen on Brassicaceae; Paphos District: Nr Arminou Reservoir, 34.883435°N, 32.750988°E, 29.IV.2015, (5♀); 2.7 km SW of Acheleia, Potamos tis Ezouzas, 34.729004°N, 32.457544°E, 30.IV.2015, (1♀), all Kyrenia district records C. Schmid-Egger leg., A.W. Ebmer det., all Limassol and Paphos district records S.P.M. Roberts leg., A. Pauly det.

Distribution. Cyprus, Western Asia, Southern Europe (Spain, Greece), Eastern Europe (Czech Republic, Hungary, Russian Federation), Western Asia (Israel, Armenia), Central Asia, Southern Asia.

***Lasioglossum (Hemihalictus) medinai* (Vachal, 1895)**

References. Mavromoustakis (1949 [“1948”], 1954); Ebmer (2014) [all as *L. villosulum* (Kirby)].

Integrative taxonomy (Pauly et al., 2019) resuscitated two cryptic species in this complex including *L. medinai*, the form verified to occur on Cyprus, whereas *Lasioglossum villosulum villosulum* sensu stricto has been confirmed from Greece including Crete and from Israel but not from Cyprus.

References. Mavromoustakis (1949 [“1948”], 1954); Ebmer (2014).

Distribution. Western Europe (Austria), Southern Europe (Spain, France, Italy, Greece including Crete), Eastern Europe (Romania, Russia (Volgograd)), Northern Africa (Algeria), Western Asia.

***Lasioglossum (Hemihalictus) mesosclerum* (Pérez, 1903)**

References. Ebmer (2014).

Material examined. Paphos District: 15 km SE Paphos, Kouklia, 34.72°N, 32.55°E, 20.VI.2013, (1♀); 20 km NNW Paphos, Lara Beach, 34.94°N, 32.31°E, 20.VI.2013, (1♀); 8 km N Paphos, Mavrokolympo Reservoir, 34.85°N, 32.40°E, 20.VI.2013, (1♂), all records C. Schmid-Egger leg., A.W. Ebmer det.

Distribution. Cyprus, Western Asia (France, Austria), Southern Europe, Eastern Europe, Northern Africa (Morocco, Libya, Egypt), Western Asia, Central Asia, Southern Asia (Iran, Afghanistan).

***Lasioglossum (Hemihalictus) minutissimum* (Kirby, 1802)**

References. Ebmer (2014).

Distribution. Cyprus, Widespread in Europe, Northern Africa, Western Asia (Turkey), Southern Asia (Pakistan).

***Lasioglossum (Hemihalictus) nitidiusculum* (Kirby, 1802)**

References. Scheuchl and Willner (2016).

Distribution. Cyprus, Widespread in Europe, Northern Africa (Morocco, Algeria, Tunisia), Western Asia (Turkey), Central Asia (Turkmenistan, Kazakhstan, Tajikistan), Southern Asia (Iran).

Lasioglossum (Sphecodogastra) obscuratum (Morawitz, 1876)

References. Mavromoustakis (1949 ["1948"], 1951, 1952, 1954, 1958 ["1957"]).

Mavromoustakis localities. Polemedia Hills, Yermasoyia River, Episkopi, Amathus, Fasoulla, Yerasa, Mt. Troodos Kannoures Springs, Mt. Troodos open slopes, Amiantos, Near Paramytha, Lania, Kykkou Monastery, Famagusta.

Material examined. Limassol District: Troodos, Chionistra, 34.9317°N, 32.8664°E, 14-16.V.2012, (1♂, 1♀), pan trap (UAEG); Troodos, Chionistra, 34.9317°N, 32.8664°E, 31.V.2012, 2.VI.2012, (2♂, 4♀), pan trap (UAEG); Paphos District: 20 km NNW Paphos, Lara Beach, 34.94°N, 32.31°E, 20.VI.2013, (1♀), all Limassol district records S. Dimitriou leg., J. Devalez det., all Paphos district records C. Schmid-Egger leg., A.W. Ebmer det.

Distribution. Cyprus, Western Europe (Austria), Southern Europe (Croatia, Greece), Eastern Europe, Western Asia, Central Asia, Southern Asia (Iran, Afghanistan).

Lasioglossum (Lasioglossum) pallens (Brullé, 1832)

References. Warncke (1982); Ebmer (2014).

Material examined. Nicosia District: Kakopetria, 34.992°N, 32.9082°E, 25-27.IV.2012, S. Dimitriou leg., A. Ebmer det. (1♀), pan trap (UAEG); Limassol District: 2 km N of Anogyra, 34.748126°N, 32.732248°E, 1.V.2015, S.P.M. Roberts leg., A. Pauly det. (2♀).

Distribution. Cyprus, Western Europe, Southern Europe (Spain, Italy, Greece), Northern Europe (Lithuania), Eastern Europe (Czech Republic, Hungary), Northern Africa (Morocco), Western Asia (Turkey), Southern Asia (Iran), Eastern Asia (Mongolia).

Notes. The subspecies described from Cyprus is *Lasioglossum pallens kantarae* (Warncke, 1982), from Kantara Castle: 35.4064°N, 33.9233°E, 7.IV.1953, K. Warncke det. ♂, (KW).

Lasioglossum (Sphecodogastra) pauxillum (Schenck, 1853)

References. Pittioni (1950); Ebmer (2014).

Distribution. Cyprus, Widespread in Europe, Northern Africa (Morocco to Tunisia), Western Asia, Central Asia, Southern Asia (Iran).

Lasioglossum (Dialictus) podolicum (Noskiewicz, 1925)

References. Ebmer (2014).

Distribution. Cyprus, Western Europe (France, Switzerland), Southern Europe, Eastern Europe (Hungary, Ukraine), Western Asia (Turkey), Southern Asia (Iran).

Lasioglossum (Hemihalictus) puncticolle (Morawitz, 1872)

References. Ebmer (2014).

Distribution. Cyprus, Western Europe, Southern Europe, Northern Europe (United Kingdom), Eastern Europe, Northern Africa, Western Asia (Turkey, Israel, Georgia), Southern Asia (Iran).

Lasioglossum (Hemihalictus) pygmaeum (Schenck, 1853)

References. Ebmer (2014).

Material examined. Kyrenia District: 15 km E Kyrenia, 'Turtle Beach', 35.334413°N, 33.494187°E, 10.IV.2007, (1♀); Limassol District: 2 km N of Anogyra, 34.748126°N, 32.732248°E, 1.V.2015, (1♀), collecting pollen at *Cistus creticus* (Cistaceae); Sovereign Base Area, Episkopi Kensington Cliffs, 34.670772°N, 32.846923°E, 4.V.2015, (3♂); Anogyra to Pachna Road km 4, 34.764269°N, 32.757736°E, 5.V.2015, (1♀), all Kyrenia district records C. Schmid-Egger leg., A.W. Ebmer det., all Limassol district records S.P.M. Roberts leg., A. Pauly det.

Distribution. Cyprus, Western Europe, Southern Europe, Eastern Europe, Northern Africa (Morocco to Tunisia), Western Asia, Central Asia (Turkmenistan, Kazakhstan, Tajikistan), Southern Asia.

***Lasioglossum (Hemihalictus) transitorium* (Schenck, 1870)**

References. Erlandsson (1979).

Material examined. Kyrenia District: 15 km E Kyrenia, 'Turtle Beach', 35.334413°N, 33.494187°E, 10.IV.2007, (1♀); Limassol District: Anogyra to Avdimou Road km 2, 34.723986°N, 32.736892°E, 3.V.2015, (1♂, 1♀), visiting Apiaceae; Sovereign Base Area, Episkopi, Kensington Cliffs, 34.670772°N, 32.846923°E, 4.V.2015, (2♀), all Kyrenia district records C. Schmid-Egger leg., A.W. Ebmer det., all Limassol district records S.P.M. Roberts leg., A. Pauly det.

Distribution. Cyprus, Western Europe (France), Southern Europe, Eastern Europe (Bulgaria).

***Lasioglossum (Sphecodogastra) tricinctum* (Schenck, 1874)**

References. Ebmer (2014).

Material examined. Famagusta District: 15 km E Rizokarpaso, 'Golden Sands', 35.64°N, 34.55°E, 9.VIII.2001, (1♀); Paphos District: 20 km N Paphos, Kathikas, 34.90°N, 32.42°E, 20.VI.2013, (1♂); 20 km NNW Paphos, Lara Beach, 34.94°N, 32.31°E, 20.VI.2013, C. Schmid-Egger leg., A.W. Ebmer det. (1♀); 8 km N Paphos, Mavrokolympos Reservoir, 34.85°N, 32.40°E, 20.VI.2013, (1♀, 1♂), all records C. Schmid-Egger leg., A.W. Ebmer det.

Distribution. Cyprus, Western Europe, Southern Europe, Eastern Europe (Hungary, Poland, Ukraine), Western Asia (Turkey, Azerbaijan), Southern Asia (Iran).

Notes. The subspecies described from Cyprus is *Lasioglossum tricinctum lonicerae* Ebmer, 2014, from Mt. Troodos: 34.9234°N, 32.8833°E, 11.VII.1987, A.W. Ebmer leg., A.W. Ebmer det. ♂, (AWE).

***Lasioglossum (Hemihalictus) truncaticolle* (Morawitz, 1877)**

References. Ebmer (2014).

Distribution. Cyprus, Western Europe (France), Southern Europe, Eastern Europe, Northern Africa (Algeria), Western Asia (Israel), Central Asia (Kazakhstan), Southern Asia (Iran).

Lasioglossum (Leuchalictus) zonulum (Smith, 1848)

References. Ebmer (2014).

Distribution. Cyprus, Widespread in Europe, Western Asia (Turkey, Azerbaijan), Southern Asia (Iran), Eastern Asia (China).

Genus *Sphecodes* LATREILLE, 1804

14 species.

Sphecodes albilabris (Fabricius, 1793)

References. Pittioni (1950); Mavromoustakis (1951, 1952, 1953, 1957a) (Warncke, 1992).

Mavromoustakis localities. Cherkes, Moni River, Near Limassol, Nicosia, Polemedia Hills, Salipes marshes near Akrotiri, Trimiklini, Yermasoyia River, Zakaki marshes.

Distribution. Cyprus, Widespread in Europe, Northern Africa, Western Asia, Central Asia, Southern Asia (Iran, India).

Notes. Includes specimens labelled *S. fumipennis* by Mavromoustakis, which are referable to this species. According to Warncke (1992) Cyprus specimens refer to *S. a. rubripes* Spinola, 1838, variously treated by recent authors as a valid subspecies or as a species.

Sphecodes alternatus Smith, 1853

References. Mavromoustakis (1949 ["1948"]); Pittioni (1950); Mavromoustakis (1952, 1954).

Mavromoustakis localities. Asomatos, Pera Pedi, Akrounda.

Distribution. Cyprus, Western Europe (France, Austria), Southern Europe, Eastern Europe, Northern Africa, Western Asia, Central Asia, Southern Asia (Iran), Eastern Asia (China).

Notes. Described from Cyprus as *Sphecodes alternatus lindbergi* Pittioni, 1950, from Geroskipou, E of Paphos: 34.76666°N, 32.46666°E, 20.VII.1939, H. Lindberg leg., B. Pittioni det., (MZHF).

***Sphecodes croaticus* Meyer, 1922**

References. Blüthgen (1937); Mavromoustakis (1949 [“1948”], 1952).

Mavromoustakis localities. Limassol, Episkopi, Yermasoyia River.

Distribution. Cyprus, Western Europe, Southern Europe, Eastern Europe, Northern Africa (Morocco), Western Asia (Turkey), Central Asia (Turkmenistan).

Notes. The subspecies described from Cyprus is *Sphecodes croaticus cypricus* Blüthgen, 1937, from Limassol: 34.66839°N, 33.03252°E, 7.III.1931, G.A. Mavromoustakis leg., P.A.V. Blüthgen det. ♀, (MFNB).

***Sphecodes ephippius* (Linnaeus, 1767)**

Material examined. Limassol District: Yermasoyia Dam, 34.755799°N, 33.096194°E, 7.III.2017, Bee Course students leg., M. Schwarz det. (1♀).

Distribution. Cyprus, Widespread in Europe, Northern Africa, Western Asia (Turkey), Eastern Asia.

***Sphecodes gibbus* (Linnaeus, 1758)**

References. Blüthgen (1937); Mavromoustakis (1949 [“1948”]); Pittioni (1950); Mavromoustakis (1952, 1954, 1957a); Georghiou (1977).

Mavromoustakis localities. Limassol, Episkopi, Pera Pedi, Akrounda, Moni River, Younarka (near Zakaki), Near Asomatos.

Distribution. Cyprus, Widespread in Europe, Northern Africa, Western Asia, Central Asia, Southern Asia, Eastern Asia (China, Mongolia).

Notes. Described from Cyprus as *Sphecodes pergibbus* Blüthgen, 1937, from [Limassol; Episcopi]: 34.675134°N, 32.882598°E, IV-VI, [G.A. Mavromoustakis] leg., P.A.V. Blüthgen, det., (MFNB).

***Sphecodes longuloides* Blüthgen, 1923**

References. Warncke (1992).

Distribution. Cyprus, Southern Europe (Spain, Italy, Portugal), Northern Africa (Morocco, Algeria, Tunisia).

***Sphecodes longulus* Hagens, 1882**

References. Scheuchl and Willner (2016).

Distribution. Cyprus, Widespread in Europe, Northern Africa (Tunisia, Libya), Western Asia (Turkey, Syria, Armenia), Central Asia, Southern Asia (Iran), Eastern Asia (China, Japan).

***Sphecodes monilicornis* (Kirby, 1802)**

References. Mavromoustakis (1949 [“1948”], 1952, 1957a); Pittioni (1950).

Mavromoustakis localities. Limassol, Fassouri, Mt. Troodos, Cherkas, Moni River, Pyrga (Larnaca).

Material examined. Limassol District: 1 km E of Pissouri, 34.677579°N, 32.722066°E, 27.IV.2015, S.P.M. Roberts leg./det. (2♀).

Distribution. Cyprus, Widespread in Europe, Northern Africa, Western Asia, Central Asia (Turkmenistan, Uzbekistan, Tajikistan), Southern Asia (Iran, Pakistan, India), Eastern Asia.

Notes. Described from Cyprus as *Sphecodes quadratus cephalotiformes* Pittioni, 1950, from Mt. Troodos, Chionistra: 34.9364°N, 32.8636°E, 17.VI.1939, H. Lindberg leg., B.

Pittioni det., (MZHF). *Sphcodes monilicornis* is recognised sensu lato following Nieto et al. (2014), including forms that have been considered distinct such as *Sphcodes cephalotes*.

***Sphcodes pellucidus* Smith, 1845**

References. Mavromoustakis (1949 [“1948”], 1952).

Mavromoustakis localities. Episkopi, Pera Pedi, Ayios Kostantinos of Pitsilia.

Distribution. Cyprus, Widespread in Europe, Northern Africa, Western Asia, Central Asia (Turkmenistan, Kyrgyzstan), Southern Asia (Iran), Eastern Asia (China, Mongolia).

***Sphcodes pinguiculus* Pérez, 1903**

References. Warncke (1992).

Distribution. Cyprus, Western Europe (France), Southern Europe (Spain, Italy, Greece), Eastern Europe, Northern Africa, Western Asia (Turkey), Eastern Asia (Mongolia).

***Sphcodes pseudofasciatus* Blüthgen, 1925**

Material examined. Limassol District: Yermasoyia Dam, 34.755799°N, 33.096194°E, 7.III.2017, Bee Course students leg., M. Schwarz det. (2♀).

Distribution. Cyprus, Western Europe, Southern Europe (Spain, Italy, Portugal), Eastern Europe, Western Asia (Turkey).

***Sphcodes puncticeps* Thomson, 1870**

References. Mavromoustakis (1949 [“1948”], 1952).

Mavromoustakis localities. Cherkes, Yermasoyia River.

Distribution. Cyprus, Widespread in Europe, Northern Africa (Egypt), Western Asia (Israel), Central Asia (Uzbekistan, Tajikistan), Southern Asia (Iran), Eastern Asia (Mongolia).

***Sphecodes rufiventris* (Panzer, 1798)**

References. Mavromoustakis (1949 [“1948”], 1952).

Mavromoustakis localities. Episkopi, Pera Pedi.

Distribution. Cyprus, Widespread in Europe, Northern Africa (Morocco, Algeria), Western Asia, Central Asia (Uzbekistan, Kazakhstan, Tajikistan), Southern Asia (Iran).

***Sphecodes schenckii* Hagens, 1882**

References. Warncke (1992).

Distribution. Cyprus, Western Asia, Southern Europe, Eastern Europe, Northern Africa, Western Asia (Turkey), Southern Asia (Iran).

NOMIINI

Genus *Pseudapis* KIRBY, 1900

4 species.

***Pseudapis (Nomiapis) bispinosa* (Brullé, 1832)**

References. Mavromoustakis (1949 [“1948”]); Pittioni (1950); Mavromoustakis (1951, 1952, 1957a); Ebmer (2014).

Mavromoustakis localities. Limassol, Akrotiri Forest, Cherkes, Zakaki, Near Akrotiri, Moni, Pyrgos, Larnaca, Eftagonia.

Distribution. Cyprus, Western Europe (France), Southern Europe, Eastern Europe, Northern Africa, Western Asia, Central Asia, Southern Asia, Eastern Asia (China).

***Pseudapis (Nomiapis) diversipes* (Latreille, 1806)**

References. Mavromoustakis (1948); Pittioni (1950); Mavromoustakis (1951, 1952, 1957a); Ebmer (2014).

Mavromoustakis localities. Limassol, Cherkes, Akrotiri Bay, Yermasoyia River, Moni, Tsada, Erimi, Pera Pedi, Chiflicoudia marshes, Near Akhyritou, Kathikas, Near Enkomi of Famagusta, Larnaca, Ayia Varvara Stavrovouni.

Material examined. Famagusta District: Achna Dam, 35.05519°N, 33.814011°E, 28.X.2016, (1♀), visiting *Dittrichia viscosa* (Asteraceae); Paphos District: Polis, 35.053539°N, 32.351197°E, 30.X.2016, (2♂, 1♀), visiting *Dittrichia viscosa* (Asteraceae), all records S.P.M. Roberts leg., A. Pauly det.

Distribution. Cyprus, Western Europe, Southern Europe, Eastern Europe, Central Asia.

***Pseudapis (Nomiapis) equestris* (Gerstäcker, 1872)**

References. Ebmer (2014).

Distribution. Cyprus, Southern Europe (Greece), Western Asia, Central Asia (Turkestan), Southern Asia (Iran).

***Pseudapis (Nomiapis) valga* (Gerstäcker, 1872)**

References. Ebmer (2014).

Distribution. Cyprus, Southern Europe, (North Macedonia, Spain, Greece), Eastern Europe (Czech Republic), Western Asia, Central Asia (Turkmenistan, Kazakhstan, Tajikistan), Southern Asia (Iran, Pakistan).

NOMIOIDINI

Genus *Ceylalictus* STRAND, 1913

1 species.

***Ceylalictus (Ceylalictus) variegatus* (Olivier, 1789)**

References. Cockerell (1931); Mavromoustakis (1949 [“1948”]); Pittioni (1950); Mavromoustakis (1951, 1952); Georghiou (1977); Ebmer (2014).

Mavromoustakis localities. Limassol, Cherkes, Zakaki, Akrotiri Bay and Forest, Yermasoyia River, Moni River, Pernera coast of Paralimni, Akrotiri Bay Bogazi shore.

Material examined. Paphos District: 2.7 km SW of Acheleia, Potamos tis Ezouzas, 34.729004°N, 32.457544°E, 30.IV.2015, (7♀), collecting pollen on *Tamarix* (Tamaricaceae); Polis, 35.037305°N, 32.391073°E, 30.X.2016, (1♂), visiting *Ceratonia siliqua* (Fabaceae); Larnaca District: Zygi, 34.731233°N, 33.343487°E, 28.X.2016, (1♂), visiting *Ceratonia siliqua* (Fabaceae), all records S.P.M. Roberts leg., A. Pauly det.

Distribution. Cyprus, Widespread in Europe, Western Africa, Northern Africa, Western Asia, Central Asia, Southern Asia, Eastern Asia.

Genus *Nomioides* SCHENCK, 1867

1 species.

***Nomioides (Nomioides) minutissimus* (Rossi, 1790)**

References. Mavromoustakis (1949 [“1948”]); Pittioni (1950); Mavromoustakis (1952); Ebmer (2014).

Mavromoustakis localities. Limassol, Akrotiri Bay, Yermasoyia River.

Distribution. Cyprus, Widespread in Europe, Northern Africa, Western Asia (Turkey, Israel, Georgia), Central Asia, Southern Asia, Eastern Asia (China, Mongolia).

ROPHITINI

Genus *Dufourea* LEPELETIER, 1841

1 species.

***Dufourea (Cyprirorophites) cypria* Mavromoustakis, 1952**

Type locality-country. Cyprus, Famagusta: 35.125°N, 33.941667°E, 24.IV.1949, G.A. Mavromoustakis leg., G.A. Mavromoustakis det. ♂, (DAAN).

References. Mavromoustakis (1952); Ebmer (2014).

Mavromoustakis localities. Famagusta.

Distribution. Cyprus, Western Asia (Turkey).

COLLETIDAE

COLLETINI

Genus *Colletes* LATREILLE, 1802

7 species.

***Colletes brevigena* Noskiewicz, 1936**

References. Mavromoustakis (1949 [“1948”], 1951, 1952, 1953, 1957a, b).

Mavromoustakis localities. Limassol, Polemedia Hills, Akrotiri Forest, Kantara Mountains, Chiflicoudia marshes, Platania Forest, Yermasoyia River, Kellaki, Amathus, Kellaki, Zakaki, Stavrovouni Monastery, Monagroulli, Paramali.

Material examined. Nicosia District: Kakopetria, 34.992°N, 32.9082°E, 31.V.2012, 2.VI.2012, (1♀), pan trap (UAEG); Makria Kontarka, 34.9095°N, 32.8971°E, 31.V.2012, 2.VI.2012, (1♀), pan trap (UAEG); Pedoulas, 34°57.711"N, 32°49.733"E, 14.X.2017, (1♂), visiting *Hedera helix*; Between Pedoulas-Kalopanayiwts, 34°58.308"N, 32°49.775"E, 14.X.2017, (1♂), visiting *Hedera helix*; Limassol District: Troodos, Chionistra, 34.9317°N 32.8664°E, 31.V.2012, 2.VI.2012, (1♀), pan trap (UAEG); Troodos Natural Bath, 34 52.892°N, 32 52.618°E, 27.IV.2016, (1♀), visiting *Cistus creticus*; Yermasoyia Dam, 34.745849°N, 33.083579°E, 28.X.2016, (1♂), visiting *Dittrichia viscosa* (Asteraceae); Yermasoyia Dam, 34.745849°N, 33.083579°E, 28.X.2016, (1♂), visiting *Dittrichia viscosa*; Sovereign Base Area, Paramali, 34.676011°N 32.794947°E, 30.X.2016, (3♂), visiting *Dittrichia viscosa* (Asteraceae); 0.7 km N of Anogyra, 34.743911°N, 32.732439°E, 26.X.2016, (41♂, 3♀), visiting *Ceratonía siliqua* (Fabaceae); Anogyra, 34.729369°N, 32.738368°E, 11.III.2016, (1♂), visiting *Ceratonía siliqua* (Fabaceae); Anogyra, 34.742646°N, 32.730431°E, 11.III.2016, (2♂), visiting *Ceratonía siliqua* (Fabaceae); Anogyra, 34.742646°N, 32.730431°E, 22.X.2016, (1♀), visiting *Ceratonía siliqua* (Fabaceae); Anogyra, 34.729369°N, 32.738368°E, 26.X.2016, (1♂), visiting *Ceratonía siliqua* (Fabaceae); Anogyra,

34.729369°N, 32.738368°E, 11.XII.2016, (1♀), visiting *Ceratonia siliqua* (Fabaceae); Anogyra, 34.729369°N, 32.738368°E, 11.III.2017, , (1♀), visiting *Ceratonia siliqua* (Fabaceae); Akrotiri, 34.600657°N, 32.971419°E, 11.VI.2016, (3♀, 1♂); Paramali, 34.676011°N, 32.794947°E, 30.X.2016, (1♂), visiting *Ceratonia siliqua* (Fabaceae); Akrotiri, 34.600657°N, 32.971419°E, 30.X.2017, (1♀, 1♂), visiting *Dittrichia viscosa*; Sovereign Base Area, Akrotiri, 34.600657 32.971419, 29.X.2016, (3♂, 4♀), visiting *Dittrichia viscosa* (Asteraceae); Larnaca District: Zygi, 34.731233°N, 33.343487°E, 28.X.2016, (5♂, 1♀), visiting *Ceratonia siliqua* (Fabaceae) and *Dittrichia viscosa* (Asteraceae); Zygi, 34.746277°N, 33.384472°E, 28.X.2016, (11♂, 1♀), visiting *Ceratonia siliqua* (Fabaceae); Zygi, 34.731233°N, 33.343487°E, 11.IV.2016, (1♂), visiting *Ceratonia siliqua* (Fabaceae); Zygi, 34.746277°N, 33.384472°E, 11.IV.2016, (1♀), visiting *Ceratonia siliqua* (Fabaceae); Zygi, 34.77458°N, 33.448023°E, 11.IV.2016, (1♀), visiting *Ceratonia siliqua* (Fabaceae); Zygi, 34.731233°N, 33.343487°E, 23.X.2016, (1♀), visiting *Ceratonia siliqua* (Fabaceae); Avdellero, 35 00.598°N 33 35.041°E, 11.IV.2017, (1♂), visiting *Ceratonia siliqua* (Fabaceae); Famagusta District: Achna Dam, 35.05519°N, 33.814011°E, 28.X.2016, (1♂), visiting *Dittrichia viscosa* (Asteraceae); Paphos District: Polis, 35.053539°N, 32.351197°E, 30.X.2016, (10♂), (2♀), visiting *Ceratonia siliqua* (Fabaceae) and *Dittrichia viscosa* (Asteraceae); Polis, 35.036538°N, 32.373117°E, 30.X.2016, (3♂), visiting *Ceratonia siliqua* (Fabaceae); Polis, 35.037305°N, 32.391073°E, 30.X.2016, (3♂, 1♀), visiting *Ceratonia siliqua* (Fabaceae); Polis, 35.032203°N, 32.413732°E, 30.X.2016, det. (5♂, 5♀), visiting *Ceratonia siliqua* (Fabaceae); Mesogi, 34.810747°N, 32.450907°E, 30.X.2016, (7♂, 1♀), visiting *Ceratonia siliqua* (Fabaceae); Polis, 35.053539°N, 32.351197°E, 11.II.2016, (2♂), visiting *Ceratonia siliqua* (Fabaceae) and *Dittrichia viscosa* (Asteraceae); Polis, 35.037305°N, 32.391073°E, 11.II.2016, (1♀); Polis, 35.032203°N, 32.413732°E, 11.II.2016, (1♀); Polis, 35.036538°N, 32.373117°E, 21.X.2016, (1♂); Polis, 35.037305°N, 32.391073°E, 21.X.2016, (1♀); Polis, 35.037305°N, 32.391073°E, 19.XI.2016, (1♀); Polis, 35.037305°N, 32.391073°E, 11.XII.2016, (2♀); Polis, 35.036538°N, 32.373117°E, 11.II.2017, (2♀); Polis, 35.053539°N, 32.351197°E, 11.II.2017, (2♂); Polis, 35.053539°N, 32.351197°E, 11.XII.2017, (2♀); Polis, 35.037305°N, 32.391073°E, 11.XII.2017, (1♀), all Polis records visiting *Ceratonia siliqua* (Fabaceae), all Kakopetria, Makria Kontarka and Troodos Chionistra records S. Dimitriou leg., J. Devalez det., all Pedoulas, Between

Pedoulas-Kalopanayiotis, Troodos Natural Bath, Yermasoyia Dam, Anogyra, Paramali, Akrotiri, Zygi and Polis records A. Varnava leg., M. Kuhlmann det., all Yermasoyia Dam, Sovereign Base Area, Paramali, 0.7 km N of Anogyra, Sovereign Base Area, Akrotiri, Zygi, Achna Dam, Polis, Mesogi records S.P.M. Roberts leg., M. Kuhlmann det.

Distribution. Cyprus, Western Europe (France, Austria), Southern Europe, Eastern Europe (Hungary, Bulgaria, Ukraine), Western Asia (Turkey).

***Colletes creticus* Noskiewicz, 1936**

Material examined. Limassol District: Sovereign Base Area, Episkopi, Kensington Cliffs, 34.670772°N, 32.846923°E, 4.V.2015, (1♂); Pissouri 2 km S, 34.654385°N, 32.717924°E, 30.X.2016, (3♂), visiting *Dittrichia viscosa* (Asteraceae) and *Ceratonia siliqua* (Fabaceae), all records S.P.M. Roberts leg., M. Kuhlmann det.

Distribution. Cyprus, Southern Europe (Greece).

***Colletes cyprius* Noskiewicz, 1936**

Type locality-country. Cyprus, Kykkos mountains, 1500m: 34.984°N, 32.741°E, V-VI.1922/1923 or 1930, G.A. Mavromoustakis leg., J. Noskiewicz det.

References. Noskiewicz (1936); Mavromoustakis (1949 [“1948”], 1951, 1952, 1957a).

Mavromoustakis localities. Limassol, Mesayitonia, Cherkes, Yermasoyia Hills, Asomatos, Alassa River, Pera Pedi, Akrotiri Bay, Stroumbi, Livadin of Cedar (Paphos Forest), Potamitissa, Akrounda, Moni, Kellaki, Larnaca, Kykkou Monastery, Ayia Phyla, Mt. Troodos, Near Mesayitonia, Bogazi, Kathikas, Eftagonia, Xerokolimbi near Trooditissa.

Material examined. Paphos District: 15 km SE Paphos, Kouklia, 34.72°N, 32.55°E, 20.VI.2013, (1♂); 8 km N Paphos, Mavrokolympus Reservoir, 34.85°N, 32.40°E, 20.VI.2013, (1♂); Polis, 35.053539°N, 32.351197°E, 30.X.2016, (1♂), visiting *Ceratonia siliqua* (Fabaceae); Polis, 35.036538°N, 32.373117°E, 11.II.2017, (1♂), visiting *Ceratonia siliqua* (Fabaceae); Limassol District: Anogyra, 34.729369°N, 32.738368°E, 11.V.2015, (1♀), visiting *Ceratonia siliqua* (Fabaceae); Akrotiri, 34.600657°N, 32.971419°E, 5.VIII.2016, (1♀); Anogyra, 34.729369°N, 32.738368°E,

26.X.2016 (1♀), visiting *Ceratonia siliqua* (Fabaceae); Anogyra, 34.729369°N, 32.738368°E, 11.III.2017, (1♂), visiting *Ceratonia siliqua* (Fabaceae); Anogyra, 34.729369°N, 32.738368°E, 18.X.2017, (2♀), visiting *Ceratonia siliqua* (Fabaceae), all 15 km SE Paphos, Kouklia and Mavrokolympo Reservoir records, C. Schmid-Egger leg., M. Kuhlmann det., all Polis and Anogyra records A. Varnava leg., M. Kuhlmann det., all Anogyra (11.V.2015) records S. Louca leg., M. Kuhlmann det.

Distribution. Cyprus. ENDEMIC.

***Colletes hylaeiformis* Eversmann, 1852**

References. Scheuchl and Willner (2016).

Distribution. Cyprus, Western Europe (France, Germany, Austria), Southern Europe, Eastern Europe, Western Asia (Turkey, Georgia, Azerbaijan), Central Asia.

***Colletes maidli* Noskiewicz, 1936**

References. Mavromoustakis (1949 [“1948”], 1952); Georghiou (1977).

Mavromoustakis localities. Asomatos, Yermasoyia River, Evdhimou River, Famagusta.

Material examined. Limassol District: Akrotiri, 34.583676°N, 32.949306°E, 20.VI.2016, (1♀); Akrotiri, 34.352103°N, 32.562132°E, 20.VI.2016, (1♂), all records A. Varnava leg., M. Kuhlmann det.

Distribution. Cyprus, Western Europe (France), Southern Europe, Eastern Europe, Western Asia, Central Asia.

***Colletes similis* Schenck, 1853**

References. Mavromoustakis (1949 [“1948”], 1951, 1952, 1953).

Mavromoustakis localities. Limassol, Akrotiri Bay, Asomatos, Moni, Yerasa, Kato Platres, Pera Pedi, Monagroulli, Platania Forest Station, Mt. Troodos.

Material examined. Limassol District: Sovereign Base Area, Akrotiri, 34.600657°N, 32.971419°E, 29.X.2016, (1♀), visiting *Dittrichia viscosa* (Asteraceae); Paphos District:

Polis, 35.053539°N, 32.351197°E, 30.X.2016, (5♀), visiting *Dittrichia viscosa* (Asteraceae), all records S.P.M. Roberts leg., M. Kuhlmann det.

Distribution. Cyprus, Widespread in Europe, Northern Africa, Western Asia, Central Asia, Southern Asia (Iran), Eastern Asia (China).

***Colletes squamulosus* Noskiewicz, 1936**

References. Mavromoustakis (1949 [“1948”]).

Mavromoustakis localities. Larnaca.

Distribution. Cyprus, Western Asia, Central Asia (Turkmenistan).

HYLAEINI

Genus *Hylaeus* FABRICIUS, 1793

12 species.

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

References. Erlandsson (1986).

Distribution. Cyprus, Western Europe, Southern Europe, Eastern Europe, Northern Africa, Western Asia (Turkey, Georgia).

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

References. Mavromoustakis (1949 [“1948”]).

Mavromoustakis localities. Limassol, Zakaki, Asomatos, Pera Pedi, Larnaca.

Distribution. Cyprus, Widespread in Europe, Northern Africa, Western Asia (Israel), Central Asia (Turkmenistan), Southern Asia (Iran).

***Hylaeus (Spatulariella) cypricola* (Warncke, 1972)**

References. Pittioni (1950); Mavromoustakis (1957a).

Mavromoustakis localities. Cherkes.

Material examined. Limassol District: Anogyra, 34.741952°N, 32.734845°E, 3.V.2015, (2♂), visiting *Sinapis* (Brassicaceae); Sovereign Base Area, Episkopi Kensington Cliffs, 34.670772°N, 32.846923°E, 4.V.2015, (5♂, 3♀); Larnaca District: Zygi, 34.731233°N, 33.343487°E, 28.X.2016, (1♀), visiting *Ceratonia siliqua* (Fabaceae), all records S.P.M. Roberts leg., G. Holmström and H. Dathe det.

Distribution. Cyprus, Western Asia (Turkey), Northern Africa (Egypt).

Notes. Described from Cyprus as *Spatulariella (Brachyspatulariella) dimidiatus* Pittioni, 1950, from Limassol: 34.66839°N, 33.03252°E, G.A. Mavromoustakis leg., K. Warncke det., (MZHF).

***Hylaeus (Prosopis) gibbus* Saunders, 1850**

References. Alfken (1912).

Material examined. Limassol District: Sovereign Base Area, Akrotiri, 34.628771°N, 32.941031°E, 29.X.2016, (1♂, 2♀), visiting *Dittrichia viscosa* (Asteraceae); Paphos District: 2.7 km SW of Acheleia, Potamos tis Ezouzas, 34.729004°N, 32.457544°E, 30.IV.2015, (1♂, 2♀), all records S.P.M. Roberts leg., G. Holmström and H. Dathe det.

Distribution. Cyprus, Widespread in Europe, Northern Africa (Morocco, Egypt), Western Asia Central Asia (Kazakhstan), Southern Asia (Iran).

Notes. Although the Cyprus specimens listed below were determined by H. Dathe, he himself believes that DNA analysis could reveal that they might be specimens of *H. incongruus* Forster, 1871, *H. stigmorhinus* (Pérez, 1895) or the dark form of *H. pictus* (Smith, 1853) (with black scutellum) (Dathe, 2018 in litt.). It is clear that a revision of this group is required to elucidate the nature of this species group.

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

References. Alfken (1928); Pittioni (1950).

Material examined. Limassol District: 1 km E of Pissouri, 34.677579°N, 32.722066°E, 27.IV.2015, (2♂, 1♀), visiting Brassicaceae; Anogyra to Pachna Road km 4, 34.764269°N, 32.757736°E, 5.V.2015, (1♂); 0.7 km N of Anogyra, 34.743911°N, 32.732439°E, 26.X.2016, (1♀), visiting *Ceratonia siliqua* (Fabaceae); 1 km S of Anogyra, 34.727647°N, 32.73462°E, 26.X.2016, (1♀), visiting *Ceratonia siliqua* (Fabaceae); Paphos District: Nr Arminou Reservoir, 34.883435°N, 32.750988°E, 29.IV.2015, (1♂); Asprokremmos Dam, 34.720825°N, 32.551994°E, 30.IV.2015, (1♂, 2♀), visiting *Sisymbrium* (Brassicaceae); 2.7 km SW of Acheleia, Potamos tis Ezousas 34.729004°N, 32.457544°E, 30.IV.2015, (1♂); Larnaca District: Zygi, 34.731233°N, 33.343487°E, 28.X.2016, (6♀), visiting *Dittrichia viscosa* (Asteraceae) and *Ceratonia siliqua* (Fabaceae), all records S.P.M. Roberts leg., G. Holmström and H. Dathe det.

Distribution. Cyprus, Western Europe (France, Switzerland, Austria), Southern Europe, Eastern Europe, Northern Africa (Morocco, Tunisia), Western Asia, Southern Asia (Iran).

Notes. Described from Cyprus as *Prosopis brevicornis* var. *cyprica* Alfken, 1928, from [Yermasoyia; Episcopi]: 34.72231°N, 33.08497°E, 34.67513°N, 32.88260°E, G.A. Mavromoustakis leg., J.D. Alfken det.

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

References. Mavromoustakis (1949 [“1948”]); Pittioni (1950); Mavromoustakis (1957a).

Mavromoustakis localities. Finikaria River, Mesapotamos, Near Zakaki, Near Mesayitonia.

Distribution. Cyprus, Western Europe, Southern Europe, Eastern Europe, Northern Africa (Morocco, Algeria), Western Asia (Israel, Lebanon, Azerbaijan), Southern Asia (Iran).

Notes. Described from Cyprus as *Prosopis lineolata rudis* Pittioni, 1950, from Kykkos: 34.984°N, 32.741°E, 15-17.VII.1939, H. Lindberg leg., B. Pittioni det., (MZHF).

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

References. Alfken (1928); Mavromoustakis (1949 [“1948”], 1951, 1957a).

Mavromoustakis localities. Akrotiri Forest, Cherkas, Zakaki, Asomatos, Fassouri, Gape Gata, Larnaca, Pernera coast of Paralimni.

Distribution. Cyprus, Western Europe (France, Switzerland, Austria), Southern Europe, Eastern Europe, Northern Africa (Morocco), Western Asia, Central Asia (Kyrgyzstan), Southern Asia (Iran).

Notes. Described from Cyprus as *Prosopis maculiscutum* Alfken, 1928, from Cherkas: 34.65°N, 32.975°E, 7 or 24.VIII.1924, G.A. Mavromoustakis leg., J.D. Alfken det.

Hylaeus (Prosopis) pictus (Smith, 1853)

References. Mavromoustakis (1951, 1952).

Mavromoustakis localities. Near Limassol, Cherkas, Chiflicoudia marshes, Pera Pedi, Near Akrotiri, Yermasoyia River, Potamitissa, Mt. Troodos Kannoures springs, Near Cape Gata.

Distribution. Cyprus, Western Europe (France), Southern Europe, Eastern Europe (Hungary, Bulgaria), Northern Africa, Western Asia.

Hylaeus (Dentigera) rubicola Saunders, 1850

References. Alfken (1928); Mavromoustakis (1949 [“1948”]); Pittioni (1950).

Mavromoustakis localities. Yermasoyia.

Distribution. Cyprus, Western Europe (France), Southern Europe (Spain, Italy, Greece), Eastern Europe (Bulgaria), Northern Africa (Egypt), Western Asia.

Notes. Described from Cyprus as *Prosopis rectanguliceps* Alfken, 1928, from Yermasoyia: 34.7182°N, 33.08788°E, 1-20.IX.1924, G.A. Mavromoustakis leg., J.D. Alfken det.

Hylaeus (Lambdopsis) scutellatus (Spinola, 1838)

References. Alfken (1928); Mavromoustakis (1949 [“1948”]); Pittioni (1950); Mavromoustakis (1951, 1957a).

Mavromoustakis localities. Limassol, Cherkas, Zakaki, Moni, Pera Pedi, Stroumbi, Tsada.

Material examined. Paphos District: Asprokremmos Dam, 34.720825°N, 32.551994°E, 30.IV.2015, S.P.M. Roberts leg., G. Holmström and H. Dathe det. (1♂), visiting *Sisymbrium* (Brassicaceae).

Distribution. Cyprus, Southern Europe, Northern Africa (Egypt), Western Asia (Palestine to Turkey), Southern Asia (Iran).

Hylaeus (Paraprosopis) soror (Pérez, 1903)

References. Pittioni (1950).

Distribution. Cyprus, Western Europe (France), Southern Europe, Eastern Europe (Bulgaria, Russian Federation), Northern Africa, Southern Asia (Iran).

Hylaeus (Paraprosopis) taeniolatus Förster, 1871

References. Erlandsson (1986).

Material examined. Limassol District: Anogyra, 34.73663°N, 32.732715°E, 26.IV.2015, (1♂), visiting Brassicaceae; 1 km E of Pissouri, 34.677579°N, 32.722066°E, 27.IV.2015, (4♀, 1♂), visiting Brassicaceae; 2 km N of Anogyra, 34.748126°N, 32.732248°E, 1.V.2015, (1♀); Anogyra to Avdimou Road km 2, 34.723986°N, 32.736892°E, 3.V.2015, (1♂), visiting Apiaceae; Anogyra, 34.741952°N, 32.734845°E, 3.V.2015, (1♀, 3♂), visiting Brassicaceae; 0.7 km N of Anogyra, 34.745537°N, 32.73385°E, 3.V.2015, (8♂); 0.7 km N of Anogyra, 34.743911°N, 32.732439°E, 26.X.2016, (1♀), visiting Fabaceae; Yermasoyia Dam, 34.755799°N, 33.096194°E, 7.III.2017, (1♂); Paphos District: Nr Arminou Reservoir, 34.883435°N, 32.750988°E, 29.IV.2015, (1♀, 1♂); Asprokremmos Dam, 34.720825°N, 32.551994°E, 30.IV.2015, (1♀, 1♂), visiting Brassicaceae; 2.7 km SW of Acheleia, Potamos tis Ezouzas, 34.729004°N, 32.457544°E, 30.IV.2015, (2♂); Polis, 35.053539°N, 32.351197°E, 30.X.2016, (1♀, 1♂), visiting Fabaceae; Larnaca District: Zygi, 34.731233°N, 33.343487°E, 28.X.2016, (1♀, 4♂), visiting Asteraceae and Fabaceae, all records S.P.M. Roberts leg., G. Holmström and H. Dathe det.

Distribution. Cyprus, Western Europe, Southern Europe, Eastern Europe (Bulgaria), Northern Africa, Western Asia.

MEGACHILIDAE

LITHURGINI

Genus *Lithurgus* BERTHOLD, 1827

2 species.

Lithurgus (Lithurgus) chrysurus Fonscolombe, 1834

References. Mavromoustakis (1949 [“1948”], 1952, 1954, 1957a).

Mavromoustakis localities. Near Limassol, Cherkes, Pera Pedi, Mandria, Near Kalliana.

Distribution. Cyprus, Western Europe (France, Switzerland, Austria), Southern Europe, Eastern Europe, Northern Africa (Morocco), Western Asia, Central Asia (Tajikistan), Southern Asia (Iran), Eastern Asia (China).

Lithurgus (Lithurgus) tibialis Morawitz, 1875

References. Mavromoustakis (1949 [“1948”], 1957a).

Mavromoustakis localities. Cherkes, Zakaki, Asomatos, Episkopi, Pera Pedi, Fassouri, Near Famagusta, Symboulas.

Material examined. Paphos District: 15 km SE Paphos, Kouklia, 34.72°N, 32.55°E, 20.VI.2013, (1♂); 20 km N Paphos, Kathikas, 34.90°N, 32.42°E, 20.VI.2013, (2♂), all records C. Schmid-Egger leg., C. Schmid-Egger det.

Distribution. Cyprus, Southern Europe, Northern Africa, Western Asia, Central Asia (Turkmenistan), Southern Asia (Iran, Pakistan).

OSMIINI

Genus *Chelostoma* LATREILLE, 1809

3 species.

***Chelostoma (Chelostoma) comosum* Müller, 2012**

Type locality-country. Cyprus, Troodos, Kato Platres S of Foini: 34.8775°N, 32.8386°E, 1.V.2011, C. Sedivy, A. Müller leg., A. Müller det. ♂, (ETHZ).

References. Müller (2012).

Material examined. Larnaca District: 2 km S of Ora, 450m, 34.85°N, 33.20°E, 3.IV.2009, H.R. Schwenninger leg., A. Müller det. (1♀); Limassol District: Anogyra, 34.73663°N, 32.732715°E, 26.IV.2015, M. Jenner leg., G. Le Goff det. (1♂); Famagusta District: 5 km E of Rizokarpaso, 35.62°N, 34.46°E, C. Schmid-Egger leg., A. Müller det. (1♂).

Distribution. Cyprus, Western Asia.

***Chelostoma (Chelostoma) diodon* Schletterer, 1889**

References. Mavromoustakis (1951, 1952, 1957a).

Mavromoustakis localities. Yerasa, Platania Forest Station.

Material examined. Limassol District: Anogyra to Pachna Road km 4, 34.764269°N, 32.757736°E, 5.V.2015, S.P.M. Roberts leg., A. Müller det. (1♀), visiting Asteraceae.

Distribution. Cyprus, Southern Europe (Greece), Western Asia, Southern Asia (Iran).

Notes. The subspecies described from Cyprus is *Chelostoma diodon cypriacum* (Mavromoustakis, 1951), from Yerasa: 34.8025°N, 32.998056°E, 22.III.1945, G.A. Mavromoustakis leg., G.A. Mavromoustakis det. ♀, (DAAN).

***Chelostoma (Chelostoma) lucens* (Benoist, 1928)**

References. Mavromoustakis (1951, 1952, 1957a).

Mavromoustakis localities. Apsiou, Yerasa.

Distribution. Cyprus, Southern Europe (Greece), Eastern Europe (Bulgaria), Western Asia.

Genus *Heriades* SPINOLA, 1808

4 species.

***Heriades (Rhopaloheriades) clavicornis* Morawitz, 1875**

References. Ungricht, Müller and Dorn (2008).

Distribution. Cyprus, Southern Europe (Greece), Western Asia, Central Asia (Tajikistan), Southern Asia (Iran).

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

References. Mavromoustakis (1951).

Mavromoustakis localities. Mt. Troodos.

Distribution. Cyprus, Southern Europe, Eastern Europe (Bulgaria), Western Asia.

Notes. The subspecies described from Cyprus is *Heriades punctulifera troodica* (Mavromoustakis, 1951), from Mt. Troodos, open slopes, 1676.4m: 34.9234°N, 32.8833°E, 18.VII.1949 [“1948”], G.A. Mavromoustakis leg. G.A. Mavromoustakis det. ♀, (DAAN).

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

References. Mavromoustakis (1949 [“1948”], 1952).

Mavromoustakis localities. Near Limassol, Akrotiri Bay, Cherkes, Chiflicoudia marshes, Erimi, Alassa River, Evdhimou River.

Material examined. Paphos District: 20 km NNW Paphos, Lara Beach, 34.94°N, 32.31°E, 20.VI.2013, (4♀); Polis, 35.053539°N, 32.351197°E, 30.X.2016, (2♂), visiting *Dittrichia viscosa* (Asteraceae); Polis, 35.053539°N, 32.351197°E, 30.X.2016, (6♂), visiting *Dittrichia viscosa*; Limassol District: Sovereign Base Area, Akrotiri, 34.628771°N, 32.941031°E, 29.X.2016, (1♀), visiting *Dittrichia viscosa* (Asteraceae); Cherkes, 34.653067°N, 32.974233°E, 22.V.2016, (1♂); Cherkes, 34.65096°N, 32.99091°E, 26.VIII.2016, (1♀); Cherkes, 34.65096°N, 32.99091°E, 12.VIII.2016, (1♀); Cherkes, 34.6432°N 32.9952°E, 6.XI.2016, (1♀); Akrotiri, 34.628817°N, 32.940667°E,

3.VII.2016, (2♂); Akrotiri, 34.628817°N, 32.940667°E, 26.VIII.2016, (1♀); Akrotiri, 34.600657°N, 32.971419°E, 11.IX.2016, (1♂); Akrotiri, 34.628817°N, 32.940667°E, 8.X.2016, (1♀); Akrotiri, 34.628817°N, 32.940667°E, 6.XI.2016, (1♀); Akrotiri, 34.628817°N, 32.940667°E, 21.IV.2017, (1♀); Akrotiri, 34.628817°N, 32.940667°E, 3.VII.2017, (1♀, 1♂), all 20 km NNW Paphos and Lara Beach (20.VI.2013) records, C. Schmid-Egger leg., A. Müller det., all Polis (30.X.2016, 2♂) and Sovereign Base Area, Akrotiri records S.P.M. Roberts leg., S.P.M. Roberts and G. Le Goff det., all Polis (30.X.2016, 6♂), all Cherkes and Akrotiri records A. Varnava leg., A. Müller det.

Distribution. Cyprus, Western Europe (France, Switzerland), Southern Europe, Eastern Europe (Bulgaria, Slovakia), Northern Africa, Western Asia, Central Asia (Turkmenistan, Kazakhstan, Kyrgyzstan), Southern Asia.

***Heriades (Heriades) truncorum* (Linnaeus, 1758)**

References. Mavromoustakis (1949 [“1948”]); Pittioni (1950); Mavromoustakis (1952).

Mavromoustakis localities. Near Limassol, Chiflicoudia marshes, Erimi, Near Platania Forest Station, Rizokarpaso.

Material examined. Paphos District: 20 km NNW Paphos, Lara Beach, 34.94°N, 32.31°E, 20.VI.2013, (1♀); Polis, 35.053539°N, 32.351197°E, 30.X.2016, (1♀), visiting *Dittrichia viscosa* (Asteraceae); Limassol District: Cherkes, 34.653067°N, 32.974233°E, 22.V.2016, (2♀, 1♂); Cherkes, 34.659801°N, 32.99051°E, 22.V.2016, (1♀); Cherkes, 34.659801°N, 32.99051°E, 5.VI.2016, (2♀); Akrotiri, 34.600657°N, 32.971419°E, 22.V.2016, (1♂); Akrotiri, 34.628817°N, 32.940667°E, 13.X.2017, (1♀); Platres, 34.886528°N, 32.862465°E, 14.X.2017, (1♀), visiting *Hedera helix*, all 20 km NNW Paphos, Lara Beach records C. Schmid-Egger leg., A. Müller det., all Polis records S.P.M. Roberts leg., S.P.M. Roberts and G. Le Goff det., all Limassol district records A. Varnava leg., A. Müller det.

Distribution. Cyprus, Widespread in Europe, Northern Africa, Western Asia.

Genus *Hoplitis* KLUG, 1807

9 species.

Hoplitis (Alcidamea) acuticornis (Dufour and Perris, 1840)

References. Mavromoustakis (1939b, 1949 [“1948”]).

Mavromoustakis localities. Sphalangiotissa Monastery.

Material examined. Limassol District: Sovereign Base Area, Akrotiri, Bishop's Pool, 34.597305°N, 32.984521°E, 28.IV.2015, M. Jenner leg., G. Le Goff det. (1♀); Polemidia, 34.71178°N, 33.004775°E, 8.III.2017, Bee Course students leg., A. Müller det. (2♂, 1♀).

Distribution. Cyprus, Widespread in Europe (except Great Britain and northern Europe), Northern Africa, Western Asia, Central Asia, Southern Asia (Iran).

Hoplitis (Anthocopa) anipuncta (Alfken, 1935)

References. Müller (2018).

Distribution. Cyprus, Western Asia.

Hoplitis (Hoplitis) annulata (Latreille, 1811)

References. Mavromoustakis (1939b, 1949 [“1948”], 1951).

Material examined. Paphos District: 20 km NNW Paphos, Lara Beach, 34.94°N, 32.31°E, 20.VI.2013, (2♀); 8 km N Paphos, Mavrokolympus Reservoir, 34.85°N, 32.40°E, 20.VI.2013, (1♀); Asprokremmos Dam, 34.720825°N, 32.551994°E, 30.IV.2015, (1♂, 1♀), visiting *Echium angustifolium* (Boraginaceae); Limassol District: Sovereign Base Area, 8 km S Limassol, Akrotiri (near Airbase), 34.60°N, 32.97°E, 20.VI.2013, (2♀); Sovereign Base Area, Akrotiri, Bishop's Pool, 34.597305°N, 32.984521°E, 28.IV.2015, (1♂, 4♀), visiting *Echium angustifolium* (Boraginaceae); Cherkes, 34.65096°N, 32.99091°E, 9.IV.2016, (1♀); Akrotiri, 34.600657°N, 32.971419°E, 19.IV.2016, (1♂); Akrotiri, 34.600657°N, 32.971419°E, 22.V.2016, (2♂); Akrotiri, 34.601506°N, 32.986197°E, 22.V.2016, (2♂); Akrotiri, 34.600657°N, 32.971419°E, 5.V.2017, (1♀, 1♂); Akrotiri, 34.600657°N, 32.971419°E, 24.V.2017, (1♀); Akrotiri, 34.600657°N, 32.971419°E, 15.VI.2017, (1♀); Akrotiri, 34.600657°N, 32.971419°E, 26.IV.2018, (1♀); Akrotiri, 34.601506°N, 32.986197°E, 26.IV.2018, (1♂) Yermasoyia Dam, 34.755799°N, 33.096194°E, 7.III.2017, (1♂), all 20 km NNW Paphos,

Lara Beach, Mavrokolympos Reservoir and Sovereign Base Area, 8 km S Limassol, Akrotiri (near Airbase) records C. Schmid-Egger leg., A. Müller det., all Asprokremmos Dam and Sovereign Base Area, Akrotiri, Bishop's Pool records S.P.M. Roberts leg., A. Müller det., all Yermasoyia Dam records S.P.M. Roberts leg., G. Le Goff det., all Cherkes and Akrotiri records A. Varnava leg., A. Müller det.

Distribution. Cyprus, Western Europe (France), Southern Europe, Eastern Europe (Bulgaria), Northern Africa, Western Asia.

Hoplitis (Anthocopa) cypriaca (Mavromoustakis, 1938)

Type locality-country. Cyprus, Limassol: 34.66839°N, 33.03252°E, 21.IV.1938, G.A. Mavromoustakis leg., G.A. Mavromoustakis det. ♀, (DAAN).

References. Mavromoustakis (1938, 1949 [“1948”], 1952, 1953, 1954).

Mavromoustakis localities. Limassol, Evdhimou River, Near Enkomi of Famagusta, Xylophagou, Arakapas, Deryneia.

Material examined. Limassol District: Akrotiri, 34.583676°N, 32.949306°E, 27.IV.2018, A. Varnava leg, A. Müller det. (1♀).

Distribution. Cyprus, Western Asia (Israel, Jordan, Syria).

Hoplitis (Anthocopa) fasciculata (Alfken, 1934)

References. Mavromoustakis (1949 [“1948”]); Pittioni (1950); Mavromoustakis (1952).

Mavromoustakis localities. Cherkes, Yermasoyia River, Younaros of Zakaki, Deryneia.

Material examined. Paphos District: 15 km SE Paphos, Kouklia, 34.72°N, 32.55°E, 20.VI.2013, (4♀); Limassol District: Akrotiri, 34.583676°N, 32.949306°E, 24.V.2017, (1♂); Akrotiri, 34.583676°N, 32.949306°E, 26.IV.2018, (1♀), all Paphos district records C. Schmid-Egger leg., A. Müller det., all Limassol district records A. Varnava leg., A. Müller det.

Distribution. Cyprus, Southern Europe (Italy, Greece), Western Asia, Southern Asia (Iran).

Notes. Described from Cyprus as *Osmia idalia* Mavromoustakis, 1949 ["1948"], from Yermasoyia River: 34.7182°N, 33.08788°E, 5.VI.1938, G.A. Mavromoustakis leg., G.A. Mavromoustakis det. ♀, (DAAN).

***Hoplitis (Hoplitis) holmboei* (Mavromoustakis, 1949)**

Type locality-country. Cyprus, Yermasoyia River: 34.7182°N, 33.08788°E, 20.III.1937, G.A. Mavromoustakis leg., G.A. Mavromoustakis det. ♀, (DAAN).

References. Mavromoustakis (1949 ["1948"], 1952, 1957a).

Mavromoustakis localities. Polemedia Hills, Yermasoyia River, Near Amathus.

Material examined. Limassol District: Almirolivado, 34.9333°N, 32.9004°E, 14-16.V.2012, S. Dimitriou leg., A. Müller det. (1♂), pan trap (UAEG).

Distribution. Cyprus, Southern Europe (Greece).

***Hoplitis (Alcidamea) limassolica* (Mavromoustakis, 1937)**

Type locality-country. Cyprus, Limassol: 34.66839°N, 33.03252°E, 18.III.1935, G.A. Mavromoustakis leg., G.A. Mavromoustakis det. ♀, (DAAN).

References. Mavromoustakis (1937b, 1938, 1949 ["1948"], 1951, 1952, 1953, 1957a).

Mavromoustakis localities. Polemedia Hills, Yerasa, Kellaki, Trimiklini, Famagusta, Ayia Varvara (Stavrovouni).

Material examined. Limassol District: Polemidia, 34.71178°N, 33.004775°E, 8.III.2017, Bee Course students leg., A. Müller det. (1♂).

Distribution. Cyprus, Northern Africa, Western Asia.

***Hoplitis (Pentadentosmia) pomarina* (Warncke, 1991)**

References. Müller (2018).

Material examined. C. Schmid-Egger leg., A. Müller det., 2013.

Distribution. Cyprus, Southern Europe (North Macedonia, Greece), Western Asia.

***Hoplitis (Anthocopa) yermasoyiae* (Mavromoustakis, 1938)**

References. Mavromoustakis (1938, 1949 [“1948”], 1951, 1952).

Mavromoustakis localities. Polemedia Hills, Potamitissa, Yerasa, Kellaki, Near Eftagonia, Ayia Irini Station, Eleousa Monastery (Karpasian Peninsula).

Material examined. Nicosia District: Kakopetria, 34.992°N, 32.9082°E, 5-7.IV.2012, (6♂, 2♀), pan trap (UAEG); Kakopetria, 34.992°N, 32.9082°E, 25-27.IV.2012, (14♂, 10♀), pan trap (UAEG); Limassol District: 1 km E of Pissouri, 34.677579°N, 32.722066°E, 27.IV.2015, (1♀); 0.7 km N of Anogyra, 34.745537°N, 32.73385°E, 3.V.2015, (1♀); Anogyra to Pachna Road km 4, 34.764269°N, 32.757736°E, 5.V.2015, (2♀), visiting Asteraceae; Akrotiri, 34.583676°N, 32.949306°E, 23.IV.2016, (1♀); Akrotiri, 34.600657°N, 32.971419°E, 23.IV.2016, (1♀); Yermasoyia Dam, 34.755799°N, 33.096194°E, 7.III.2017, (1♂); Akrotiri, 34.601506°N, 32.986197°E, 7.IV.2017, (1♀); Akrotiri, 34.601506°N, 32.986197°E, 21.IV.2017, (1♂); Akrotiri, 34.601506°N, 32.986197°E, 14.IV.2018, (1♀, 1♂); Akrotiri, 34.601506°N, 32.986197°E, 26.IV.2018, (2♀); Paphos District: N of Elia Bridge, 34.900977°N, 32.776759°E, 29.IV.2015, (1♂), all Nicosia district records S. Dimitriou leg., A. Müller det., all 1 km E of Pissouri, 0.7 km N of Anogyra, Anogyra to Pachna Road km 4 and Paphos district records S.P.M. Roberts leg., A. Müller det., all Akrotiri records A. Varnava leg., A. Müller det., all Yermasoyia Dam records Bee Course students leg., A. Müller det.

Distribution. Cyprus, Southern Europe (North Macedonia, Albania, Greece), Western Asia.

Notes. The subspecies described from Cyprus is *Hoplitis yermasoyiae yermasoyiae*, from Yermasoyia: 34.7182°N, 33.08788°E, 21.III.1937, G.A. Mavromoustakis leg./det. ♂, (DAAN).

Genus *Osmia* PANZER, 1806

25 species.

***Osmia (Pyrosmia) amathusica* Mavromoustakis, 1937**

Type locality-country. Cyprus, Amathus ruins: 34.7125°N, 33.1419°E, 26.III.1935, G.A. Mavromoustakis leg., G.A. Mavromoustakis det. ♀, (DAAN).

References. Mavromoustakis (1937b, 1949 [“1948”], 1957a).

Mavromoustakis localities. Polemedia Hills, Choirokitia.

Material examined. Limassol District: Polemidia, 34.71178°N, 33.004775°E, 8.III.2017, Bee Course students leg., A. Müller det. (1♂).

Distribution. Cyprus, Southern Europe (Italy, Greece), Western Asia.

***Osmia (Erythrosmia) andrenoides* Spinola, 1808**

References. Mavromoustakis (1939b, 1949 [“1948”], 1951).

Mavromoustakis localities. Limassol, Polemedia Hills.

Distribution. Cyprus, Western Europe, Southern Europe, Eastern Europe, Western Asia.

***Osmia (Osmia) bicornis* (Linnaeus, 1758)**

References. Mavromoustakis (1939b, 1949 [“1948”], 1951, 1952, 1953).

Mavromoustakis localities. Apsiou, Yerasa, Trimiklini, Pera Pedi, Mt. Troodos open slopes, Listovounos Kakopetria.

Material examined. Nicosia District: Kakopetria, 34.992°N, 32.9082°E, 25-27.IV.2012, S. Dimitriou leg., J. Devalez and A. Müller det. (1♂), pan trap (UAEG).

Distribution. Cyprus, Widespread in Europe, Northern Africa, Western Asia, Central Asia (Turkmenistan, Kazakhstan, Kyrgyzstan), Southern Asia (Iran).

***Osmia (Metallinella) brevicornis* (Fabricius, 1798)**

References. Scheuchl and Willner (2016).

Distribution. Cyprus, Widespread in Europe, Northern Africa, Western Asia, Central Asia, Southern Asia (Iran, Afghanistan).

Notes. Records pertain to ssp. *leucogastra* Morawitz, 1875.

***Osmia (Helicosmia) caerulescens* (Linnaeus, 1758)**

References. Mavromoustakis (1939b, 1949 [“1948”]); Pittioni (1950); Mavromoustakis (1951, 1952, 1953, 1957a).

Mavromoustakis localities. Episkopi Forest, Potamitissa, Trimiklini, Platres, Ayios Ioannis tou Agrou, Asbestotos spring near Amathus, Platania Forest Station, Mt. Troodos open slopes, Livadin of Cedars (Paphos Forest).

Material examined. Limassol District: Amiantos, 34.918°N, 32.9472°E, 25-27.IV.2012, (1♂), pan trap (UAEG); Troodos, Chionistra, 34.9317°N, 32.8664°E, 14-16.V.2012, (1♂), pan trap (UAEG); Yermasoyia Dam, 34.755799°N, 33.096194°E, 7.III.2017, (1♂); Sovereign Base Area, Akrotiri, Bishop's Pool, 34.597305°N, 32.984521°E, 10.III.2017, (2♂); Sovereign Base Area, Episkopi, Kensington Cliffs, 34.670772°N, 32.846923°E, 4.V.2015, (1♀); Paphos District: 8 km N Paphos, Mavrokolympus Reservoir, 34.85°N, 32.40°E, 20.VI.2013, (1♀); Famagusta District: Cape Greco, 34.963264°N, 34.066211°E, 15.III.2017, (1♂), all Amiantos records S. Dimitriou leg., J. Devalez and A. Müller det., all Troodos, Chionistra records S. Dimitriou leg., A. Müller det., all Yermasoyia Dam, Sovereign Base Area, Akrotiri, Bishop's Pool and Famagusta district records S.P.M. Roberts leg., G. Le Goff det., all Sovereign Base Area, Episkopi, Kensington Cliffs records S.P.M. Roberts leg., A. Müller det., all Paphos district records C. Schmid-Egger leg., A. Müller det.

Distribution. Cyprus, Widespread in Europe, Northern Africa, Western Asia, Central Asia, Southern Asia (India), Eastern Asia, New Zealand.

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

References. Mavromoustakis (1951, 1952, 1953).

Mavromoustakis localities. Nicosia, Apsiou, Yerasa, Trimiklini, Platania Forest Station, Kykkou Monastery, Prodromos, Rizokarpaso.

Material examined. Limassol District: Anogyra, 34.73663°N, 32.732715°E, 26.IV.2015, M. Jenner leg., G. Le Goff det. (1♀).

Distribution. Cyprus, Western Europe (France), Southern Europe, Eastern Europe, Northern Africa, Western Asia, Central Asia (Turkmenistan, Uzbekistan), Southern Asia (Iran).

Osmia (Osmia) cornuta (Latreille, 1805)

References. Mavromoustakis (1938, 1949 [“1948”], 1951, 1952).

Mavromoustakis localities. Apsiou, Potamitissa, Kitromili near Polemedia.

Distribution. Cyprus, Western Europe, Southern Europe, Eastern Europe, Northern Africa, Western Asia, Central Asia (Turkmenistan, Kazakhstan), Southern Asia (Iran).

Notes. The subspecies described from Cyprus is *Osmia cornuta neoregaena* Mavromoustakis, 1938, from Saittas, 762m: 34.8708333°N, 32.9166667°E, 10.III.1937, G.A. Mavromoustakis leg./det. ♀, (DAAN).

Osmia (Pyrosmia) cyanoxantha Pérez, 1879

References. Mavromoustakis (1949 [“1948”]).

Mavromoustakis localities. Near Limassol, Mesayitonia, Yermasoyia River, Amathus, Akrounda.

Distribution. Cyprus, Western Europe (France), Southern Europe, Eastern Europe (Bulgaria), Northern Africa, Western Asia, Southern Asia (Iran).

Osmia (Helicosmia) dimidiata Morawitz, 1870

References. Mavromoustakis (1949 [“1948”], 1952, 1957a).

Mavromoustakis localities. Limassol, Mesayitonia, Apsiou, Famagusta, Near Enkomi of Famagusta, Deryneia, Near Trimiklini.

Distribution. Cyprus, Western Europe (France), Southern Europe, Eastern Europe (Bulgaria, Ukraine, Russian Federation), Northern Africa, Western Asia, Central Asia (Kyrgyzstan), Southern Asia (Iran).

***Osmia (Helicosmia) dives* Mocsáry, 1877**

References. Mavromoustakis (1949 [“1948”]).

Mavromoustakis localities. Limassol, Episkopi, Fassouri, Yermasoyia River, Amathus, Mesayitonia.

Material examined. Limassol District: Amiantos, 34.918°N, 32.9472°E, 25-27.IV.2012, (9♂), pan trap (UAEG); 1 km E of Pissouri, 34.677579°N, 32.722066°E, 27.IV.2015, (1♀), collecting pollen at *Echium angustifolium* (Boraginaceae); Cherkes, 34.641933°N, 32.963433°E, 26.IV.2018, (1♂); Akrotiri, 34.601506°N, 32.986197°E, 19.IV.2016, (1♀); Akrotiri, 34.628817°N, 32.940667°E, 30.III.2018, (1♀); Akrotiri, 34.583676°N, 32.949306°E, 14.IV.2018, (2♀); Akrotiri, 34.583676°N, 32.949306°E, 27.IV.2018, (1♀); Paphos District: 1.75 km N of Ag. Georgios, 34.911736°N, 32.327703°E, 30.IV.2015, (1♀), visiting Asteraceae, all Amiantos records S. Dimitriou leg., J. Devalez and A. Müller det., all 1 km E of Pissouri and Paphos district records S.P.M. Roberts leg., A. Müller det., all Cherkes and Akrotiri records A. Varnava leg., A. Müller det.

Distribution. Cyprus, Southern Europe (Greece), Eastern Europe (Hungary, Bulgaria), Northern Africa, Western Asia, Central Asia, Southern Asia (Iran).

***Osmia (Erythrosmia) erythrogastra* Ferton, 1905**

References. Müller (2018).

Material examined. Limassol District: Yermasoyia Dam, 34.755799°N, 33.096194°E, 7.III.2017, Bee Course students leg., A. Müller det. (1♂).

Distribution. Cyprus, Western Europe (France), Southern Europe, Western Asia.

***Osmia (Pyrosmia) ferruginea* Latreille, 1811**

References. Mavromoustakis (1939b, 1949 [“1948”], 1951, 1952).

Mavromoustakis localities. Cape Gata, Larnaca, Morphou, Near Deryneia.

Material examined. Limassol District: Yermasoyia Dam, 34.755799°N, 33.096194°E, 7.III.2017, (3♀); Yermasoyia Dam, 34.755799°N, 33.096194°E, 7.III.2017, (1♂); Polemidia, 34.71178°N, 33.004775°E, 8.III.2017, (2♀); Polemidia, 34.71178°N, 33.004775°E, 8.III.2017, (2♂, 10♀); Sovereign Base Area, Avdimou Bay Cliffs,

34.656698°N, 32.773339°E, 10.III.2017, (3♀), visiting *Onobrychis* (Fabaceae); Akrotiri, 34.601506°N, 32.986197°E, 25.III.2017, (1♂); Akrotiri, 34.583676°N, 32.949306°E, 25.III.2017, (1♂); Akrotiri, 34.600657°N, 32.971419°E, 1.III.2018, (1♂); Akrotiri, 34.5886°N, 32.9389°E, 1.III.2018, (1♀); Akrotiri, 34.628817°N, 32.940667°E, 1.III.2018, (1♂); Larnaca District: Koshi, 34.96663°N, 33.544391°E, 9.III.2018, (1♀, 1♂), visiting *Onobrychis venosa*, Yermasoyia Dam (7.III.2017, 3♀), Polemidia (8.III.2017, 2♀) and Sovereign Base Area, Avdimou Bay Cliffs records S.P.M. Roberts leg., G. Le Goff det., Yermasoyia Dam (7.III.2017, 1♂) and Polemidia (8.III.2017, 2♂, 10♀) records Bee Course students leg., A. Müller det., all Akrotiri and Larnaca district records A. Varnava leg., A. Müller det.

Distribution. Cyprus, Western Europe (France), Southern Europe, Northern Africa, Western Asia.

Osmia (Pyrosmia) hellados van der Zanden, 1984

References. Müller (2018).

Material examined. Limassol District: Yermasoyia Dam, 34.755799°N, 33.096194°E, 7.III.2017, (1♂); Polemidia, 34.71178°N, 33.004775°E, 8.III.2017, (5♂, 2♀) all records Bee Course students leg., A. Müller det.

Distribution. Cyprus, Southern Europe, Eastern Europe (Bulgaria), Western Asia.

Osmia (Helicosmia) latreillei (Spinola, 1806)

References. Mavromoustakis (1939b, 1951, 1952, 1957a); Georghiou (1977).

Mavromoustakis localities. Limassol, Cherkes, Amathus, Sand dunes of Ayios Memnon (2 miles from Famagusta).

Material examined. Limassol District: Anogyra, 34.73663°N, 32.732715°E, 26.IV.2015, (1♀); 0.7 km N of Anogyra, 34.745537°N, 32.73385°E, 3.V.2015, (1♀); Polemidia, 34.71178°N, 33.004775°E, 8.III.2017, (6♂, 2♀); Cherkes, 34.643188°N, 32.995281°E, 25.III.2017, (1♂); Cherkes, 34.643188°N, 32.995281°E, 7.IV.2017, (1♀); Cherkes, 34.653067°N, 32.974233°E, 1.III.2018, (1♂); Cherkes, 34.659801°N, 32.99051°E, 16.III.2018, (1♀); Cherkes, 34.65096°N, 32.99091°E, 16.III.2018, (1♀);

Cherkes, 34.65096°N, 32.99091°E, 30.III.2018, (1♀); Cherkes, 34.653067°N, 32.974233°E, 30.III.2018, (1♀); Paphos District: Aspro Pools, 34.720825°N, 32.551994°E, 30.IV.2015, (1♀), all Anogyra and Paphos district records M. Jenner leg., G. Le Goff det., all Polemidia records Bee Course students leg., A. Müller det., all Cherkes records A. Varnava leg., A. Müller det.

Distribution. Cyprus, Western Europe (France), Southern Europe, Northern Africa, Western Asia, Southern Asia (Iran).

***Osmia (Hoplosmia) ligurica* Morawitz, 1868**

References. Mavromoustakis (1939b, 1949 [“1948”], 1951, 1952, 1953).

Mavromoustakis localities. Evdhimou River, Potamitissa, Yerasa, Eftagonia, Trimiklini, Arakapas, Sand dunes of Ayios Memnon.

Distribution. Cyprus, Western Europe (France, Austria), Southern Europe, Eastern Europe, Northern Africa, Western Asia, Central Asia (Turkmenistan), Southern Asia (Iran).

***Osmia (Helicosmia) melanogaster* Spinola, 1808**

References. Scheuchl and Willner (2016).

Distribution. Cyprus, Western Europe (France, Austria), Southern Europe, Eastern Europe, Northern Africa, Western Asia, Central Asia (Turkmenistan, Uzbekistan), Southern Asia (Iran), Eastern Asia (China).

***Osmia (Pyrosmia) nana* Morawitz, 1874**

References. Mavromoustakis (1951).

Mavromoustakis localities. Cape Apostolos Andreas.

Distribution. Cyprus, Southern Europe (Italy, Croatia, Greece), Eastern Europe (Bulgaria, Russian Federation), Western Asia, Central Asia (Turkmenistan), Southern Asia (Iran).

***Osmia (Helicosmia) niveata* (Fabricius, 1804)**

References. Mavromoustakis (1949 [“1948”]); Georghiou (1977).

Mavromoustakis localities. Episkopi, Potamitissa.

Material examined. Limassol District: Amiantos, 34.918°N, 32.9472°E, 25.iv.2012, 27.iv.2012, (2♂), pan trap (UAEG); Sovereign Base Area, Akrotiri, Bishop's Pool, 34.597305°N, 32.984521°E, 28.IV.2015, (6♀), collecting pollen on Asteraceae (Cardueae); Anogyra, 34.741952°N, 32.734845°E, 28.IV.2015, (1♂); Cherkes, 34.65096°N, 32.99091°E, 17.IV.2016, (1♀); Cherkes, 34.65096°N, 32.99091°E, 16.III.2018, (1♀); Cherkes, 34.65096°N, 32.99091°E, 14.IV.2018, (1♀); Cherkes, 34.65096°N, 32.99091°E, 26.IV.2018, (2♀); Akrotiri, 34.601506°N, 32.986197°E, 16.III.2018, (1♂), all Amiantos records S. Dimitriou leg., J. Devalez and A. Müller det., all Sovereign Base Area, Akrotiri, Bishop's Pool records S.P.M. Roberts leg., A. Müller det., all Anogyra records M. Jenner leg., G. Le Goff det., all Cherkes and Akrotiri records A. Varnava leg., A. Müller det.

Distribution. Cyprus, Widespread in Europe, Northern Africa, Western Asia, Southern Asia (Iran), Eastern Asia (China).

***Osmia (Pyrosmia) saxicola* Ducke, 1899**

References. Mavromoustakis (1937b, 1939b, 1949 [“1948”], 1951, 1952, 1953).

Mavromoustakis localities. Near Pano Kivides, Platania Forest Station, Yerasa Hills, Hills near Paramytha.

Distribution. Cyprus, Western Europe (France), Southern Europe, Western Asia, Central Asia (Tajikistan), Southern Asia (Iran).

Notes. Described from Cyprus as *Osmia cypricola* Mavromoustakis, 1937, from Pera Pedi: 34.859444°N, 32.876111°E, 20.V.1929, G.A. Mavromoustakis leg./det. ♀, (DAAN).

***Osmia (Hoplosmia) scutellaris* Morawitz, 1868**

References. Mavromoustakis (1939b, 1949 [“1948”], 1951, 1952).

Mavromoustakis localities. Polemedia Hills, Akrotiri Forest, Cape Apostolos Andreas, Evdhimou River, Potamitissa, Yerasa.

Material examined. Limassol District: Cherkes, 34.65096°N, 32.99091°E, 9.IV.2016, (3♂); Akrotiri, 34.600657°N, 32.971419°E, 19.IV.2016, (1♀); Akrotiri, 34.600657°N, 32.971419°E, 8.V.2016, (1♀); Akrotiri, 34.600657°N, 32.971419°E, 5.V.2017, (1♂); Cherkes, 34.659801°N, 32.99051°E, 26.IV.2018, (1♀), all records A. Varnava leg., A. Müller det.

Distribution. Cyprus, Western Europe (France, Switzerland), Southern Europe, Eastern Europe, Northern Africa, Western Asia, Southern Asia (Iran).

***Osmia (Helicosmia) signata* Erichson, 1835**

References. Mavromoustakis (1949 [“1948”]); Pittioni (1950); Georghiou (1977).

Mavromoustakis localities. Limassol, Fassouri, Randidi Forest.

Material examined. Paphos District: 20 km N Paphos, Kathikas, 34.90°N, 32.42°E, 20.VI.2013, (1♀); Limassol District: Cherkes, 34.65096°N, 32.99091°E, 14.IV.2018, (2♀); Cherkes, 34.65096°N, 32.99091°E, 26.IV.2018, (1♀); Akrotiri, 34.583676°N, 32.949306°E, 10.III.2017, (1♂); Akrotiri, 34.583676°N, 32.949306°E, 26.IV.2018, (3♀); Akrotiri, 34.583676°N, 32.949306°E, 28.IV.2018, (2♀), all Paphos district records C. Schmid-Egger leg., A. Müller det., all Limassol district records A. Varnava leg., A. Müller det.

Distribution. Cyprus, Western Europe (France), Southern Europe, Eastern Europe (Ukraine), Northern Africa, Western Asia, Central Asia (Turkmenistan), Southern Asia (Iran), Eastern Asia (China).

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

References. Mavromoustakis (1939b, 1949 [“1948”], 1951, 1957a).

Mavromoustakis localities. Akrotiri forest, Near Platania Forest Station, Potamitissa, Cape Apostolos Andreas, Morphou, Choirokitia, Deryneia.

Material examined. Limassol District: Sovereign Base Area, Akrotiri, Bishop's Pool, 34.597305°N, 32.984521°E, 28.IV.2015, (1♀); Anogyra, 34.741952°N, 32.734845°E, 28.IV.2015, (1♀); Anogyra, 34.741952°N, 32.734845°E, 3.V.2015, (1♀); Anogyra, 34.724979°N, 32.737225°E, 1.IV.2016, (1♂); Troodos, Kannoures Spring, 34.940989°N, 32.872738°E, 21.VIII.2016, (1♂); Yermasoyia Dam, 34.755799°N, 33.096194°E, 7.III.2017, (1♀); Yermasoyia Dam, 34.755799°N, 33.096194°E, 7.III.2017, (1♂); Polemidia, 34.71178°N, 33.004775°E, 8.III.2017, (1♀); Polemidia, 34.71178°N, 33.004775°E, 8.III.2017, (7♀); Akrotiri, 34.601506°N, 32.986197°E, 26.IV.2018, (1♀), all Sovereign Base Area, Akrotiri, Bishop's Pool records S.P.M. Roberts leg., A. Müller det., Anogyra records M. Jenner leg., G. Le Goff det., Anogyra (1.IV.2016, 1♂), Troodos, Kannoures Spring and Akrotiri records A. Varnava leg., A. Müller det., Yermasoyia Dam (7.III.2017, 1♀) and Polemidia (8.III.2017, 1♀) records S.P.M. Roberts leg., G. Le Goff det., Yermasoyia Dam (7.III.2017, 1♂) and Polemidia (8.III.2017, 7♀) records Bee Course students leg., A. Müller det.

Distribution. Cyprus, Western Europe, Southern Europe, Eastern Europe, Northern Africa, Western Asia, Central Asia (Kazakhstan).

***Osmia (Allosmia) sybarita* Smith, 1853**

References. Mavromoustakis (1939b, 1949 [“1948”]).

Mavromoustakis localities. Polemedia Hills, Near Paramytha, Randidi Forest, Near Deryneia.

Material examined. Limassol District: Filitos, 34.800043°N, 33.000918°E, 1.IV.2016, (1♀); Akrotiri, 34.600657°N, 32.971419°E, 23.IV.2016, (1♀); Akrotiri, 34.583676°N, 32.949306°E, 16.III.2018, (1♂); Yermasoyia Dam, 34.755799°N, 33.096194°E, 7.III.2017, (1♂); Polemidia, 34.71178°N, 33.004775°E, 8.III.2017, (1♂, 3♀), all Filitos and Akrotiri records A. Varnava leg., A. Müller det., all Yermasoyia Dam and Polemidia records Bee Course students leg., A. Müller det.

Distribution. Cyprus, Southern Europe (Albania, Greece), Eastern Europe (Bulgaria), Western Asia.

***Osmia (Pyrosmia) teunissenii* van der Zanden, 1981**

References. Ungricht, Müller and Dorn (2008).

Distribution. Cyprus, Southern Europe (Italy, Croatia, Greece), Western Asia.

***Osmia (Pyrosmia) viridana* Morawitz, 1874**

References. Mavromoustakis (1939b, 1949 [“1948”], 1951, 1952, 1953, 1957a).

Mavromoustakis localities. Polemedia Hills, Trimiklini, Near Paramytha, Near Pano Kivides, Near Cape Gata, Morphou, Panagia ton Katharadon Monastery (Kyrenia).

Material examined. Limassol District: 0.7 km N of Anogyra, 34.745537°N, 32.73385°E, 3.V.2015, (1♀), visiting *Trifolium* (Fabaceae); Anogyra, 34.741952°N, 32.734845°E, 3.V.2015, (2♀); Anogyra to Pachna Road km 4, 34.764269°N, 32.757736°E, 5.V.2015, (2♀); Filitos, 34.800043°N, 33.000918°E, 1.IV.2016, (1♀); Polemedia, 34.71178°N, 33.004775°E, 8.III.2017, (2♂); Polemedia, 34.71178°N, 33.004775°E, 8.III.2017, (5♂, 1♀), all 0.7 km N of Anogyra and Anogyra to Pachna Road km 4 records S.P.M. Roberts leg., A. Müller det., all Anogyra records M. Jenner leg., G. Le Goff det., all Filitos records A. Varnava leg., A. Müller det., Polemedia (8.III.2017, 2♂) records S.P.M. Roberts leg., G. Le Goff det., Polemedia (8.III.2017, 5♂, 1♀) records Bee Course students leg., A. Müller det.

Distribution. Cyprus, Western Europe (France, Italy, Germany), Southern Europe, Eastern Europe (Bulgaria, Ukraine, Russian Federation), Northern Africa, Western Asia, Central Asia, Southern Asia (Iran).

Notes. The subspecies described from Cyprus is *Osmia viridana nicosiana* Mavromoustakis, 1939, from Ayia Fyla: 34.71947°N, 33.01962°E, 22.II.1937, G.A. Mavromoustakis leg., G.A. Mavromoustakis det. ♀, (DAAN).

Genus *Protosmia* DUCKE, 1900

3 species.

***Protosmia (Protosmia) glutinosa* (Giraud, 1871)**

References. Mavromoustakis (1951).

Mavromoustakis localities. Mt. Troodos.

Distribution. Cyprus, Western Europe (France), Southern Europe, Eastern Europe (Bulgaria), Northern Africa, Western Asia (Turkey).

Protosmia (Protosmia) monstrosa (Pérez, 1895)

References. Mavromoustakis (1939b).

Distribution. Cyprus, Southern Europe (Greece), Northern Africa, Western Asia.

Protosmia (Protosmia) paradoxa (Friese, 1899)

References. Mavromoustakis (1939b, 1949 [“1948”]); Pittioni (1950).

Mavromoustakis localities. Cape Apostolos Andreas, Eleousa Monastery (Karpasia).

Material examined. Limassol District: 1 km E of Pissouri, 34.677579°N, 32.722066°E, 27.IV.2015, (1♂); Sovereign Base Area, Akrotiri, Bishop's Pool, 34.597305°N, 32.984521°E, 28.IV.2015, (1♀), collecting pollen on *Echium angustifolium* (Boraginaceae); 2 km N of Anogyra, 34.748126°N, 32.732248°E, 1.V.2015, (1♂), visiting Asteraceae; Anogyra to Pachna Road km 4, 34.764269°N, 32.757736°E, 5.V.2015, (1♂, 1♀), visiting Asteraceae; Filitos, 34.800043°N, 33.000918°E, 1.IV.2016, (2♂); Polemidia, 34.71178°N, 33.004775°E, 8.III.2017, (1♂), all 1 km E of Pissouri, Sovereign Base Area, Akrotiri Bishop's Pool, 2 km N of Anogyra and Anogyra to Pachna Road km 4 records S.P.M. Roberts leg., A. Müller det., all Filitos records A. Varnava leg., A. Müller det., all Polemidia records S.P.M. Roberts leg., G. Le Goff det.

Distribution. Cyprus, Southern Europe (Greece), Western Asia.

ANTHIDIINI

Genus *Anthidiellum* COCKERELL, 1904

2 Species.

***Anthidiellum (Anthidiellum) brevisculum* (Mavromoustakis, 1949)**

References. Mavromoustakis (1949 [“1948”], 1951, 1952, 1953, 1957a).

Mavromoustakis localities. Mt. Troodos, Livadin of Cedars (Paphos Forest), Ayios Ilarion, Xerokolimbi (near Trooditissa), Platania Forest, Mt. Troodos Chionistra.

Distribution. Cyprus, Southern Europe (Spain, Greece), Eastern Europe (Bulgaria, Romania), Northern Africa (Tunisia), Western Asia (Turkey, Lebanon, Israel), Southern Asia (Iran).

Notes. The subspecies described from Cyprus is *Anthidiellum brevisculum troodicum* Mavromoustakis, 1949 [“1948”], from Mt. Troodos, 1524 m: 34.908°N, 32.866°E, 14.VI.1935, G.A. Mavromoustakis leg., G.A. Mavromoustakis det. ♀, (DAAN).

***Anthidiellum (Anthidiellum) strigatum* (Panzer, 1805)**

References. Mavromoustakis (1949 [“1948”], 1951, 1952, 1957a).

Mavromoustakis localities. Limassol, Cherkes, Erimi, Alassa River, Chiflicoudia marshes, Livadin of Cedars (Paphos Forest), Ayia Irini (Kyrenia), Moni River, Finikaria, Symboulas, Paramali, Zakaki, Asomatos, Salipes marshes near Akrotiri.

Distribution. Cyprus, Widespread in Europe, Northern Africa, Western Asia, Central Asia, Southern Asia (Iran), Eastern Asia.

Genus *Anthidium* FABRICIUS, 1804

5 species.

***Anthidium (Anthidium) cingulatum* Latreille, 1809**

References. Mavromoustakis (1949 [“1948”], 1952, 1957a).

Mavromoustakis localities. Limassol, Polemedia Hills, Akrotiri Forest and Bay, Asomatos, Yermasoyia River, Eftagonia, Lania, Cape Gata, Trimiklini, Platres, Salipes marshes, Curium (near Episkopi), Episkopi, Moni, Evdhimou River, Near Platania Forest Station, Livadin of Cedars (Paphos Forest), Mt. Troodos, Symboulas Forest, Ayia Irini Station, Kykkou Monastery, Famagusta.

Material examined. Limassol District: Sovereign Base Area, Episkopi, Kensington Cliffs, 34.670772°N, 32.846923°E, 4.V.2015, S.P.M. Roberts leg., J. Praz det. (1♀), visiting Lamiaceae.

Distribution. Cyprus, Western Europe (France, Austria, Germany), Southern Europe, Eastern Europe, Northern Africa, Western Asia, Central Asia, Southern Asia (Iran), Eastern Asia (China).

***Anthidium (Anthidium) diadema* Latreille, 1809**

References. Mavromoustakis (1949 ["1948"], 1951, 1957a).

Mavromoustakis localities. Limassol, Polemedia Hills, Mesayitonia, Ayios Athanasios, Yermasoyia River, Younarka (near Zakaki), Curium (near Episkopi), Near Akhyritou, Pernera coast of Paralimni.

Material examined. Limassol District: Sovereign Base Area, Episkopi, Kensington Cliffs, 34.670772°N, 32.846923°E, 4.V.2015, S.P.M. Roberts leg., J. Praz det. (1♀), visiting Asteraceae.

Distribution. Cyprus, Western Europe (France, Belgium), Southern Europe, Eastern Europe (Bulgaria), Northern Africa (Morocco, Algeria.), Central Asia, Southern Asia (Iran), Eastern Asia (China).

***Anthidium (Anthidium) florentinum* (Fabricius, 1775)**

References. Cockerell (1910); Mavromoustakis (1949 ["1948"], 1957).

Mavromoustakis localities. Ayios Ioannis (Agros), Odou, Stavros (Paphos Forest), Krios River, Zakaki.

Distribution. Cyprus, Western Europe, Southern Europe, Eastern Europe, Northern Africa, Western Asia, Central Asia, Southern Asia (Iran), Eastern Asia (China).

Notes. Described from Cyprus as *Anthidium florentinum cypriacum* Mavromoustakis, 1949 ["1949 ["1948"]"], from Agios Ioannis, 34.86777°N, 32.69027°E, VII.1930, G.A. Mavromoustakis leg., G.A. Mavromoustakis det. ♀, (DAAN).

***Anthidium (Anthidium) loti* Perris, 1852**

References. Mavromoustakis (1949 [“1948”], 1951, 1952, 1957a); Georghiou (1977).

Mavromoustakis localities. Limassol, Polemedia Hills, Cherkes, Episkopi, Chiflicoudia marshes, Pera Pedi, Fassouri, Moni River, Zakaki, Episkopi Forest.

Distribution. Cyprus, Western Europe (France), Southern Europe, Eastern Europe (Hungary, Bulgaria, Romania), Western Asia (Turkey), Central Asia, Southern Asia (Iran).

***Anthidium (Proanthidium) undulatum* Dours, 1873**

References. Mavromoustakis (1939a, 1949 [“1948”], 1951, 1952, 1957a).

Mavromoustakis localities. Limassol, Yermasoyia River, Eftagonia, Mesayitonia, Polemedia Hills, Episkopi, Erimi, Ayia Varvara (Stavrovouni), Famagusta, Glypha (near Akanthou), Mt. Troodos.

Distribution. Cyprus, Western Europe (France), Southern Europe (Croatia, North Macedonia, Greece), Northern Africa (Algeria), Western Asia, Southern Asia (Iran).

Notes. The subspecies described from Cyprus is *Anthidium undulatum holozonium* (Mavromoustakis, 1939), from Limassol: 34.66839°N, 33.03252°E, G.A. Mavromoustakis leg., G.A. Mavromoustakis det. ♀, (DAAN).

Genus *Icteranthidium* MICHENER, 1948

2 species.

***Icteranthidium ferrugineum* (Fabricius, 1787)**

References. Mavromoustakis (1949 [“1948”], 1951).

Mavromoustakis localities. Akrotiri Bay, Famagusta, Ayios Memnon, Yermasoyia River, Near Episkopi.

Distribution. Cyprus, Southern Europe (Spain), Northern Africa (Morocco, Tunisia to Egypt), Western Africa (Mauritania), Western Asia, Central Asia (Turkmenistan, Kazakhstan), Southern Asia (Iran), Eastern Asia (China).

***Icteranthidium grohmanni* (Spinola, 1838)**

References. Pittioni (1950); Mavromoustakis (1957a).

Mavromoustakis localities. Mt. Troodos, Yermasoyia River.

Distribution. Cyprus, Southern Europe, Eastern Europe (Bulgaria, Ukraine), Northern Africa (from Morocco to Egypt), Western Asia, Central Asia (Kyrgyzstan), Southern Asia (Iran), Eastern Asia (China).

Genus *Rhodanthidium* ISENSEE, 1927

1 species.

***Rhodanthidium (Rhodanthidium) septemdentatum* (Latreille, 1809)**

References. Mavromoustakis (1949 [“1948”], 1951).

Mavromoustakis localities. Polemedia Hills, Northern Mountains Kantara, Near Amathus, Episkopi Forest, Symboulas Forest.

Distribution. Cyprus, Western Europe, Southern Europe, Eastern Europe, Western Asia.

Genus *Eoanthidium* POPOV, 1950

1 species.

***Eoanthidium (Eoanthidium) insulare* (Morawitz, 1874)**

References. Mavromoustakis (1937a, 1949 [“1948”], 1951, 1952, 1953, 1957a).

Mavromoustakis localities. Polemedia Hills, Moni River, Evdhimou River, Mt. Troodos Kannoures springs, Mt. Troodos open slopes, Livadin of Cedars (Paphos Forest), Platania

Forest Station, Ayios Ilarion (Northern Mountain), Xerokolimbi (near Trooditissa), Pasha Livadin (Mt. Troodos), Eagle's Bath (Mt. Troodos).

Material examined. Limassol District: Almirolivado, 34.9333°N, 32.9004°E, 16-18.IX.2011, S. Dimitriou leg., J. Devalez det. (1♀), pan trap (UAEG).

Distribution. Cyprus, Southern Europe (Croatia, Greece), Western Asia (Turkey), Central Asia (Tajikistan).

Notes. Described from Cyprus as *Dianthidium insulare* var. *lemesium* Mavromoustakis, 1937, from Limassol: 34.66839°N, 33.03252°E, 26.VI.1931, G.A. Mavromoustakis leg./det. ♀, (DAAN).

Genus *Stelis* PANZER, 1806

2 species.

***Stelis (Stelis) murina* Perez, 1884**

References. Warncke (1992); Kasperek (2015).

Distribution. Cyprus, Southern Europe and Northern Africa.

Notes. Recorded as a subspecies of *S. phaeoptera* (Kirby, 1802) by Warncke (1992). *Stelis phaeoptera* sensu stricto may occur on Cyprus as depicted on the map in Kasperek (2015), but the area of overlap, hosts, and identification criteria of these forms remain uncertain as noted in text of the revision and as confirmed by its author (M. Kasperek in litt.). Pending further verification, we treat *S. phaeoptera* sensu stricto as unverified in the supplementary text.

***Stelis (Protostelis) signata* (Latreille, 1809)**

References. Popov (1944); Mavromoustakis (1949 [“1948”], 1952).

Mavromoustakis localities. Limassol, Polemedia Hills, Cherkes, Alassa River, Livadin of Cedars (Paphos Forest), Near Akrotiri (village), Yermasoyia River.

Distribution. Cyprus, Widespread in Europe, Northern Africa (Morocco, Algeria, Tunisia), Central Asia (Kazakhstan), Southern Asia (Iran).

DIOXYINI

Genus *Aglaoapis* CAMERON, 1901

1 species.

***Aglaoapis tridentata* (Nylander, 1848)**

References. Mavromoustakis (1949 ["1948"]).

Mavromoustakis localities. Polemedia Hills (Limassol).

Distribution. Cyprus, Widespread in Europe, Western Asia, Central Asia (Kyrgyzstan), Eastern Asia (China).

Notes. Described from Cyprus as *Dioxoides tridentata limassolica* Mavromoustakis, 1949 ["1948"], from Polemedia Hills, 4 miles NW of Limassol: 34.7134°N, 32.9812°E, 20.V.1939, G.A. Mavromoustakis leg./det. ♀, (DAAN).

Genus *Dioxys* LEPELETIER & SERVILLE, 1825

2 species.

***Dioxys cinctus* (Jurine, 1807)**

References. Popov (1944); Mavromoustakis (1949 ["1948"]).

Mavromoustakis localities. Polemedia Hills, Ayia Phyla, Sphalangiotissa Monastery.

Distribution. Cyprus, Western Europe (France, Switzerland, Austria), Southern Europe, Eastern Europe, Northern Africa, Western Asia (Israel), Central Asia (Uzbekistan).

***Dioxys pumilus* Gerstäcker, 1869**

References. Popov (1944); Mavromoustakis (1949 ["1948"], 1957a).

Mavromoustakis localities. Limassol, Episkopi.

Distribution. Cyprus, Southern Europe (Spain, Italy, Greece), Northern Africa (Morocco, Algeria, Tunisia), Western Asia (Turkey, Israel, Syria), Southern Asia (Iran).

Notes. Described from Cyprus as *Dioxys cypriaca* Popov, 1944, from Limassol: 34.66839°N, 33.03252°E, V.1935; IV.1936, G.A. Mavromoustakis leg., V.V. Popov det. (ZISP).

MEGACHILINI

Genus *Coelioxys* LATREILLE, 1809

12 Species.

Coelioxys (Allocoelioxys) acanthopyga Alfken, 1940

References. Alfken (1940); Mavromoustakis (1952).

Distribution. Cyprus, Southern Europe (Greece), Western Asia (Israel).

Notes. Described from Cyprus as *Coelioxys carinulata* Alfken, 1940, from Cherkas: 34.65°N, 32.975°E, 29.VI.1939, G.A. Mavromoustakis leg., J.D. Alfken det. ♀, (MFNB).

Coelioxys (Allocoelioxys) acanthura (Illiger, 1806)

References. Mavromoustakis (1949 [“1948”], 1952).

Mavromoustakis localities. Limassol, Cherkas, Evdhimou River, Near Akrotiri.

Distribution. Cyprus, Western Europe (France), Southern Europe, Eastern Europe (Hungary, Ukraine), Northern Africa, Western Asia (Turkey).

Coelioxys (Allocoelioxys) afer Lepeletier, 1841

References. Mavromoustakis (1949 [“1948”], 1951, 1952, 1957a).

Material examined. Paphos District: 20 km N Paphos, Kathikas, 34.90°N, 32.42°E, 20.VI.2013, (2♀); Limassol District: Troodos, Mt. Olympos, 34.93°N, 32.86°E, 20.VI.2013, (2♀), all records C. Schmid-Egger leg., C. Schmid-Egger det.

Distribution. Cyprus, Widespread in Europe, Northern Africa (from Morocco to Tunisia), Western Asia (Turkey, Oman), Central Asia, Southern Asia (Iran).

***Coelioxys (Allocoelioxys) argenteus* Lepeletier, 1841**

References. Mavromoustakis (1949 [“1948”], 1951, 1952).

Mavromoustakis localities. Limassol, Yermasoyia River, Cherkes, Polemedia Hills, Asomatos, Episkopi, Chiflicoudia marshes, Fassouri, Ayia Irini (Kyrenia), Near Akrotiri, Moni, Paramali, Near Enkomi of Famagusta.

Distribution. Cyprus, Western Europe (France), Southern Europe, Eastern Europe (Romania), Northern Africa, Western Asia (Turkey), Central Asia (Turkmenistan), Southern Asia (Iran), Eastern Asia (China).

***Coelioxys (Allocoelioxys) brevis* Eversmann, 1852**

References. Mavromoustakis (1949 [“1948”]).

Mavromoustakis localities. Limassol, Cherkes, Near Enkomi of Famagusta.

Distribution. Cyprus, Western Europe (France, Germany, Austria), Southern Europe, Eastern Europe, Northern Africa, Western Asia (Turkey), Central Asia, Southern Asia (Iran), Eastern Asia (China).

***Coelioxys (Melissoctonia) conoideus* (Illiger, 1806)**

References. Mavromoustakis (1949 [“1948”], 1952, 1957a).

Mavromoustakis localities. Limassol, Cherkes, Potamitissa, Odou, Erimi, Trooditissa Monastery.

Distribution. Cyprus, Widespread in Europe, Northern Africa, Western Asia (Turkey), Southern Asia (Iran).

***Coelioxys (Liothyrapis) decipiens* Spinola, 1838**

Reported by Mavromoustakis under its junior synonym *Paracoelioxys decipiens*.

References. Mavromoustakis (1949 [“1948”]); Pittioni (1950); Mavromoustakis (1952, 1957).

Mavromoustakis localities. Limassol, Erimi, Cherkes, Famagusta.

Distribution. Cyprus, Southern Europe (Greece), Northern Africa, Western Asia (Turkey), Central Asia, Southern Asia (Iran, India), Eastern Asia (China).

***Coelioxys (Allocoelioxys) echinatus* Förster, 1853**

References. Scheuchl and Willner (2016).

Distribution. Cyprus, Western Europe, Southern Europe, Eastern Europe, Northern Africa (Morocco, Algeria, Egypt), Western Asia (Turkey, Israel, Iraq), Southern Asia (Iran, Afghanistan).

***Coelioxys (Allocoelioxys) elegantulus* Alfken, 1934**

References. Mavromoustakis (1949 [“1948”]); Pittioni (1950); Mavromoustakis (1952, 1957a).

Mavromoustakis localities. Limassol, Polemedia Hills, Cherkes, Chiflicoudia marshes, Yermasoyia River.

Distribution. Cyprus, Southern Europe (Greece), Northern Africa (Algeria, Egypt), Western Asia (Turkey, Israel, Palestine).

***Coelioxys (Allocoelioxys) haemorrhoea* Förster, 1853**

References. Alfken (1940); Mavromoustakis (1949 [“1948”]); Pittioni (1950); Mavromoustakis (1952).

Mavromoustakis localities. Limassol, Cherkes, Asomatos, Chiflicoudia marshes.

Distribution. Cyprus, Western Europe (Austria), Southern Europe (Spain, Greece), Eastern Europe (Romania), Northern Africa, Western Asia (Turkey, Israel), Central Asia, Southern Asia (Iran, Pakistan, India), Eastern Asia (China).

***Coelioxys (Paracoelioxys) inermis* Kirby 1802**

References. Scheuchl and Willner (2016).

Distribution. Cyprus, Widespread in Europe, Northern Africa (Morocco, Algeria), Western Asia (Turkey), Central Asia (Uzbekistan, Kyrgyzstan), Southern Asia (Iran), Eastern Asia (China).

***Coelioxys (Allocoelioxys) polycentris* Förster, 1853**

References. Pittioni (1950).

Distribution. Cyprus, Western Europe (France, Austria), Southern Europe, Eastern Europe, Southern Asia (Iran), Southern Asia (Iran, Pakistan), Eastern Asia (Mongolia).

Genus *Megachile* LATREILLE, 1802

17 species.

***Megachile (Creightonella) albisecta* (Klug, 1817)**

References. Cockerell (1931); Mavromoustakis (1939b, 1949 [“1948”]); Pittioni (1950); Mavromoustakis (1951, 1954, 1957a).

Mavromoustakis localities. Limassol, Polemedia Hills, Cherkes, Erimi, Evdhimou River, Pera Pedi, Pissouri, Ayia Irini (Kyrenia), Near Akrotiri village, Yermasoyia River, Moni River, Pernera coast of Paralimni, Younarka (near Zakaki), Near Ayios Theodoros (Pitsillia).

Material examined. Paphos District: 20 km N Paphos, Kathikas, 34.90°N, 32.42°E, 20.VI.2013, C. Schmid-Egger leg., C. Praz det. (1♀, 1♂).

Distribution. Cyprus, Western Europe (France, Switzerland), Southern Europe, Eastern Europe, Northern Africa, Western Asia, Central Asia, Eastern Asia (China).

Notes. The subspecies described from Cyprus is *Megachile albisecta cyprica* Cockerell, 1931, from Limassol: 34.66839°N, 33.03252°E, 15-17.VII.1928, G.A. Mavromoustakis leg., T.D.A. Cockerell det. ♀.

***Megachile (Eutricharaea) anatolica* Rebmann, 1968**

References. Soltani et al. (2017).

Distribution. Cyprus, Southern Europe (Italy, Greece), Western Asia, Southern Asia (Iran).

***Megachile (Eutricharaea) apicalis* Spinola, 1808**

References. Mavromoustakis (1939b, 1949 [“1948”]); Pittioni (1950); Mavromoustakis (1951, 1952, 1957a).

Mavromoustakis localities. Limassol, Polemedia Hills, Cherkes, Near Akrotiri, Paramali, Davlos coast, Tsada, Chiflicoudia marshes, Livadin of Cedars (Paphos Forest), Krios River (Kaledonia Falls), Glypha (near Akanthou), Younarka (near Zakaki), Near Mesayitonia, Ayios Memnon near Famagusta, Younaros of Zakaki, Akrotiri (village), Ayios Ilarion, Mt. Pentadactylos, Garillis River, Pachna.

Material examined. Paphos District: 15 km SE Paphos, Kouklia, 34.72°N, 32.55°E, 20.VI.2013, (1♀, 2♂); 20 km NNW Paphos, Lara Beach, 34.94°N, 32.31°E, 20.VI.2013, (1♀); 6 km W Polis, botanical garden, 35.03°N, 32.37°E, 20.VI.2013, (1♀); Limassol District: 8 km S Limassol, Akrotiri (near Airbase), 34.60°N, 32.97°E, 20.VI.2013, C. (1♀, 1♂), all records Schmid-Egger leg., C. Praz det.

Distribution. Cyprus, Widespread in Europe, Western Asia, Central Asia (Uzbekistan), Southern Asia (Iran, Pakistan), Eastern Asia (China).

***Megachile (Megachile) centuncularis* (Linnaeus, 1758)**

References. Mavromoustakis (1953, 1954, 1957a, b).

Mavromoustakis localities. Limassol, Cherkes, Famagusta, Platania Forest Station, Platres, Pera Pedi, Kilani, Odou, Yermasoyia River, Chiflicoudia marshes, Eagle’s Bath (Mt. Troodos).

Distribution. Cyprus, Widespread in Europe, Northern Africa, Western Asia, Central Asia (Kazakhstan), Southern Asia (Iran, India).

Notes. Described from Cyprus as *Megachile centuncularis nesiotica* Mavromoustakis, 1953, from Limassol: 34.66839°N, 33.03252°E, VIII.1936, G.A. Mavromoustakis leg., G.A. Mavromoustakis det. ♀, (DAAN).

***Megachile (Chalicodoma) cypricola* Mavromoustakis, 1938**

Type locality-country. Cyprus, Ayia Phyla: 34.7198°N, 33.0195°E, 23.III.1938, G.A. Mavromoustakis leg., G.A. Mavromoustakis det. ♀, (DAAN).

References. Mavromoustakis (1938, 1949 [“1948”], 1951, 1952, 1957a).

Mavromoustakis localities. Apsiou, Near Pano Kivides, Yerasa Hills, Choirokitia, Ayia Napa.

Material examined. Limassol District: Sovereign Base Area, Avdimou Bay Cliffs, 34.656698°N, 32.773339°E, 27.IV.2015, (1♀); Sovereign Base Area, Avdimou Bay Cliffs, 34.656698°N, 32.773339°E, 27.IV.2015, (1♀); 3.5 km SE of Moni, 34.706873°N, 33.211916°E, 14.III.2017, (2♂, 1♀), visiting *Onobrychis venosa* (Fabaceae); 3.5 km SE of Moni, 34.706873°N, 33.211916°E, 14.III.2017, (2♀, 1♂), visiting *Onobrychis venosa* (Fabaceae); 0.5 km W of Agios Georgios, 34.706786°N, 33.229364°E, 14.III.2017, (1♀); 0.5 km W of Agios Georgios, 34.706786°N, 33.229364°E, 14.III.2017, (2♀); Agios Georgios, 34.706786°N, 33.229364°E, 27.II.2018, (1♀, 3♂), visiting *Onobrychis venosa* (Fabaceae); Avdimou Bay Cliffs, 34.656698°N, 32.773339°E, 17.III.2018, (5♀), visiting *Onobrychis venosa* (Fabaceae); Paramali, 34.66198333°N, 32.80439444°E, 17.III.2018, (3♀), visiting *Onobrychis venosa* (Fabaceae); Larnaca District: 2.1 km S of Choirokoitia, 34.777521°N, 33.33622°E, 14.III.2017, (1♂); Choirokitia, 34.777521°N, 33.33622°E, 4.III.2018, (1♀), Sovereign Base Area, Avdimou Bay Cliffs records M. Jenner leg., C. Praz det. and S.P.M. Roberts leg., C. Praz det., 3.5 km SE of Moni (14.III.2017, 2♂, 1♀), 0.5 km W of Agios Georgios (14.III.2017, 1♀) and 2.1 km S of Choirokoitia records S.P.M. Roberts leg., S.P.M. Roberts det., 3.5 km SE of Moni (14.III.2017, 2♀, 1♂) and 0.5 km W of Agios Georgios (14.III.2017, 2♀) records A. Varnava leg., S.P.M. Roberts det., Agios Georgios, Avdimou Bay Cliffs, Paramali, and Choirokitia (4.III.2018) records A. Varnava leg., A. Varnava det.

Distribution. Cyprus. ENDEMIC.

***Megachile (Pseudomegachile) ericetorum* (Lepeletier, 1841)**

References. Georghiou (1977).

Material examined. Limassol District: Yermasoyia Dam, 34.745849°N, 33.083579°E, 28.X.2016, S.P.M. Roberts leg., G. Le Goff det. (1♀), visiting *Dittrichia viscosa* (Asteraceae).

Distribution. Cyprus, Western Europe, Southern Europe, Eastern Europe, Northern Europe (Finland), Northern Africa, Western Asia, Southern Asia (Iran), Eastern Asia (China).

***Megachile (Pseudomegachile) farinosa* Smith, 1853**

References. Dorchin and Praz (2018).

Material examined. Paphos District: 15 km SE Paphos, Koukليا, 34.72°N, 32.55°E, 20.VI.2013, (1♂); 8 km N Paphos, Mavrokolympo Reservoir, 34.85°N, 32.40°E, 20.VI.2013, (3♂), all records C. Schmid-Egger leg., C. Praz det.

Distribution. Cyprus, Southern Europe (Greece), Western Asia (Turkey, Syria, Iraq), Southern Asia (Iran).

***Megachile (Eutrichareae) inexpectata* Rebmann, 1968**

Material examined. Paphos District: 6 km NE Polis, beach 35.06°N, 32.46°E, 20.VI.2013, C. Schmid-Egger leg., C. Praz det. (2♂).

Distribution. Cyprus, Northern Africa (Morocco, Algeria, Tunisia), Western Asia.

***Megachile (Eutrichareae) leachella* Curtis, 1828**

References. Georghiou (1977).

Material examined. Paphos District: 15 km SE Paphos, Koukليا, 34.72°N, 32.55°E, 20.VI.2013, (4♀, 3♂); 20 km N Paphos, Kathikas, 34.90°N, 32.42°E, 20.VI.2013, (1♂); 20 km NNW Paphos, Lara Beach, 34.94°N, 32.31°E, (12♀, 7♂); 6 km W Polis, botanical

garden, 35.03°N, 32.37°E, 20.VI.2013, (1♀); 8 km N Paphos, Mavrokolympos Reservoir, 34.85°N, 32.40°E, 20.VI.2013, (2♀, 1♂); Polis, 35.053539°N, 32.351197°E, 30.X.2016, (1♂), visiting *Dittrichia viscosa* (Asteraceae); Limassol District: Troodos, Mt. Olympos, 34.93°N, 32.86°E, (1♂); Yermasoyia Dam, 34.745849°N, 33.083579°E, 28.X.2016, (1♂, 4♀), visiting *Dittrichia viscosa* (Asteraceae); Sovereign Base Area, Akrotiri, 34.600657°N, 32.971419°E, 29.X.2016, (1♀), visiting *Dittrichia viscosa* (Asteraceae); Sovereign Base Area, Paramali, 34.676011°N, 32.794947°E, 30.X.2016, (1♂), visiting *Dittrichia viscosa* (Asteraceae); Larnaca District: Zygi, 34.731233°N, 33.343487°E, 28.X.2016, (1♀), visiting *Dittrichia viscosa* (Asteraceae); Famagusta District: Achna Dam, 35.05519°N, 33.814011°E, 28.X.2016, (2♂, 1♀), visiting *Dittrichia viscosa* (Asteraceae), all 15 km SE Paphos Kouklia, 20 km N Paphos Kathikas, 20 km NNW Paphos Lara Beach, 6 km W Polis botanical garden, 8 km N Paphos Mavrokolympos Reservoir and Troodos Mt. Olympos records C. Schmid-Egger leg., C. Praz det., Polis, Yermasoyia Dam, Sovereign Base Area Akrotiri, Sovereign Base Area Paramali, Zygi, and Achna Dam records S.P.M. Roberts leg., S.P.M. Roberts and G. Le Goff det.

Distribution. Cyprus, Widespread in Europe, Central Asia.

***Megachile (Eutricharaea) marginata* Smith, 1853**

References. Mavromoustakis (1939b).

Material examined. Paphos District: 15 km SE Paphos, Kouklia, 34.72°N, 32.55°E, 20.VI.2013, C. Schmid-Egger leg., C. Praz det. (2♀, 2♂).

Distribution. Cyprus, Southern Europe, Northern Africa (Tunisia), Western Asia (Turkey, Iraq), Central Asia (Kyrgyzstan, Tajikistan), Southern Asia (Afghanistan, Pakistan).

***Megachile (Megachile) melanopyga* Costa, 1863**

References. Mavromoustakis (1957a); Georghiou (1977).

Mavromoustakis localities. Platania Forest Station, Odou, Yermasoyia River, Near Zakaki.

Distribution. Cyprus, Western Europe, Southern Europe (Spain, Italy, Slovenia), Eastern Europe, Western Asia, Eastern Asia (China).

Notes. Described from Cyprus as *Megachile melanopyga zakakica* Mavromoustakis, 1957, from Platania Forest Station, Mt. Troodos: 34.9473°N, 32.9284°E, 5.IX.1951, G.A. Mavromoustakis leg., G.A. Mavromoustakis det. ♀.

***Megachile (Eurymella) patellimana* Spinola, 1838**

References. Pittioni (1950); Mavromoustakis (1951, 1952).

Mavromoustakis localities. Famagusta, Near Akrotiri, Moni River, Akrotiri (village), Ayios Memnon.

Material examined. Paphos District: 20 km NNW Paphos, Lara Beach, 34.94°N, 32.31°E, 20.VI.2013, (10♀, 7♂); 6 km W Polis, botanical garden, 35.03°N, 32.37°E, 20.VI.2013, (1♂); 8 km N Paphos, Mavrokolympos Reservoir, 34.85°N, 32.40°E, 20.VI.2013, (1♂), all records C. Schmid-Egger leg., C. Praz det.

Distribution. Cyprus, Western Africa (Niger, Nigeria), Southern Africa (Namibia, Botswana), Northern Africa (Egypt, Sudan), Eastern Africa (Mozambique), Western Asia (Israel, Saudi Arabia, United Arab Emirates), Southern Asia (Pakistan).

***Megachile (Eutricharea) pilidens* Alfken, 1890**

References. Cockerell (1931).

Material examined. Limassol District: Amiantos, 34.918°N, 32.9472°E, 15-17.IX.2011, S. Dimitriou leg., J. Devalez det. (1♀), pan trap (UAEG).

Distribution. Cyprus, Northern Africa (Morocco), Western Europe, Southern Europe, Eastern Europe, Central Asia.

***Megachile (Eutricharea) posti* Mavromoustakis, 1952**

Type locality-country. Cyprus, Polemedia Hills: 34.699444°N, 32.996944°E, 5.VII.1949, G.A. Mavromoustakis leg., G.A. Mavromoustakis det. ♀, (DAAN).

References. Mavromoustakis (1952).

Mavromoustakis localities. Polemedia Hills.

Distribution. Cyprus. ENDEMIC.

Notes. The status of this species has long been in question but Praz (2017) is of the opinion that *M. posti* is a good species and distinct from *M. basilaris* Morawitz, 1875, with which it has been synonymised in the past.

***Megachile (Chalicodoma) roeweri* (Alfken, 1928)**

References. Mavromoustakis (1939b, 1949 [“1948”], 1952, 1954).

Mavromoustakis localities. Limassol, Pera Pedi, Akrotiri (village).

Distribution. Cyprus, Southern Europe (Greece), Western Asia (Turkey).

Notes. The subspecies described from Cyprus is *Megachile roeweri akrotirica* Mavromoustakis, 1939, from Akrotiri Forest: 34.5843°N, 32.9676°E, 23.V.1938, G.A. Mavromoustakis leg., G.A. Mavromoustakis det. ♀, (DAAN).

***Megachile (Eutricharaea) rotundata* (Fabricius, 1787)**

References. Mavromoustakis (1939b, 1952).

Mavromoustakis localities. Chiflicoudia marshes, Erimi, Salipes marshes near Akrotiri.

Distribution. Cyprus, Widespread in Europe, Northern Africa, Western Asia (Turkey, Georgia, Azerbaijan), Central Asia, Southern Asia (Iran, Pakistan, India), Eastern Asia (China, Mongolia), Australia, New Zealand.

***Megachile (Paracella) troodica* Mavromoustakis, 1953**

References. Mavromoustakis (1953); Zanden (1992).

Mavromoustakis localities. Mt. Troodos, Chionistra, Xerokolimbi.

Distribution. Cyprus. ENDEMIC.

Notes. Described from Cyprus as *Megachile (Eutricharaea) mavromoustakisi* van der Zanden, 1992, from Mt. Troodos, 1676m (open slopes in the forest of *Pinus nigra pallasiana* Lamb.): 34.9234°N, 32.8833°E, 7.VII.1936, G.A. Mavromoustakis leg., G.A. Mavromoustakis det. ♀ (DAAN).

APIDAE

ANTHOPHORINI

Genus *Amegilla* FRIESE, 1897

4 Species.

***Amegilla (Zebramegilla) albigena* (Lepeletier, 1841)**

References. Mavromoustakis (1949 [“1948”], 1951).

Mavromoustakis localities. Limassol, Polemedia Hills, Ayios Athanasios, Tsada, Mt. Troodos, Chionistra, Kato Platres, Ayios Ioannis Agrou, Famagusta, Stroumbi, Kathikas.

Material examined. Nicosia District: Kakopetria, 34.992°N, 32.9082°E, 15-17.IX.2011, (1♂), pan trap (UAEG); Limassol District: Almirolivado, 34.9333°N, 32.9004°E, 16-18.IX.2011, (4♀, 3♂), pan trap (UAEG), all records S. Dimitriou leg., J. Devalez det.

Distribution. Cyprus, Western Europe (France, Switzerland, Austria), Southern Europe, Eastern Europe, Northern Africa, Western Asia, Central Asia, Southern Asia (Iran, Pakistan), Eastern Asia (China).

***Amegilla (Micramegilla) glauca* (Alfken, 1926)**

References. Mavromoustakis (1949 [“1948”]); Pittioni (1950); Mavromoustakis (1951, 1952, 1957a).

Mavromoustakis localities. Chiflicoudia marshes, Akrotiri Bay and Forest, Cherkes, Famagusta, Paramali.

Distribution. Cyprus, Northern Africa (Egypt).

***Amegilla (Amegilla) quadrifasciata* (de Villers, 1789)**

References. Mavromoustakis (1949 [“1948”], 1951, 1952, 1957a); Georghiou (1977).

Mavromoustakis localities. Limassol, Pissouri, Akrotiri Bay, Fasouri, Polemedia, Cherkes, Asomatos, Chiflicoudia marshes, Moni, Eftagonia, Evdhimou River, Platania Forest Station, Famagusta, Mt. Troodos, Chionistra, Kannoures springs, Kathikas, Livadin of Cedars (Paphos Forest), Akanthou, Ayia Irini (Kyrenia district).

Material examined. Limassol District: Almirolivado, 34.9333°N, 32.9004°E, 16-18.IX.2011, S. Dimitriou leg., J. Devalez det. (1♀), pan trap (UAEG).

Distribution. Cyprus, Widespread in Europe, Northern Africa, Western Asia, Central Asia, South-Eastern Asia (Myanmar), Eastern Asia.

***Amegilla (Zebramegilla) salviae* (Morawitz, 1876)**

References. Scheuchl and Willner (2016).

Mavromoustakis localities. Limassol.

Distribution. Cyprus, Western Europe (Switzerland, Austria), Southern Europe, Eastern Europe, Northern Africa, Western Asia (Turkey, Azerbaijan), Central Asia, Southern Asia (Iran), Eastern Asia (China).

Genus *Anthophora* LATREILLE, 1803

8 species.

***Anthophora (Anthophora) canescens* Brullé, 1832**

References. Lepeletier (1841); Dours (1869); Costa (1883); Mavromoustakis (1949 [“1948”], 1951, 1952, 1953, 1954, 1957a); Georghiou (1977).

Mavromoustakis localities. Limassol, Polemedia, Hills, Episkopi, Ayios Athanasios, Apsiou, Pera Pedi, Akrotiri Bay, Fassouri, Yermasoyia River, Pissouri, Fasoulla, Yerasa, Pyrgos, Near Paramytha, Moni, Kellaki, Zakaki, Saettas, Morphou, Amathus, Kyrenia, Famagusta, Nicosia.

Material examined. Nicosia District: 35.1688°N, 33.367°E, 13.III.2006, A. Grace leg., J. Devalez det. (2♂), hand net (UAEG); Paphos District: 34.7626°N, 32.4108°E, 25.II.2000, 8.III.2000, H. Wolf leg., J. Devalez det. (2♀), hand net (UAEG).

Distribution. Cyprus, Southern Europe, Western Europe (France, Switzerland), Northern Africa, Western Asia.

Notes. This is the taxon sometimes referred to as *Anthophora subterranea* Germar, 1826.

***Anthophora (Pyganthophora) dalmatica* Pérez, 1902**

Material examined. Limassol District: Almirolivado, 34.9333°N, 32.9004°E, 14.V.2012, 16.V.2012, S. Dimitriou leg., J. Devalez det. (1♀), pan trap, (UAEG); Nicosia District: 35.1688°N, 33.367°E, 13.III.2006, A. Grace leg., A. Grace det. (2♀), insect net, (UAEG).

Distribution. Cyprus, Southern Europe.

Notes. The true status of this taxon is not certain and Rasmont (in litt.) suggests that it could be a ssp. of *A. atroalba* Lepeletier, 1841. Whatever the status, the taxon is newly recognised in Cyprus.

***Anthophora (Paramegilla) harmalae* Morawitz, 1877**

References. Mavromoustakis (1949 [“1948”], 1951).

Mavromoustakis localities. Limassol, Tsada, Krios River near Kilani, Mt. Troodos Kannoures springs.

Distribution. Cyprus, Eastern Europe (Russian Federation), Northern Africa, Western Asia, Central Asia, Southern Asia (Iran).

***Anthophora (Anthophora) plumipes* (Pallas, 1772)**

References. Mavromoustakis (1949 [“1948”], 1957); Georghiou (1977).

Mavromoustakis localities. Limassol, Yermasoyia River, Cherkes, Fassouri, Trimiklini, Episkopi, Kilani, Amathus, Fasoulla, Yerasa, Fassouri, Pera Pedi, Potamitissa, Pyrgos,

Near Paramytha, Saettas, Kellaki, Ayios Kostantinos Pitsilia, Kyrenia, Ayios Ilarion, Nicosia.

Material examined. Nicosia District: Kakopetria, 34.992°N, 32.9082°E, 5-7.IV.2012, (1♀), pan trap (UAEG); Makria Kontarka, 34.9095°N, 32.8971°E, 14-16.V.2012, (1♀), pan trap (UAEG), all records S. Dimitriou leg., J. Devalez det.

Distribution. Cyprus, Widespread in Europe, Northern Africa, Western Asia, Central Asia (Kazakhstan), Southern Asia (Iran, Afghanistan).

Notes. Described from Cyprus as *Anthophora acervorum cypriaca* Mavromoustakis, 1957, from Amathus ruins: 34.7125°N, 33.1419°E, 27.II.1935, G.A. Mavromoustakis leg./det. ♂.

***Anthophora (Lophanthophora) robusta* (Klug, 1845)**

References. Mavromoustakis (1949 [“1948”]); Pittioni (1950); Mavromoustakis (1951, 1957a).

Mavromoustakis localities. Limassol, Polemedia Hills, Episkopi, Ayios Athanasios, Pera Pedi, Kato Platres, Mt. Troodos Chionistra, Curium (near Episkopi), Trimiklini, Ayios Athanasios, Mt. Troodos Pasha Livadin.

Distribution. Cyprus, Western Europe (France), Southern Europe, Eastern Europe (Bulgaria, Romania, Ukraine), Northern Africa (Morocco, Algeria), Western Asia, Central Asia (Turkmenistan, Kazakhstan).

***Anthophora (Pyganthophora) rogenhoferi* Morawitz, 1871**

References. Mavromoustakis (1949 [“1948”], 1951, 1952, 1953, 1954, 1957a); Georghiou (1977).

Mavromoustakis localities. Limassol, Mesayitonia, Akrotiri Forest, Episkopi, Apsiou, Kantara Mountains, Kaloiri Hills, Kellaki, Pera Pedi, Fassouri, Amathus, Fasoulla, Yerasa, Pyrgos, Larnaca, Nicosia, Karpasian Peninsula, Eleousa Monastery, Morphou, Ayios Ilarion, Randidi Forest, Rizokarpaso.

Distribution. Cyprus, Southern Europe (Italy, Greece), Western Asia, Central Asia, Southern Asia (Iran).

***Anthophora (Pyganthophora) rubricrus* Dours, 1870**

References. Mavromoustakis (1949 [“1948”], 1951, 1952, 1953, 1954, 1957a).

Mavromoustakis localities. Limassol, Polemedia Hills, Mesayitonia, Akrotiri Forest/Bay, Apsiou, Pera Pedi, Fassouri, Yermasoyia River, Amathus, Fasoulla, Yerasa, Pyrgos, Near Paramytha, Akrounda, Kellaki, Lania, Pareklisia, Trimiklini, Morphou, Amathus, Kyrenia, Famagusta.

Material examined. Nicosia District: 35.1688°N, 33.367°E, 13.III.2006, A. Grace leg., J. Devalez det. (5♂, 8♀), insect net (UAEG); Paphos District: 34.7626°N, 32.4108°E, 25.II.2000, 8.III.2000, H. Wolf leg., J. Devalez det. (4♀), insect net (UAEG).

Distribution. Cyprus, Southern Europe (Greece), Western Asia (Israel).

***Anthophora (Lophanthophora) rutilans* Dours, 1870**

Type locality-country. Cyprus, Nicosia: 35.166667°N, 33.366667°E, Sichel leg., Dours collection, J.A. Dours det. ♂ (MNHN).

References. Dours (1870); Mavromoustakis (1949 [“1948”], 1951, 1952, 1953, 1954, 1957a).

Mavromoustakis localities. Limassol, Polemedia, Kitromili near Polemedia, near Ayios Athanasios, Cherkes, Akrotiri Forest, Mesayitonia, Episkopi, Fassouri, Yermasoyia River, Pera Pedi, Amathus, Potamitissa, Fasoulla, Yerasa, Kellaki, Moni, Near Paramytha, Amyrou Monastery (near Apsiou), Ayios Ilarion, Near Famagusta, Morphou, Mesayitonia-Fasoula.

Material examined. Paphos District: 34.7626°N, 32.4108°E, 25.II.2000, 8.III.2000, H. Wolf leg., J. Devalez det. (1♂), insect net (UAEG).

Distribution. Cyprus, Southern Europe (Greece), Eastern Europe (Russian Federation), Western Asia.

AMMOBATINI

Genus *Ammobates* LATREILLE, 1809

3 species.

***Ammobatoides abdominalis* (Eversmann, 1852)**

References. Scheuchl and Willner (2016).

Distribution. Cyprus, Western Europe (Austria), Southern Europe, Eastern Europe, Western Asia (Turkey, Lebanon), Central Asia (Kazakhstan), Southern Asia (Iran), Eastern Asia (China).

***Ammobates (Ammobates) biastoides* Friese, 1895**

References. Mavromoustakis (1954).

Mavromoustakis localities. Cherkes.

Distribution. Cyprus, Northern Africa (Algeria), Western Asia (Turkey, Israel).

Notes. The subspecies described from Cyprus is *Ammobates biastoides globosus* Mavromoustakis, 1954, from Cherkes: 34.65°N, 32.975°E, 16.VI.1939, G.A. Mavromoustakis leg., G.A. Mavromoustakis det. ♀ (DAAN).

***Ammobates (Ammobates) mavromoustakisi* Popov, 1944**

References. Popov (1944); Mavromoustakis (1949 [“1948”], 1951, 1954).

Mavromoustakis localities. Limassol, Cherkes, Zakaki, Ayios Athanasios, Farangas near Famagusta, Paramali, Yermasoyia.

Distribution. Cyprus, Western Asia (Turkey, Palestine, Israel), Central Asia (Uzbekistan, Tajikistan), Southern Asia (Iran).

Notes. The subspecies described from Cyprus is *Ammobates mavromoustakisi mavromoustakisi*, from Limassol, Ayios Athanasios, Cherkes: 34.72075°N, 33.05327°E, 34.65635°N, 32.98748°E, G.A. Mavromoustakis leg., V.V. Popov. det. (ZISP).

Genus *Chiasmognathus* ENGEL, 2006

1 species.

***Chiasmognathus orientanus* (Warncke, 1983)**

References. Warncke (1983).

Distribution. Cyprus, Southern Europe (Greece), Eastern Europe (Bulgaria, Romania), Western Asia (Turkey, Palestine, Israel).

Notes. Described from Cyprus as *Pasites (Parammobatodes) orientanus cyprius* Warncke, 1983, from Yermasoyia River: 34.7182°N, 33.08788°E, 27.VII.1967, G.A. Mavromoustakis leg., K. Warncke det. ♀, (KW).

All records of *Ch. orientanus* from Cyprus have been assigned to *ssp. cyprius*.

Genus *Parammobatodes* POPOV, 1931

1 species.

***Parammobatodes minutus* (Mocsáry, 1878)**

References. Scheuchl and Willner (2016).

Distribution. Cyprus, Western Europe (Austria), Southern Europe (Greece), Eastern Europe, Western Asia.

Genus *Pasites* JURINE, 1807

1 species.

***Pasites maculatus* Jurine, 1807**

References. Cockerell (1910); Popov (1944); Mavromoustakis (1949 [“1948”], 1951, 1952, 1957a).

Mavromoustakis localities. Limassol, Polemedia Hills, Cherkes, Moni River, Farangas near Famagusta, Ayia Napa.

Distribution. Cyprus, Western Europe (France, Switzerland, Austria), Southern Europe, Eastern Europe, Northern Africa, Western Asia, Central Asia, Southern Asia (Iran, Afghanistan, Pakistan), Eastern Asia (China, Mongolia).

ANCYLAINI

Genus *Ancyla* LEPELETIER, 1841

1 species.

***Ancyla holtzi* Friese, 1902**

References. Mavromoustakis (1949 [“1948”]).

Mavromoustakis localities. Limassol, Cherkes, Zakaki, Asomatos, Near Enkomi of Famagusta.

Distribution. Cyprus, Southern Europe (Greece), Eastern Europe (Bulgaria), Western Asia (Turkey, Iraq), Southern Asia (Iran).

Genus *Tarsalia* MORAWITZ, 1895

2 species.

***Tarsalia ancyliformis* Popov, 1935**

References. Pittioni (1950); Mavromoustakis (1952, 1953).

Mavromoustakis localities. Limassol, Cherkes, Yermasoyia River, Moni, Salipes marshes near Akrotiri, Yermasoyia Hills, Near Asomatos, Near Trachoni.

Distribution. Cyprus, Southern Europe (Italy), Western Asia (Turkey), Central Asia (Turkmenistan, Uzbekistan, Tajikistan), Southern Asia (Iran).

Notes. Described from Cyprus as *Tarsalia ancyliformis mediterranea* Pittioni, 1950, from Geroskipou: 34.7559°N, 32.4516°E, 20.VII.1939, H. Lindberg leg., B. Pittioni det.

Includes *T. mediterranea* which is now regarded as a ssp. of *Tarsalia ancyliformis* (MZHF).

***Tarsalia hirtipes* Morawitz, 1894**

References. Mavromoustakis (1952, 1953, 1957a).

Mavromoustakis localities. Limassol, Cherkos.

Distribution. Cyprus, Western Asia (Turkey), Central Asia (Turkmenistan, Uzbekistan), Southern Asia (Iran).

Notes. Described from Cyprus as *Tarsalia hirtipes cypriaca* Mavromoustakis, 1952, from Cherkos: 34.65°N, 32.975°E, 3.VIII.1933, G.A. Mavromoustakis leg./det. ♀, (DAAN).

Includes *T. cypriaca* which is now regarded as a ssp. of *Tarsalia hirtipes*.

APINI

Genus *Apis* LINNAEUS, 1758

1 species.

***Apis (Apis) mellifera* Linnaeus, 1758**

References. Pittioni (1950); Georghiou (1977).

Distribution. Cyprus, Widespread in Europe, Africa, Western Asia, Central Asia, Southern Asia, Australia, New Zealand.

Notes. The subspecies described as *Apis mellifera cypria* Pollmann, 1879, from unknown location, det. A. Pollmann.

Beekeeping is widely practised throughout the island.

BOMBINI

Genus *Bombus* LATREILLE, 1802

2 species.

***Bombus (Sibircobombus) niveatus* Kriechbaumer, 1870**

References. Rasmont and Iserbyt (2014); Rasmont et al. (2015).

Distribution. Cyprus, Southern Europe (Greece, Albania), Eastern Europe (Bulgaria, Ukraine), Western Asia (Lebanon, Syria), Southern Asia (Iran), Eastern Asia (China).

Notes. Lack of recent records for Cyprus indicates the need for a conservation assessment of its status on the island.

***Bombus (Bombus) terrestris* (Linnaeus, 1758)**

References. Mavromoustakis (1949 [“1948”]); Pittioni (1950); Georghiou (1977).

Material examined. Nicosia District: Linou, 35.0755°N, 32.9164°E, 14-16.V.2012, (1♀), pan trap (UAEG); Kakopetria, 34.992°N, 32.9082°E, 15-17.IX.2011, (2♀), pan trap (UAEG); Kakopetria, 34.992°N, 32.9082°E, 5-7.IV.2012, (2♀), pan trap (UAEG); Kakopetria, 34.992°N, 32.9082°E, 14-16.V.2012, (2♀), pan trap (UAEG); Limassol District: Amiantos, 34.918°N, 32.9472°E, 14-16.V.2012, (1♀), pan trap (UAEG); Amiantos, 34.918°N, 32.9472°E, 31.V.2012, 2.VI.2012, (1♂, 3♀), pan trap (UAEG); Almirolivado, 34.9333°N, 32.9004°E, 16-18.IX.2011, (2♀), pan trap (UAEG); Almirolivado, 34.9333°N, 32.9004°E, 14-16.V.2012, (29♀), pan trap (UAEG); Almirolivado, 34.9333°N, 32.9004°E, 31.V.2012, 2.VI.2012, (6♀), pan trap (UAEG); Makria Kontarka, 34.9095°N, 32.8971°E, 16-18.IX.2011, (3♀), pan trap (UAEG); Makria Kontarka, 34.9095°N, 32.8971°E, 14-16.V.2012, (15♀) (UAEG); Makria Kontarka, 34.9095°N, 32.8971°E, 31.V.2012, 2.VI.2012, (2♂, 1♀), pan trap (UAEG); Troodos, Chionistra, 34.9317°N, 32.8664°E, 14-16.V.2012, (3♂, 18♀), pan trap (UAEG); Troodos, Chionistra, 34.9317°N, 32.8664°E, 16-18.IX.2011, (1♂), pan trap (UAEG); Troodos, Chionistra, 34.9317°N, 32.8664°E, 31.V.2012, 2.VI.2012, (12♀), pan trap (UAEG); Troodos, Mt. Olympos, 34.93°N, 32.86°E, 20.VI.2013, (6♀); Sovereign Base Area, Avdimou Bay Cliffs, 34.656698°N, 32.773339°E, 27.IV.2015; Sovereign Base Area, Episkopi, Kensington Cliffs, 34.670772°N, 32.846923°E, 4.V.2015, all Linou, Kakopetria, Amiantos, Almirolivado, Makria Kontarka and Troodos Chionistra records S. Dimitriou leg., J. Devalez det., Troodos Mt. Olympos records C. Schmid-Egger leg., C. Schmid-Egger det., Sovereign Base Area, Avdimou Bay Cliffs and Sovereign Base Area, Episkopi, Kensington Cliffs records S.P.M. Roberts leg., S.P.M. Roberts det.

Distribution. Cyprus, Widespread in Europe, Northern Africa, Central Asia (Kazakhstan, Kyrgyzstan, Uzbekistan), Southern Asia (Iran, Afghanistan), Eastern China (China, Mongolia), Australia, New Zealand.

CERATININI

Genus *Ceratina* LATREILLE, 1802

8 species.

Ceratina (Neoceratina) bispinosa Handlirsch, 1889

References. Mavromoustakis (1949 [“1948”]); Pittioni (1950); Mavromoustakis (1952, 1957a).

Mavromoustakis localities. Limassol, Cherkes, Eftagonia, Zakaki, Ayios Athanasios.

Distribution. Cyprus, Southern Europe (Croatia, Greece), Eastern Europe (Romania), Western Asia.

Ceratina (Euceratina) chrysomalla Gerstäcker, 1869

References. Mavromoustakis (1949 [“1948”]); Mavromoustakis (1951, 1952, 1954, 1957a,b).

Mavromoustakis localities. Limassol, Cherkes, Apsiou, Pera Pedi, Moni, Yermasoyia River/Hills (Kaloiri), Yerasa, Lania, Ayia Varvara (Stavrovouni), Platres, Pyrga.

Distribution. Cyprus, Southern Europe (Greece), Eastern Europe (Romania, Ukraine, Bulgaria), Western Asia, Southern Asia (Iran).

Ceratina (Euceratina) cypriaca Mavromoustakis, 1949

Type locality-country. Cyprus, Pera Pedi: 609 m, 34.8580°N, 32.8730°E, 27.V.1929, G.A. Mavromoustakis leg., G.A. Mavromoustakis det. ♀, (DAAN).

References. Mavromoustakis (1949 [“1948”]); Pittioni (1950); Mavromoustakis (1951, 1952, 1953, 1957a).

Distribution. Cyprus. ENDEMIC.

***Ceratina (Euceratina) dallatorreana* Friese, 1896**

References. Mavromoustakis (1949 ["1948"]).

Mavromoustakis localities. Polemedia Hills, Apsiou, Livadin of Cedars (Paphos Forest), Mt. Troodos, Trimiklini, Eftagonia, Pera Pedi, Kykkou Monastery, Stavrovouni, Mesapotamos, Xerokolimbi (near Trooditissa), Potamitissa.

Distribution. Cyprus, Western Europe (France), Southern Europe, Eastern Europe, Northern Africa (Morocco, Algeria, Tunisia), Western Asia, Central Asia (Turkmenistan, Kyrgyzstan, Uzbekistan), Southern Asia (Iran).

***Ceratina (Euceratina) mandibularis* Friese, 1896**

References. Mavromoustakis (1949 ["1948"]); Pittioni (1950); Mavromoustakis (1951, 1952, 1953, 1954, 1958 ["1957"]).

Mavromoustakis localities. Cherkes, Chiflicoudia marshes, Yermasoyia River, Yerasa, Trimiklini, Erimi, Kathikas.

Material examined. Paphos District: 2.7 km SW of Acheleia, Potamos tis Ezouzas, 34.729004°N, 32.457544°E, 30.IV.2015, S.P.M. Roberts leg./det. (3♂).

Distribution. Cyprus, Northern Africa (Egypt), Western Asia (Turkey).

***Ceratina (Euceratina) moricei* Friese, 1899**

References. Mavromoustakis (1949 ["1948"], 1952, 1957a).

Mavromoustakis localities. Limassol, Cherkes, Asomatos, Yermasoyia River, Pyrgos, Trimiklini, Yermasoyia Hills.

Distribution. Cyprus, Western Asia (Turkey), Southern Asia (Iran).

***Ceratina (Dalyatina) parvula* Smith, 1854**

References. Mavromoustakis (1949 [“1948”]); Pittioni (1950); Mavromoustakis (1951).

Mavromoustakis localities. Limassol, Yermasoyia River.

Distribution. Cyprus, Western Europe (France), Southern Europe, Eastern Europe (Bulgaria), Northern Africa, Western Asia, Central Asia (Turkmenistan).

***Ceratina (Neoceratina) schwarzi* Kocourek, 1998**

References. Terzo (1998).

Distribution. Cyprus, Southern Europe, Eastern Europe (Romania, Bulgaria), Western Asia, Southern Asia (Iran).

EPEOLINI

Genus *Epeolus* LATREILLE, 1802

2 species.

***Epeolus bischoffi* (Mavromoustakis, 1954)**

References. Bogusch and Hadrava (2018).

Mavromoustakis specimens in the Snow Entomological Museum Collection, Kansas, USA: Akrotiri Bay, 34.62°N, 33.00°E, 12.VII.1943; Zakaki, 23.VI.1949; Salamis, 18.VI.1957; Akrotiri Bay, 34.62°N, 33.00°E, 20.VII.1933; Akrotiri Bay, 34.62°N, 33.00°E, 1.VIII.1933; Akrotiri Bay, 34.62°N, 33.00°E, 12.VII.1943, all records G.A. Mavromoustakis leg./det.

Distribution. Cyprus, Western Asia.

***Epeolus transitorius* Eversmann, 1852**

References. Bogusch and Hadrava (2018).

Distribution. Cyprus, Western Europe (France), Southern Europe, Eastern Europe (Russian Federation), Northern Africa (Morocco), Western Asia, Central Asia (Turkmenistan, Kazakhstan, Uzbekistan), Southern Asia (Iran).

EUCERINI

Genus *Eucera* SCOPOLI, 1770

21 species.

***Eucera (Hetereucera) aequata* Vachal, 1907**

Material examined. Limassol District: Akrotiri, 34.600657°N, 32.971419°E, 8.V.2016, (1♀); Akrotiri, 34.600657°N, 32.971419°E, 7.IV.2017, (2♂); Akrotiri, 34.600657°N, 32.971419°E, 21.IV.2017, (1♀, 2♂); Akrotiri, 34.600657°N, 32.971419°E, 5.V.2017, (1♀); Akrotiri, 34.600657°N, 32.971419°E, 30.III.2018, (2♂); Akrotiri, 34.600657°N, 32.971419°E, 28.IV.2019 (1♀), all records A. Varnava leg., A. Dorchin det.

Distribution. Cyprus, Western Asia (Turkey, Israel, Syria).

***Eucera (Tetralonia) alticincta* (Lepeletier, 1841)**

References. Mavromoustakis (1949 [“1948”]).

Mavromoustakis localities. Odou, Krios River near Kilani.

Distribution. Cyprus, Widespread in Europe except in the North, Northern Africa, Western Asia (Turkey).

***Eucera (Hetereucera) bidentata* Pérez, 1887**

References. Mavromoustakis (1949 [“1948”], 1951, 1952, 1957a); Georghiou (1977).

Mavromoustakis localities. Limassol, Mesayitonia, Fassouri, Yermasoyia River, Nicosia, Famagusta, Amathus, Fasoulla, Morphou, Rizokarpaso, Ayia Irini station (near Limassol).

Material examined. Kyrenia District: 15 km E Kyrenia, 'Turtle Beach', 35.334413°N, 33.494187°E, 10.IV.2013, (1♀); Famagusta District: Protaras, Cape Greco, 34.963264°N, 34.066211°E, 15.III.2017, (1♀); Achna Dam, 35.05519°N, 33.814011°E, 19.II.2018, (1♂); Limassol District: Cherkes, 34.653067°N, 32.974233°E, 10.III.2017, (1♂); Cherkes, 34.641933°N, 32.963433°E, 25.III.2017, (1♂); Cherkes, 34.653067°N, 32.974233°E, 25.III.2017, (1♂); Cherkes, 34.653067°N, 32.974233°E, 14.II.2018, (2♂); Cherkes, 34.653067°N, 32.974233°E, 1.III.2018, (2♂); Cherkes, 34.650960°N, 32.990910°E, 1.III.2018, (1♂); Cherkes, 34.641933°N, 32.963433°E, 1.III.2018, (1♂); Cherkes, 34.650960°N, 32.990910°E, 30.III.2018, (1♀); Akrotiri, 34.601506°N, 32.986197°E, 25.III.2017, (1♂); Akrotiri, 34.628817°N, 32.940667°E, 25.III.2017, (1♂); Akrotiri, 34.601506°N, 32.986197°E, 1.III.2018, (1♂), all Kyrenia district records C. Schmid-Egger leg., S. Risch det., all Famagusta and Limassol district records A. Varnava leg., A. Dorchin det.

Distribution. Cyprus, Southern Europe (Italy, Greece), Western Asia (Turkey, Israel, Syria).

Eucera (Hetereucera) caeruleascens Friese, 1899

References. Mavromoustakis (1949 [“1948”], 1951, 1952, 1957a).

Mavromoustakis localities. Limassol, Polemedia Hills, Mesayitonia, Cherkes, Apsiou, Cape Apostolos Andreas, Yermasoyia River, Yerasa, Pyrgos, Akrounda, Pareklisia, Randidi Forest.

Material examined. Kyrenia District: 5 km E of Kyrenia, "Turtle Beach", 35.334413°N, 33.494187°E, 10.IV.2007; Famagusta District: 15 km E of Rizokarpaso, "Golden Sands", 35.64°N, 34.55°E, 10.IV.2007, 1 (♀) (AMNH), all records C. Schmid-Egger leg., S. Risch det.

Distribution. Cyprus, Western Asia (Turkey, Israel), Southern Asia (Iran).

Eucera (Eucera) cypria Alfken, 1933

Type locality-country. Cyprus, Limassol: 34.66839°N, 33.03252°E, 13-27.II.1927, G.A. Mavromoustakis leg., J.D. Alfken det.

References. Alfken (1933); Mavromoustakis (1949 [“1948”], 1951, 1953, 1954, 1957a); Tkalčú (1984).

Mavromoustakis localities. Limassol, Polemedia Hills, Mesayitonia, Pera Pedi, Fassouri, Yermasoyia River, Famagusta, Amathus, Yerasa, Larnaca, Near Paramytha, Mesayitonia-Fasoulla, Moni, Lania, Trimiklini.

Material examined. Limassol District: Anogyra, 34.724979°N, 32.737225°E, 23.II.2016, (1♂); Cherkes, 34.650960°N, 32.990910°E, 1.III.2018, (1♂), all records A. Varnava leg., A. Dorchin det.

Distribution. Cyprus, Southern Europe (Greece), Western Asia (Israel), Southern Asia (Iran).

***Eucera (Eucera) dalmatica* Lepeletier, 1841**

References. Mavromoustakis (1949 [“1948”], 1952, 1957a); Georghiou (1977).

Mavromoustakis localities. Limassol, Akrotiri Forest, Near Enkomi of Famagusta, Younarka, Pyrga, Xylophagou, Ormideia, Near Deryneia, Ayios Memnon (Famagusta).

Material examined. Limassol District: Akrotiri, 34.628817°N, 32.940667°E, 24.V.2017, A. Varnava leg., A. Dorchin det. (1♂).

Distribution. Cyprus, Western Europe (France), Southern Europe, Eastern Europe, Northern Africa (Morocco), Western Asia, Southern Asia (Iran).

***Eucera (Eucera) dimidiata* Brullé, 1832**

References. Mavromoustakis (1949 [“1948”], 1951, 1952, 1953, 1954, 1957a); Georghiou (1977).

Mavromoustakis localities. Limassol, Polemedia Hills, Episkopi, Fassouri, Yermasoyia River, Mesayitonia, Fasoulla, Pera Pedi, Amathus, Trimiklini, Kyrenia, Morphou, Famagusta, Sandy shore of Salamis (near Famagusta), Larnaca.

Material examined. Nicosia District: City Center, 35.1688°N, 33.367°E, 13.III.2006, (5♂, 16♀), insect net (UAEG); Limassol District: Anogyra, 34.724979°N, 32.737225°E, 23.II.2016, (1♀, 3♂); Ayios Dimitrianos, 8.III.2016, (1♂); Aswmatos, 8.III.2016, (1♂); Pissouri, 34.65093056°N, 32.72539722°E, 5.II.2017, (1♂); Cherkes, 34.641933°N,

32.963433°E, 23.II.2017, (1♂); Cherkes, 34.650960°N, 32.990910°E, 25.III.2017, (2♀); Cherkes, 34.641933°N, 32.963433°E, 25.III.2017, (1♀); Cherkes, 34.659801°N, 32.990510°E, 25.III.2017, (3♀); Cherkes, 34.641933°N, 32.963433°E, 21.IV.2017, (2♀); Cherkes, 34.641933°N, 32.963433°E, 1.II.2018, (1♂); Cherkes, 34.653067°N, 32.974233°E, 14.II.2018, (1♂); Cherkes, 34.641933°N, 32.963433°E, 1.III.2018, (1♀); Cherkes, 34.659801°N, 32.990510°E, 1.III.2018, (1♀); Cherkes, 34.659801°N, 32.990510°E, 16.III.2018, (2♀); Akrotiri, 34.588600°N, 32.938900°E, 1.III.2018, (1♀); Akrotiri, 34.628817°N, 32.940667°E, 1.III.2018, (1♂); Larnaca District: Choirokitia, 34.777521°N 33.33622°E, 27.II.2018, (1♀); Famagusta District: Deryneia, 23.III.2016, (1♀); Protaras, Cape Greco, 34.963264°N, 34.066211°E, 5.II.2018, (1♂); Achna Dam, 35.05519°N, 33.814011°E, 19.II.2018, (1♀), Nicosia district records A. Grace leg., S. Risch det., all Limassol, Larnaca, and Famagusta district records A. Varnava leg., A. Dorchin det.

Distribution. Cyprus, Southern Europe (Greece), Northern Africa (Algeria, Tunisia, Egypt), Western Asia (Turkey, Israel, Saudi Arabia), Southern Asia (Iran, Afghanistan).

***Eucera (Heterocera) furfurea* Vachal, 1907**

References. Alfken (1933); Mavromoustakis (1949 [“1948”]).

Mavromoustakis localities. Limassol, Akrotiri Forest, Pissouri, Nicosia.

Distribution. Cyprus, Southern Europe (Greece), Western Asia (Turkey, Israel).

***Eucera (Heterocera) gaullei* Vachal, 1907**

References. Alfken (1933); Mavromoustakis (1949 [“1948”], 1951); Georghiou (1977).

Mavromoustakis localities. Limassol, Akrotiri Forest, Episkopi, Yermasoyia River, Kato Platres, Potamitissa, Kyrenia, Sphalangiotissa Monastery, Northern Mountains Kantara, Near Salamis, Ayios Ilarion.

Material examined. Nicosia District: City Center, 35.1688°N, 33.367°E, 13.III.2006, (4♂), insect net (UAEG); Limassol District: Cherkes, 34.641933°N, 32.963433°E, 8.V.2016, (1♀); Akrotiri, 34.601506°N, 32.986197°E, 21.IV.2017, (1♀); Akrotiri,

34.600657°N, 32.971419°E, 26.IV.2018, (1♀), all Nicosia district records A. Grace leg., S. Risch det., all Limassol district records A. Varnava leg., A. Dorchin det.

Distribution. Cyprus, Western Asia.

Eucera (Tetralonia) glauca (Fabricius, 1775)

References. Pittioni (1950); Mavromoustakis (1952, 1957a); Tkalčů (1979).

Mavromoustakis localities. Pyrga (Larnaca).

Mavromoustakis specimens in the Snow Entomological Museum Collection, Kansas, USA: Asomatos, 34.64°N, 32.96°E, 26.VI.1951, G.A. Mavromoustakis leg./det., (1♀) and 3 unspecified specimens.

Distribution. Cyprus, Southern Europe (Greece), Western Asia (Turkey, Iraq), Southern Asia (Iran).

Eucera (Tetralonia) inulae (Tkalčů, 1979)

References. Tkalčů (1979).

Mavromoustakis specimens in the Snow Entomological Museum Collection, Kansas, USA:

Limassol, Kilani, 14.VII.1937, G.A. Mavromoustakis leg., D.B. Baker det., 3 specimens.

Material examined. Limassol District: Akrotiri; 34.600657°N, 32.971419°E, 29.X.2016, S.P.M. Roberts leg./det., foraging on *Dittrichia viscosa* (Asteraceae), (1♂, 1♀).

Distribution. Cyprus, Southern Europe, Eastern Europe (Ukraine, Bulgaria, Russian Federation), Southern Asia (Iran).

Eucera (Synhalonia) mavromoustakisi (Tkalčů, 1984)

Type locality-country. Cyprus, Lania: 34.82444°N, 32.92083°E, 2.VI.1964, G.A. Mavromoustakis leg., B. Tkalčů det. ♂ (FSAG).

References. Tkalčů (1984).

Distribution. Cyprus. ENDEMIC.

***Eucera (Tetralonia) malvae* (Rossi, 1790)**

References. Mavromoustakis (1949 [“1948”]).

Mavromoustakis localities. Polemedia Hills, Mesayitonia, Akrotiri Forest, Symboulas Chiflik (near Limassol), Near Platania Forest Station, Lania, Ayia Varvara (Stavrovouni), Near Ayios Athanasios, Hills near Trimiklini.

Distribution. Cyprus, Widespread across Europe, Western Asia (Turkey).

***Eucera (Eucera) palaestinae* Friese, 1922**

Material examined. Limassol District: Akrotiri, 34.601506°N, 32.986197°E, 21.IV.2017, (1♂); Akrotiri, 34.601506°N, 32.986197°E, 1.III.2018, (3♀); Akrotiri, 34.600657°N, 32.971419°E, 1.III.2018, (2♀), all Limassol district records A. Varnava leg., A. Dorchin det.

Distribution. Cyprus, Western Asia, Southern Asia (Iran).

***Eucera (Eucera) proxima* Morawitz, 1875**

References. Mavromoustakis (1949 [“1948”], 1951, 1952).

Material examined. Limassol District: Troodos, Chionistra, 34.9317°N, 32.8664°E, 31.V.2012, 2.VI.2012, (1♂), pan trap, (UAEG); Akrotiri, 34.628817°N, 32.940667°E, 25.III.2017, (1♀); Akrotiri, 34.601506°N, 32.986197°E, 7.IV.2017, (1♀); Akrotiri, 34.601506°N, 32.986197°E, 21.IV.2017, (1♀); Akrotiri, 34.628817°N, 32.940667°E, 21.IV.2017, (1♀); Akrotiri, 34.600657°N, 32.971419°E, 1.III.2018, (1♂), all Troodos, Chionistra records S. Dimitriou leg., S. Risch det., all Akrotiri records A. Varnava leg., A. Dorchin det.

Distribution. Cyprus, Western Europe (France), Southern Europe, Eastern Europe, Western Asia (Turkey, Syria), Central Asia (Turkmenistan, Uzbekistan, Tajikistan), Southern Asia (Iran).

Notes. Also recorded as *E. graeca* Radoszkowski, 1876 e.g. Rasmont et al. 2017. Precedence is given to *proxima* following Nieto et al. (2014; see methodology).

***Eucera (Eucera) seminuda* Brullé, 1832**

References. Scheuchl and Willner (2016).

Distribution. Cyprus, Western Europe (France, Austria), Southern Europe (North Macedonia, Italy, Greece), Eastern Europe, Northern Africa (Tunisia), Western Asia (Turkey, Armenia).

***Eucera (Eucera) sinufascia* Dorchin, 2018**

References. Tkalčú (1979).

Material examined. Limassol District: Cherkas, 34.641933°N, 32.963433°E, 10.III.2017, A. Varnava leg., A. Dorchin det. (1♂).

Distribution. Cyprus, Southern Europe (Greece (Aegean islands)), Western Asia.

Notes. Synonymising *Tetraloniella* under *Eucera*, the name became a junior homonym of *Eucera (Tetralonia) penicillata* (Friese, 1905) and *Eucera sinufascia* Dorchin 2018 was proposed as a replacement Dorchin et al. (2018).

***Eucera (Eucera) sulamita* Vachal, 1907**

Material examined. Northern Cyprus, 10 km N of Famagusta, Salamis, 35.187°N, 33.899°E, 4.X.2007, C. Schmid-Egger leg., S. Risch det. (1♂) (AMNH).

Distribution. Cyprus, Western Asia (Israel).

***Eucera (Heteucera) syriaca* Dalla Torre, 1896**

References. Mavromoustakis (1949 [“1948”], 1951, 1957a); Georghiou (1977).

Mavromoustakis localities. Limassol, Polemedia Hills, Mesayitonia, Ayia Phyla, Nicosia, Sphalangiotissa Monastery, Fassouri, Famagusta, Amathus, Near Enkomi of Famagusta.

Material examined. Famagusta District: 5 km E of Rizokarpaso, 35.63°N, 34.50°E, 10.IV.2007,; Limassol District: Akrotiri, 34.583676°N, 32.949306°E, 14.IV.2018, (1♀); Akrotiri, 34.583676°N, 32.949306°E, 28.IV.2018, (1♀), all Famagusta district records C. Schmid-Egger leg., S. Risch det., all Limassol district records A. Varnava leg., A. Dorchin det.

Distribution. Cyprus, Western Asia, Southern Asia (Iran).

***Eucera (Synhalonia) tricincta* Erichson, 1835**

References. Tkalčú (1984).

Distribution. Cyprus, Western Europe (Austria), Southern Europe (Spain, Italy, Greece), Eastern Europe, Northern Africa, Western Asia.

***Eucera (Synhalonia) zeta* Dalla Torre, 1896**

References. Mavromoustakis (1952).

Mavromoustakis localities. Pera Pedi, Potamitissa, Moni, Kellaki, Saettas, Kitromili, Mt. Kornos.

Distribution. Cyprus, Southern Europe (Greece), Western Asia, Central Asia (Turkmenistan), Southern Asia (Iran).

Notes. Described from Cyprus as *Eucera vernalis sintenisi* Mavromoustakis, 1952 from, Potamitissa: 34.9075°N, 32.989444°E, 16.III.1947, G.A. Mavromoustakis leg., G.A. Mavromoustakis det. ♀, (DAAN).

MELECTINI

Genus *Melecta* LATREILLE, 1802

7 species.

***Melecta (Melecta) albifrons* (Forster, 1771)**

References. Mavromoustakis (1949 [“1948”], 1951); Lieftinck (1980).

Mavromoustakis localities. Nicosia, Mt. Troodos, Yermasoyia River, Amathus, Potamitissa, Yerasa, Near Amathus, Prodromos, Dragontospillios cave.

Distribution. Cyprus, Widespread in Europe, Northern Africa, Western Asia, Southern Asia (Iran).

Melecta (Melecta) duodecimmaculata (Rossi, 1790)

References. Mavromoustakis (1949 [“1948”]); Georghiou (1977); Lieftinck (1980).

Mavromoustakis localities. Polemedia Hills, Mesayitonia, Limassol, Ayia Phyla, Fassouri, Yermasoyia River, Amathus, Yerasa.

Distribution. Cyprus, Western Europe (France), Southern Europe, Northern Africa, Western Asia, Central Asia, Southern Asia (Iran).

Melecta (Melecta) italica Radoszkowski, 1876

References. Lieftinck (1980).

Distribution. Cyprus, Western Europe (France), Southern Europe, Northern Africa, Western Asia, Eastern Asia.

Melecta (Melecta) leucorhyncha Gribodo, 1894

References. Lieftinck (1980).

Distribution. Cyprus, Western Europe (France), Southern Europe, Eastern Europe (Ukraine), Northern Africa, Western Asia, Eastern Asia.

Melecta (Melecta) luctuosa (Scopoli, 1770)

References. Scheuchl and Willner (2016).

Distribution. Cyprus, Widespread in Europe, Northern Africa, Western Asia, Central Asia, Southern Asia (Iran, Pakistan).

***Melecta (Melecta) mundula* Lieftinck, 1983**

References. Lieftinck (1983); Schwarz (1999).

Distribution. Cyprus, Southern Europe (Greece), Eastern Europe (Russian Federation), Western Asia (Turkey, Israel, Jordan), Central Asia, Southern Asia (Iran).

Notes. Described from Cyprus as *Melecta megaera* Lieftinck, 1980, from Polemedia: 34.699444°N, 32.996944°E, 9.III.1950, G.A. Mavromoustakis leg., M.A. Lieftinck det. ♂, (MFNB).

***Melecta (Melecta) tuberculata* Lieftinck, 1980**

References. Lieftinck (1980).

Distribution. Cyprus, Western Europe (France), Southern Europe (Portugal, Spain, Greece), Eastern Europe (Bulgaria, Russian Federation), Western Asia (Turkey, Israel, Lebanon), Eastern Asia.

Genus *Thyreus* PANZER, 1806

5 species.

***Thyreus affinis* (Morawitz, 1874)**

References. Pittioni (1950); Lieftinck (1968); Mavromoustakis (1951, 1952).

Mavromoustakis localities. Limassol, Polemedia Hills, Akrotiri Bay, Near Akrotiri, Younaros of Zakaki.

Distribution. Cyprus, Western Europe (France), Southern Europe, Eastern Europe, Northern Africa, Western Asia, Central Asia, Southern Asia (Iran, Pakistan).

***Thyreus elegans* (Morawitz, 1877)**

References. Lieftinck (1968).

Distribution. Cyprus, Southern Europe, Northern Africa, Western Asia, Central Asia (Turkmenistan, Kyrgyzstan), Southern Asia (Iran, Pakistan).

***Thyreus histrionicus* (Illiger, 1806)**

References. Mavromoustakis (1949 [“1948”], 1951, 1952, 1957a); Lieftinck (1968); Georghiou (1977).

Mavromoustakis localities. Limassol, Polemedia Hills, Mesayitonia, Cherkes, Akrotiri Bay, Near Akrotiri, Near Enkomi of Famagusta, Yermasoyia River, Akrounda, Moni River, Mt. Troodos Chionistra, Perner coast of Paralimni, Younarka (near Zakaki), Krios River near Kilani, near Fassouri.

Material examined. Paphos District: 20 km NNW Paphos, Lara Beach, 34.94°N, 32.31°E, 20.VI.2013, C. Schmid-Egger leg., M. Schwarz det. (1♀).

Distribution. Cyprus, Western Europe (France, Austria), Southern Europe, Eastern Europe, Northern Africa, Western Asia, Central Asia, Southern Asia (Iran), Eastern Asia (China).

***Thyreus picaron* Lieftinck, 1968**

Material examined. Paphos District: 20 km NNW Paphos, Lara Beach, 34.94°N, 32.31°E, 20.VI.2013, C. Schmid-Egger leg., M. Schwarz det. (1♂).

Distribution. Cyprus, Western Europe (France), Southern Europe, Eastern Europe (Bulgaria, Romania).

***Thyreus ramosus* (Lepelletier, 1841)**

References. Mavromoustakis (1949 [“1948”], 1951, 1952, 1954); Lieftinck (1968); Georghiou (1977).

Mavromoustakis localities. Limassol, Cherkes, Episkopi, Ayios Athanasios, Pera Pedi, Akrotiri Bay, Moni, Near Akrotiri, Yermasoyia River, Eftagonia, Xerokolimbi Stream near Trooditissa, Platres, Pera Pedi.

Material examined. Paphos District: 20 km NNW Paphos, Lara Beach, 34.94°N, 32.31°E, 20.VI.2013, C. Schmid-Egger leg., M. Schwarz det. (1♂).

Distribution. Cyprus, Western Europe (France, Switzerland, Austria), Southern Europe, Eastern Europe, Northern Africa, Western Asia, Central Asia, Southern Asia, Eastern Asia (China).

NOMADINI

Genus *Nomada* SCOPOLI, 1770

39 species.

***Nomada babi* Schwarz and Standfuss, 2007**

References. Smit (2018).

Distribution. Cyprus, Southern Europe (Croatia, Greece), Eastern Europe (Ukraine, Bulgaria), Western Asia (Turkey, Syria).

***Nomada bifasciata* Olivier, 1812**

References. Smit (2018).

Distribution. Cyprus, Widespread in Europe, Northern Africa, Western Asia (Turkey).

***Nomada caspia* Morawitz, 1894**

References. Smit (2018).

Distribution. Cyprus, Southern Europe (Croatia, Greece), Western Asia (Turkey, Israel, Lebanon), Central Asia (Turkmenistan).

***Nomada cherkesiana* Mavromoustakis, 1955**

Type locality-country. Cyprus, Cherkes: 34.65°N, 32.975°E, 30.III.1950, G.A. Mavromoustakis leg., G.A. Mavromoustakis det. ♀, (DAAN).

References. Mavromoustakis (1955, 1957a); Smit (2018).

Mavromoustakis localities. Cherkes, Yermasoyia River, Yerasa.

Distribution. Cyprus, Southern Europe (Greece), Western Asia (Turkey, Israel).

***Nomada confinis* Schmiedeknecht, 1882**

References. Smit (2018).

Distribution. Cyprus, Western Europe (Switzerland), Southern Europe, Eastern Europe (Bulgaria), Western Asia, Southern Asia (Iran).

***Nomada cypria* Mavromoustakis, 1952**

Type locality-country. Cyprus, Cherkes: 34.65°N, 32.975°E, 15.III.1950, G.A. Mavromoustakis leg., G.A. Mavromoustakis det. ♀, (DAAN).

References. Schwarz (1999); Mavromoustakis (1952); Smit (2018).

Distribution: Cyprus, Southern Europe (Greece), Western Asia (Israel).

***Nomada cypricola* Mavromoustakis, 1955**

Type locality-country. Cyprus, Zakaki: 34.6563°N 33.0029°E, 17.VI.1949, G.A. Mavromoustakis leg., G.A. Mavromoustakis det. ♀, (DAAN).

References. Mavromoustakis (1957a); Smit (2018).

Mavromoustakis localities. Limassol, Polemedia Hills, Ayia Irini (near Palodkia), Sphalangiotissa Monastery (near Limassol).

Distribution. Cyprus. ENDEMIC.

***Nomada erythrocephala* Morawitz, 1871**

References. Mavromoustakis (1949 [“1948”]); Smit (2018).

Mavromoustakis localities. Limassol, Polemedia Hills, Episkopi Forest, Ayia Irini Station (near Limassol).

Distribution. Cyprus, Western Europe (France), Southern Europe (Spain, Greece), Eastern Europe, Western Asia (Turkey).

***Nomada filicornis* Schwarz and Smit, 2018**

References. Smit (2018).

Smit paratype localities: Limassol, Vavla, Akrotiri, Kapedhes.

Distribution. Cyprus, Southern Europe (Italy, Greece), Western Asia (Turkey, Jordan, Syria).

***Nomada flavinervis* Brullé, 1832**

References. Mavromoustakis (1955, 1957a); Smit (2018).

Mavromoustakis localities. Limassol, Pera Pedi, Lania, Kellaki, Fasoulla, Trimiklini, Episkopi, Yermasoyia River.

Distribution. Cyprus, Southern Europe (Greece), Eastern Europe (Bulgaria), Western Asia (Turkey, Israel).

***Nomada flavoguttata* (Kirby, 1802)**

References. Mavromoustakis (1949 [“1948”]); Smit (2018).

Mavromoustakis localities. Limassol.

Material examined. Limassol District: Yermasoyia Dam, 34.755799°N, 33.096194°E, 7.III.2017, Bee Course students leg., M. Schwarz det. (4♀).

Distribution. Cyprus, Widespread in Europe, Northern Africa, Western Asia, Central Asia, Southern Asia (Iran), Eastern Asia (China).

***Nomada fucata* Panzer, 1798**

References. Mavromoustakis (1949 [“1948”]); Georghiou (1977); Smit (2018).

Mavromoustakis localities. Limassol, Yermasoyia River, Amathus, Potamitissa.

Material examined. Limassol District: Yermasoyia Dam, 34.755799°N, 33.096194°E, 7.III.2017, Bee Course students leg., M. Schwarz det. (1♀).

Distribution. Cyprus, Widespread in Europe, Northern Africa, Western Asia, Central Asia (Kazakhstan, Kyrgyzstan), Southern Asia (Pakistan).

***Nomada fulvicornis* Fabricius, 1793**

References. Pittioni (1950); Smit (2018).

Distribution. Cyprus, Widespread in Europe, Northern Africa, Western Asia, Central Asia, Southern Asia (Iran, Pakistan, India), Eastern Asia (China).

***Nomada furva* Panzer, 1798**

References. Smit (2018).

Distribution. Cyprus, Western Europe, Southern Europe, Eastern Europe, Northern Africa (Algeria), Western Asia (Turkey, Georgia), Central Asia.

***Nomada gageae* Schwarz and Smit, 2018**

Type locality-country. Cyprus, Limassol: 34.66839°N, 33.03252°E, 25.I.1949 [“1948”], G.A. Mavromoustakis leg., J. Smit det. ♀, (MSAA). Paratypes: Cyprus, Limassol, 28.I.1949 [“1948”], G.A. Mavromoustakis leg., J. Smit/M. Schwarz det. 2♂.

References. Smit (2018).

Distribution. Cyprus. ENDEMIC.

***Nomada goodeniana* (Kirby, 1802)**

References. Smit (2018).

Distribution. Cyprus, Widespread in Europe, Western Asia, Central Asia, Southern Asia (Iran).

***Nomada immaculata* Morawitz, 1874**

References. Mavromoustakis (1949 [“1948”]); Smit (2018).

Mavromoustakis localities. Polemedia Hills, Episkopi, Yerasa.

Distribution. Cyprus, Southern Europe (Greece, North Macedonia), Eastern Europe (Hungary, Russia), Northern Africa, Western Asia (Armenia), Southern Asia (Afghanistan, Pakistan).

***Nomada incisa* Schmiedeknecht, 1882**

References. Smit (2018).

Distribution. Cyprus, Southern Europe, Eastern Europe, Western Asia (Turkey).

***Nomada integra* Brullé, 1832**

References. Smit (2018).

Distribution. Cyprus, Widespread in Europe, Northern Africa, Western Asia, Central Asia.

***Nomada kohli* Schmiedeknecht, 1882**

References. Smit (2018).

Distribution. Cyprus, Western Europe (France, Germany, Austria), Southern Europe, Eastern Europe, Northern Africa, Western Asia (Turkey, Israel).

***Nomada kornosica* Mavromoustakis, 1958**

Type locality-country. Cyprus, Mt. Kornos (Northern Mountains): 35.1379°N, 33.1379°E, 23.III.1953, G.A. Mavromoustakis leg., G.A. Mavromoustakis det. ♀.

References. Mavromoustakis (1958); Smit (2018).

Distribution. Cyprus, Southern Europe (Greece).

***Nomada limassolica* Mavromoustakis, 1955**

Type locality-country. Cyprus, Limassol: 34.66839°N, 33.03252°E, 13.III.1953, G.A. Mavromoustakis leg., G.A. Mavromoustakis det. ♂, (DAAN).

References. Mavromoustakis (1955, 1957); Smit (2018).

Distribution. Cyprus, Southern Europe (Greece), Eastern Europe (Bulgaria), Western Asia (Turkey, Israel).

***Nomada lucidula* Schwarz, 1967**

References. Smit (2018).

Distribution. Cyprus, Southern Europe (Albania, Greece), Eastern Europe (Bulgaria), Western Asia (Turkey, Israel).

***Nomada mutica* Morawitz, 1872**

References. Smit (2018).

Distribution. Cyprus, Western Europe, Southern Europe, Eastern Europe (Hungary, Romania), Western Asia.

***Nomada nesiotica* Mavromoustakis, 1958**

Type locality-country. Cyprus, Fasoulla [8 km N of Limassol]: 34.761667°N, 33.026944°E, 9.III.1951, G.A. Mavromoustakis leg., G.A. Mavromoustakis det. ♀, (DAAN).

References. Mavromoustakis (1958 ["1957"]); Smit (2018).

Mavromoustakis localities. Limassol, Fasoulla, Apsiou, Yerasa, Amathus, Yermasoyia River, Pera Pedi, Lania, Trimiklini, Kellaki.

Material examined. Limassol District: Yermasoyia Dam, 34.755799°N, 33.096194°E, 7.III.2017, Bee Course students leg., M. Schwarz det. (8♀).

Distribution. Cyprus, Southern Europe (Greece).

***Nomada numida* Lepeletier, 1841**

References. Mavromoustakis (1949 ["1948"]); Smit (2018).

Mavromoustakis localities. Ayios Athanasios, Yermasoyia River, Near Paramytha, Ayia Varvara (Stavrovouni), Pernera coast of Paralimni.

Distribution. Cyprus, Western Europe (France), Southern Europe, Eastern Europe, Northern Africa, Western Asia (Turkey, Israel, Iraq).

***Nomada pallispinosa* Schwarz, 1967**

References. Smit (2018).

Material examined. Limassol District: Polemidia, 34.71178°N, 33.004775°E, 8.III.2017, Bee Course students leg., M. Schwarz det. (2♀).

Distribution. Cyprus, Southern Europe, Eastern Europe (Bulgaria, Russian Federation), Western Asia (Turkey, Israel).

***Nomada pleurosticta* Herrich-Schäffer, 1839**

References. Smit (2018).

Distribution. Cyprus, Western Europe, Southern Europe (Spain, Greece), Eastern Europe (Czech Republic, Hungary, Slovakia), Northern Africa (Tunisia), Western Asia (Turkey), Southern Asia (Iran).

***Nomada polemediana* Mavromoustakis, 1957**

Type locality-country. Cyprus, Limassol: 34.66839°N, 33.03252°E, 17.IV.1954, G.A. Mavromoustakis leg., G.A. Mavromoustakis det. ♀, (DAAN).

References. Mavromoustakis (1957b; Warncke (1967); Smit (2018).

Distribution. Cyprus. ENDEMIC.

***Nomada propinqua* Schmiedeknecht, 1882**

References. Mavromoustakis (1952); Smit (2018).

Mavromoustakis localities. Apsiou, Hills near Paramytha, Mt. Kornos.

Distribution. Cyprus, Southern Europe, Western Asia (Israel).

***Nomada pyrgosica* Schwarz and Smit, 2018**

Type locality-country. Cyprus, Famagusta, Rizokarpaso: 35.59881°N, 34.2772°E, 29.III.2012, Schwenninger leg., J. Smit det. ♀, (MSAA).

References. Smit (2018).

Distribution. Cyprus, Western Asia (Turkey).

***Nomada stigma* Fabricius, 1804**

References. Mavromoustakis (1955, 1957b); Smit (2018).

Distribution. Cyprus, Widespread in Europe, Northern Africa (Algeria), Western Asia (Turkey), Central Asia (Kazakhstan).

Notes. The subspecies described from Cyprus is *Nomada stigma cypricola* Mavromoustakis, 1955, from Zakaki: 34.6563°N, 33.0029°E, 17.VI.1949, G.A. Mavromoustakis leg. G.A. Mavromoustakis det. ♀, (DAAN).

***Nomada striata* Fabricius, 1793**

References. Mavromoustakis (1951, 1957a); Smit (2018).

Mavromoustakis localities. Chiflicoudia marshes (near Limassol), Pera Pedi, Amathus.

Distribution. Cyprus, Widespread in Europe, Northern Africa (Morocco), Western Asia, Central Asia (Kazakhstan).

***Nomada succincta* Panzer, 1798**

References. Scheuchl and Willner (2016); Smit (2018).

Distribution. Widespread in Europe, Northern Africa, Western Asia, Central Asia (Turkmenistan, Kazakhstan).

***Nomada teunissenii* Schwarz and Smit, 2018**

Type locality-country. Cyprus, Akanthou: 35.3741°N, 33.7558°E, 12.III.1981, H. Teunissen leg., J. Smit det. ♂ (MSAA). Paratypes: Cyprus, Mt Kornos, 9.III.1981, H. Teunissen leg., Smit/ Schwarz det. 1 ♂; Cyprus, Kantara, 2000m, 19.III.1971, K.M. Guichard leg., Smit/ Schwarz det. 1 ♀.

References. Smit (2018).

Distribution. Cyprus. ENDEMIC.

***Nomada thersites* Schmiedeknecht, 1882**

References. Smit (2018).

Distribution. Cyprus, Southern Europe (Spain, Italy, Greece), Eastern Europe (Hungary, Ukraine, Russian Federation), Western Asia (Turkey, Israel), Central Asia (Kazakhstan, Kyrgyzstan), Southern Asia (Iran).

***Nomada tridentirostris* Dours, 1873**

References. Smit (2018).

Distribution. Cyprus, Western Europe (France, Switzerland, Austria), Southern Europe, Eastern Europe (Poland, Hungary, Bulgaria), Northern Africa, Western Asia (Turkey, Israel), Southern Asia (Iran).

***Nomada trispinosa* Schmiedeknecht, 1882**

References. Mavromoustakis (1952, 1953); Smit (2018).

Mavromoustakis localities. Limassol, Cherkes, Apsiou, Trimiklini.

Material examined. Limassol District: Yermasoyia Dam, 34.755799°N, 33.096194°E, 7.III.2017, (6♀); Polemidia, 34.71178°N, 33.004775°E, 8.III.2017, (3♀), all records Bee Course students leg., M. Schwarz det.

Distribution. Cyprus, Western Europe (Austria), Southern Europe (Greece, Slovenia), Eastern Europe, Western Asia (Israel, Jordan, Azerbaijan), Eastern Asia (China).

***Nomada yermasoyiae* Schwarz, Smit & Gusenleitner, 2018**

References. Schwarz, Smit and Gusenleitner (2018).

Type localities: Cyprus, Cherkos: 23.III.1950, ♀, G.A. Mavromoustakis leg., in coll. M. Schwarz. Allotype: Cyprus, Cherkos, 23.III.1950, ♂, G.A. Mavromoustakis leg., in coll. M. Schwarz. Paratypes: Cyprus: Limassol, 28.III.1959, G.A. Mavromoustakis leg., 1 ♀, 2 ♂; Cyprus, Amathus, 7.III.1966, 1 ♂, G.A. Mavromoustakis leg.

Distribution. Cyprus, Western Asia (Israel).

XYLOCOPINI

Genus *Xylocopa* LATREILLE, 1802

4 species.

***Xylocopa (Copoxya) iris* (Christ, 1791)**

References. Pittioni (1950); Mavromoustakis (1949 [“1948”], 1952).

Mavromoustakis localities. Moni River, Livadin of Cedars (Paphos Forest).

Material examined. Paphos District: 15 km SE Paphos, Kouklia, 34.72°N, 32.55°E, 20.VI.2013, (1♂); 20 km N Paphos, Kathikas, 34.90°N, 32.42°E, 20.VI.2013, (1♀, 1♂); 20 km NNW Paphos, Lara Beach, 34.94°N, 32.31°E, 20.VI.2013, (1♀, 1♂); 6 km NE Polis, beach, 35.06°N, 32.46°E, 20.VI.2013, (1♂); N of Elia Bridge, 34.900977°N, 32.776759°E, 29.IV.2015, (1♂); Limassol District: 8 km E Limassol, on road, 34.67°N, 32.85°E, 20.VI.2013, (1♀); Anogyra to Avdimou Road km 2, 34.723986°N, 32.736892°E, 3.V.2015, (1♀); 0.7 km N of Anogyra, 34.745537°N, 32.73385°E, 3.V.2015, (1♀), all 15 km SE Paphos Kouklia, 20 km N Paphos Kathikas, 20 km NNW Paphos Lara Beach, 6 km NE Polis, beach and 8 km E Limassol, on road records C. Schmid-Egger leg./det., all N of Elia Bridge, Anogyra to Avdimou Road km 2 and 0.7 km N of Anogyra records S.P.M. Roberts leg./ det.

Distribution. Cyprus, Western Europe (France, Switzerland, Austria), Southern Europe, Eastern Europe, Northern Africa, Western Asia, Central Asia, Southern Asia (Iran, Afghanistan).

***Xylocopa (Proxylocopa) olivieri* Lepeletier, 1841**

References. Pittioni (1950); Mavromoustakis (1949 [“1948”], 1951, 1952).

Mavromoustakis localities. Limassol, Akrotiri Forest, Evdhimou River, Pera Pedi, Platres, Near Kilani, Near Cape Akamas, Near Trimiklini.

Material examined. Nicosia District: Kakopetria, 34.992°N, 32.9082°E, 15-17.IX.2011, (1♀), pan trap (UAEG); Kakopetria, 34.992°N, 32.9082°E, 14-16.V.2012, (1♂, 1♀), pan trap (UAEG), all records S. Dimitriou leg., J. Devalez det.

Distribution. Cyprus, Southern Europe (Albania, North Macedonia, Greece), Eastern Europe (Russian Federation), Northern Africa (Egypt), Western Asia (Israel), Central Asia (Turkmenistan, Kyrgyzstan), Southern Asia (Iran).

***Xylocopa (Koptortosoma) pubescens* Spinola, 1838**

References. Rasmont et al. (2017).

Material examined. Nicosia District: City Center, 35.1688°N, 33.367°E, 13.III.2006, (1♂), insect net (UAEG); Agios Sozomenos, 35.06687°N, 33.43580°E, 4.III.2019, (1♀) (from photograph); Paphos District: 15 km SE Paphos, Kouklia, 34.72°N, 32.55°E, 20.VI.2013, (1♀); Paphos, Venus Beach Hotel, 34.78°N, 32.40°E, 7.VIII.2016, (1♀) (from photograph); Larnaca District: Prosfygikos Synoikismos EAC, 34.983633°N, 33.745922°E, 2.IV.2016, (1♀); Prosfygikos Synoikismos EAC, 34.983633°N, 33.745922°E, VII.2017, (1♀); Prosfygikos Synoikismos EAC, 34.983633°N, 33.745922°E, 2.III.2018, (1♀); Limassol District: Akrotiri, 34.583602°N 32.949536°E, 17.IV.2016, (1♀); Akrotiri, 34.583602°N, 32.949536°E, 8.V.2016 (1♀); Polemidia, 34.711178°N, 33.004775°E, 8.III.2017, (1♀); Akrotiri, 34.600427°N 32.971111°E, 14.IV.2018, (1♀), Nicosia City center records A. Grace leg., J. Devalez and A. Pauly det., Agios Sozomenos records E. Tzirkalli leg., S.P.M. Roberts det., 15 km SE Paphos, Kouklia records C. Schmid-Egger leg., C. Schmid-Egger det., Paphos, Venus Beach Hotel records S. Bagshaw leg., S.P.M. Roberts det., Prosfygikos Synoikismos EAC (2.IV.2016) A. Varnava leg., S.P.M. Roberts det., Prosfygikos Synoikismos EAC (VII.2017, 2.III.2018) records A. Varnava leg., A. Varnava det., Akrotiri (records

17.IV.2016, 8.V.2016) A. Varnava leg., S.P.M. Roberts det., all Polemidia records S.P.M. Roberts leg./det., Akrotiri records (14.IV.2018) A. Varnava leg./det.

Distribution. Cyprus, Southern Europe (Greece), Widespread in Africa, Western Asia, South-eastern Asia (Myanmar), Central Asia, Southern Asia.

Xylocopa (Xylocopa) violacea (Linnaeus, 1758)

References. Mavromoustakis (1949 [“1948”]); Pittioni (1950); Mavromoustakis (1951, 1952).

Mavromoustakis localities. Limassol, Polemedia Hills, Akrotiri Bay, Yerasa, Kitromili near Polemedia, Chiflicoudia marshes, Bogazi shore.

Material examined. Nicosia District: Kakopetria, 34.992°N, 32.9082°E, 25-27.IV.2012, (1♀), pan trap (UAEG); Limassol District: Amiantos, 34.918°N, 32.9472°E, 31.V.2012, 2.VI.2012, (1♀), pan trap (UAEG); Paphos District: 20 km NNW Paphos, Lara Beach, 34.94°N, 32.31°E, 20.VI.2013, (4♀), all Nicosia district and Amiantos records S. Dimitriou leg., J. Devalez det., all Paphos district records C. Schmid-Egger leg., C. Schmid-Egger det.

Distribution. Cyprus, Widespread in Europe.

2.5 Discussion

The first modern checklist of the wild bees of Cyprus provides information on the species reported on the island based on previous publications and new collections. The list contains 369 species of wild bees that were accepted/verified by the authors to occur on the island. The Mediterranean is well known for its high bee diversity, a result of the high floral diversity and optimal weather conditions (Michener 2007, Nieto et al. 2014).

Cyprus has greater species richness of bees than larger islands, such as New Guinea, Honshu, Great Britain, and Borneo (Ascher and Pickering 2018). The bee species richness of the island compares well to that of other Mediterranean islands (Fig. 3), with only Lesvos (at least 600 species: Nielsen et al. 2011, Petanidou et al. unpublished data) and

Sicily (562 species: [cf. 575 species according to J. S. Ascher, unpublished, based in part on Scheuchl and Willner, 2016]) having greater richness than Cyprus. Crete, Sardinia, and Corsica are reported to host 351, 296, and 263 bee species, respectively (Ascher unpublished, cf. Scheuchl and Willner, 2016; Ascher and Pickering 2018), while Mallorca 175 (Baldock 2014), Malta 108 (Balzan et al. 2016, 2017), Ibiza and Formentera 77 (Baldock 2014), Madeira and Porto Santo 19 (Fellendorf et al. 1999) and Menorca 13 species (Baldock 2014). A recent study by Kaloveloni et al. (2018) reported the following bee species diversity for islands in the Aegean Archipelago: Anafi (59), Chios (208), Folegandros (46), Ikaria (102), Ios (78), Karpathos (105), Kea (114), Kos (142), Kythnos (59), Limnos (178), Milos (38), Mykonos (38), Paros (60), Samothraki (128), Santorini (67), Serifos (68), Syros (68), Thassos (169), and Tinos (95). However, differences in the sampling effort between islands may bias bee diversity estimates. Sampling for wild bees on the island of Cyprus has focused traditionally on the southern part of the island (Fig. 1). Collections of samples reported for the first time in the current study also concentrated on the southern part of the island (Fig. 1), where the Republic of Cyprus exercises full control, because of difficulties in reaching and collecting samples from the northern part of Cyprus. The lower under-sampling in the north of the island, both historical and present, probably leads to an underestimation of the bee species richness on the island.

The bee fauna of Cyprus shows similarity to that of southern Europe and Middle East (Levant), while the similarity with North Africa appears weaker. Cyprus meets the definition of an oceanic island as it emerged from the sea, but the Messinian Salinity Crisis that led to the virtual drying up of the Mediterranean around 6 mya (Nicolaou et al. 2016) probably facilitated the arrival of many species of bees, as has been proposed for other species, including mammals (Nicolaou et al. 2016). The more recent drop of the sea level during the last glacial maxima of the Pleistocene (25,000 to 18,000 years ago) that exposed underwater seamounts could also have aided bee dispersal from Asia Minor (Anatolia) in a stepping stone model, even though bees would need to fly over 40 km over water to reach the different islets (Nicolaou et al. 2016). A detailed analysis of the biogeographical affinities of the species present on the island will improve our understanding of historical dispersal events.

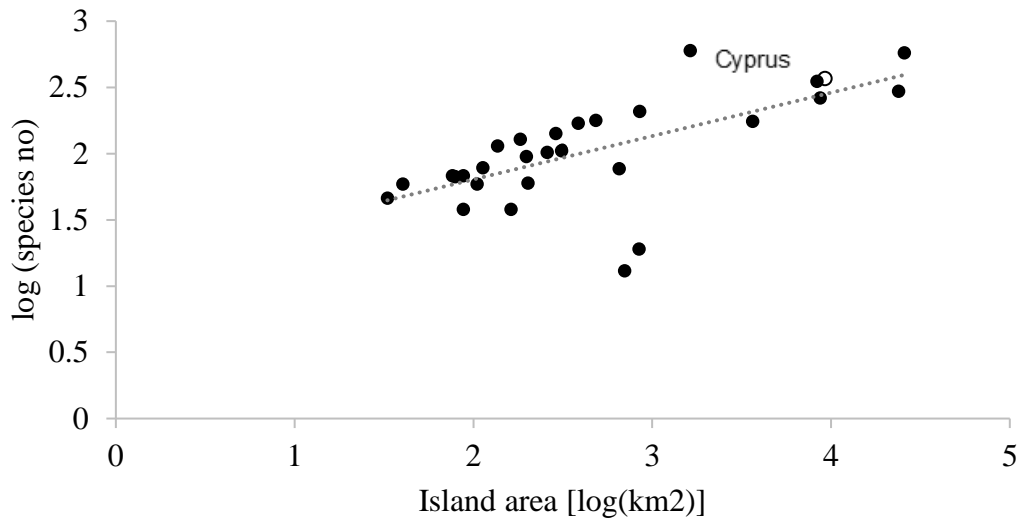


Figure 3. Diversity of bee fauna in 30 Mediterranean islands as a function of island area (logarithm transformed data). See text for the islands and their untransformed bee species numbers. Cyprus represented by the open circle.

There are 2,051 bee species in Europe (Rasmont et al. 2017), as listed in the European Red List of Bees, with 400 species endemic to Europe (20.4%) (Nieto et al. 2014). Most endemic species occur in southern Europe with a higher diversity in the Mediterranean, predominantly in the Iberian, Italian, and Balkan Peninsulas. Cyprus with 21 endemic species ranks second after Crete with 52 endemics followed by Sicily (10), Corsica (5) and Sardinia (1). The wild bee endemism rate for Cyprus (5.7%) is similar to that for butterflies (6.1%), with three endemics out of 49 species (John 2016), but much lower than that for Orthoptera (16.9%, Siedle et al. 2016). The endemic species are mainly medium- to small-sized bees and mostly ground nesters. They have been reported to forage on many plant species, some of which are endemic to the island, including *Onobrychis venosa* (Fig. 2D), *Teucrium cyprium*, and *Nepeta troodi* (Edwards et al. 2016).

Approximately 9% of assessed European bee species are classified as threatened [0.4% - Critically Endangered, 2.4% - Endangered, 1.2% - Vulnerable, 5.2% - Near Threatened, (Nieto et al. 2014)]. In Cyprus, the endemic *Megachile cypricola* is listed as Critically Endangered. Field work conducted in support of the current study has shown that the species is still present in Cyprus, but the population size and trend still need to be

evaluated to review its status. As the specimens were collected only on the endemic plant *Onobrychis venosa*, a first mitigation measure could be the conservation of strong populations of the host plant. Moreover, *Ammobatoides abdominalis*, *Bombus niveatus* and *Parammobatodes minutus*, listed as Endangered in Europe (Nieto et al. 2014), require re-evaluation of their conservation status, as they have not been collected from the island in recent years.

Climate change, degradation and fragmentation of natural habitats, urbanisation, monoculture farming and frequent use of pesticides affect the diversity of bees throughout the world (Potts et al. 2010). Cyprus is no exception to the rule, as natural areas are converted into development projects to meet the increasing needs of the tourism and housing industry. The intensive use of pesticides in farm fields is another factor that potentially impacts wild bee populations (Michener 2007), and anecdotal evidence suggests that honeybee poisonings are frequent on the island. The value of the 32 insect-pollinated crops grown on Cyprus exceeds €37 million euros annually (Agricultural Statistics 2015), underlining the importance of taking measures to conserve both honeybee and wild bee populations. While the role of wild bees in pollinating agricultural crops has never been studied before on Cyprus, it is very likely that they support and enhance agricultural production, especially in areas where honeybee populations are low.

Conserving wild bees requires the establishment of a monitoring program to assess the most significant pressures on their populations and to identify effective conservation practices. Climate change and/or other anthropogenic pressures including agricultural intensification and conversion of natural areas to urban fabric are prominent factors that need to be studied, but without more recent data on population trends it is almost impossible to design effective conservation practices. Many of the original locations where Mavromoustakis sampled for bees have been or are being converted into urban areas. Future studies need to document the impact of urban development on bee conservation and the potential value of anthropogenic habitats for wild bee conservation. The current work provides a baseline for future studies of wild bee diversity on the island of Cyprus and elsewhere.

2.6 Conclusions

Mediterranean islands are well known for their bee diversity, a result of their isolation, high floral diversity and optimal nesting conditions (Nieto et al. 2014, Kaloveloni et al. 2018). Cyprus hosts 369 bee species, with 5.7% endemic to the island. The island hosts species of conservation concern in Europe, such as the Critically Endangered *Megachile cypricola* and the Endangered *Ammobatoides abdominalis*, *Bombus niveatus*, and *Parammobatodes minutus*. Conserving wild bees requires the establishment of a monitoring program to assess their population trends, the most significant threats on their populations and to identify effective conservation practices. The current study is the first step towards conserving wild bees on the island of Cyprus.

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2.8 Supplementary Materials

The list below is of species reported from Cyprus, but which are of uncertain occurrence on the island or have been excluded recently. The list:

- includes species whose taxonomic status is unclear, often due to incomplete understanding of species boundaries, identification criteria, and distributions of cryptic species (e.g., Pauly et al., 2015; 2019).
- includes species whose presence is based on records not corroborated by further evidence from collections or the most current and reliable literature.
- reports species reports of taxa that are, as currently delimited, not expected to occur in the eastern Mediterranean region.
- reports a morphospecies that may be new to science.

The intent of this section is to document nominal taxa that might potentially occur on Cyprus but cannot be included on the main list without further verification and those that have been plausibly reported by recent authors but are now regarded as pertaining to different, related forms. We do not list all trivial nomenclatural or taxonomic updates nor all clearly erroneous citations.

Georghiou's checklist Georghiou (1977) recorded a number of nominal taxa from Cyprus, in addition to those currently accepted for the island. Several names cited are mis-cited and cannot be reliably interpreted (e.g., "*Eucera simillima* Sm." and "*Megachile konowi* Fr.") and several species that can be interpreted unambiguously are not known in the vicinity of Cyprus (cf. Nieto et al., 2014; Scheuchl and Willner, 2016; Ascher and Pickering, 2018). Taxa cited by Georghiou that we reject as plausibly occurring on Cyprus including the following: *Anthophora garrula* Rossi [= *Amegilla garrula* (Rossi, 1790)], *Andrena florea* Fabricius, 1793, *Anthophora pubescens* (Fabricius, 1781), *Tetralonia radozkowsii* Morawitz [= *Eucera alborufa* (Radoszkowski, 1871)], *Halictus rubicundus* (Christ, 1791), *Halictus sexcinctus* (Fabricius, 1775), and *Halictus tumulorum* (Linnaeus, 1758).

Andrena (Ulandrena) abbreviata Dours, 1873

Andrena abbreviata sensu stricto does not occur on Cyprus, whereas the related taxon *polemediana*, now considered a separate species, occurs on Cyprus.

References: Pittioni (1950).

Distribution: Southern Europe (Greece), Eastern Europe.

Andrena (Parandrenella) bicarinata Morawitz, 1876

Gusenleitner and Schwarz (2002) revised the species and documented its history of misinterpretations. As presently delimited, this is a species of Central Asia and does not occur on Cyprus.

References: Mavromoustakis (1957).

Mavromoustakis localities: Limassol, Cherkos, Pissouri.

Distribution: Central Asia (Tajikistan, Turkmenistan).

Andrena (Chlorandrena) taraxaci Giraud, 1861

Cited for Cyprus by Scheuchl and Willner (2016) but Schwenninger (2015) recorded only the related species *A. orientana* and *A. crepidis* from Cyprus not *A. taraxaci sensu stricto*.

Bombus (Megabombus) argillaceus (Scopoli, 1763)

Atlas Hymenoptera <http://www.atlashymenoptera.net/page.asp?id=169> maps do not include Cyprus records for this species, but the text of the species page states, “*B. argillaceus* is found throughout the Balkanic [sic] Peninsula, in Creta [sic], Cyprus, Turkey, Caucasus, Transcaucasia and N. Iran, including the Kopet-Dag.”

Ceratina (Euceratina) nigrolabiata Friese, 1896

M. Terzo (in litt.) comments that all records attributable to “*C. nigrolabiata*” in Cyprus correctly refer instead to an undescribed species of *Ceratina (Euceratina)*.

References: Mavromoustakis (1949 [“1948”]); Pittioni (1950).

Mavromoustakis localities: Prodromos, Mandria, Evdhimou River.

Distribution: Western Europe (France, Switzerland, Austria), Southern Europe, Eastern Europe, Western Asia (Turkey).

Colletes hederæ Schmidt and Westrich, 1993

Recorded from Cyprus on an online species page, but this apparently pertains to *Colletes brevigena* ("<https://www.bwars.com/bee/colletidae/colletes-hederæ>"). Species in the complex are difficult to distinguish, even with reference to DNA barcodes, so further research is required (M. Kuhlmann, in litt.).

Eucera (Eucera) nigrescens Pérez, 1879

Reports of this species pertain to *E. cypria*.

References: Scheuchl and Willner (2016).

Distribution: Cyprus, Western Europe, Southern Europe, Eastern Europe, Western Asia (Turkey, Jordan), Southern Asia (Iran).

Halictus (Halictus) fulvipes (Klug, 1817)

No firm evidence beyond this single report of Pittioni to suggest this West Mediterranean species is present in Cyprus, and the presence there was explicitly rejected by Scheuchl and Willner (2016) and Ebmer (2014).

References: Pittioni (1950).

Distribution: Western Europe (France), Southern Europe, Eastern Europe (Hungary).

Halictus (Vestitohalictus) pici Perez, 1895

Reported from Cyprus by Pittioni but not subsequently confirmed (Ebmer, 2014).

References: Pittioni (1950).

Distribution: Northern Africa, Western Asia (Israel).

Halictus (Halictus) senilis (Eversmann, 1852)

The record pertains to *H. subsenilis* (Ebmer 2014; Kuhlmann et al. 2015).

References: Mavromoustakis (1949 [“1948”]); Pittioni (1950); Mavromoustakis (1957a).

Mavromoustakis localities: Ayia Phyla, Famagusta, Amathus, Episkopi Forest, Ayia Varvara (Stavrovouni), Pernera coast (Paralimni), Near Nicosia.

Distribution: Cyprus, Southern Europe (Spain (Canary Islands)), Eastern Europe (Russian Federation), Northern Africa (Tunisia, Egypt), Western Asia (Israel, Iraq), Central Asia, Southern Asia (Pakistan), Eastern Asia (China, Mongolia).

Halictus (Vestitohalictus) vestitus Lepeletier, 1841

Halictus vestitus has been applied historically to several species of subgenus *Vestitohalictus sensu lato*, with material from Cyprus likely referable to misidentified *H. pollinosus*, *H. cypricus* or *H. pulvereus*.

References: Mavromoustakis (1949 [“1948”]); Pittioni (1950); Georghiou (1977).

Mavromoustakis localities: Limassol.

Distribution: Iberian Peninsula and the Balearic Islands.

Hylaeus (Dentigera) brevicornis Nylander, 1852

Unverified from Cyprus. The *brevicornis*-group within the subgenus *Dentigera* contains many near cryptic species, current knowledge suggests that historic records are misinterpretations of species like *Hylaeus imparilis*, *Hylaeus kahri* and *Hylaeus intermedius*.

References: Alfken (1928); Mavromoustakis (1949 [“1948”]).

Mavromoustakis localities: Limassol, Mesayitonia, Cherkes, Zakaki, Asomatos, Pernera coast of Paralimni.

Distribution: Cyprus, Widespread in Europe, Northern Africa (Morocco), Southern Asia (Iran).

Hylaeus (Paraprosopis) pictipes Nylander, 1852

References: Warncke (1972a).

Distribution: Cyprus, Southern Europe, Western Asia (Turkey, Israel).

Hylaeus (Spatulariella) punctatus (Brullé, 1832)

A very abundant and variable species distributed widely across the Mediterranean Region. In the Eastern Mediterranean its distribution overlaps with later-described sibling species. The historic records very likely refer to other species within the subgenus *Spatulariella* that have been described during the 20th century, like *Hylaeus cypricola* or *Hylaeus longimaculus*.

References: Alfken (1928); Mavromoustakis (1949 [“1948”]).

Mavromoustakis localities: Cherkes, Yermasoyia, Finikaria River, Mesapotamos.

Distribution: Cyprus, Widespread in Europe. Introduced to North and South America.

Hylaeus (Prosopis) purpurissatus (Vachal, 1895)

There is no reliable evidence to support the presence of this west-Mediterranean taxon in Cyprus. Confirming its presence as a Cyprus species would require DNA work and a major revision of the *Hylaeus gibbus* group.

References: Pittioni (1950).

Distribution: North Africa (Algeria), with a recent report from New York City in the United States where adventive (Ascher and Pickering, 2018, based on an identification by H. Dathe).

Hylaeus (Paraprosopis) sinuatus (Schenck, 1853)

The species delimitation needs further study.

References: Scheuchl and Willner (2016).

Distribution: Widespread in Europe, Western Asia, Central Asia (Iran).

Lasioglossum (Lasioglossum) bischoffi (Blüthgen, 1931)

Ebmer (2014) does not report this species for Cyprus. The record refers to the later described *L. aphrodite*.

References: Ebmer (1988).

Distribution: Cyprus, Southern Europe (Croatia, Serbia, Greece), Eastern Europe (Hungary), Western Asia (Turkey, Israel).

Lasioglossum (Hemihalictus) crassepunctatum (Blüthgen, 1923)

References: Ebmer (2000); Scheuchl and Willner (2016). However, not recorded in Ebmer (2014) and thus regarded as uncertain here.

Distribution: Western Europe (France, Austria), Southern Europe, Eastern Europe.

Lasioglossum (Dialictus) nitidulum (Fabricius, 1804)

Not recorded by Ebmer (2014) so regarded here as uncertain.

References: Scheuchl and Willner (2016).

Distribution: Widespread in Europe.

Lasioglossum (Hemihalictus) villosulum (Kirby, 1802)

Integrative taxonomy resuscitated two cryptic species in this complex including *L. medinai*, the form verified to occur on Cyprus. *Lasioglossum villosulum villosulum sensu stricto* has been confirmed from Greece including Crete and from Israel, so should be looked for on Cyprus, but there are no verified records (Pauly et al., 2019).

References: Mavromoustakis (1949 [“1948”], 1954); Ebmer (2014).

Distribution: Widespread in Europe, Northern Africa, Central Asia, Eastern Asia.

Megachile (Eutricharaea) fertoni Pérez, 1895

Part of a poorly known complex where no author has correctly identified the species, so this name is applied provisionally to material cited below. Males have been confused with *M. apicalis* and females with *semicircularis* Zanden and other species.

References: none.

Material examined: Paphos District: 15 km SE Paphos Kouklia, 34.72°N, 32.55°E, 20.VI.2013, (2♂); 20 km NNW Paphos, Lara Beach, 34.94°N, 32.31°E, 20.VI.2013, (1♀); 6 km NE Polis, beach, 35.06°N, 32.46°E, 20.VI.2013, (1♀), all records C. Schmid-Egger leg., C. Praz det.

Distribution: Cyprus, Western Europe (France), Southern Europe (Spain, Italy), Northern Africa.

***Megachile (Chalicodoma) hungarica* Mocsáry, 1877**

This taxon is probably not present in Cyprus. The taxon was described as *Chalicodoma fallax* from Cyprus. It is very likely a synonym of *Megachile roeweri* or *Megachile roeweri akrotirica* if accepting a narrow species concept. A broader species concept of the lefebvrei group (Praz, 2017) would result in other senior synonyms to be the valid species.

Type Locality-Country: Cyprus, Keryneia: J.D. Alfken det.

References: Alfken (1933).

Distribution: Cyprus, Southern Europe (Greece), Eastern Europe (Hungary, Bulgaria, Slovakia).

***Nomada arrogans* Schmiedeknecht, 1882**

Not included in Smit 2018. Excluded from the main list pending re-evaluation of material in the Mavromoustakis collection.

References: Mavromoustakis (1957).

Mavromoustakis localities: Pera Pedi.

Distribution: Southern Europe (Greece), Eastern Europe (Romania, Ukraine), Western Asia (from Turkey to Israel).

Nomada mauritanica Lepeletier, 1841

The only record is from Mavromoustakis (1949 [“1948”]) as “*N. mauretanic* var. *manni* Friese” [the correct author of this taxon is Morawitz]. This taxon is now considered to be a synonym of *Nomada numida* (Smit, 2018), or a subspecies of this.

References: Mavromoustakis (1949 [“1948”]).

Distribution: Cyprus, Western Europe (Switzerland, Germany), Southern Europe, Eastern Europe (Czech Republic), Northern Africa, Western Asia, Central Asia (Turkmenistan).

Osmia (Helicosmia) aurulenta Panzer, 1799

Not reported for Cyprus in the Palaearctic Osmiine bee checklist [Müller A (2018)].

References: Scheuchl and Willner (2016), where reported as a doubtful record.

Distribution: Widespread in Europe and Western Asia.

Pseudapis (Nomiapis) fugax (Morawitz, 1877)

This species has been erroneously recorded from Cyprus because of a mis-identification (Ebmer, 2014).

References: Pittioni (1950).

Distribution: Cyprus, Northern Africa (Egypt), Western Asia (Turkey), Central Asia, Southern Asia (Iran).

Pseudapis (Nomiapis) monstrosa (Costa, 1861)

Reports of this species pertain to *P. valga* (Ebmer, 2014).

References: Mavromoustakis (1949 [“1948”]).

Mavromoustakis localities: Polemedia Hills.

Distribution: Cyprus, Southern Europe, Eastern Europe (Bulgaria, Ukraine), Western Asia (Turkey, Israel, Azerbaijan).

Stelis (Stelis) phaeoptera (Kirby, 1802)

Warncke (1992) recorded only subspecies *murina* (treated here as a species following Kasperek, 2015). Kasperek (2015) noted regarding *S. murina*, “It is not clear whether, and if so, its range overlaps with that of *S. phaeoptera*” and for this reason we treat the latter’s occurrence as Cyprus as uncertain (despite being mapped for Cyprus in that revision).

References: Popov (1944); Mavromoustakis (1949 [“1948”], 1957a).

Distribution: Cyprus, Widespread in Europe.

Thyreus scutellaris (Fabricius, 1781)

Reported by Pittioni (1950) under its junior synonym *Thyreus crassicornis*. No further records or literature reports of this species for Cyprus are known and its status there is doubtful. Lieftinck (1968) did not record it from Cyprus but noted a potentially wide range in Western Asia and the eastern Mediterranean.

References: Pittioni (1950).

Distribution: Southern Europe (Croatia), Western and Central Asia, Eastern Asia (China).

Table S1. Acronyms of museum / personal collections where specimens are located.

AMNH: American Museum of Natural History, United States
AWE: Andreas Werner Ebmer private collection, Austria
DAAN: Department of Agriculture, Nicosia, Cyprus
ETHZ: Eidgenössische Technische Hochschule, Zürich, Switzerland
FSAG: Zoologie Generale et Appliquée, Belgium
KW: Klaus Warncke private collection formerly in Germany now in Austria
MFNB: Museo Friulano di Storia Naturale, Italy

MNHN: Muséum National d'Histoire Naturelle, Paris, France
MSAA: Maximilian Schwarz private collection in Ansfelden (near Linz) in Austria
MZHF: University of Helsinki, Zoological Museum, Finland
NHMUK: Natural History Museum, UK
OLML: Oberösterreichisches Landesmuseum, Linz, Austria
SMNS: Staatliches Museum für Naturkunde, Germany
UAEG: University of the Aegean, Lesvos, Greece
ZISP: Zoological Institute, Russian Academy of Sciences, Russia

Table S2. Grouping of countries into geographic regions based on United Nations, Department of Economic and Social Affairs, Population Division (2017) (ST/ESA/SER.A/408).

Western Europe: Austria, Belgium, France, Germany, Liechtenstein, Luxembourg, Monaco, Netherlands, Switzerland.
Southern Europe: Albania, Andorra, Bosnia and Herzegovina, Croatia, Gibraltar, Greece, Holy See, Italy, Malta, Portugal, San Marino, Slovenia, Spain, The former Yugoslav Republic of Macedonia, Yugoslavia.
Northern Europe: Channel Islands, Denmark, Estonia, Faeroe Islands, Finland, Iceland, Ireland, Isle of Man, Latvia, Lithuania, Norway, Sweden, United Kingdom of Great Britain and Northern Ireland.
Eastern Europe: Belarus, Bulgaria, Czech Republic, Hungary, Poland, Republic of Moldova, Romania, Russian Federation, Slovakia, Ukraine.
Western Africa: Benin, Burkina Faso, Cape Verde, Cote d'Ivoire, Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Mauritania, Niger, Nigeria, St. Helena, Senegal, Sierra Leone, Togo.
Southern Africa: Botswana, Lesotho, Namibia, South Africa, Swaziland.
Northern Africa: Algeria, Egypt, Libya, Morocco, Sudan, Tunisia, Western Sahara.

Eastern Africa: Burundi, Comoros, Djibouti, Eritrea, Ethiopia, Kenya, Madagascar, Malawi, Mauritius, Mozambique, Reunion, Rwanda, Seychelles, Somalia, Uganda, United Republic of Tanzania, Zambia, Zimbabwe.
Western Asia: Armenia, Azerbaijan, Bahrain, Cyprus, Georgia, Iraq, Israel, Jordan, Kuwait, Lebanon, Occupied Palestinian Territory, Oman, Qatar, Saudi Arabia, Syrian Arab Republic, Turkey, United Arab Emirates, Yemen.
South-eastern Asia: Brunei Darussalam, Cambodia, East Timor, Indonesia, Lao People's Republic, Malaysia, Myanmar, Philippines, Singapore, Thailand, Viet Nam.
Central Asia: Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, Uzbekistan.
Southern Asia: Afghanistan, Bangladesh, Bhutan, India, Iran, Maldives, Nepal, Pakistan, Sri Lanka.
Eastern Asia: China, Hong Kong SAR, Democratic People's Republic of Korea, Japan, Mongolia, Republic of Korea.

Table S3. Geographic coordinates for type specimens from Cyprus (see Fig. 1 for the map). The first column indicates whether the nomenclature is currently valid (V), or whether the taxon has been synonymised (S). Taxa described from Cyprus as subspecies are reported as such to indicate the potentially interesting variation within the taxon. See main text for the species name under which synonymised specimens were described. Coordinates for type specimens do not represent exact locations, but the general area of the location from which the species was described, as no geographic coordinates were recorded at the time of description.

Species	V/ S	Geographic coordinates	
<i>Ammobates (Ammobates) biastoides globosus</i>	V	34.65°N	32.975°E
<i>Ammobates (Ammobates) mavromoustakisi</i> <i>mavromoustakisi</i>	V	34.65635°N	32.98748°E
<i>Ammobates (Ammobates) mavromoustakisi</i> <i>mavromoustakisi</i>	V	34.72075°N	33.05327°E
<i>Andrena (Aciandrena) tenuiformis</i>	V	34.9364°N	32.8636°E
<i>Andrena (Aenandrena) chaetogastra</i>	V	34.9364°N	32.8636°E
<i>Andrena (Chlorandrena) crepidis</i>	V	34.904°N	32.761°E
<i>Andrena (Chlorandrena) panurgimorpha</i>	V	34.66839°N	33.03252°E
<i>Andrena (Chrysandrena) merula</i>	V	34.9816°N	32.9712°E
<i>Andrena (Cordandrena) cypria</i>	V	34.9364°N	32.8636°E
<i>Andrena (Margandrena) hyacinthina</i>	V	34.7182°N	33.08788°E
<i>Andrena (Margandrena) sibthorpi</i>	V	34.7134°N	32.9812°E
<i>Andrena (Micrandrena) cervina</i>	V	34.66839°N	33.03252°E
<i>Andrena (Micrandrena) lindbergella</i>	V	34.9364°N	32.8636°E
<i>Andrena (Notandrena) ungeri</i>	V	34.66395°N	32.99979°E

<i>Andrena (Plastandrena) cypricola</i>	V	34.9059°N	32.9431°E
<i>Andrena (Plastandrena) oligotricha</i>	V	34.859444°N	32.876111°E
<i>Andrena (Poecilandrena) limassolica</i>	V	34.66839°N	33.03252°E
<i>Andrena (Ptilandrena) kornosica</i>	V	35.33253°N	33.11675°E
<i>Andrena (Troandrena) saettana</i>	V	34.8708333°N	32.9166667° E
<i>Andrena (Truncandrena) pareklisiae</i>	V	34.82444°N	32.92083°E
<i>Andrena (Ulandrena) neocyprica</i>	V	34.66839°N	33.03252°E
<i>Andrena (Ulandrena) polemediana</i>	V	34.9816°N	32.9712°E
<i>Andrena (Truncandrena) rufomaculata paramythensis</i>	V	34.757°N	32.972°E
<i>Anthidiellum (Anthidiellum) brevisculum troodicum</i>	V	34.908°N	32.866°E
<i>Anthidium (Proanthidium) undulatum holozonium</i>	V	34.66839°N	33.03252°E
<i>Anthophora (Lophanthophora) rutilans</i>	V	35.166667°N	33.366667°E
<i>Ceratina (Euceratina) cyprica</i>	V	34.858°N	32.873°E
<i>Chelostoma (Chelostoma) comosum</i>	V	34.8775°N	32.8386°E
<i>Chelostoma (Chelostoma) diodon cypricum</i>	V	34.8025°N	32.998056°E
<i>Colletes cypricus</i>	V	34.984°N	32.741°E
<i>Dufourea (Cyprirorophites) cypria</i>	V	35.125°N	33.941667°E
<i>Eucera (Eucera) cypria</i>	V	34.66839°N	33.03252°E
<i>Eucera (Synhalonia) mavromoustakisi</i>	V	34.82444°N	32.92083°E
<i>Halictus (Halictus) nicosiae</i>	V	35.166667°N	33.366667°E
<i>Halictus (Seladonia) cypricus</i>	V	34.66839°N	33.03252°E

<i>Halictus (Seladonia) pollinosus limissicus</i>	V	34.66839°N	33.03252°E
<i>Heriades (Michenerella) punctulifera troodica</i>	V	34.9234°N	32.8833°E
<i>Hoplitis (Alcidamea) limassolica</i>	V	34.66839°N	33.03252°E
<i>Hoplitis (Anthocopa) cypriaca</i>	V	34.66839°N	33.03252°E
<i>Hoplitis (Hoplitis) holmboei</i>	V	34.7182°N	33.08788°E
<i>Hoplitis (Anthocopa) yermasoyiae yermasoyiae</i>	V	34.7182°N	33.08788°E
<i>Lasioglossum (Dialictus) akroundicum</i>	V	34.768889°N	33.079444°E
<i>Lasioglossum (Lasioglossum) aphrodite</i>	V	34.9045°N	32.86849°E
<i>Lasioglossum (Hemihalictus) laevidorsum troodicum</i>	V	34.9234°N	32.8833°E
<i>Lasioglossum (Lasioglossum) pallens kantarae</i>	V	35.4064°N	33.9233°E
<i>Lasioglossum (Sphecodogastra) tricinctum lonicerae</i>	V	34.9234°N	32.8833°E
<i>Megachile (Chalicodoma) cypricola</i>	V	34.7198°N	33.0195°E
<i>Megachile (Eutricharaea) posti</i>	V	34.69944°N	32.996944°E
<i>Megachile (Creightonella) albisecta cyprica</i>	V	34.66839°N	33.03252°E
<i>Megachile (Chalicodoma) roeweri akrotirica</i>	V	34.5843°N	32.9676°E
<i>Nomada cherkesiana</i>	V	34.65°N	32.975°E
<i>Nomada cypria</i>	V	34.65°N	32.975°E
<i>Nomada cypricola</i>	V	34.6563°N	33.0029°E
<i>Nomada cypricola</i>	V	34.66839°N	33.03252°E
<i>Nomada gageae</i>	V	34.66839°N	33.03252°E

<i>Nomada kornosica</i>	V	35.33253°N	33.11675°E
<i>Nomada limassolica</i>	V	34.66839°N	33.03252°E
<i>Nomada nesiotica</i>	V	34.761667°N	33.026944°E
<i>Nomada polemediana</i>	V	34.66839°N	33.03252°E
<i>Nomada pyrgosica</i>	V	35.61877°N	34.38956°E
<i>Nomada teunisseni</i>	V	35.3741°N	33.7558°E
<i>Nomada stigma cypricola</i>	V	34.6563°N	33.0029°E
<i>Osmia (Pyrosmia) amathusica</i>	V	34.7125°N	33.1419°E
<i>Osmia (Osmia) cornuta neoregaena</i>	V	34.8708333°N	32.9166667° E
<i>Osmia (Pyrosmia) viridana nicosiana</i>	V	34.71947°N	33.01962°E
<i>Sphecodes croaticus cypricus</i>	V	34.66839°N	33.03252°E
<i>Aglaopis tridentata</i>	S	34.7134°N	32.9812°E
<i>Andrena (Brachyandrena) colletiformis</i>	S	34.6978°N	32.592°E
<i>Andrena (Cryptandrena) ventricosa</i>	S	34.65°N	32.975°E
<i>Andrena (Euandrena) bicolor</i>	S	34.66839°N	33.03252°E
<i>Andrena (Melanapis) fuscosa</i>	S	35.166667°N	33.366667°E
<i>Andrena (Melandrena) limata</i>	S	35.166667°N	33.366667°E
<i>Andrena (Melandrena) morio</i>	S	34.66839°N	33.03252°E
<i>Andrena (Melandrena) thoracica</i>	S	34.66839°N	33.03252°E
<i>Andrena (Poliandrena) pyrozonata</i>	S	34.859444°N	32.876111°E
<i>Andrena (Suandrena) aegypticola</i>	S	35.125°N	33.941667°E
<i>Andrena (Taeniandrena) similis</i>	S	34.66839°N	33.03252°E
<i>Andrena (Truncandrena) canaeae</i>	S	34.76666°N	32.46666°E
<i>Anthidium (Anthidium) florentinum</i>	S	34.86777°N	32.69027°E

<i>Anthophora (Anthophora) plumipes</i>	S	34.7125°N	33.1419°E
<i>Chiasmognathus orientanus</i>	S	34.7182°N	33.08788°E
<i>Coelioxys (Allocoelioxys) acanthopyga</i>	S	34.65°N	32.975°E
<i>Dioxys pumilus</i>	S	34.66839°N	33.03252°E
<i>Eoanthidium (Eoanthidium) insulare</i>	S	34.66839°N	33.03252°E
<i>Eucera (Synhalonia) zeta</i>	S	34.9075°N	32.989444°E
<i>Hoplitis (Anthocopa) fasciculata</i>	S	34.7182°N	33.08788°E
<i>Hylaeus (Dentigera) imparilis</i>	S	34.67513°N	32.8826°E
<i>Hylaeus (Dentigera) imparilis</i>	S	34.72231°N	33.08497°E
<i>Hylaeus (Dentigera) rubicola</i>	S	34.7182°N	33.08788°E
<i>Hylaeus (Paraprosopis) lineolatus</i>	S	34.984°N	32.741°E
<i>Hylaeus (Prosopis) meridionalis</i>	S	34.65°N	32.975°E
<i>Hylaeus (Spatulariella) cypricola</i>	S	34.66839°N	33.03252°E
<i>Lasioglossum (Lasioglossum) kotschyi</i>	S	34.9045°N	32.86849°E
<i>Megachile (Anodonteutricharaea) troodica</i>	S	34.9234°N	32.8833°E
<i>Megachile (Megachile) centuncularis</i>	S	34.66839°N	33.03252°E
<i>Megachile (Megachile) melanopyga</i>	S	34.9473°N	32.9284°E
<i>Melecta (Melecta) mundula</i>	S	34.699444°N	32.996944°E
<i>Osmia (Pyrosmia) saxicola</i>	S	34.859444°N	32.876111°E
<i>Sphecodes (Sphecodes) alternatus</i>	S	34.76666°N	32.46666°E
<i>Sphecodes (Sphecodes) gibbus</i>	S	34.67513°N	32.8826°E
<i>Sphecodes (Sphecodes) monilicornis</i>	S	34.9364°N	32.8636°E
<i>Tarsalia ancyliformis</i>	S	34.7559°N	32.4516°E
<i>Tarsalia hirtipes</i>	S	34.65°N	32.975°E

Table S4: Geographic coordinates for unpublished records of bee species (see Fig. 1 for the map).

Species	Geographic coordinates	
<i>Eucera (Hetereucera) bidentata</i>	34.963264°N	34.066211°E
<i>Amegilla (Amegilla) quadrifasciata</i>	34.9333°N	32.9004°E
<i>Amegilla (Zebramegilla) albigena</i>	34.9333°N	32.9004°E
<i>Amegilla (Zebramegilla) albigena</i>	34.992°N	32.9082°E
<i>Andrena (Aciandrena) aciculata</i>	34.597305°N	32.984521°E
<i>Andrena (Aciandrena) aciculata</i>	34.600657°N	32.971419°E
<i>Andrena (Aciandrena) aciculata</i>	34.71178°N	33.004775°E
<i>Andrena (Aciandrena) aciculata</i>	34.764269°N	32.757736°E
<i>Andrena (Aciandrena) lamiana</i>	34.741952°N	32.734845°E
<i>Andrena (Chlorandrena) crepidis</i>	34.93°N	32.78°E
<i>Andrena (Chlorandrena) crepidis</i>	34.918°N	32.9472°E
<i>Andrena (Chlorandrena) crepidis</i>	34.992°N	32.9082°E
<i>Andrena (Chlorandrena) gordia</i>	34.883435°N	32.750988°E
<i>Andrena (Chlorandrena) orientana</i>	34.600657°N	32.971419°E
<i>Andrena (Chlorandrena) orientana</i>	34.748126°N	32.732248°E
<i>Andrena (Chlorandrena) panurgimorpha</i>	34.764269°N	32.757736°E
<i>Andrena (Chrysandrena) hesperia</i>	34.600657°N	32.971419°E
<i>Andrena (Chrysandrena) hesperia</i>	34.918°N	32.9472°E
<i>Andrena (Chrysandrena) hesperia</i>	34.656698°N	32.773339°E
<i>Andrena (Cordandrena) torda</i>	34.963264°N	34.066211°E
<i>Andrena (Cryptandrena) brumanensis</i>	34.755799°N	33.096194°E
<i>Andrena (Cryptandrena) brumanensis</i>	34.745537°N	32.73385°E

<i>Andrena (Cryptandrena) monacha</i>	34.755799°N	33.096194°E
<i>Andrena (Euandrena) bicolor</i>	34.9317°N	32.8664°E
<i>Andrena (Holandrena) variabilis</i>	34.764269°N	32.757736°E
<i>Andrena (Holandrena) variabilis</i>	34.9333°N	32.9004°E
<i>Andrena (Margandrena) hyacinthina</i>	34.755799°N	33.096194°E
<i>Andrena (Melanapis) fuscosa</i>	34.963264°N	34.066211°E
<i>Andrena (Melandrena) elmaria</i>	34.963264°N	34.066211°E
<i>Andrena (Melandrena) elmaria</i>	34.755799°N	33.096194°E
<i>Andrena (Melandrena) limata</i>	34.600657°N	32.971419°E
<i>Andrena (Melandrena) morio</i>	34.963264°N	34.066211°E
<i>Andrena (Melandrena) morio</i>	34.71178°N	33.004775°E
<i>Andrena (Melandrena) morio</i>	34.992°N	32.9082°E
<i>Andrena (Melandrena) nigroaenea</i>	34.9317°N	32.8664°E
<i>Andrena (Melandrena) nigroaenea</i>	34.9095°N	32.8971°E
<i>Andrena (Melandrena) nigroaenea</i>	34.918°N	32.9472°E
<i>Andrena (Melandrena) nigroaenea</i>	34.9333°N	32.9004°E
<i>Andrena (Melandrena) nigroaenea</i>	34.992°N	32.9082°E
<i>Andrena (Micrandrena) alfkenelloides</i>	34.764269°N	32.757736°E
<i>Andrena (Micrandrena) alfkenelloides</i>	34.745537°N	32.73385°E
<i>Andrena (Micrandrena) alfkenelloides</i>	34.677579°N	32.722066°E
<i>Andrena (Micrandrena) cervina</i>	34.963264°N	34.066211°E
<i>Andrena (Micrandrena) cervina</i>	34.748126°N	32.732248°E
<i>Andrena (Parandrenella) nisoria</i>	34.755799°N	33.096194°E
<i>Andrena (Plastandrena) cypricola</i>	34.992°N	32.9082°E
<i>Andrena (Plastandrena) cypricola</i>	35.0755°N	32.9164°E

<i>Andrena (Plastandrena) oligotricha</i>	34.748126°N	32.732248°E
<i>Andrena (Plastandrena) oligotricha</i>	34.883435°N	32.750988°E
<i>Andrena (Ptilandrena) glidia</i>	34.9333°N	32.9004°E
<i>Andrena (Ptilandrena) glidia</i>	34.992°N	32.9082°E
<i>Andrena (Ptilandrena) glidia</i> Warncke	34.9317°N	32.8664°E
<i>Andrena (Ptilandrena) vetula</i>	34.963264°N	34.066211°E
<i>Andrena (Ptilandrena) vetula</i>	34.764269°N	32.757736°E
<i>Andrena (Ptilandrena) vetula</i>	34.73663°N	32.732715°E
<i>Andrena (Ptilandrena) vetula</i>	34.741952°N	32.734845°E
<i>Andrena (Ptilandrena) vetula</i>	34.723986°N	32.736892°E
<i>Andrena (Ptilandrena) vetula</i>	34.661805°N	32.804261°E
<i>Andrena (Ptilandrena) vetula</i>	34.883435°N	32.750988°E
<i>Andrena (Simandrena) combinata</i>	34.9095°N	32.8971°E
<i>Andrena (Taeniandrena) leucopsis</i>	34.9333°N	32.9004°E
<i>Andrena (Taeniandrena) ovatula</i>	34.755799°N	33.096194°E
<i>Andrena (Taeniandrena) similis</i>	34.755799°N	33.096194°E
<i>Andrena (Taeniandrena) similis</i>	34.883435°N	32.750988°E
<i>Andrena (Truncandrena) truncatilabris</i>	34.71178°N	33.004775°E
<i>Andrena (Truncandrena) truncatilabris</i>	34.597305°N	32.984521°E
<i>Andrena (Truncandrena) truncatilabris</i>	34.755799°N	33.096194°E
<i>Andrena (Truncandrena) truncatilabris</i>	34.883435°N	32.750988°E
<i>Andrena (Ulandrena) neocyprica</i>	34.748126°N	32.732248°E
<i>Andrena (Ulandrena) polemediana</i>	34.741952°N	32.734845°E
<i>Andrena (Zonandrena) flavipes</i>	34.764269°N	32.757736°E
<i>Andrena (Zonandrena) flavipes</i>	34.9317°N	32.8664°E

<i>Andrena (Zonandrena) flavipes</i>	34.9095°N	32.8971°E
<i>Andrena (Zonandrena) flavipes</i>	34.918°N	32.9472°E
<i>Andrena (Zonandrena) flavipes</i>	34.9333°N	32.9004°E
<i>Andrena (Zonandrena) flavipes</i>	34.755799°N	33.096194°E
<i>Andrena (Zonandrena) flavipes</i>	34.992°N	32.9082°E
<i>Andrena (Zonandrena) flavipes</i>	34.883435°N	32.750988°E
<i>Andrena (Zonandrena) flavipes</i>	34.729004°N	32.457544°E
<i>Anthidium (Anthidium) cingulatum</i>	34.670772°N	32.846923°E
<i>Anthidium (Anthidium) diadema</i>	34.670772°N	32.846923°E
<i>Anthophora (Anthophora) canescens</i>	34.7626°N	32.4108°E
<i>Anthophora (Anthophora) plumipes</i>	34.9095°N	32.8971°E
<i>Anthophora (Anthophora) plumipes</i>	34.992°N	32.9082°E
<i>Anthophora (Lophanthophora) rutilans</i>	34.7626°N	32.4108°E
<i>Anthophora (Pyganthophora) dalmatica</i>	34.9333°N	32.9004°E
<i>Anthophora (Pyganthophora) rubricrus</i>	34.7626°N	32.4108°E
<i>Bombus (Bombus) terrestris</i>	34.9095°N	32.8971°E
<i>Bombus (Bombus) terrestris</i>	34.9317°N	32.8664°E
<i>Bombus (Bombus) terrestris</i>	34.918°N	32.9472°E
<i>Bombus (Bombus) terrestris</i>	34.9333°N	32.9004°E
<i>Bombus (Bombus) terrestris</i>	34.656698°N	32.773339°E
<i>Bombus (Bombus) terrestris</i>	34.670772°N	32.846923°E
<i>Bombus (Bombus) terrestris</i>	34.93°N	32.86°E
<i>Bombus (Bombus) terrestris</i>	34.992°N	32.9082°E
<i>Bombus (Bombus) terrestris</i>	35.0755°N	32.9164°E
<i>Ceratina (Euceratina) mandibularis</i>	34.729004°N	32.457544°E

<i>Cealalictus (Cealalictus) variegatus</i>	34.731233°N	33.343487°E
<i>Cealalictus (Cealalictus) variegatus</i>	34.729004°N	32.457544°E
<i>Cealalictus (Cealalictus) variegatus</i>	35.037305°N	32.391073°E
<i>Chelostoma (Chelostoma) comosum</i>	34.73663°N	32.732715°E
<i>Chelostoma (Chelostoma) diodon</i>	34.764269°N	32.757736°E
<i>Coelioxys (Allocoelioxys) afer</i>	34.93°N	32.86°E
<i>Colletes brevigena</i>	35.05519°N	33.814011°E
<i>Colletes brevigena</i>	34.731233°N	33.343487°E
<i>Colletes brevigena</i>	35 00.598°N	33 35.041°E
<i>Colletes brevigena</i>	34.746277°N	33.384472°E
<i>Colletes brevigena</i>	34.77458°N	33.448023°E
<i>Colletes brevigena</i>	34.600657°N	32.971419°E
<i>Colletes brevigena</i>	34.9317°N	32.8664°E
<i>Colletes brevigena</i>	34.9095°N	32.8971°E
<i>Colletes brevigena</i>	34.745849°N	33.083579°E
<i>Colletes brevigena</i>	34.745849°N	33.083579°E
<i>Colletes brevigena</i>	34.676011°N	32.794947°E
<i>Colletes brevigena</i>	34.743911°N	32.732439°E
<i>Colletes brevigena</i>	34.729369°N	32.738368°E
<i>Colletes brevigena</i>	34.742646°N	32.730431°E
<i>Colletes brevigena</i>	34 52.892°N	32 52.618°E
<i>Colletes brevigena</i>	34.992°N	32.9082°E
<i>Colletes brevigena</i>	34 57.711°N	32 49.733°E
<i>Colletes brevigena</i>	34 58.308°N	32 49.775°E
<i>Colletes brevigena</i>	35.053539°N	32.351197°E

<i>Colletes brevigena</i>	35.036538°N	32.373117°E
<i>Colletes brevigena</i>	35.037305°N	32.391073°E
<i>Colletes brevigena</i>	35.032203°N	32.413732°E
<i>Colletes brevigena</i>	34.810747°N	32.450907°E
<i>Colletes creticus</i>	34.670772°N	32.846923°E
<i>Colletes creticus</i>	34.654385°N	32.717924°E
<i>Colletes cyprius</i>	34.729369°N	32.738368°E
<i>Colletes cyprius</i>	34.72°N	32.55°E
<i>Colletes cyprius</i>	35.053539°N	32.351197°E
<i>Colletes cyprius</i>	35.036538°N	32.373117°E
<i>Colletes similis</i>	34.600657°N	32.971419°E
<i>Colletes similis</i>	35.053539°N	32.351197°E
<i>Eoanthidium (Eoanthidium) insulare</i>	34.9333°N	32.9004°E
<i>Eucera (Heterocera) bidentata</i>	35.05519°N	33.814011°E
<i>Eucera (Heterocera) bidentata</i>	35.334413°N	33.494187°E
<i>Eucera (Heterocera) bidentata</i>	34.653067°N	32.974233°E
<i>Eucera (Heterocera) bidentata</i>	34.65096°N	32.99091°E
<i>Eucera (Heterocera) bidentata</i>	34.628817°N	32.940667°E
<i>Eucera (Heterocera) caerulescens</i>	35.64°N	34.55°E
<i>Eucera (Heterocera) caerulescens</i>	35.63°N	34.5°E
<i>Eucera (Heterocera) caerulescens</i>	35.334413°N	33.494187°E
<i>Eucera (Eucera) cypria</i>	34.65096°N	32.99091°E
<i>Eucera (Eucera) dalmatica</i>	35.334413°N	33.494187°E
<i>Eucera (Eucera) dalmatica</i>	34.628817°N	32.940667°E
<i>Eucera (Eucera) dimidiata</i>	34.963264°N	34.066211°E

<i>Eucera (Eucera) dimidiata</i>	35.05519°N	33.814011°E
<i>Eucera (Eucera) dimidiata</i>	34.777521°N	33.33622°E
<i>Eucera (Eucera) dimidiata</i>	34.653067°N	32.974233°E
<i>Eucera (Eucera) dimidiata</i>	34.65096°N	32.99091°E
<i>Eucera (Eucera) dimidiata</i>	34.628817°N	32.940667°E
<i>Eucera (Eucera) dimidiata</i>	35.1688°N	33.367°E
<i>Eucera (Hetereucera) gaullei</i>	35.1688°N	33.367°E
<i>Eucera (Eucera) proxima</i>	35.64°N	34.55°E
<i>Eucera (Eucera) proxima</i>	35.334413°N	33.494187°E
<i>Eucera (Eucera) proxima</i>	34.9317°N	32.8664°E
<i>Eucera (Eucera) proxima</i>	34.628817°N	32.940667°E
<i>Eucera (Eucera) sulamita</i>	35.64°N	34.55°E
<i>Eucera (Eucera) sulamita</i>	35.63°N	34.5°E
<i>Eucera (Eucera) sulamita</i>	35.19°N	33.9°E
<i>Eucera (Hetereucera) syriaca</i>	35.64°N	34.55°E
<i>Eucera (Hetereucera) syriaca</i>	35.63°N	34.5°E
<i>Halictus (Halictus) asperulus</i>	34.72°N	32.55°E
<i>Halictus (Halictus) brunnescens</i>	34.918°N	32.9472°E
<i>Halictus (Halictus) brunnescens</i>	34.9333°N	32.9004°E
<i>Halictus (Halictus) brunnescens</i>	34.6°N	32.97°E
<i>Halictus (Halictus) brunnescens</i>	34.992°N	32.9082°E
<i>Halictus (Halictus) brunnescens</i>	35.0755°N	32.9164°E
<i>Halictus (Halictus) brunnescens</i>	34.94°N	32.31°E
<i>Halictus (Halictus) nicosiae</i>	34.764269°N	32.757736°E
<i>Halictus (Halictus) nicosiae</i>	34.723986°N	32.736892°E

<i>Halictus (Halictus) nicosiae</i>	34.745537°N	32.73385°E
<i>Halictus (Halictus) nicosiae</i>	34.748126°N	32.732248°E
<i>Halictus (Halictus) nicosiae</i>	34.93°N	32.86°E
<i>Halictus (Halictus) nicosiae</i>	34.72°N	32.55°E
<i>Halictus (Halictus) nicosiae</i>	34.85°N	32.4°E
<i>Halictus (Halictus) quadricinctus</i>	34.677579°N	32.722066°E
<i>Halictus (Halictus) quadricinctus</i>	34.748126°N	32.732248°E
<i>Halictus (Halictus) resurgens</i>	34.731233°N	33.343487°E
<i>Halictus (Halictus) resurgens</i>	34.628771°N	32.941031°E
<i>Halictus (Halictus) resurgens</i>	34.656698°N	32.773339°E
<i>Halictus (Halictus) resurgens</i>	34.73663°N	32.732715°E
<i>Halictus (Halictus) resurgens</i>	34.745537°N	32.73385°E
<i>Halictus (Halictus) resurgens</i>	34.748126°N	32.732248°E
<i>Halictus (Halictus) resurgens</i>	34.85°N	32.4°E
<i>Halictus (Halictus) resurgens</i>	34.94°N	32.31°E
<i>Halictus (Halictus) tetrazonianellus</i>	34.677579°N	32.722066°E
<i>Halictus (Halictus) tetrazonianellus</i>	34.72°N	32.55°E
<i>Halictus (Halictus) tetrazonianellus</i>	34.9°N	32.42°E
<i>Halictus (Halictus) tetrazonianellus</i>	34.94°N	32.31°E
<i>Halictus (Seladonia) cephalicus</i>	34.628771°N	32.941031°E
<i>Halictus (Seladonia) cephalicus</i>	34.764269°N	32.757736°E
<i>Halictus (Seladonia) cephalicus</i>	34.677579°N	32.722066°E
<i>Halictus (Seladonia) cephalicus</i>	34.93°N	32.86°E
<i>Halictus (Seladonia) cephalicus</i>	34.72°N	32.55°E
<i>Halictus (Seladonia) cephalicus</i>	35.03°N	32.37°E

<i>Halictus (Seladonia) cephalicus</i>	35.053539°N	32.351197°E
<i>Halictus (Seladonia) cephalicus</i>	34.85°N	32.4°E
<i>Halictus (Seladonia) cephalicus</i>	34.9°N	32.42°E
<i>Halictus (Seladonia) cephalicus</i>	35.06°N	32.46°E
<i>Halictus (Seladonia) cypricus</i>	34.72°N	32.55°E
<i>Halictus (Seladonia) phryganicus</i>	34.670772°N	32.846923°E
<i>Halictus (Seladonia) phryganicus</i>	34.6°N	32.97°E
<i>Halictus (Seladonia) phryganicus</i>	34.72°N	32.55°E
<i>Halictus (Seladonia) phryganicus</i>	35.03°N	32.37°E
<i>Halictus (Seladonia) phryganicus</i>	34.85°N	32.4°E
<i>Halictus (Seladonia) phryganicus</i>	35.06°N	32.46°E
<i>Halictus (Seladonia) pollinosus</i>	34.764269°N	32.757736°E
<i>Halictus (Seladonia) pollinosus</i>	34.918°N	32.9472°E
<i>Halictus (Seladonia) pollinosus</i>	34.729004°N	32.457544°E
<i>Halictus (Seladonia) pulvereus</i>	34.9°N	32.42°E
<i>Heriades (Heriades) rubicola</i>	34.628771°N	32.941031°E
<i>Heriades (Heriades) rubicola</i>	34.653067°N	32.974233°E
<i>Heriades (Heriades) rubicola</i>	34.6432°N	32.9952°E
<i>Heriades (Heriades) rubicola</i>	34.65096°N	32.99091°E
<i>Heriades (Heriades) rubicola</i>	34.628817°N	32.940667°E
<i>Heriades (Heriades) rubicola</i>	35.053539°N	32.351197°E
<i>Heriades (Heriades) rubicola</i>	34.94°N	32.31°E
<i>Heriades (Heriades) truncorum</i>	34.653067°N	32.974233°E
<i>Heriades (Heriades) truncorum</i>	34.886528°N	32.862465°E
<i>Heriades (Heriades) truncorum</i>	34.628817°N	32.940667°E

<i>Heriades (Heriades) truncorum</i>	35.053539°N	32.351197°E
<i>Heriades (Heriades) truncorum</i>	34.94°N	32.31°E
<i>Hoplitis (Alcidamea) acuticornis</i>	34.71178°N	33.004775°E
<i>Hoplitis (Alcidamea) acuticornis</i>	34.597305°N	32.984521°E
<i>Hoplitis (Alcidamea) limassolica</i>	34.71178°N	33.004775°E
<i>Hoplitis (Anthocopa) fasciculata</i>	34.72°N	32.55°E
<i>Hoplitis (Anthocopa) yermasoyiae</i>	34.764269°N	32.757736°E
<i>Hoplitis (Anthocopa) yermasoyiae</i>	34.755799°N	33.096194°E
<i>Hoplitis (Anthocopa) yermasoyiae</i>	34.745537°N	32.73385°E
<i>Hoplitis (Anthocopa) yermasoyiae</i>	34.677579°N	32.722066°E
<i>Hoplitis (Anthocopa) yermasoyiae</i>	34.992°N	32.9082°E
<i>Hoplitis (Anthocopa) yermasoyiae</i>	34.900977°N	32.776759°E
<i>Hoplitis (Hoplitis) annulata</i>	34.597305°N	32.984521°E
<i>Hoplitis (Hoplitis) annulata</i>	34.755799°N	33.096194°E
<i>Hoplitis (Hoplitis) annulata</i>	34.65096°N	32.99091°E
<i>Hoplitis (Hoplitis) annulata</i>	34.6°N	32.97°E
<i>Hoplitis (Hoplitis) annulata</i>	34.85°N	32.4°E
<i>Hoplitis (Hoplitis) annulata</i>	34.720825°N	32.551994°E
<i>Hoplitis (Hoplitis) annulata</i>	34.94°N	32.31°E
<i>Hoplitis (Hoplitis) holmboei</i>	34.9333°N	32.9004°E
<i>Hylaeus (Dentigera) imparilis</i>	34.731233°N	33.343487°E
<i>Hylaeus (Dentigera) imparilis</i>	34.764269°N	32.757736°E
<i>Hylaeus (Dentigera) imparilis</i>	34.743911°N	32.732439°E
<i>Hylaeus (Dentigera) imparilis</i>	34.677579°N	32.722066°E
<i>Hylaeus (Dentigera) imparilis</i>	34.727647°N	32.73462°E

<i>Hylaeus (Dentigera) imparilis</i>	34.883435°N	32.750988°E
<i>Hylaeus (Dentigera) imparilis</i>	34.720825°N	32.551994°E
<i>Hylaeus (Lambdopsis) scutellatus</i>	34.720825°N	32.551994°E
<i>Hylaeus (Paraprosopis) taeniolatus</i>	34.731233°N	33.343487°E
<i>Hylaeus (Paraprosopis) taeniolatus</i>	34.755799°N	33.096194°E
<i>Hylaeus (Paraprosopis) taeniolatus</i>	34.73663°N	32.732715°E
<i>Hylaeus (Paraprosopis) taeniolatus</i>	34.741952°N	32.734845°E
<i>Hylaeus (Paraprosopis) taeniolatus</i>	34.723986°N	32.736892°E
<i>Hylaeus (Paraprosopis) taeniolatus</i>	34.743911°N	32.732439°E
<i>Hylaeus (Paraprosopis) taeniolatus</i>	34.745537°N	32.73385°E
<i>Hylaeus (Paraprosopis) taeniolatus</i>	34.677579°N	32.722066°E
<i>Hylaeus (Paraprosopis) taeniolatus</i>	34.748126°N	32.732248°E
<i>Hylaeus (Paraprosopis) taeniolatus</i>	34.883435°N	32.750988°E
<i>Hylaeus (Paraprosopis) taeniolatus</i>	35.053539°N	32.351197°E
<i>Hylaeus (Paraprosopis) taeniolatus</i>	34.729004°N	32.457544°E
<i>Hylaeus (Paraprosopis) taeniolatus</i>	34.720825°N	32.551994°E
<i>Hylaeus (Prosopis) gibbus</i>	34.628771°N	32.941031°E
<i>Hylaeus (Prosopis) gibbus</i>	34.729004°N	32.457544°E
<i>Hylaeus (Spatulariella) cypricola</i>	34.731233°N	33.343487°E
<i>Hylaeus (Spatulariella) cypricola</i>	34.741952°N	32.734845°E
<i>Hylaeus (Spatulariella) cypricola</i>	34.670772°N	32.846923°E
<i>Lasioglossum (Dialictus) akroundicum</i>	34.9317°N	32.8664°E
<i>Lasioglossum (Dialictus) akroundicum</i>	34.93°N	32.86°E
<i>Lasioglossum (Evylaeus) marginatum</i>	35.334413°N	33.494187°E
<i>Lasioglossum (Evylaeus) marginatum</i>	34.73663°N	32.732715°E

<i>Lasioglossum (Evyllaesus) marginatum</i>	34.764269°N	32.757736°E
<i>Lasioglossum (Evyllaesus) marginatum</i>	34.656698°N	32.773339°E
<i>Lasioglossum (Evyllaesus) marginatum</i>	34.745537°N	32.73385°E
<i>Lasioglossum (Evyllaesus) marginatum</i>	34.748126°N	32.732248°E
<i>Lasioglossum (Evyllaesus) marginatum</i>	34.883435°N	32.750988°E
<i>Lasioglossum (Evyllaesus) marginatum</i>	34.729004°N	32.457544°E
<i>Lasioglossum (Hemihalictus) convexiusculum</i>	34.93°N	32.86°E
<i>Lasioglossum (Hemihalictus) griseolum</i>	35.06°N	32.46°E
<i>Lasioglossum (Hemihalictus) griseolum</i>	34.94°N	32.31°E
<i>Lasioglossum (Hemihalictus) lucidulum</i>	34.72°N	32.55°E
<i>Lasioglossum (Hemihalictus) mesosclerum</i>	34.72°N	32.55°E
<i>Lasioglossum (Hemihalictus) mesosclerum</i>	34.85°N	32.4°E
<i>Lasioglossum (Hemihalictus) mesosclerum</i>	34.94°N	32.31°E
<i>Lasioglossum (Hemihalictus) pygmaeum</i>	35.334413°N	33.494187°E
<i>Lasioglossum (Hemihalictus) pygmaeum</i>	34.764269°N	32.757736°E
<i>Lasioglossum (Hemihalictus) pygmaeum</i>	34.670772°N	32.846923°E
<i>Lasioglossum (Hemihalictus) transitorium</i>	35.334413°N	33.494187°E
<i>Lasioglossum (Hemihalictus) transitorium</i>	34.723986°N	32.736892°E
<i>Lasioglossum (Hemihalictus) transitorium</i>	34.670772°N	32.846923°E
<i>Lasioglossum (Lasioglossum) aegyptiellum</i>	34.72°N	32.55°E
<i>Lasioglossum (Lasioglossum) aphrodite</i>	34.9317°N	32.8664°E
<i>Lasioglossum (Lasioglossum) kotschy</i>	34.9317°N	32.8664°E
<i>Lasioglossum (Lasioglossum) pallens</i>	34.748126°N	32.732248°E
<i>Lasioglossum (Lasioglossum) pallens</i>	34.992°N	32.9082°E
<i>Lasioglossum (Leuchalictus) leucozonium</i>	34.918°N	32.9472°E

<i>Lasioglossum (Leuchalictus) leucozonium</i>	34.992°N	32.9082°E
<i>Lasioglossum (Leuchalictus) leucozonium</i>	35.0755°N	32.9164°E
<i>Lasioglossum (Sphecodogastra) anellum</i>	34.731233°N	33.343487°E
<i>Lasioglossum (Sphecodogastra) anellum</i>	34.746277°N	33.384472°E
<i>Lasioglossum (Sphecodogastra) anellum</i>	34.677579°N	32.722066°E
<i>Lasioglossum (Sphecodogastra) anellum</i>	34.654385°N	32.717924°E
<i>Lasioglossum (Sphecodogastra) anellum</i>	34.883435°N	32.750988°E
<i>Lasioglossum (Sphecodogastra) anellum</i>	34.72°N	32.55°E
<i>Lasioglossum (Sphecodogastra) anellum</i>	34.85°N	32.4°E
<i>Lasioglossum (Sphecodogastra) anellum</i>	34.720825°N	32.551994°E
<i>Lasioglossum (Sphecodogastra) anellum</i>	35.06°N	32.46°E
<i>Lasioglossum (Sphecodogastra) anellum</i>	34.94°N	32.31°E
<i>Lasioglossum (Sphecodogastra) damascenum</i>	34.670772°N	32.846923°E
<i>Lasioglossum (Sphecodogastra) lineare</i>	34.9317°N	32.8664°E
<i>Lasioglossum (Sphecodogastra) malachurum</i>	34.597305°N	32.984521°E
<i>Lasioglossum (Sphecodogastra) malachurum</i>	34.72°N	32.55°E
<i>Lasioglossum (Sphecodogastra) malachurum</i>	34.729004°N	32.457544°E
<i>Lasioglossum (Sphecodogastra) malachurum</i>	34.94°N	32.31°E
<i>Lasioglossum (Sphecodogastra) obscuratum</i>	34.9317°N	32.8664°E
<i>Lasioglossum (Sphecodogastra) obscuratum</i>	34.94°N	32.31°E
<i>Lasioglossum (Sphecodogastra) tricinctum</i>	35.64°N	34.55°E
<i>Lasioglossum (Sphecodogastra) tricinctum</i>	34.85°N	32.4°E
<i>Lasioglossum (Sphecodogastra) tricinctum</i>	34.9°N	32.42°E
<i>Lasioglossum (Sphecodogastra) tricinctum</i>	34.94°N	32.31°E
<i>Lithurgus (Lithurgus) tibialis</i>	34.72°N	32.55°E

<i>Lithurgus (Lithurgus) tibialis</i>	34.9°N	32.42°E
<i>Megachile (Chalicodoma) cypricola</i>	34.777521°N	33.33622°E
<i>Megachile (Chalicodoma) cypricola</i>	34.656698°N	32.773339°E
<i>Megachile (Chalicodoma) cypricola</i>	34.66198333°N	32.80439444°E
<i>Megachile (Chalicodoma) cypricola</i>	34.706873°N	33.211916°E
<i>Megachile (Chalicodoma) cypricola</i>	34.706786°N	33.229364°E
<i>Megachile (Chalicodoma) ericetorum</i>	34.745849°N	33.083579°E
<i>Megachile (Creightonella) albisecta</i>	34.9°N	32.42°E
<i>Megachile (Eurymella) patellimana</i>	35.03°N	32.37°E
<i>Megachile (Eurymella) patellimana</i>	34.85°N	32.4°E
<i>Megachile (Eurymella) patellimana</i>	34.94°N	32.31°E
<i>Megachile (Eutricharaea) apicalis</i>	34.6°N	32.97°E
<i>Megachile (Eutricharaea) apicalis</i>	34.72°N	32.55°E
<i>Megachile (Eutricharaea) apicalis</i>	35.03°N	32.37°E
<i>Megachile (Eutricharaea) apicalis</i>	34.94°N	32.31°E
<i>Megachile (Eutricharaea) fertoni</i>	34.72°N	32.55°E
<i>Megachile (Eutricharaea) fertoni</i>	35.06°N	32.46°E
<i>Megachile (Eutricharaea) fertoni</i>	34.94°N	32.31°E
<i>Megachile (Eutricharaea) inexpectata</i>	35.06°N	32.46°E
<i>Megachile (Eutricharaea) marginata</i>	34.72°N	32.55°E
<i>Megachile (Eutricharea) leachella</i>	35.05519°N	33.814011°E
<i>Megachile (Eutricharea) leachella</i>	34.731233°N	33.343487°E
<i>Megachile (Eutricharea) leachella</i>	34.600657°N	32.971419°E
<i>Megachile (Eutricharea) leachella</i>	34.745849°N	33.083579°E
<i>Megachile (Eutricharea) leachella</i>	34.676011°N	32.794947°E

<i>Megachile (Eutricharea) leachella</i>	34.93°N	32.86°E
<i>Megachile (Eutricharea) leachella</i>	34.72°N	32.55°E
<i>Megachile (Eutricharea) leachella</i>	35.03°N	32.37°E
<i>Megachile (Eutricharea) leachella</i>	35.053539°N	32.351197°E
<i>Megachile (Eutricharea) leachella</i>	34.85°N	32.4°E
<i>Megachile (Eutricharea) leachella</i>	34.9°N	32.42°E
<i>Megachile (Eutricharea) leachella</i>	34.94°N	32.31°E
<i>Megachile (Eutricharea) pilidens</i>	34.918°N	32.9472°E
<i>Megachile (Pseudomegachile) farinosa</i>	34.72°N	32.55°E
<i>Megachile (Pseudomegachile) farinosa</i>	34.85°N	32.4°E
<i>Melitturga (Melitturga) syriaca</i>	34.755799°N	33.096194°E
<i>Melitturga (Melitturga) syriaca</i>	34.900977°N	32.776759°E
<i>Nomada flavoguttata</i>	34.755799°N	33.096194°E
<i>Nomada fucata</i>	34.755799°N	33.096194°E
<i>Nomada nesiotica</i>	34.755799°N	33.096194°E
<i>Nomada pallispinosa</i>	34.71178°N	33.004775°E
<i>Nomada trispinosa</i>	34.71178°N	33.004775°E
<i>Nomada trispinosa</i>	34.755799°N	33.096194°E
<i>Osmia (Allosmia) sybarita</i>	34.71178°N	33.004775°E
<i>Osmia (Allosmia) sybarita</i>	34.755799°N	33.096194°E
<i>Osmia (Allosmia) sybarita</i>	34.800043°N	33.000918°E
<i>Osmia (Erythrosmia) erythrogastra</i>	34.755799°N	33.096194°E
<i>Osmia (Helicosmia) caerulescens</i>	34.963264°N	34.066211°E
<i>Osmia (Helicosmia) caerulescens</i>	34.597305°N	32.984521°E
<i>Osmia (Helicosmia) caerulescens</i>	34.9317°N	32.8664°E

<i>Osmia (Helicosmia) caerulea</i>	34.918°N	32.9472°E
<i>Osmia (Helicosmia) caerulea</i>	34.755799°N	33.096194°E
<i>Osmia (Helicosmia) caerulea</i>	34.670772°N	32.846923°E
<i>Osmia (Helicosmia) caerulea</i>	34.85°N	32.4°E
<i>Osmia (Helicosmia) dives</i>	34.918°N	32.9472°E
<i>Osmia (Helicosmia) dives</i>	34.677579°N	32.722066°E
<i>Osmia (Helicosmia) dives</i>	34.628817°N	32.940667°E
<i>Osmia (Helicosmia) dives</i>	34.911736°N	32.327703°E
<i>Osmia (Helicosmia) latreillei</i>	34.71178°N	33.004775°E
<i>Osmia (Helicosmia) latreillei</i>	34.653067°N	32.974233°E
<i>Osmia (Helicosmia) latreillei</i>	34.65096°N	32.99091°E
<i>Osmia (Helicosmia) latreillei</i>	34.73663°N	32.732715°E
<i>Osmia (Helicosmia) latreillei</i>	34.745537°N	32.73385°E
<i>Osmia (Helicosmia) latreillei</i>	34.720825°N	32.551994°E
<i>Osmia (Helicosmia) niveata</i>	34.597305°N	32.984521°E
<i>Osmia (Helicosmia) niveata</i>	34.918°N	32.9472°E
<i>Osmia (Helicosmia) niveata</i>	34.65096°N	32.99091°E
<i>Osmia (Helicosmia) niveata</i>	34.741952°N	32.734845°E
<i>Osmia (Helicosmia) signata</i>	34.65096°N	32.99091°E
<i>Osmia (Helicosmia) signata</i>	34.9°N	32.42°E
<i>Osmia (Hoplosmia) scutellaris</i>	34.65096°N	32.99091°E
<i>Osmia (Osmia) bicornis</i>	34.992°N	32.9082°E
<i>Osmia (Pyrosmia) amathusica</i>	34.71178°N	33.004775°E
<i>Osmia (Pyrosmia) cephalotes</i>	34.73663°N	32.732715°E
<i>Osmia (Pyrosmia) ferruginea</i>	34.71178°N	33.004775°E

<i>Osmia (Pyrosmia) ferruginea</i>	34.656698°N	32.773339°E
<i>Osmia (Pyrosmia) ferruginea</i>	34.755799°N	33.096194°E
<i>Osmia (Pyrosmia) ferruginea</i>	34.628817°N	32.940667°E
<i>Osmia (Pyrosmia) hellados</i>	34.71178°N	33.004775°E
<i>Osmia (Pyrosmia) hellados</i>	34.755799°N	33.096194°E
<i>Osmia (Pyrosmia) submicans</i>	34.71178°N	33.004775°E
<i>Osmia (Pyrosmia) submicans</i>	34.597305°N	32.984521°E
<i>Osmia (Pyrosmia) submicans</i>	34.755799°N	33.096194°E
<i>Osmia (Pyrosmia) submicans</i>	34.741952°N	32.734845°E
<i>Osmia (Pyrosmia) submicans</i>	34.940989°N	32.872738°E
<i>Osmia (Pyrosmia) viridana</i>	34.71178°N	33.004775°E
<i>Osmia (Pyrosmia) viridana</i>	34.764269°N	32.757736°E
<i>Osmia (Pyrosmia) viridana</i>	34.741952°N	32.734845°E
<i>Osmia (Pyrosmia) viridana</i>	34.745537°N	32.73385°E
<i>Osmia (Pyrosmia) viridana</i>	34.800043°N	33.000918°E
<i>Protosmia (Protosmia) paradoxa</i>	34.71178°N	33.004775°E
<i>Protosmia (Protosmia) paradoxa</i>	34.597305°N	32.984521°E
<i>Protosmia (Protosmia) paradoxa</i>	34.764269°N	32.757736°E
<i>Protosmia (Protosmia) paradoxa</i>	34.800043°N	33.000918°E
<i>Protosmia (Protosmia) paradoxa</i>	34.677579°N	32.722066°E
<i>Protosmia (Protosmia) paradoxa</i>	34.748126°N	32.732248°E
<i>Pseudapis (Nomiapis) diversipes</i>	35.05519°N	33.814011°E
<i>Pseudapis (Nomiapis) diversipes</i>	35.053539°N	32.351197°E
<i>Sphecodes ephippius</i>	34.755799°N	33.096194°E
<i>Sphecodes monilicornis</i>	34.677579°N	32.722066°E

<i>Sphecodes pseudofasciatus</i>	34.755799°N	33.096194°E
<i>Thyreus histrionicus</i>	34.94°N	32.31°E
<i>Thyreus picaron</i>	34.94°N	32.31°E
<i>Thyreus ramosus</i>	34.94°N	32.31°E
<i>Xylocopa (Copoxylla) iris</i>	34.723986°N	32.736892°E
<i>Xylocopa (Copoxylla) iris</i>	34.745537°N	32.73385°E
<i>Xylocopa (Copoxylla) iris</i>	34.67°N	32.85°E
<i>Xylocopa (Copoxylla) iris</i>	34.72°N	32.55°E
<i>Xylocopa (Copoxylla) iris</i>	34.9°N	32.42°E
<i>Xylocopa (Copoxylla) iris</i>	35.06°N	32.46°E
<i>Xylocopa (Copoxylla) iris</i>	34.900977°N	32.776759°E
<i>Xylocopa (Copoxylla) iris</i>	34.94°N	32.31°E
<i>Xylocopa (Koptortosoma) pubescens</i>	34.71178°N	33.004775°E
<i>Xylocopa (Koptortosoma) pubescens</i>	35.1688°N	33.367°E
<i>Xylocopa (Koptortosoma) pubescens</i>	34.72°N	32.55°E
<i>Xylocopa (Koptortosoma) pubescens</i>	34.78°N	32.4°E
<i>Xylocopa (Proxylocopa) olivieri</i>	34.992°N	32.9082°E
<i>Xylocopa (Xylocopa) violacea</i>	34.918°N	32.9472°E
<i>Xylocopa (Xylocopa) violacea</i>	34.992°N	32.9082°E
<i>Xylocopa (Xylocopa) violacea</i>	34.94°N	32.31°E

CHAPTER 3

3 Chapter 3: Historical changes in bee species richness in two areas with contrasting land use patterns on Cyprus

3.1 Abstract

Wild bee populations are in decline, yet only a few research studies evaluated historical changes in bee assemblages, and up to now none at a southern latitude. We rely on a unique data set compiled by the bee taxonomist George Mavromoustakis covering a 30-year period beginning 100 years ago, and recent biweekly samplings over two years to analyze changes in species richness. We focus on two areas with contrasting land use patterns: Cherkas Chiftlik-Asomatos (CC_Asomatos) with a mainly agricultural and Akrotiri with a mainly seminatural land use profile. Changes in landscape use categories were mild and relatively similar in the two areas, with urban development more scattered in CC_Asomatos. In addition, CC_Asomatos experienced drastic changes in land use intensity, with an increase in the use of high-input agricultural methods, including synthetic insecticides, beginning with DDT from around 1945. We detected a substantial species turnover, with 43 species collected only in historical samples, 77 only in recent samples, while 42 persisted in both periods. Mavromoustakis reported 50 species from Akrotiri and 80 from CC_Asomatos, out of which 26 were common. We collected 110 species from Akrotiri, and 68 from CC_Asomatos with 53 common. There was a statistically significant difference in the frequency of species extinctions, with CC_Asomatos losing species at twice the rate of Akrotiri, at ca. 75 and 35% respectively. We also found that 18 species that were present in CC_Asomatos in historical samples were detected only in Akrotiri recent samples. None of the species extinct from Akrotiri were present in recent CC_Asomatos collections. The richness of plants visited by bees was higher in Akrotiri, with a significant relationship between plant richness and bee species richness. We hypothesize that the main drivers for species extinctions are the intensive use of synthetic pesticides, and the loss of habitat and floral diversity because of the expansion of agriculture and urban development. Thirteen species new to Cyprus, as well as three species new to science are reported as part of the current work. Our findings highlight the importance of historical data in understanding bee diversity and the

need for establishing a long-term monitoring program and conservation actions for the bee species of Cyprus.

Keywords: Wild bees, plant networks, landscape characterization, historical sampling

3.2 Introduction

Pollinators are indispensable for ecosystem structure and function. Many wild and cultivated plants rely on pollinators, and especially bees for reproduction (Potts et al., 2010; Klein et al., 2007; van der Sluijs and Vaage, 2016). Eighty-seven of the leading global food crops rely on animal pollination, with ca. 35% of global food supply pollination depended (Klein et al. 2007). The annual global value of pollination is estimated at US\$195 to ~US\$387 billion annually (Porto et al., 2020).

A total of 20,555 species of bees have been recorded worldwide, with more than 2,500 of them in Europe (Nieto et al., 2014; Orr et al., 2021). Pollinators are in serious decline, facing several threats that jeopardise their existence. Climate change and anthropogenic factors negatively affect both honeybee and wild bee populations (Biesmeijer et al., 2006; LeBuhn and Luna, 2021). Major threats driving bee population decline and extinction are climate change and land-use changes resulting in habitat loss (degradation, destruction, fragmentation) (Carvalho et al., 2013; Cariveau and Winfree, 2015).

Intensive agriculture is one of the major threats to pollinators. The use of insecticides, monoculture, degradation of agricultural landscapes, the limited flower resources and overgrazing by livestock affect bee species negatively (Kremen et al., 2002; Senapathi et al., 2017). Overgrazing negatively impacts bee species because of the degradation of flower-rich permanent grasslands (Le Feon et al., 2010). However, the response to intensive agricultural practices differs between species. Bumble bees show less sensitivity to intensive agriculture than wild bees (Le Feon et al., 2010) while smaller-bodied species and those with shorter flight seasons are influenced more than large-bodied species which can forage at larger distances (De Palma et al., 2015). Ekroos et al. (2020) studied bee diversity in several grasslands in Europe and highlighted the importance of very low or no use of nitrogen to maintain and protect bee species.

Seminal work assessed changes in bee richness over large swaths of land, providing evidence for wild bee population declines (e.g. Cameron et al. 2011; Zattara et al. 2021). Parallel work focusing specifically on the effect of land use change on wild bees provided useful insights (Senapathi et al., 2015; Bommarco et al. 2014). For instance, Senapathi et al. (2015) reported that 75% of research sites in England were characterized by a significant decline in species richness of bees and wasps, because of landscape changes over time. The arable land expansion has negative effects on species richness, due to intensive agricultural practices and monocultures, while areas surrounded by heterogeneous landscapes (e.g. flower-rich areas, hedgerows) improve species conservation. Bommarco et al. 2014 showed that bees responded rapidly to landscape change, possibly because of the loss of nesting sites. The reduction of floral diversity and abundance and difficulties in searching for nesting sites are ascribed to habitat loss (Goulson et al., 2015; LeBuhn and Luna 2021). The response to habitat loss caused by urbanisation differs among species. For example, a positive effect of urbanization was observed on bumblebees, cavity-nesting bees and later-season small-bodied bees and a negative effect was observed on hoverflies (Senapathi et al., 2017). Except for habitat loss, many other factors including diseases, parasites (*Varroa* mites in honeybees), parasitoids, pathogens, invasive species, and pesticide use, have a potential role in bee population declines (Brown and Paxton, 2009; Goulson et al., 2015).

Most of the work investigating historical changes in bee diversity focused at northern latitudes (e.g. Rasmussen et al. 2022; Grixti and Packer, 2006; Bartomeus et al., 2013; Mathiasson and Rehan, 2019; Graham et al., 2021; Cameron et al, 2011) because of the availability of past historical data. Data on past species presence at southern latitudes are not readily available, probably a result of the concentration of sampling efforts around the areas where bee taxonomists worked or resided in the past. In the current work, we take advantage of the work of the wild bee taxonomist George Mavromoustakis, to compare historical changes in species richness at a southern latitude.

Mavromoustakis was probably the only major wild bee taxonomist residing and actively collecting bees at southern latitudes before the 1950's. Mavromoustakis lived on the southern part of the Mediterranean island of Cyprus, a biodiversity hotspot (Myers et al. 2000). He profusely collected bees on the island for close to 50 years and published his

work on the bees of Cyprus in a series of eight papers (Mavromoustakis 1949[“1948”], 1951, 1952, 1953, 1954, 1955, 1957a, 1958 [“1957”]).

While Mavromoustakis collected bees throughout the island, most of his samplings took place at locations very close to his residence. He frequently collected specimens at a seminatural area surrounding the salt lake in the Akrotiri peninsula and an adjacent area, Cherkes Chiftlik - Asomatos (CC_Asomatos), which was converted to large scale agriculture at the beginning of his samplings. Twenty-seven natural habitats have been recorded in Akrotiri Peninsula under the Natura 2000, and Akrotiri Marsh is a Ramsar site, an important bird area and a special protection area (JNCC 2008). This area is also a special area of conservation for habitats and wild flora and fauna species. The two areas provide constant and contrasting land use patterns for close to a century, with Akrotiri characterized as mainly seminatural and CC_Asomatos as mainly agricultural.

In the current work, we compare historical changes in bee richness between the two areas and assess species diversity and abundance for recent collections. We rely on the extensive historical record of bee species made by Mavromoustakis and compare it with recent data aiming to (a) document historical changes in bee richness between a mostly semi-natural and a mostly agricultural land use history (b) use networks to obtain estimates of specialization within plant-pollinator networks from recent samplings in the two regions, (c) explore the effects of land use on bee diversity.

3.3 Materials and methods

3.3.1 Study area

Cyprus is the third biggest island in the Mediterranean with a surface area of 9,251 km². Mavromoustakis collected specimens throughout Cyprus between 1916 to 1957 (Mavromoustakis 1949[“1948”], 1951, 1952, 1953, 1954, 1955, 1957a, 1958 [“1957”]), recording a total of 237 species. A lot of his sampling effort was directed at the Akrotiri peninsula, a marshlands region near his hometown of Limassol (Figure 4). The Akrotiri peninsula is divided into two main administrative regions, with contrasting land use patterns: The Akrotiri village administrative area (Akrotiri), consisting mainly of semi-natural areas, and the Cherkes-Chiflik / Asomatos areas (CC_Asomatos), with mainly agricultural land use (Figure 4).

To manage the significant malarial problems in the region, the British administration planted port jackson wattle (*Acacia saligna*), river red gum (*Eucalyptus camaldulensis*), tuart (*E. gomphocephala*), and casuarina (*Casuarina cunninghamiana*) beginning in the 1930's (Pescott et al., 2018). Eucalyptus and casuarina plantations were largely restricted to the north of the salt lake, on the south part of CC_Asomatos area, whereas there is a narrow band of Jackson wattle on the north side of Akrotiri area, along the south coast of the salt lake (Pescott et al., 2018). Beginning in the 1940's there was widespread use of DDT for malaria control in both areas (Zogaris 2017).

Large parts of the Akrotiri area remained largely unchanged from the period of Mavromoustakis samplings (P1 period), with the majority of the contiguous area consisting of semi-natural habitat and agricultural plots (Figure 5b). Notable changes in the Akrotiri area occurred during the 20th century with road construction and land cultivation. A Royal Air Force base was built in 1955, covering 2 128 ha. Within the fence of the base, there are swathes of maquis vegetation (Sollars 2005). Part of the Akrotiri administrative area today includes an area that the British used to call “Minor State Forest” with coastal maquis, or ‘scrub forest’, small plantations of non-native Aleppo pine (early 20th century) and mosaics of phrygana and steppe (Pescott et al., 2018). The main crops cultivated in Akrotiri today are citrus, cereals, potatoes, table grapes, vetch, and olive trees.

In contrast, the neighbouring CC_Asomatos administrative area has been farmed for close to a century (Figure 4). At the beginning of P1, the CC_Asomatos area experienced drastic changes, as major areas were converted to large scale citrus and vine farming, with ca. 30 000 cypress trees planted for use as wind barriers (Efimerida Lemosos, 2019). In the 1940's tobacco was planted in several fields in the area. Today, the south part of CC_Asomatos area, on the north side of the salt lake, is covered by non-native plants planted by the British - eucalypts, Jackson wattle, casuarina (*Casuarina cunninghamiana*) and mixtures of eucalypts and wattle (*Acacia saligna*). The main crops cultivated in CC_Asomatos are citrus and cereals.

Historical sampling data (P1): We obtained historical data on wild bee species presence from samplings carried out by G. Mavromoustakis (Mavromoustakis 1949[“1948”], 1951, 1952, 1953, 1954, 1955, 1957a, 1958 [“1957”]) in Akrotiri and CC_Asomatos (Figure 4). The samplings covered the period between 1924-1956 (P1: Past period). Mavromoustakis sampled bees using an insect net and noted the general area of collection of each specimen, usually the administrative boundaries of villages or specifically named locations, which were used to assign species to each of the two administrative areas (Figure 4).



Figure 4. Map of the 10 sampling sites surveyed for wild bees in the two regions, Cherkes Chiftlik-Asomatos (green dots) and Akrotiri (red dots).

Recent sampling data: The recent dataset (P2) includes wild bees collected from 2016 to 2018 at five different sampling sites in each of Akrotiri and Cherkas Chiftlik-Asomatos region. During selecting our sampling sites (P2), we tried to cover as much area as possible, considering Mavromoustakis sampling locations (P1). Each site was located at a minimum of 1 km from its neighbouring site (Figure 4). The dataset used for the current study includes data from April 2016 to April 2018.

Wild bees were sampled at each site using insect-net biweekly and coloured pan traps once per month for two years (24 months). A combination of the two methods is very important for the detailed assessment of bee assemblages (Westphal et al., 2008). Plastic bowls (22 cm diameter, 8 cm depth and 400 ml capacity) were painted with UV-fluorescent yellow, white, and blue spray (Motip spray, Motip, Wolvega, Netherlands, yellow: Motip effect fluorescent yellow 400ml, 01CCR10, blue: Motip spray gloss blue 500ml, 01MOSP05, white: Motip spray gloss white 500ml, 01MOSP02). At each site, a group of three pan traps, one from each colour, were mounted on a wooden pole at vegetation height, filled with 400 ml of water and one drop of detergent. They were set up at all sites on a single day once a month and were retrieved 24 h later. Collected specimens from pan traps were stored in falcon tubes filled with 96% ethanol and transferred to the laboratory for pinning.

For sweep-net sampling, we used variable transect walks at each site (Westphal et al., 2008), at a slow speed among attractive resource patches and collected bees during an observational period of 30 minutes between 8:30-15:00 on sunny days every two weeks. Sweep netting was conducted by the same person (AV). Flowers visited by bees were recorded in each sampling site during net sampling. Each bee was captured and stored in an individual falcon tube where the flower from which the bee was collected was noted. Plants from which bees were collected were identified based on Christofides (2017) and / or Hand et al. (2011). Bees that could be identified in the field were released. Specimens collected with an insect net were stored in an individual labelled falcon tube and killed in the freeze. Afterwards, they were pinned and stored in insect boxes and identified to genus level by the first author (AV) using several keys (Michener 2007; Michez et al., 2019). Samples were then sent to several bee expert taxonomists for identification at species level (see 'Acknowledgements'). Honeybees, *Apis mellifera*, were not captured nor included in the analyses.

3.3.2 Land-use changes characterization

To compare land use changes between P1 and P2 we carried out land cover classification at the area level for both Akrotiri and CC_Asomatos based on the administrative boundaries of each area. Most of Mavromoustakis collections reported species at the administrative boundary layer.

First, we georeferenced available aerial photographs from 1957 (all sampling sites in Akrotiri) and 1963 (all sampling sites CC_Asomatos) for P1. For P2 period, we used orthophotos taken in 2014. All aerial photographs were obtained from the Department of Lands and Surveys of Cyprus (resolution unit, 2). We then manually classified land cover into four major types: 1) agricultural area, 2) forest and seminatural areas (pine forest, garrigue and phrygana), 3) salt meadows and sand/gravel shores and 4) artificial surface (including buildings, residential houses, and any bare surface), in order to have a better representation of the land use classes present in both periods. In addition, land use classification was carried out at fine scale, within a 400 m radius for each sampling site for P2, to assess the impact of surrounding land use type on wild bee abundance and diversity. Agricultural area and forest-seminatural areas have more entomophilous flowers than the salt meadows, sand/gravel shores and artificial surfaces. All geographic analyses were performed using ArcGIS v.17 software (ESRI 2017).

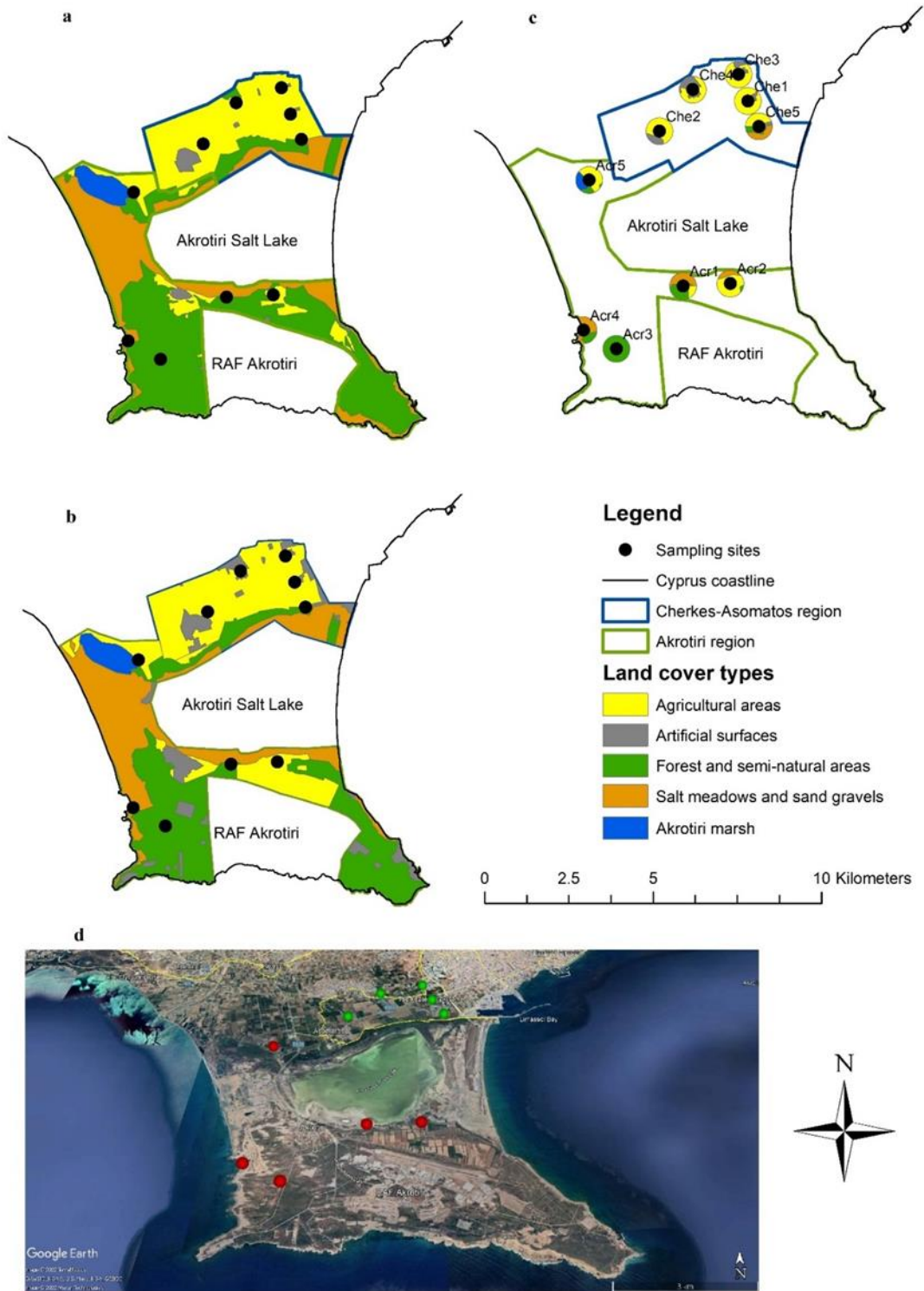


Figure 5. Land cover types for Akrotiri and Cherkas Chiftlik-Asomatos regions for a) historical (P1) and b) recent (P2) sampling based on aerial photos and orthophotos, respectively from the Department of Lands and Surveys. Figure 5c

shows characterization of land use types within a 400 m radius for each of the 10 sites for P2. Figure 5d is a google maps satellite picture of the area. See Materials and Methods for more information on the methodology.

3.3.3 Data analysis

All statistical analyses were carried out in the open-source R language and environment for statistical computing (R Core Team, 2021). Data were pooled within periods (P1 and P2) and regions (Akrotiri and Cherkas Chiftlik-Asomatos) for calculating total species richness.

For the P2 sampling, we used pooled data from all the sampling sites, sampling years, and sampling techniques (netting and pan traps, because these techniques can be considered to be complementary) to calculate species accumulation curves with the "vegan" package (Oksanen et al., 2013) to assess the survey's adequacy of the two regions. We calculated the observed species accumulation curves and total expected species richness using a bootstrapping procedure with 999 random permutations. Total expected species richness was assessed using Chao (Chao and Chiu, 2016). We also plotted heat maps with the pheatmap package (Kolde, 2013) to visualise wild bee abundance across sampling sites.

Furthermore, we calculated the Shannon-Wiener diversity index and the Simpson index for each sampling site. We computed Pielou's evenness index (J), to analyse the species' evenness among sites. We also calculated the β diversity to determine the degree of similarity in community composition. Beta diversity partitioning was performed following the Cardoso et al. method (2014) to describe the number of different communities in the two study areas (total beta diversity (β_{total}), species replacement "turnover" (β_{repl}) and species difference (β_{rich}). To visualize differences in bee community composition among regions and sampling sites, we made an NMDS (non-metric multidimensional scaling) ordination plot with the Bray–Curtis dissimilarity matrix of standardized bee abundances, using the vegan package (Oksanen et al., 2019).

To examine the effect of land-use changes parameters on bee species richness (S) and Shannon diversity index (H), generalized linear models (GLMs) and linear models (LMs) were developed. The explanatory variables used were the % cover of the forest and semi-natural area estimated in a 400 m buffer at each site, the host plant richness (number of

host plants per site), and the sampling year (2-level factor, 2016-2017, and 2017-2018). The effects of the explanatory variables were analysed using a negative binomial error distribution for bee species richness (count data) and fitted to GLMs, while Shannon diversity index was tested with LMs (data were normally distributed). Model selection was based on the Akaike Information Criterion for small sample sizes (AICc). Model performance was checked graphically using diagnostic plots and also the normality of residuals was checked by Kolmogorov-Smirnov tests (Zuur et al., 2010). We also calculated adjusted R-squared (linear models) as a measure of the explanatory power of the LMs models. All analyses were performed using “MASS”, “car” and “AICcmodavg” packages (Venables and Ripley 2002; Fox and Weisberg 2011; Mazerolle 2020) in R4.1.2. (R Core Team, 2021).

Analysis of plant-pollinator networks: For each plant-pollinator network, we estimated three metrics that are potentially relevant for biodiversity conservation: nestedness (network in which the species with many interactions interact with the species with few interactions and vice versa), connectance (the proportion of all possible interactions realized) and interaction evenness (Shannon evenness of interaction matrix). We performed an analysis of plant-pollinator networks to explore the links between bees and flowers in the two localities. These networks are very important as a tool in community ecology (Blüthgen et al., 2009). All analyses were performed using the R software version 4.1.2 (R Development Core Team 2021) and package “bipartite” (Dormann et al., 2008).

3.4 Results

3.4.1 Land-use changes characterization

Area-level land-use changes characterization: The aerial photos taken as part of a nationwide survey in 1957 for the Akrotiri area show that at the end of the P1 period, ca. 55% of the Akrotiri area was forest-seminatural areas, 30% salt meadows and sand gravels, and 9% agricultural areas (Table 1, Figure 5). In 2014 orthophotos representative of the P2 period, agricultural areas increased by 6%, artificial surfaces by 5% with a reduction of forest and seminatural areas by 10 %. In both P1 and P2, a large area in

Akrotiri region was covered by a military airport and other military installations, which were not available in photographs.

For CC_Asomatos aerial photos taken shortly after the end of P1 - in 1963- show that ca. 70% of the area was agricultural, with ca. 14% forest, 13% salt meadows and sand gravels and 4% artificial surfaces (Table 2). By P2, agricultural areas and forest/seminatural areas dropped by ca. 4% each, while artificial surfaces increased by 7%.

While there were no aerial photos or land use maps covering earlier periods for either region, local leaders informed us that there were limited changes in land use patterns between the beginning to the middle of last century.

Sampling point-level land-use changes characterization for P2: With the exception of Che5, land use types at all remaining sites at Cherkes Chiftlik-Asomatos were agricultural with varying levels of artificial areas (Figure 5). Che 5 consisted mostly of salt meadows and gravels and agriculture. At Akrotiri, the five sites were more diverse with respect to land use types, with none of the sites containing artificial surfaces, and only two sites containing agricultural plots at substantial proportions.

Table 1: Landscape cover types (%) of the two regions Akrotiri and Cherkes Chiftlik-Asomatos for historical (P1) and recent (P2) periods.

Type	Akrotiri		Cherkes Chiftlik-Asomatos	
	PI	P2	PI	P2
	Land cover area (%)			
Agricultural areas	8.93	14.93	69.8	65.91
Akrotiri marsh	4.17	4.29	0	0
Artificial surfaces	0.84	6.28	3.5	11.16
Forest and semi-natural areas	55.48	45.46	13.71	9.21
Salt meadows and sand gravels	30.58	29.04	12.99	13.72

3.4.2 Comparison of species richness for Akrotiri and CC_Asomatos areas for historical (P1) and recent (P2) sampling

Recent sampling (P2) resulted in the recording of 1501 bee specimens belonging to 131 bee species/morphospecies (11 morphospecies, 10 from Halictidae and one from Megachilidae family) from Akrotiri and 1294 bee specimens belonging to 81 species/morphospecies (13 morphospecies belonging to Halictidae family) from CC_Asomatos (Figure 6). Sixty-nine species were found only in Akrotiri, 19 species only in CC_Asomatos, with another 62 species shared between the two areas (Figure 6a), resulting in a total of 150 species and five bee families (Andrenidae, Apidae, Colletidae, Halictidae, Megachilidae). The Apidae was the most abundant and diverse group, with 45 species followed by the Megachilidae with 37 species and one morphospecies, the Andrenidae, with 31 species, the Halictidae, with 27 species and morphospecies (14 morphospecies) and the Colletidae, with 10 species.

From the 150 species recorded in P2, thirteen species are new for Cyprus. Ten were recorded in Akrotiri: *Amegilla fasciata* (Fabricius, 1775), *Amegilla savignyi* (Lepelletier, 1841), *Anthophora orientalis* Morawitz, 1877, *Eucera nigrifacies* Lepelletier, 1841, *Megachile argentata* (Fabricius, 1793), *Megachile deceptor* Pérez, 1890, *Megachile fertoni* Pérez, 1896, *Pseudoanthidium palestinicum* (Mavromoustakis, 1938), *Pseudoanthidium stigmaticorne* (Dours, 1873), *Hylaeus moricei* (Friese, 1898). In CC_Asomatos five species new for Cyprus were recorded: *Anthophora orientalis* Morawitz, 1877, *Eucera nigrifacies* Lepelletier, 1841, *Nomada concolor* Schmiedeknecht, 1882, *Andrena falcinella* Warncke, 1969, *Andrena impunctata* Pérez, 1895.

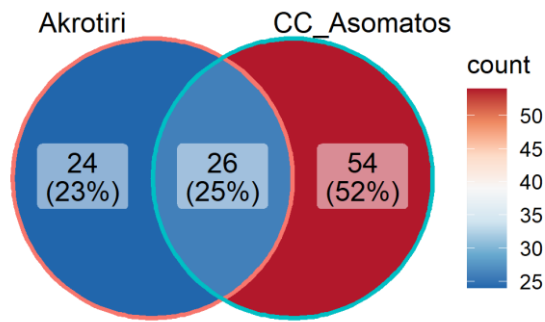
An important result of this study was the discovery of three species new to science: *Anthophora nov. sp. A*, *Melecta nov. sp. A*, *Melecta nov. sp. B*, with all present in Akrotiri and only *Anthophora nov. sp. A* present in both sampling regions (Table S5, Supplementary materials).

Out of a total of 150 species recorded in P2, 143 were collected only with net, seven only with pan traps and 46 species were collected with both methods. Species collected with pan traps only were *Andrena morio*, *Anthophora senescens*, *Lasioglossum sp_D*, *Lasioglossum sp_F*, *Lasioglossum sp_G*, *Lasioglossum leucozonium* and *Xylocopa*

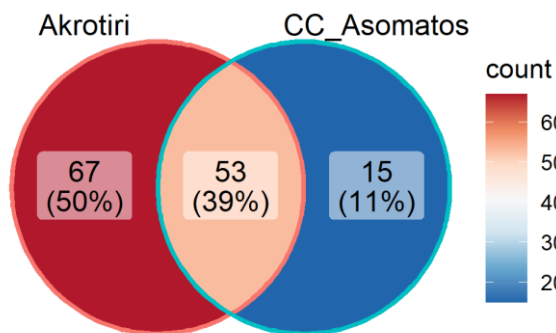
olivieri. *Andrena ungeri* and *Anthophora plumipes* were collected with pan traps in Akrotiri area while they were collected only with net in CC_Asomatos area. In addition, *Halictus*_sp. C, *Megachile patellimana*, *Hylaeus taeniolatus* and *Lasioglossum marginatum*, were collected with pan traps in CC_Asomatos area while they were collected only with net in Akrotiri area. Thirty-seven species were collected with pan traps from Akrotiri and 32 species from CC_Asomatos.

The morphospecies for which no assignment to species could be made belonged to the Halictidae genera *Lasioglossum* (eight morphospecies, *Lasioglossum* sp. A to *Lasioglossum* sp. H), *Halictus* (four morphospecies, *Halictus* sp. A to *Halictus* sp. D) and *Sphecodes* (two, *Sphecodes* sp. A and *Sphecodes* sp. B), while one morphospecies belonged to Megachilidae (*Megachile* s. str. sp_A). Seven specimens belonging to the family Andrenidae, in the following subgenera: *Aciandrena*, *Chlorandrena*, *Euandrena*, *Micrandrena* and *Melandrena*, were excluded from the analyses as they are very challenging to identify and still await a proper revision.

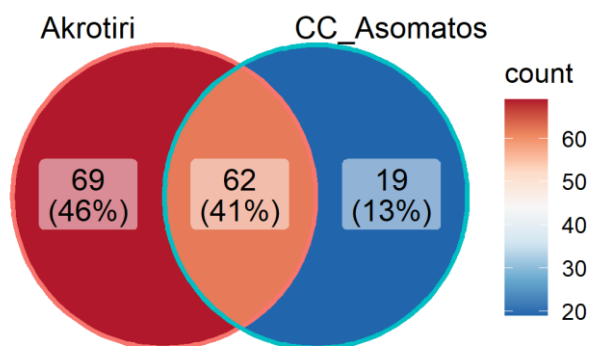
Recent sampling (P2) resulted in the recording of 120 bee species (excluding morphospecies and the seven specimens for which no assignment could be made) from Akrotiri and 68 species from CC_Asomatos (Figure 6b). Historical (P1) sampling by Mavromoustakis between 1924-1956 resulted in records of 104 distinct species from the two areas, with 54 species from CC_Asomatos, 24 from Akrotiri and 26 species present in both areas (Figure 7c). Abundance of data were not available from P1. To compare directly bee richness between P1 and P2 we excluded 14 morphospecies collected in P2 from the Halictidae and one morphospecies in the Megachilidae (Figure 7c), as no direct comparisons could be made with P1 sampling. The morphospecies were distributed as follows: 10 from Halictidae and one from Megachilidae family from Akrotiri area and 13 morphospecies from Halictidae family from CC_Asomatos area. Nine morphospecies were common among the two study areas. Morphospecies were distributed across all sampling sites in the two regions, with Akr5 and Che3 having the greater number of morphospecies, with eight and nine respectively.



a)



b)

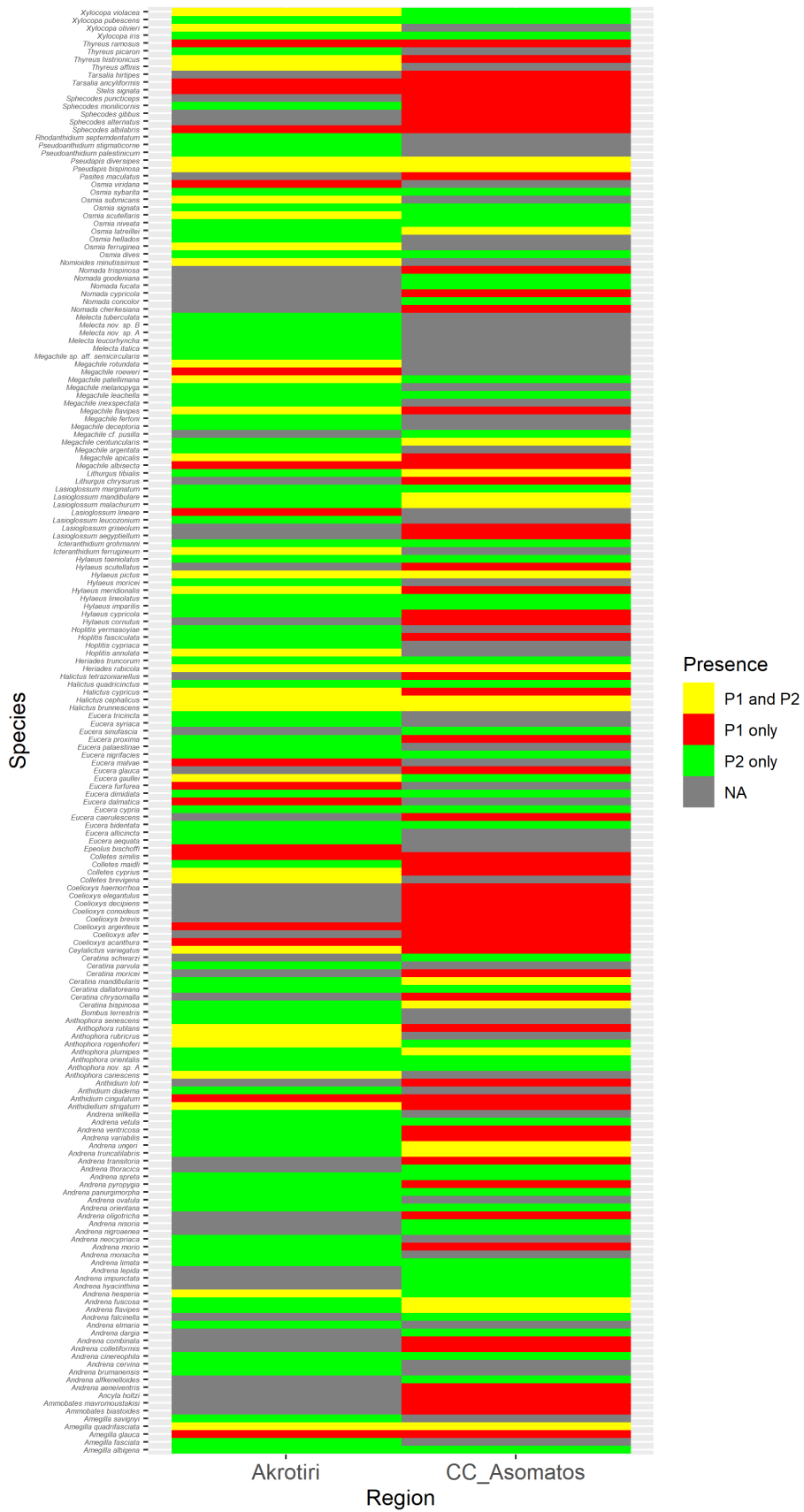


c)

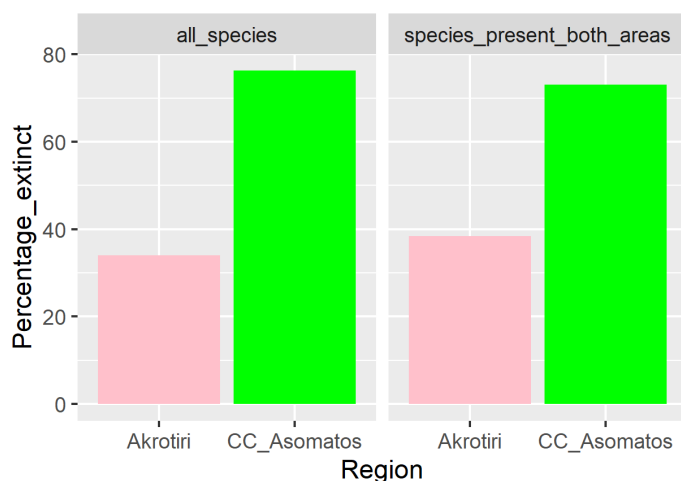
Figure 6: Venn diagrams illustrating species richness in CC_Asomatos and Akrotiri in a) Historical sampling (P1), b) Recent sampling (P2) without morphospecies (14 Halictidae and one Megachilidae morphospecies) and c) Recent sampling (P2) with morphospecies included. Note that species number increases with colour warmth.

In total 164 species were reported from P1 and P2 (Figure 7a). *Andrena morio* was collected in both periods but in P2 only via pan traps; *Anthophora senescens* collected only in P2 via pan traps. A total of 42 species occurred in both P1 and P2, while 43 species were recorded only in P1, and 77 species were recorded only in P2 (Figure 7a). A total of 80 and 47 species that were not reported in P1, were recorded in P2 in Akrotiri and CC_Asomatos, respectively (Figure 7a).

In Akrotiri, 17 species recorded from P1 were not re-discovered in P2, while 33 species were resampled. In CC_Asomatos, 61 species recorded from P1 were not re-discovered in P2 period, while 19 were re-sampled. There was a statistically significant difference in the frequency of extinct / rediscovered species between the two areas ($\chi^2 = 21.16$, $df = 1$, $P < 0.001$, Figure 7b). To evaluate whether the higher extinction rates for CC_Asomatos might have been due to sampling inefficiency for P2, we looked at a subset of the dataset, concentrating on species present in P1 and detected in P2 in the other region. We found that 18 species that were present in CC_Asomatos in P1 but not P2 were detected in Akrotiri in P2. For eleven of those species, there was at least one of the host plants they were collected on in CC_Asomatos.



a)



b)

Figure 7. Presence / absence of bee species from Akrotiri and CC_Asomatos areas during historical (P1) and recent (P2) sampling for a) all species recorded in the areas during P1 and P2. Yellow is used for species present in both P1 and P2, red for species present only in P1, and green for species present only in P2. Figure 7b shows the percentage of extinct species from each area for all species present in P1 (left) and for species that were present in both areas in P1 (right).

3.4.3 Detailed analysis of wild bee diversity for P2

The species accumulation curve for all sampling sites reflected a good sampling effort (Figure 8a), whereas the curves for the two regions did not reach saturation, with 131 species for Akrotiri and 81 species for CC_Asomatos. Species richness was extrapolated using different estimators (Chao, ACE) suggesting that sampling efficiency was quite high (Table 2). We also calculated diversity indicators for the ten localities (Shannon, Simpson, Pielou) as presented in Table 2. The most diverse sampling sites in terms of Shannon-Wiener diversity index was Akr1, while Akr4 was the least diverse (Table 2). Evenness analysis showed that for most of the sites, the evenness index (J') value varies between 0.65-0.80, which indicates good community evenness. A total of three sites showed a lower evenness value: Akr4, Che2 and Che4. The species responsible for the reduction of the J' value of those sites are the ones with high abundance (Figure 9). *Eucera dimidiata* and *Lasioglossum malachurum* were noticeably abundant at Che2 (Figure 9b). Ground nesting bees belonging to *Lasioglossum sp.* and *Andrena sp.* were observed during samplings, especially in the CC_Asomatos region with Che2 recording several

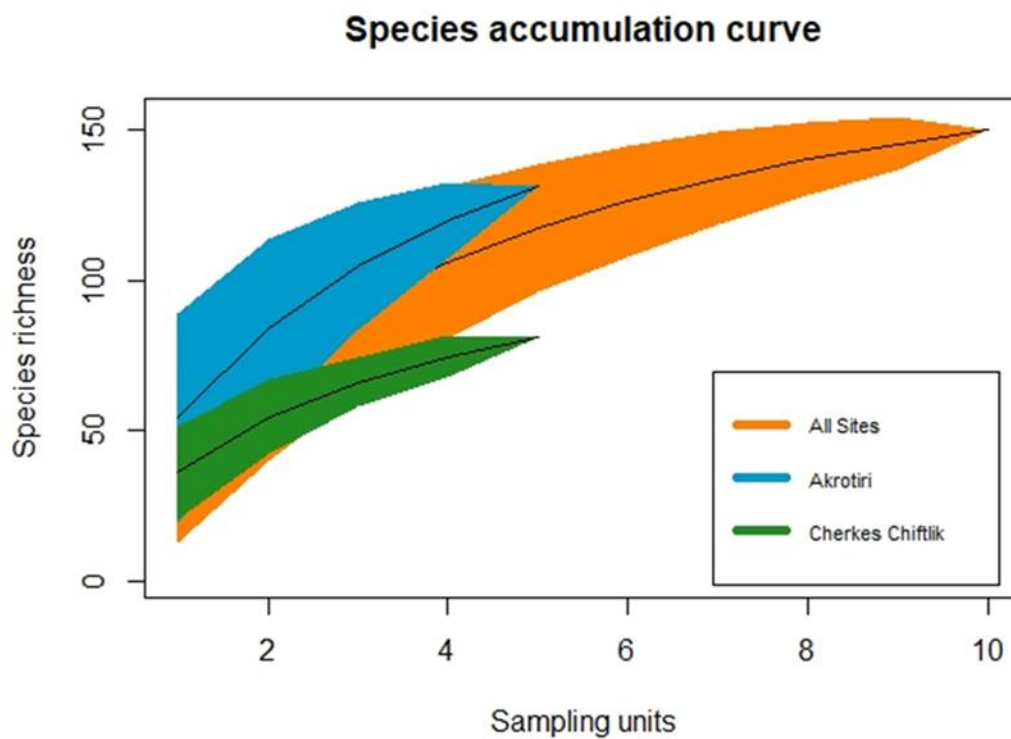
aggregations with nests. *Eucera* bees were observed in a large aggregate in the Akrotiri region and especially in the Akr1 site near *Ophrys* plants.

Richness in the Akrotiri sites was higher than for CC_Asomatos sites, with the exception of Akr4, a site located very close to the sea (Figure 4 and Figure 5). The most abundant site from Akrotiri was Akr1 and from CC_Asomatos was Che2 (Table 2). The NDMS plot showed a higher similarity among CC_Asomatos sites than among Akrotiri sites (Figure 8b).

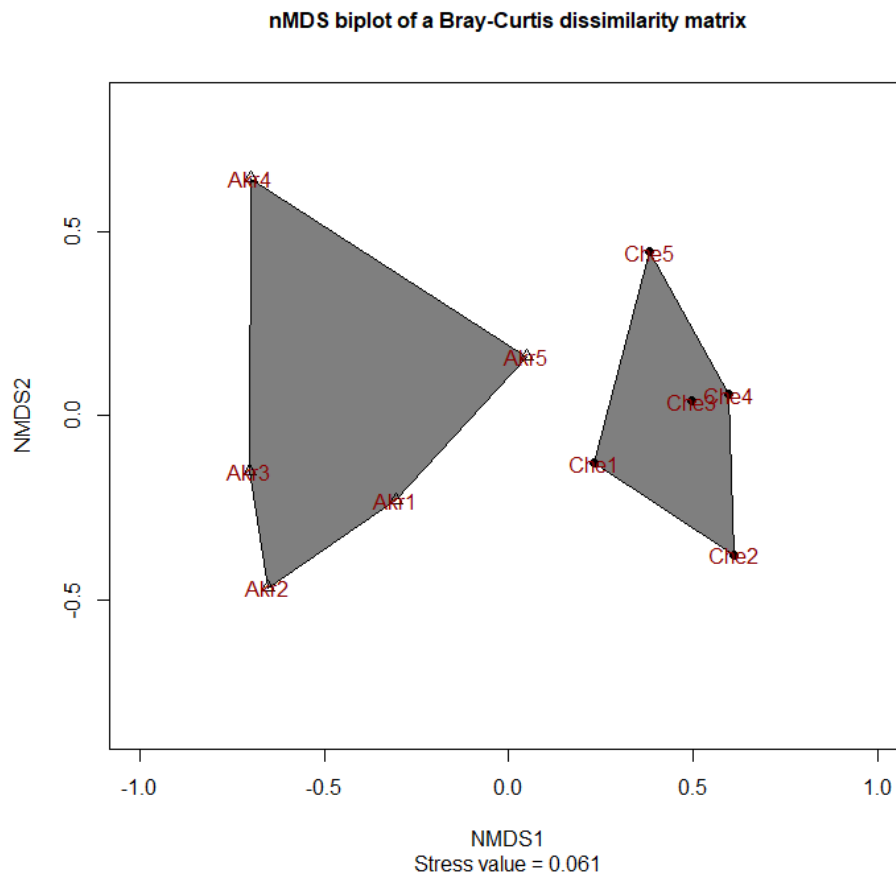
Interaction networks: The network of interactions in the Akrotiri region consisted of 123 species/morphospecies of bees and 64 species of plants. The nestedness was 4.80, connectance 0.05 and interaction evenness 0.58 (Figure 10b). *Onopordum cyprium* was the plant with the highest betweenness centrality index, followed by *Echium angustifolium*, *Thymus capitatus* and *Centaurea hyalolepis*. The network of interactions in the Cherkas Chiftlik-Asomatos region consisted of 74 species of bees and 37 species of plants. The nestedness was 5.00, connectance was 0.07 and interaction evenness 0.53 (Figure 10a). *Sinapis alba* was the plant with the highest betweenness centrality index, followed by *Glebionis coronaria*, *Oxalis-pes caprae* and *Heliotropium sp.*. In the Akrotiri area, polylectic bees were more common than oligolectic with 89 and 19 species respectively. The same was true for CC_Asomatos with 51 species of polylectic bees and 11 oligolectic (excluding morphospecies and species on which the details on foraging habitats are not known from the given bibliography). Polylectic bees collect pollen from multiple plants while oligolectic are restricted to several, usually related species (one genus or family).

Table 2: Abundance, species richness, and diversity indicators in the ten sampling sites, 2016-2018.

	Type_Site	Site	Abundance	SR	Simpson	Shannon	Pielou	Chao	ACE
1	Akr1	Akrotiri	447	74	0.947	3.56	0.827	89.813	95.513
2	Akr2	Akrotiri	269	54	0.953	3.43	0.859	63.067	73.557
3	Akr3	Akrotiri	371	59	0.915	3.10	0.759	77.071	88.390
4	Akr4	Akrotiri	179	22	0.794	2.15	0.694	25.000	30.956
5	Akr5	Akrotiri	235	62	0.940	3.44	0.834	111.600	111.556
6	Che1	Che.Chi.-Asom.	271	42	0.904	2.99	0.801	63.000	56.097
7	Che2	Che.Chi.-Asom.	501	45	0.841	2.47	0.650	54.545	61.119
8	Che3	Che.Chi.-Asom.	139	39	0.877	2.76	0.754	78.429	84.610
9	Che4	Che.Chi.-Asom.	289	31	0.826	2.26	0.658	49.200	50.688
10	Che5	Che.Chi.-Asom.	94	24	0.775	2.24	0.705	54.333	51.968



a)



b)

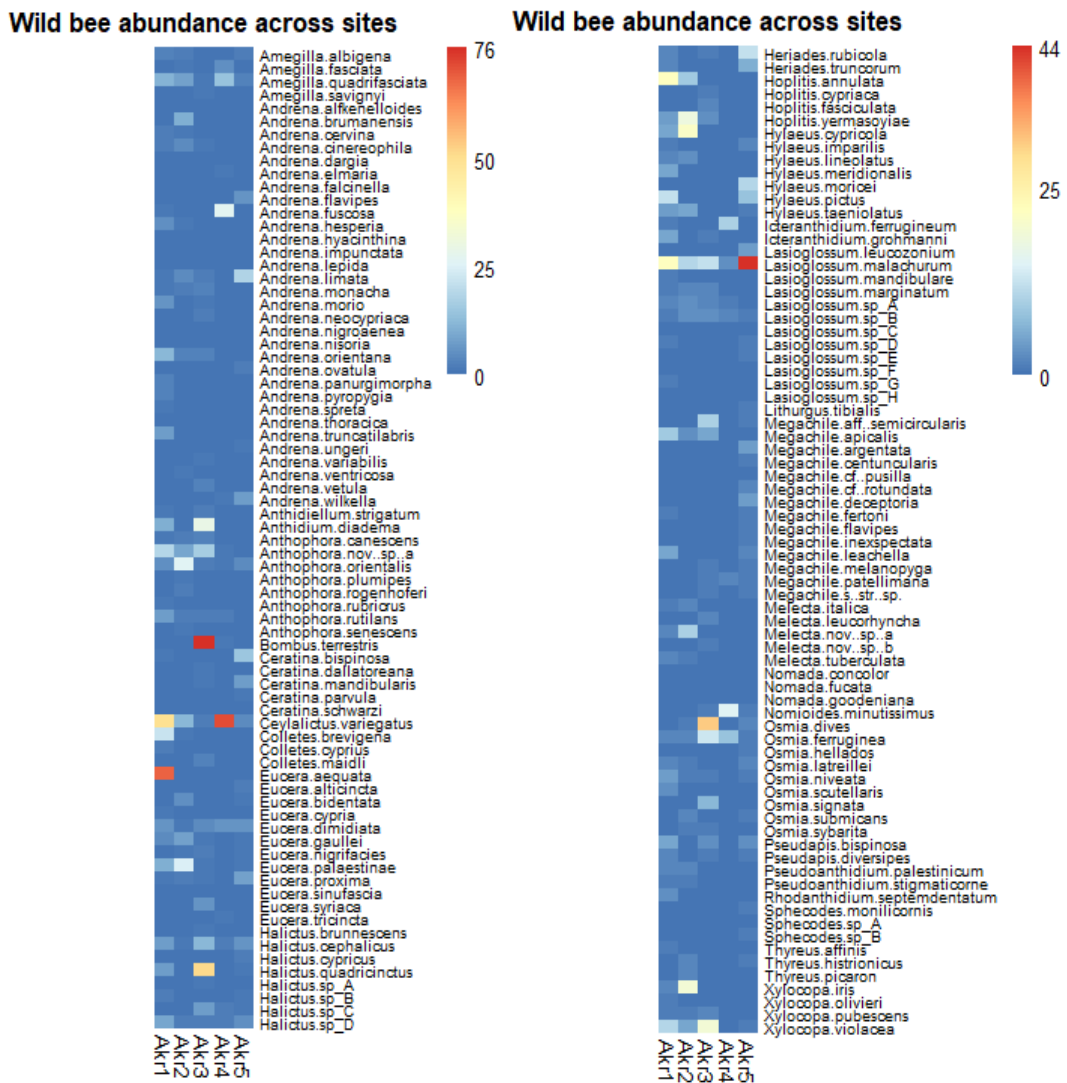
Figure 8: a) Observed species-accumulation curves for each sampling area in recent (P2) period, and b) NMDS bee-species composition per region in recent (P2) period. Each point on the plot (black dots=Cherkes Chiftlik-Asomatos and triangle=Akrotiri region) represents the composition of species found at a sampling site. NMDS ordination was made from Bray-Curtis dissimilarity matrix of bee species' standardized abundances (stress value = 0.06).

Table 3: Beta diversity: Beta total (β_{total}), beta replacement (β_{repl}), and beta richness difference (β_{rich}) for Akrotiri and CC_Asomatos for recent sampling (P2). Method Cardoso.

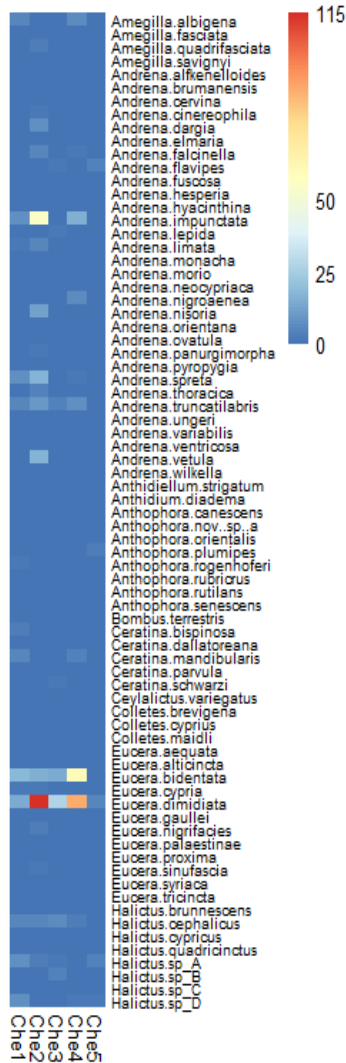
	β_{total}	β_{repl}	β_{rich}
Akrotiri	0.785	0.563	0.222
Cherkes Chiftlik	0.605	0.234	0.371

Total beta diversity was higher in the Akrotiri region than in CC_Asomatos. Partitioning beta diversity returned a higher contribution of β_{repl} (species turnover) for Akrotiri than for the CC_Asomatos region while β_{rich} (nestedness) had a higher value for CC_Asomatos (Table 3).

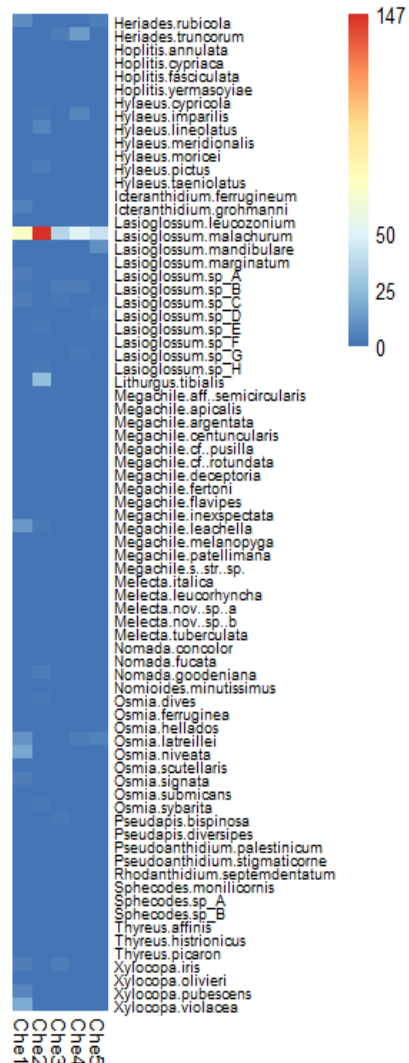
a)



Wild bee abundance across sites

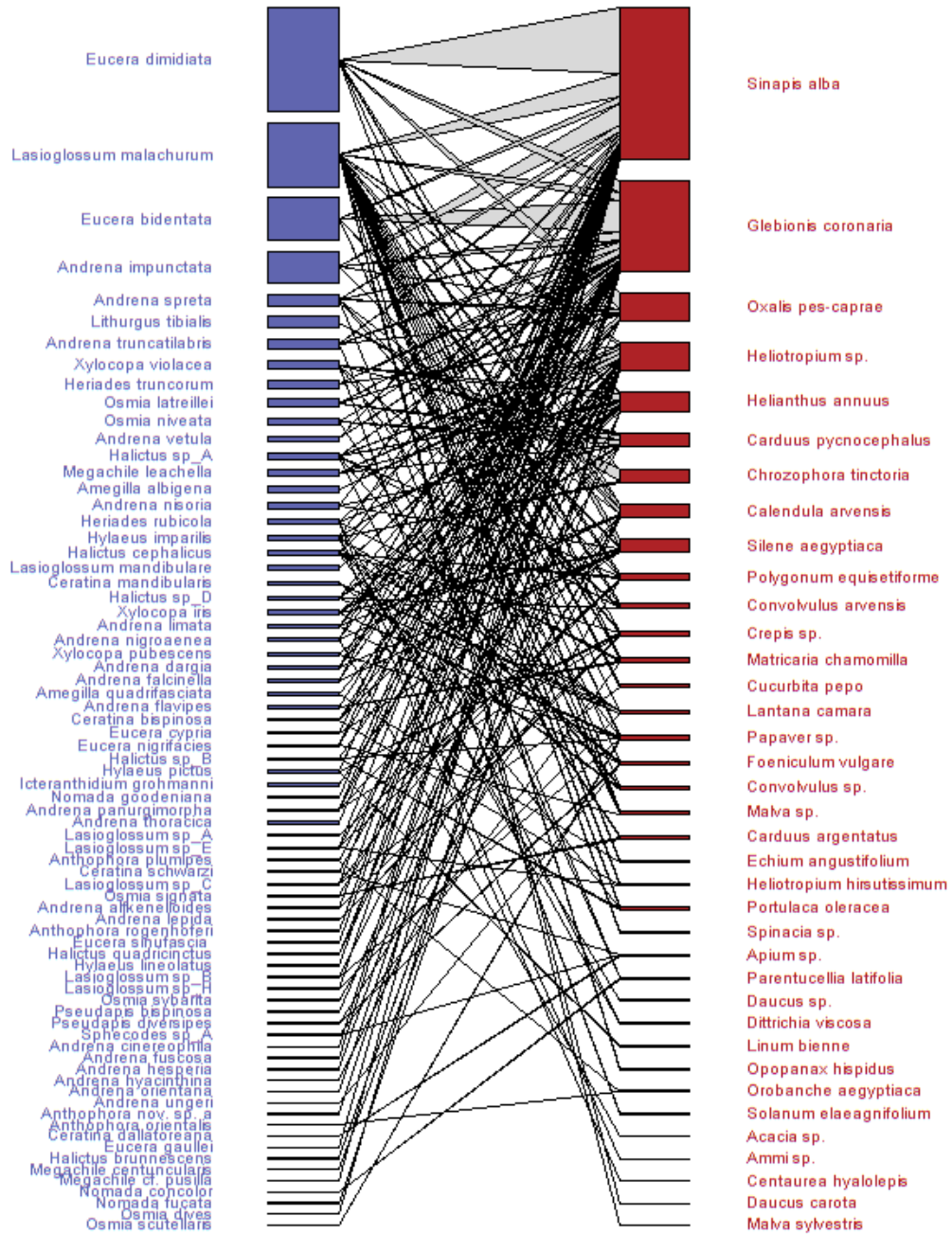


Wild bee abundance across sites

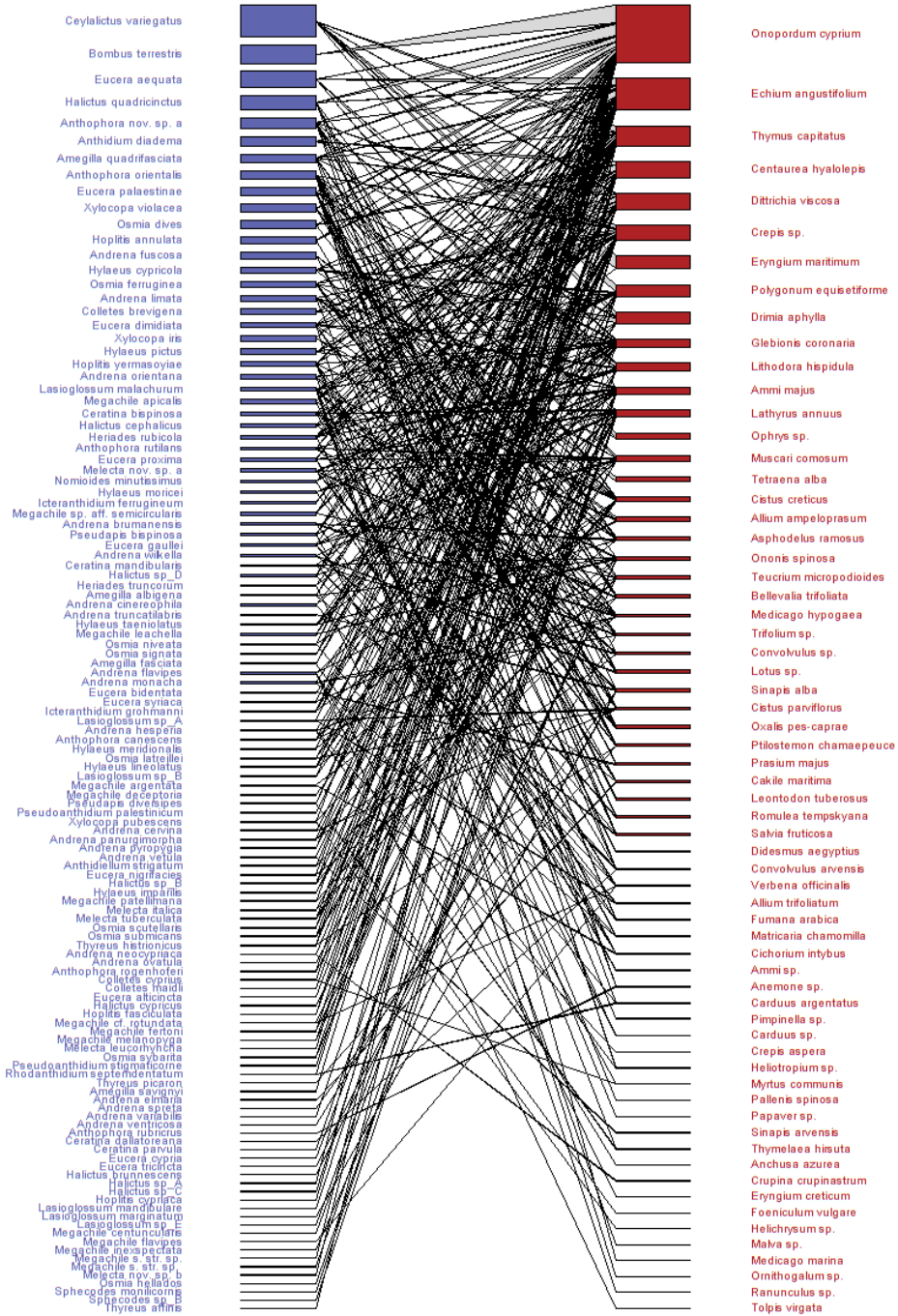


b)

Figure 9: Heatmaps illustrating species abundance in the five sites for recent (P2) sampling period for each of a) Akrotiri and b) CC_Asomatos areas.



a)



b)

Figure 10: Bipartite graph of bee-plant interactions network for a) CC_Asomatos and b) Akrotiri areas for recent (P2) sampling period. Bees are represented on the left side of the graph and plants on the right side. In the network, each species of plant and bee is represented by a rectangle. The width of the rectangles represents the relative frequency of interactions of each species. Diagonal lines forming triangles connect the bee species to plant species, with the width of the triangle base representing the number of interactions observed.

3.4.4 Effects of land-use changes parameters

Both GLMs and LMs indicated that the % cover of the forest and semi-natural area as well as the host plant richness were the most important parameters, predicting overall bee species richness and Shannon diversity index (Table 4). Factor year was not included in the best models as this parameter had no significant effect on the response variables (summary statistics of GLMs and LMs are presented in Supplementary materials, Table S6).

Table 4: Best GLMs and LMs for bee species richness (S) and Shannon diversity index (H); AICc: Akaike Information Criterion for small sample sizes, d.f.: degree of freedom, R²: adjusted R-squared explained.

Variables	d.f.	Estimate	SE	z value	P
S (AICc = 148.34)					
(Intercept)		2.54	0.15	16.85	<0.001
Forest & semi-natural area	17	0.01	0.00	2.92	<0.001
Host Plants		0.06	0.01	5.71	<0.001
H (R² = 0.27)					
(Intercept)		1.57	2.11	7.41	<0.001
Forest & semi-natural area	17	0.00	0.00	1.84	>0.05
Host Plants		0.08	0.02	4.97	<0.001

3.5 Discussion

Comparing historical records with recent sampling enables the study of changes in bee communities over time (Turley et al., 2022). Our study represents the first comprehensive work after Mavromoustakis' extensive bee samplings, as we have revisited and sampled two species-rich areas with contrasting land use patterns and rich historical bee records. Akrotiri and CC_Asomatos, the two focal areas of the current work, are adjacent to each other, with the former characterized as mostly seminatural and the latter as mostly agricultural.

Virtually all species in P2 were (also) captured with netting, which was the method used by Mavromoustakis. There was a substantial species turnover between the two sampling periods, with 43 species collected only in P1, 42 in both periods and 77 only in P2 (Figure 7a). Mavromoustakis collected more species in CC_Asomatos, the mainly agricultural region while we recorded a substantially higher number of species in Akrotiri, a mainly seminatural area (Figure 7a).

Positive or negative variations in species richness and abundance compared to historical records were observed in previous studies (Grixti and Packer, 2006; Bartomeus et al., 2013; Mathiasson and Rehan, 2019; Graham et al., 2021). Grixti and Packer (2006) revisited a study area after 34 years and recorded more species than in the past, which they attributed to habitat heterogeneity. Aldercotte et al. 2021, found that wild bee visitations in watermelon flowers declined by more than half in an eight-year interval, however the authors state that their analysis suggests that the decline might have been a result of stochastic variation. A more global trend was reported by Zattara et al., 2021, who gathered information from the Global Biodiversity Information Facility (GBIF) and showed that 25% less species were reported between 2006 to 2015 compare to pre-1990. They highlight the need for the establishment of monitoring programs to fill the data gap on global bee decline.

The current study provides new insights into the causes of bee species declines, as the sampling design allowed the direct comparison of two neighbouring areas, with different land uses. There was a statistically significant difference in the frequency of species extinctions between the two areas, with CC_Asomatos losing species at twice the rate of Akrotiri, at ca. 75 and 35% respectively, with essentially the same rate holding true for species present in both areas in P1 (Figure 7a, b). In Akrotiri, 17 species recorded from P1 were not rediscovered in P2, while 33 species were resampled. In CC_Asomatos, 61 species recorded from P1 were not rediscovered in P2, while only 19 were resampled.. There were no species present in Akrotiri in P1 but not P2, that were detected in CC_Asomatos in P2. We suggest that the extinction rate observed in CC_Asomatos is a result of the different land use types in the area, and not a sampling artefact.

Anthropogenic activities such as agricultural intensification and artificial constructions which lead to land cover changes are among the most important threats to bees, affecting species richness and abundance (Senapathi et al., 2015). The landscape at the end of P1,

ca. 60 years ago was dominated by agricultural areas in the CC_Asomatos region and by forest and seminatural areas in the Akrotiri region. The two areas have seen generally mild land use changes since Mavromoustakis collections (Figure 5, Table 1). However, urban development is more scattered in CC_Asomatos, affecting all CC_Asomatos sampling sites, but none of the Akrotiri sites. The Akrotiri area retains large and uninterrupted areas of seminatural vegetation.

Insecticide use is a major driver of wild bee declines (Brittain and Potts, 2011; Goulson et al., 2015; Ward et al., 2022). More than 60% of CC_Asomatos area has been used for agriculture in both the historic and the present period. However, the advent of chemical pesticides after the 1950's, as well as the adoption of intensive agricultural methods by the large citrus farms of the area probably exerted significant pressures on bee populations. Competition by honeybee colonies which are found in high numbers in CC_Asomatos during citrus blossoming is an additional pressure on wild bee populations. The diversity of wild plants from which bees were collected was strikingly higher for Akrotiri than for CC_Asomatos, with 64 plant species recorded in Akrotiri belonging to 22 families, and 37 plant species recorded in CC_Asomatos belonging to 19 families (Figure 10). Plant species belonging to the family Asteraceae supported a high abundance and richness of bees in both regions. These findings are similar to Martins et al., 2013 and Nichols et al., 2019 who found that Asteraceae were the most visited plant family and vital for wild bee diversity. *Onopordum cyprium* (Asteraceae) seems to be the most attractive plant in Akrotiri and exists only in the area, while *Sinapis alba* (Brassicaceae) was the most visited plant species in CC_Asomatos. *Sinapis alba* is visited by both, managed and wild bees in the Mediterranean (Ropars et al., 2022). It was more abundant in the CC_Asomatos area which is an agricultural area. Polylectic bees were more abundant in both areas than oligolectic bees. Plant-pollinator network studies are very important to explain species loss and co-occurrence (Ollerton et al., 2011; Burkle et al., 2013). In addition, the high correlation between plant species centrality and attractiveness to bees can be very important for ecological restoration (Maia et al., 2019). According to Wood et al., 2019 species which have specific food preferences are more vulnerable to extinction, e.g. bumble bees are less able to forage on alternative host plants due to the absence of preferred flowers and historical specimens are very important for a better

understanding of species ecology. Ecological restoration helps wild bee conservation as habitat loss is considered one of the major threats (Tonietto and Larkin, 2017).

Wild bee abundance varies among several habitats and depends on land-use pressures. Species react differently to land-use practices according to their vulnerability and ecological traits (De Palma et al., 2015). Bumble bees are less sensitive in intensive agriculture than wild bees (Le Feon et al., 2010) while smaller-bodied species, with shorter flight seasons are found at lower numbers in intensive agriculture areas than large-bodied species which can forage at longer distances (De Palma et al., 2015). According to Geslin et al., 2016, ground nesting bees are more sensitive to urbanization than aboveground nesting species, which are increasing in urban areas along with large-bodied bees. An analysis of the ecological traits of extinct species in the current work can provide useful insights on extinction drivers.

Another aspect that can affect variation in species number between historical and present sampling is the period when bees were collected. Although Mavromoustakis reported collection month for a small proportion of his reports, it seems that he collected more frequently during the spring and summer, with many species records from June to August in the two focal areas of the current work (Mavromoustakis 1949[“1948”], 1951, 1952, 1953, 1954, 1955, 1957a, 1958 [“1957”]). In addition, he sampled the two areas over a 30-year period, compared to the two years for the current study. Recent samplings were performed biweekly with netting and once per month with pan traps, which could explain the higher species richness reported for P2. The accumulation curves were not far from saturation for either area (Figure 8a). However, there was also a difference in species richness increase between the two areas, as species number increased by more than two-fold for Akrotiri, while it remained essentially unchanged for CC_Asomatos (Figure 76a, b). The similar species richness in CC_Asomatos between the two periods seems to be a result of the higher extinction rate detected for the area (Figure 7b).

Sampling efforts over time may bias results as collectors change their methodology (Bartomeus et al., 2013). Thompson et al., 2021 noted that different sampling methods affect species richness results, as there are differences in the capture efficiency for different species. In the current work, the use of pan traps had only a minor effect on results, as we collected only six species in pan traps that were not collected via net, and only one of them was present in P1. The low number of captures in pan traps might have

been a direct result of the small number of traps used – one triplet per site for 24 h, a result of environmental restrictions. Rasmussen et al., 2022 report that it is possible that collectors in the past spent more hours sampling bees, at different locations because of transportation difficulties. Furthermore, historical data is oftentimes biased as the collectors are familiar with the taxonomy of their findings and they used to collect the most important or interesting findings for them (Rasmussen et al., 2022). Thus, rigorous analysis of specimen level data in historical research must be very meticulous compared with research that traces changes in the bee fauna. Hence, past, and recent samplings may not have targeted the same species or habitats (Vray et al., 2019). Although the historical dataset used in the current work might suffer from the same problems, there are reasons to believe that the effect was minimal: Transportation was not a significant problem, as the two areas are very close to each other, and within a 11 km radius from Mavromoustakis residence, and he visited the areas repeatedly over a 30-year period. And although as a famed taxonomist of his era, Mavromoustakis would have focused on species of interest to him, he did publish a series of eight papers focusing specifically on the bee fauna of Cyprus, out of which we retrieved the records for this work (Mavromoustakis 1949[“1948”], 1951, 1952, 1953, 1954, 1955, 1957a, 1958 [“1957”]).

Comparison of the two regions, Akrotiri and CC_Asomatos, in the P2 period, shows higher species richness in more sites located in Akrotiri, a mainly seminatural area. Akr1 was the first site in recorded species richness (Table 2). There was also a significant relationship between host plant diversity and species richness (Table 4). Similarly, Ebeling et al., 2008 observed that the species richness was affected by flowering plant diversity. The 13 new species for Cyprus for the first time, 10 in Akrotiri and five in CC_Asomatos, as well as the three species new to science highlight the importance of the general area for wild bee conservation. The Mediterranean basin is recognized as a biodiversity hotspot and many countries host several bee species. Cyprus hosts close to 400 species (Varnava et al., 2020), Boustani et al. (2021) documented 573 species in Lebanon while Balzan et al. (2016) recorded 95 species in Malta. It is therefore essential to establish a long-term monitoring program to determine the status of wild bees throughout the island (Graham et al., 2021).

Study limitations

The recent sampling in the current work used a restricted number of 10 sites to represent the areas sampled by Mavromoustakis in the past. This approach was required as there is no information (e.g. coordinates) on the exact site where Mavromoustakis collect the bees, except a general name for each area / locality. It is therefore important to interpret with caution conclusions from statistical analyses on the relationship between the changes in wild bee communities and the changes in land cover based on two localities (ten sites). In addition, no information on wild bee abundance from P1 is available. Furthermore, differences in the frequency and season of sampling may have affected the results. Limitations on bee taxonomy were important as few species belonging to the Halictidae family remain unidentified and separated into morphospecies. In addition, a few other species remain unidentified and belong to Megachilidae family. While these species could not affect the main conclusions of the work in a substantial manner, future work will focus on their determination. Changes in the climate between the two periods were not taken into account in the current work. However, the small distance between the two areas suggests that any climate change effects would have been similar. However, further studies on climate change, bee pathogens and diseases are necessary to identify the major threats to bee populations (Cameron et al., 2011).

3.6 Conclusions

Our study was the first comprehensive work after Mavromoustakis's collections that explored changes in wild bee assemblages by using historical data of species richness records after almost 100 years from when he begun sampling. We detected a twice as high wild bee extinction rate for CC_Asomatos, a mainly agricultural area, affected by urban development than for Akrotiri, a mainly seminatural area. Our study shows the importance and limitations of historical data to enhance our knowledge of the effects on wild bees and changes in species richness and abundance.

Additional sampling of bees and plant-pollinator networks is needed to establish a monitoring program and conservation actions for wild bee protection. Regional assessments, revision of priorities and sustainable management of wild pollinators are critically essential (Koh et al., 2015). Furthermore, continued monitoring of wild bees and recording how different agricultural practices affect bees in nesting or habitat

availability will be very important (Mathiasson and Rehan, 2019). Also, more sustainable methods, including the reduction in pesticide use, habitat fragmentation, promoting bee-friendly plants, and increasing nesting opportunities or providing deadwood and nesting holes should be adopted to help bee conservation (Klein et al., 2007; Goulson et al., 2015). Long-term conservation of biodiversity and ecosystem services could be achieved by a holistic ecosystem approach (Senapathi et al., 2015).

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3.8 Supplementary Materials

Table S5. Species of bees recorded from Limassol Cyprus, during the sampling periods P1:1924-1956 (Mavromoustakis G.) and P2:2016-2018 (Varnava A.) in Akrotiri and CC_Asomatos regions.

Thirteen species were new to Cyprus, *Amegilla fasciata*, *A. savignyi*, *Anthophora orientalis*, *Eucera nigrifacies*, *Nomada concolor*, *Andrena falcinella*, *A. impunctata*, *Megachile argentata*, *M. deceptoria*, *M. fertoni*, *Pseudoanthidium palestinicum*, *P. stigmaticorne*, *Hylaeus moricei* and three species new for science, *Anthophora nov. sp. A*, *Melecta nov. sp. A* and *Melecta nov. sp. B*.

Endemic species (E) = *Andrena cervina*, *Colletes cyprius*

	1924-1956	2016-2018	1924-1956	2016-2018
	Akrotiri	Akrotiri	CC_Asomatos	CC_Asomatos
APIDAE				
<i>Amegilla albigena</i>		X		X
<i>Amegilla fasciata</i>		X		
<i>Amegilla glauca</i>	X		X	
<i>Amegilla quadrifasciata</i>	X	X	X	X
<i>Amegilla savignyi</i>		X		
<i>Ammobates biastoides</i>			X	
<i>Ammobates mavromoustakisi</i>			X	
<i>Ancyla holtzi</i>			X	
<i>Anthophora canescens</i>	X	X		
<i>Anthophora orientalis</i>		X		X
<i>Anthophora plumipes</i>		X	X	X
<i>Anthophora rogenhoferi</i>	X	X		X
<i>Anthophora rutilans</i>	X	X	X	
<i>Anthophora rubricrus</i>	X	X		
<i>Anthophora senescens</i>		X		
<i>Anthophora nov. sp. A</i>		X		X
<i>Bombus terrestris</i>		X		
<i>Ceratina bispinosa</i>		X	X	X
<i>Ceratina chrysomalla</i>			X	
<i>Ceratina dallatoreana</i>		X		X
<i>Ceratina moricei</i>			X	
<i>Ceratina mandibularis</i>		X	X	X
<i>Ceratina parvula</i>		X		
<i>Ceratina schwarzi</i>				X
<i>Epeolus bischoffi</i>	X			

<i>Eucera aequata</i>		x		
<i>Eucera alticincta</i>		x		
<i>Eucera bidentata</i>		x		x
<i>Eucera caerulescens</i>			x	
<i>Eucera cypria</i>		x		x
<i>Eucera dalmatica</i>	x			
<i>Eucera dimidiata</i>		x		x
<i>Eucera furfurea</i>	x			
<i>Eucera gaullei</i>	x	x		x
<i>Eucera glauca</i>			x	
<i>Eucera malvae</i>	x			
<i>Eucera nigrifacies</i>		x		x
<i>Eucera palaestinae</i>		x		
<i>Eucera proxima</i>		x	x	
<i>Eucera sinufascia</i>				x
<i>Eucera syriaca,</i>		x		
<i>Eucera tricincta</i>		x		
<i>Melecta italica</i>		x		
<i>Melecta leucorhyncha</i>		x		
<i>Melecta nov. sp. A</i>		x		
<i>Melecta nov. sp. B</i>		x		
<i>Melecta tuberculata</i>		x		
<i>Nomada cherkesiana</i>			x	
<i>Nomada concolor</i>				x
<i>Nomada cypricola</i>			x	
<i>Nomada fucata</i>				x
<i>Nomada goodeniana</i>				x
<i>Nomada trispinosa</i>			x	
<i>Pasites maculatus</i>			x	
<i>Tarsalia ancyliformis</i>	x		x	
<i>Tarsalia hirtipes</i>			x	
<i>Thyreus affinis</i>	x	x		
<i>Thyreus histrionicus</i>	x	x	x	
<i>Thyreus picaron</i>		x		
<i>Thyreus ramosus</i>	x		x	
<i>Xylocopa iris</i>		x		x
<i>Xylocopa pubescens</i>		x		x
<i>Xylocopa olivieri</i>	x	x		
<i>Xylocopa violacea</i>	x	x		x
ANDRENIDAE				
<i>Andrena aeneiventris</i>			x	
<i>Andrena alfenelloides</i>				x
<i>Andrena brumanensis</i>		x		
<i>Andrena cervina</i> (E)		x		
<i>Andrena cinereophila</i>		x		x
<i>Andrena colletiformis</i>			x	
<i>Andrena combinata</i>			x	

<i>Andrena dargia</i>				X
<i>Andrena elmaria</i>		X		
<i>Andrena falcinella</i>				X
<i>Andrena flavipes</i>		X	X	X
<i>Andrena fuscosa</i>		X	X	X
<i>Andrena hesperia</i>	X	X		X
<i>Andrena hyacinthina</i>				X
<i>Andrena impunctata</i>				X
<i>Andrena lepida</i>				X
<i>Andrena limata</i>		X		X
<i>Andrena monacha</i>		X		
<i>Andrena morio</i>		X	X	
<i>Andrena neocyprica</i>		X		
<i>Andrena nigroaenea</i>				X
<i>Andrena nisoria</i>				X
<i>Andrena oligotricha</i>			X	
<i>Andrena orientana</i>		X		X
<i>Andrena ovatula</i>		X		
<i>Andrena panurgimorpha</i>		X		X
<i>Andrena pyropygia</i>		X	X	
<i>Andrena spreta</i>		X		X
<i>Andrena thoracica</i>				X
<i>Andrena transitoria</i>			X	
<i>Andrena truncatilabris</i>		X	X	X
<i>Andrena ungeri</i>		X	X	X
<i>Andrena variabilis</i>		X	X	
<i>Andrena ventricosa</i>		X	X	
<i>Andrena vetula</i>		X		X
<i>Andrena wilkella</i>		X		
MEGACHILIDAE				
<i>Anthidiellum strigatum</i>	X	X	X	
<i>Anthidium cingulatum</i>	X		X	
<i>Anthidium diadema</i>		X		
<i>Anthidium loti</i>			X	
<i>Coelioxys acanthura</i>	X		X	
<i>Coelioxys afer</i>			X	
<i>Coelioxys argenteus</i>	X		X	
<i>Coelioxys brevis</i>			X	
<i>Coelioxys conoideus</i>			X	
<i>Coelioxys decipiens</i>			X	
<i>Coelioxys elegantulus</i>			X	
<i>Coelioxys haemorrhoea</i>			X	
<i>Heriades rubicola</i>	X	X	X	X
<i>Heriades truncorum</i>		X		X
<i>Hoplitis annulata</i>	X	X		
<i>Hoplitis cyprica</i>		X		
<i>Hoplitis fasciculata</i>		X	X	

<i>Hoplitis yermasoyiae</i>		X		
<i>Icteranthidium ferrugineum</i>	X	X		
<i>Icteranthidium grohmanni</i>		X		X
<i>Lithurgus chrysurus</i>			X	
<i>Lithurgus tibialis</i>		X	X	X
<i>Megachile albisecta</i>	X		X	
<i>Megachile apicalis</i>	X	X	X	
<i>Megachile argentata</i>		X		
<i>Megachile centuncularis</i>		X	X	X
<i>Megachile deceptoris</i>		X		
<i>Megachile fertoni</i>		X		
<i>Megachile flavipes</i>	X	X	X	
<i>Megachile inexpectata</i>		X		
<i>Megachile leachella</i>		X		X
<i>Megachile melanopyga</i>		X		
<i>Megachile patellimana</i>	X	X		X
<i>Megachile cf. pusilla</i>				X
<i>Megachile roeweri</i>	X			
<i>Megachile rotundata</i>	X	X		
<i>Megachile s. str. sp_A</i>		X		
<i>Megachile sp. aff. semicircularis</i>		X		
<i>Osmia dives</i>		X		X
<i>Osmia ferruginea</i>	X	X		
<i>Osmia hellados</i>		X		
<i>Osmia latreillei</i>		X	X	X
<i>Osmia niveata</i>		X		X
<i>Osmia scutellaris</i>	X	X		X
<i>Osmia signata</i>		X		X
<i>Osmia submicans</i>	X	X		
<i>Osmia sybarita</i>		X		X
<i>Osmia viridana</i>	X			
<i>Pseudoanthidium palestinicum</i>		X		
<i>Pseudoanthidium stigmaticorne</i>		X		
<i>Rhodanthidium septemdentatum</i>		X		
<i>Stelis signata</i>	X		X	
HALICTIDAE				
<i>Cealylictus variegatus</i>	X	X	X	
<i>Halictus sp_A</i>		X		X
<i>Halictus sp_B</i>		X		X
<i>Halictus sp_C</i>		X		X
<i>Halictus sp_D</i>		X		X
<i>Halictus brunnescens</i>	X	X	X	X
<i>Halictus cephalicus</i>	X	X	X	X
<i>Halictus cypricus</i>	X	X	X	
<i>Halictus quadricinctus</i>		X		X
<i>Halictus tetrazonianellus</i>			X	
<i>Lasioglossum sp_A</i>		X		X

<i>Lasioglossum sp_B</i>		x		x
<i>Lasioglossum sp_C</i>				x
<i>Lasioglossum sp_D</i>		x		x
<i>Lasioglossum sp_E</i>		x		x
<i>Lasioglossum sp_F</i>				x
<i>Lasioglossum sp_G</i>		x		x
<i>Lasioglossum sp_H</i>				x
<i>Lasioglossum aegyptiellum</i>			x	
<i>Lasioglossum griseolum</i>			x	
<i>Lasioglossum leucozonium</i>		x		
<i>Lasioglossum lineare</i>	x			
<i>Lasioglossum malachurum</i>		x	x	x
<i>Lasioglossum mandibulare</i>		x	x	x
<i>Lasioglossum marginatum</i>		x		x
<i>Nomioides minutissimus</i>	x	x		
<i>Pseudapis bispinosa</i>	x	x	x	x
<i>Pseudapis diversipes</i>	x	x	x	x
<i>Sphecodes sp_A</i>				x
<i>Sphecodes sp_B</i>		x		
<i>Sphecodes albilabris</i>	x		x	
<i>Sphecodes alternatus</i>			x	
<i>Sphecodes gibbus</i>			x	
<i>Sphecodes monilicornis</i>		x	x	
<i>Sphecodes puncticeps</i>			x	
COLLETIDAE				
<i>Colletes brevigena</i>	x	x		
<i>Colletes cyprius</i> (E)	x	x	x	
<i>Colletes maidli</i>		x	x	
<i>Colletes similis</i>	x		x	
<i>Hylaeus cornutus</i>			x	
<i>Hylaeus cypricola</i>		x	x	
<i>Hylaeus imparilis</i>		x		x
<i>Hylaeus lineolatus</i>		x		x
<i>Hylaeus meridionalis</i>	x	x	x	
<i>Hylaeus moricei</i>		x		
<i>Hylaeus pictus</i>	x	x	x	x
<i>Hylaeus scutellatus</i>			x	
<i>Hylaeus taeniolatus</i>		x		x

Table S6. Set of GLMs and LMs, for bee species richness (S) and Shannon diversity index (H). FSA: % cover of forest and semi-natural areas, HP: host plant richness. Models are ranked based on their corresponding AICc and R². The best models are presented in bold.

Metric	Model (GLMs)	d.f.	Log-Likelihood	AICc	Akaike weight
S	FSA + HP	17	-68.84	148.34	0.73
	FSA + HP+ Year	16	-68.60	151.49	0.88
	HP	18	-72.23	151.97	1
Metric	Model (LMs)		R²		
H	FSA + HP	17	0.57		
	FSA + HP+ Year	16	0.54		
	FSA	17	0.01		
	HP	18	0.51		

CHAPTER 4

4 Chapter 4: Assessing the biodiversity and the impact of pollinators on carob production

4.1 Abstract

As the current climate crisis intensifies, drought resistant crops are becoming more important due to their ability to withstand the increasingly hotter and drier summers. Such crops are valuable for pollinators as they provide food resources for wild and managed species. The carob tree (*Ceratonia siliqua* L.) represents an example of a heat- and drought- resistant crop, able to grow in dry areas with practically no inputs. The current study assessed the diversity of wild bees and other pollinators relying on carob flowers, as well as the contribution of animal pollination to carob production. Carob flowers were subjected to two treatments: Open pollination, where inflorescences were left untreated, and wind pollination, where inflorescences were bagged in a mesh during blooming. Weekly observations during blooming showed that *Apis mellifera* was the most frequent floral visitor followed by wild bees and wasps. Carob flowers were visited by at least 10 different wild bee species. Open-pollinated flowers produced significantly more pods, with the benefit ranging from 4 to 16 times higher production, depending on the region. Open pollination led to pods with greater weight, length and number of seeds compared to pods derived from wind pollination. The results of the current study highlight the importance of animal pollination to carob production, as well as the significance of carob trees to wild bee conservation.

Keywords: Climate change, *Ceratonia siliqua* L., pollination, bees, *Apis*, *Colletes*, *Hylaeus*

4.2 Introduction

Pollination is one of the most important ecosystem services, with most plant species depending on pollination by animals (Potts et al., 2010; Potts et al., 2016; Pan et al., 2022). Flower-visiting animals are responsible for the pollination of more than 70% of the leading global food crops, representing 35% of global production (Holzschuh et al., 2012). Insects such as bees, butterflies, moths, flies, wasps, beetles and thrips and vertebrates, such as birds, bats, lizards, and other mammals are the most important pollinators (Potts et al., 2016; Pires and Maués, 2020; Khalifa et al., 2021). The estimated global value of pollination ranges from US\$195 billion to US\$387 billion annually (Porto et al., 2020). Human well-being benefits from pollinators, as their presence ensures crop food security, conserves the diversity of wild plants, maintains the production of honey and other beekeeping products, and supports cultural ecosystem services (Potts et al., 2016; Garibaldi et al., 2011).

Social and wild bees are considered the most important pollinators of wild and cultivated plants, with approximately 20,000 species described worldwide (Winfrey et al., 2008; Nieto et al., 2014). Managed *Apis* species, such as *A. mellifera*, are considered the leading pollination providers (Klein et al., 2007). However, the threats faced by honey bees over recent years increased the importance of wild bees as alternative or complementary providers of pollination services (Mallinger and Gratton, 2015; Blitzer et al., 2016). Wild bees contribute to the pollination of many crops, such as coffee, melon, tomato, sunflower, canola, blueberries, apple, and almonds, among many others (Mandelik and Roll, 2009; Nieto et al., 2014). According to MacInnis and Forrest (2019), strawberries pollinated by wild bees were heavier than those pollinated by honeybees. The pollination effectiveness depended on wild bee abundance as floral pollen loads were not affected by species richness. In another study, wild bees were identified as the most important pollinators with strawberry fruit produced having fewer malformations, greater weight and longer shelf-life, resulting in higher commercial value (Klatt et al., 2014). Similar results have also been reported for other fresh fruits, such as sweet cherry (Holzschuh et al., 2012). In addition, a higher diversity and abundance of wild bees resulted in enhanced fruit set in apple orchards (Blitzer et al., 2016). The use of managed solitary bees like *Osmia* can increase fruit set in almond orchards, where a small

population ensured effective pollination even though social bees were 10 times more abundant (Koh et al., 2018; Bosch et al., 2021).

The carob tree (*Ceratonia siliqua* L) is an underutilized crop with descending trends regarding production volumes, yet it represents an excellent model of a heat- and drought- resistant crop, grown in dry areas with practically no inputs (Davies, 1970; Eshghi et al., 2018); its longevity in some cases can reach 200 years (Ait Chitt et al., 2007). It is an evergreen dioecious species with some hermaphroditic forms (Batlle and Tous, 1997). Carob tree domestication in the Mediterranean region dates back to the Roman times and was associated with the introduction of scion grafting in the Mediterranean basin (Zohary, 2002). Work by Baumel et al. (2022) points out to multiple origins of domestication of locally selected genotypes, as well as scattered long-distance westward dispersals, along migration routes by Romans, Greeks and Arabs. In the last decades, cultivation spread in areas with a similar climate to the Mediterranean, including California, Arizona, Mexico, Argentina, Australia, India, and South Africa (Batlle and Tous, 1997). Carob pods have traditionally been used as feed for livestock (Kotrotsios et al., 2012), and for human nutrition, consisting of dietary fiber, sugars, and a range of bioactive compounds, such as polyphenols and pinitol (Batlle and Tous, 1997; Nasar-Abbas et al., 2016; Goulas et al., 2016).

Carob cultivation is linked to the culture and traditions of Cyprus; in the past the crop has had substantial importance to the rural economy (Davies, 1970). Currently, the remaining carob trees (ca. 2000 ha) are a defining feature of the high nature value farmland landscape of Cyprus (Zomeni et al., 2018), and form together with olive trees the basic constituents of the habitat type 9320 (Oleo-ceratonion - olive tree and carob tree forests) of Annex I of the Habitats Directive (92/43/EEC). It is an entomophilous species, mainly pollinated by flies, bees, and wasps but is also wind-pollinated, depending on the habitat (Dafni et al., 2012; Tous, 2013; USDA, 2017).

Diurnal and nocturnal entomophilous pollinators visit carob flowers (Dafni et al., 2012). However, scarce information exists on the contribution of wild bee species to carob pollination, as well as on the importance of carob flowers to wild bee species. Dafni et al. 2012 reported two unidentified wild bee species visiting carob flowers, and a few other studies refer to *Apis mellifera* as a key carob tree pollinator (Linskens and Scholten 1980; Retana et al., 1990; Ortiz et al., 1996). Cyprus hosts 369 bee species (Varnava et al.,

2020), but no data exist on their importance to carob pollination. Furthermore, there is no information on the contribution of pollinators to carob production. The current work aimed at assessing the contribution of insects to carob pollination towards yield efficiency and at documenting the diversity of wild bees in carob groves.

4.3 Materials and Methods

4.3.1 Bee presence-absence study

The bee presence-absence study was conducted in the following distinct carob growing regions: (1) North-West Coast (Polis Chrysochous area), (2) the South Plateau (Anogyra area) and (3) the South Coast (Zygi area) in 2016 (Figure 11). NW Coast and the S. Plateau were additionally used for sampling in the 2017 growing season. The three regions represent different landscape types, with the NW Coast classified as settled cultivated coastal lowland, the South Coast as settled cultivated coastal alluvial plain and the South Plateau as settled agrosilvopastoral plateau (Warnock, Griffiths and Vogiatzakis, 2008). Carob groves were located at a minimum distance of 1 km from each other. One male and four female trees were sampled for each of the four carob groves in each region. Most carob groves on the island contain a single male tree. Application of pesticides is very uncommon in carob groves, and no pesticide applications were made to the groves selected for the current work.



Figure 11. Study sites for the bee presence-absence and carob pollination studies. Bee presence-absence study: North-West Coast - NW C1-4 green dots, South Plateau - SP1-4 red dots, South Coast - SC1-4 yellow dots. South-East Lowlands - SE1 brown dot.

Each carob grove was sampled weekly for five consecutive weeks during carob blooming on Julian days 294 to 323 in 2016 (October 21 to November 19, 2016) and 293 to 322 in 2017 (October 18 to November 20, 2017). Samplings were conducted between 08:30-12:30. For each tree, observations were carried out for two min on each of the four cardinal sides of the tree (north, west, south, and east), resulting in a total of eight min per tree and 40 minutes per carob grove (five trees x eight minutes each). For each tree side, data regarding the presence-absence of *A. mellifera*, wild bees and other potential pollinators (e.g. wasps, Diptera) were collected. Wild bee specimens representing different morphospecies were collected with a net and transferred to the laboratory for identification at the genus/species level.

4.3.2 Carob pollination study

The carob pollination study was conducted in three carob groves, one each in the NW Coast (NW C 4), the S. Plateau (SP 1) and the South-East Lowlands (SE 1, Figure 11) in

2017. The groves in NW Coast and S. Plateau were selected among the ones used for the bee presence-absence study. The SE Lowlands region is classified as settled lowlands farmland (Warnock, Griffiths and Vogiatzakis, 2008). Based on discussions with growers, the trees in NW C 4 and SP 1 belonged to the landrace Tillyria, while the ones in the SE 1 to the landrace Apostolika, but we note that in many cases it is not possible to separate the two landraces based on morphology alone (Kyratzis et al., 2021).

To assess the contribution of insects to pollination, groups of inflorescences on trees in each carob grove were assigned to two different treatments: a) open pollination, and b) wind pollination. In the open pollination, carob tree inflorescences were not subjected to any treatment, while in the wind pollination inflorescences were enclosed in an insect-proof mesh bag (1 mm size mesh opening) before the start of blooming. For each of the 20 trees per carob grove, two branches were randomly selected with one group of inflorescences per branch assigned to open pollination and another group assigned to wind pollination (20 trees x 2 branches per tree x 1 group of inflorescences per treatment per branch). Carob inflorescences are found in groups on branches. The number of inflorescences per group varied from five to 30 (median = 15) in the SE Lowlands, four to 16 in the S. Plateau (median = 9), and six to 20 in NW Coast (median = 10).

The mesh bags were removed at the end of November, after the end of blooming. All mature carob pods produced were harvested on Julian day 182 of 2018 (July 1st, 2018). Carob pods were transferred to the lab, where we measured the weight, length, and number of seeds produced per pod.

To examine the short-term transfer of pollen by the wind from male to female trees we placed pollen traps on one male (the only male tree present in the carob grove) and five female trees in the SE Lowlands carob grove. Female trees were located at 12, 60, 63 109 and 172 m from the male tree. Pollen traps were constructed using 10 cm diameter and 4.5 cm depth plastic bowls, the base of which was covered with 3 cm height gypsum plaster to limit shaking by the wind. A 9 cm Petri dish, with a filter paper covering its base and filled with 30 ml of 99.5% glycerin was placed within the bowl. The pollen traps were hung on the tree, with a total of four traps for each of the male and five female trees (24 traps in total). The traps remained in the trees for 24 h (18/11/2017-19/11/2017). After collection of the traps, the glycerin was transferred into 50 ml falcon tubes and stored in the lab at -20 °C. To retrieve pollen grains present in the glycerin, falcons were

centrifuged at 3500 *g* at 4 °C for 20 min. If present, a small part of the pollen pellet was removed, dissolved in 50 µl water, stained with fuchsin and observed under a microscope to confirm the presence or absence of pollen grains.

4.3.3 Statistical analyses

All statistical analyses were carried out in the open-source R language and environment for statistical computing (R Core Team, 2021). Data were curated and plotted using the tidyverse package (Wickham et al. 2019).

The bee presence-absence data were analyzed in a generalized linear mixed-effects model framework using the package lme4 (function glmer) (Bates et al., 2015), with a log link and a binomial distribution. The response variable was wild bee presence (present or absent). Two analyses were carried out. First an analysis of the 2016 data for all three regions with fixed factors region (NW Coast, S. Plateau, S. Coast), week (5 sampling weeks), tree sex (Male or Female), tree side (N, S, E, W), *A. mellifera* presence, and wasp presence (present or absent).

The second analysis included the NW Coast – S. Lowlands groves which were sampled both in 2016 and 2017. The fixed factors for the model were region (N. Coast, S. Lowlands), year (2016 or 2017), week (5 sampling weeks), tree sex (Male or Female), tree side (N, S, E, W) *A. mellifera* presence and wasp presence (present or absent).

Interactions between the fixed factors were not modelled in either analysis, as their inclusion led to model convergence problems. Tree was included as a random factor for both analyses. Including both plot and tree nested within plot as random factors resulted in a singular model fit, indicating that the random effect structure was too complex to be supported by the data. Model fitting was carried out using the Bobyqa algorithm with the maximum number of iterations set to 2*10⁹. The significance of fixed effects was assessed using F-tests, with denominator degrees of freedom obtained by running the model in lme as a linear mixed effects model (package nlme) (Pinheiro et al., 2021), as discussed by Bolker (2022). Model diagnostics were performed in the DHARMA package using the function simulateResiduals (Hartig, 2021). The function runs tests for correct distribution (KS test), dispersion and residuals, as well as the Levene test for homogeneity of variance. All models fitted the data well.

For the carob pollination study, the data on the number of pods produced in open vs wind pollination were analyzed in a generalized linear mixed effects model framework using the package `glmmTMB` (function `glmmTMB`) (Brooks et al. 2017). Preliminary data analyses showed that the pod number data were over-dispersed, with greater variation than that predicted by the poisson model. The package `glmmTMB` allows for the modeling of data using a log link, and a negative binomial distribution (family `nbinom1`, where the variance increases linearly with the mean). Treatment (Open – Wind Pollination), carob grove (SE Lowlands 1, NW Coast 4, S. Plateau 1) and their interaction were included as fixed effects, while tree and branch nested within tree were incorporated in the model as random effects. The significance of fixed effects was assessed using the `Anova` function of the `car` package (Fox and Weisberg, 2019), which applies Wald chi-square tests. We point our readers to the ongoing discussion about the use of p-values and the different options available to evaluate models at the GLMM FAQ site (Bolker, 2022). The data on pod weight were analyzed in a linear mixed effects framework (function `lmer`) in the package `lme4` (Bates et al. 2015). The model included treatment (open – wind pollination), carob grove (SE Lowlands 1 vs NW Coast 4 vs S. Plateau 1) and their interaction as fixed effects. The data from SE Lowlands were not included in the analysis as there were only five pods produced by a total of three carob trees in the wind pollination treatment. Tree, branch nested within tree, and inflorescence nested within branch, within tree were incorporated in the model as random effects. Degrees of freedom for F-tests were estimated with Satterthwaite’s approximation as implemented in the `ANOVA` function of the package `lmerTest` (Kuznetsova et al., 2017).

Model diagnostics were performed in the `DHARMA` package (Hartig, 2021) using the function `simulateResiduals`, as outlined in the bee presence-absence study. All models fitted the data well, with the exception of pod weight data where there was a slight departure from variance homogeneity of the simulated residuals, which did not seem to be a major issue after checking the plot of simulated scaled residuals (data not shown).

4.4 Results

4.4.1 Bee presence-absence study

The overwhelming majority of insect visitors to carob flowers belonged to the order Hymenoptera, i.e. social and wild bees and wasps (Figure 12, 13), while negligible visits by Lepidoptera or Diptera (Syrphidae) were detected (data not shown). *Apis mellifera* was the most common species, on both male and female trees, followed by wild bees and wasps (Figure 12). As shown in Figure 13, there was a trend of more insect presences at the beginning of carob blooming.

Identified wild bees belonged to ten different species, representing three families: Halictidae with *Lasioglossum sp.* and *Ceylalictus variegatus*, Andrenidae with *Andrena bicolor*, *Andrena vulpecula* and *Andrena aff. rufitibialis* and Colletidae with *Colletes brevigena*, *Colletes cyprius*, *Hylaeus cypricola*, *Hylaeus imparilis* and *Hylaeus taeniolatus*. *Colletes brevigena* and *H. taeniolatus* were present in all sampling regions during both years (Figure 14). NW_Coast_4 was the most species-rich plot with seven species represented, followed by NW_Coast_1 with six species and NW_Coast_3, S_Plateau_1, S_Coast_4 and SE_Lowland_1 with five species each.

The wasp specimens represented three species belonging to three genera and two families: Crabronidae with *Cerceris sp.* and *Philanthus sp.* and Vespidae with *Vespula germanica* (Figure 14). *Cerceris sp.* and *V. germanica* were present in all sampling regions, while *Philanthus sp.* was present only in NW_Coast and SE_Lowland.

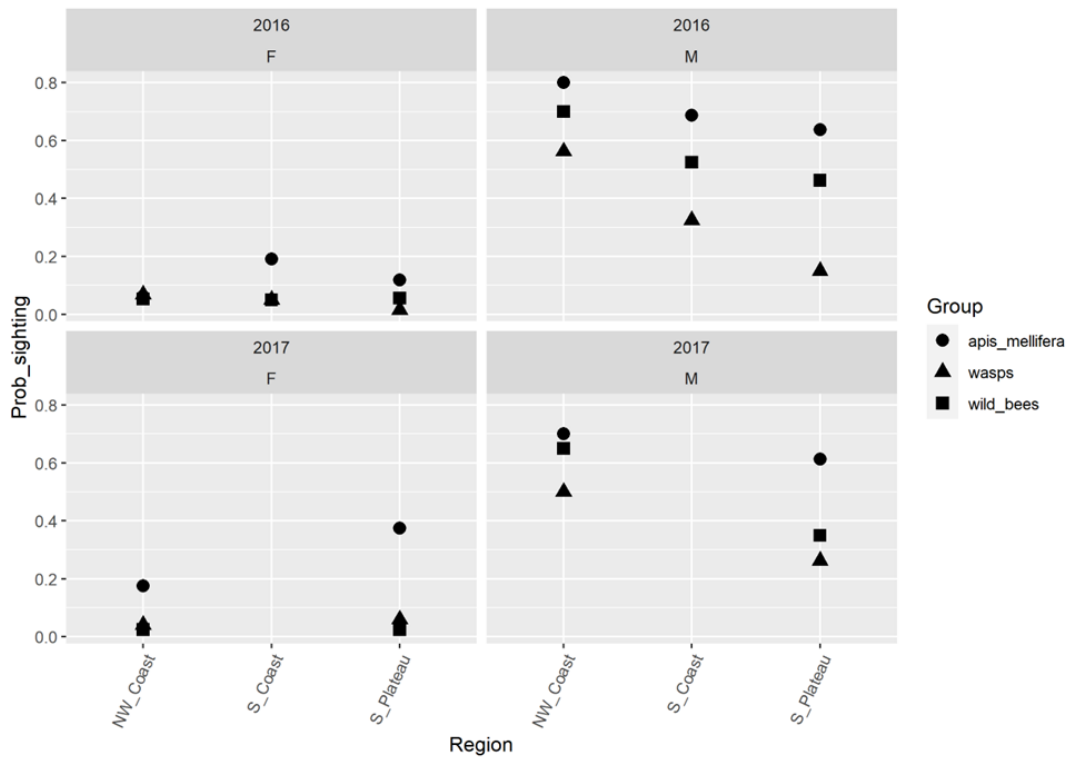


Figure 12: Probability of sighting wild bees, *A. mellifera*, or wasps on female (F) and male (M) carob trees in the three sampling regions for 2016 and 2017. The S. Coast region was sampled in 2016 only. Each point represents the probability of observing at least one individual of the species group at a sampling point (each of four tree sides, five trees per plot, four plots per region) during five weeks of sampling.

The impact of different factors on wild bee presence is shown in Table 5 (NW Coast, S. Coast and S. Plateau in 2016) and Table 6 (NW Coast, S. Plateau in 2016 and 2017). In both analyses, there was a significant effect of tree sex, *A. mellifera* presence, and wasp presence on wild bee presence ($P < 0.001$). The effect of region, week and year were not significant ($P > 0.05$). Sightings of wild bees were more frequent on male trees and trees with *A. mellifera* or wasp presence (Figures 12, 13).

Table 5: Statistical analyses for the generalized mixed-effects model evaluating the effect of region, week, tree sex, tree side, *A. mellifera* and wasp presence on wild bee presence in three regions in 2016.

Fixed Effects	df		<i>F</i> -value	<i>P</i> -value
Region (NW Coast, S. Coast, S. Plateau)	2	56	0.18	0.84
Week	4	1131	1.84	0.12
Tree sex (male or female)	1	56	19.79	< 0.001
Tree side (N, S, E, W)	3	1131	0.48	0.70
<i>Apis mellifera</i> presence	1	1131	52.37	< 0.001
Wasp presence	1	1131	27.62	< 0.001
*SD for Random Effect of Carob Tree (<i>n</i> =60)			2.76	
Residual degrees of freedom			1186	

* SD: standard deviation. See Materials and Methods and Results for more information on statistical analyses.

Table 6: Statistical analyses for the generalized mixed-effects model evaluating the effect of region, year, week, tree sex, tree side, *A. mellifera* or wasp presence on wild bee presence in two regions in 2016 and 2017.

Fixed Effects	df		<i>F</i> -value	<i>P</i> -value
Region (NW Coast, S. Plateau)	1	37	0.07	0.79
Year	1	1550	0.74	0.39
Week	4	1550	1.95	0.10
Tree sex (male or female)	1	37	22.08	< 0.001
Tree side (N, S, E, W)	3	1550	0.62	0.60
<i>Apis mellifera</i> presence	1	1550	56.64	< 0.001
Wasp presence	1	1550	21.83	< 0.001
*SD for Random Effect of Carob Tree (<i>n</i> =40)			2.82	
Residual degrees of freedom			1586	

* SD: standard deviation. See Materials and Methods and Results for more information on statistical analyses.

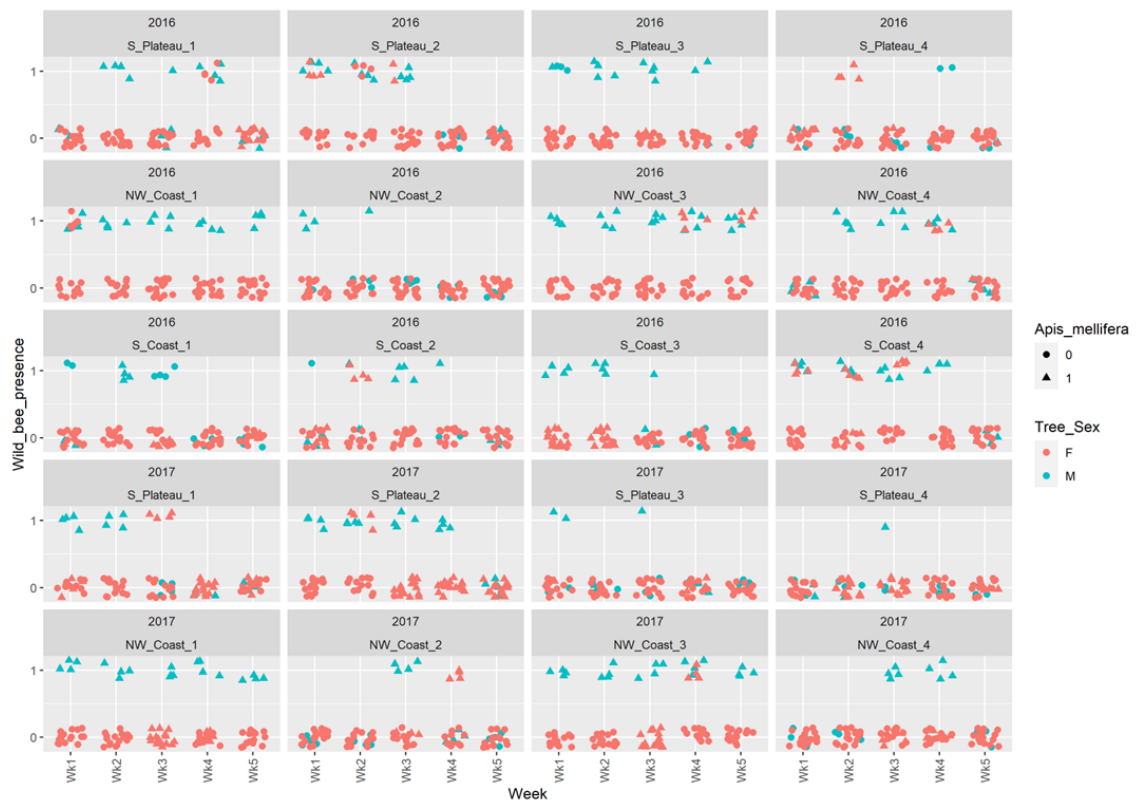


Figure 13. Wild bee presence in the 12 different carob plots sampled for the bee presence-absence study in 2016 and 2017 (S. Coast plots were sampled only in 2016). The graphs show presence or absence of wild bees on four female (red color) and one male tree (cyan) per plot, during five weeks of sampling. All four sides of each tree were sampled, resulting in 20 samples per plot per sampling. Circles show absence of *A. mellifera* at the sampling tree site, while triangles show presence of *A. mellifera*. Consequently, a circle at $y = 1$ means that wild bees were present in the absence of *A. mellifera*. Horizontal and vertical jitter was added to allow visualization of all data points. See Materials and Methods for more details on sampling.

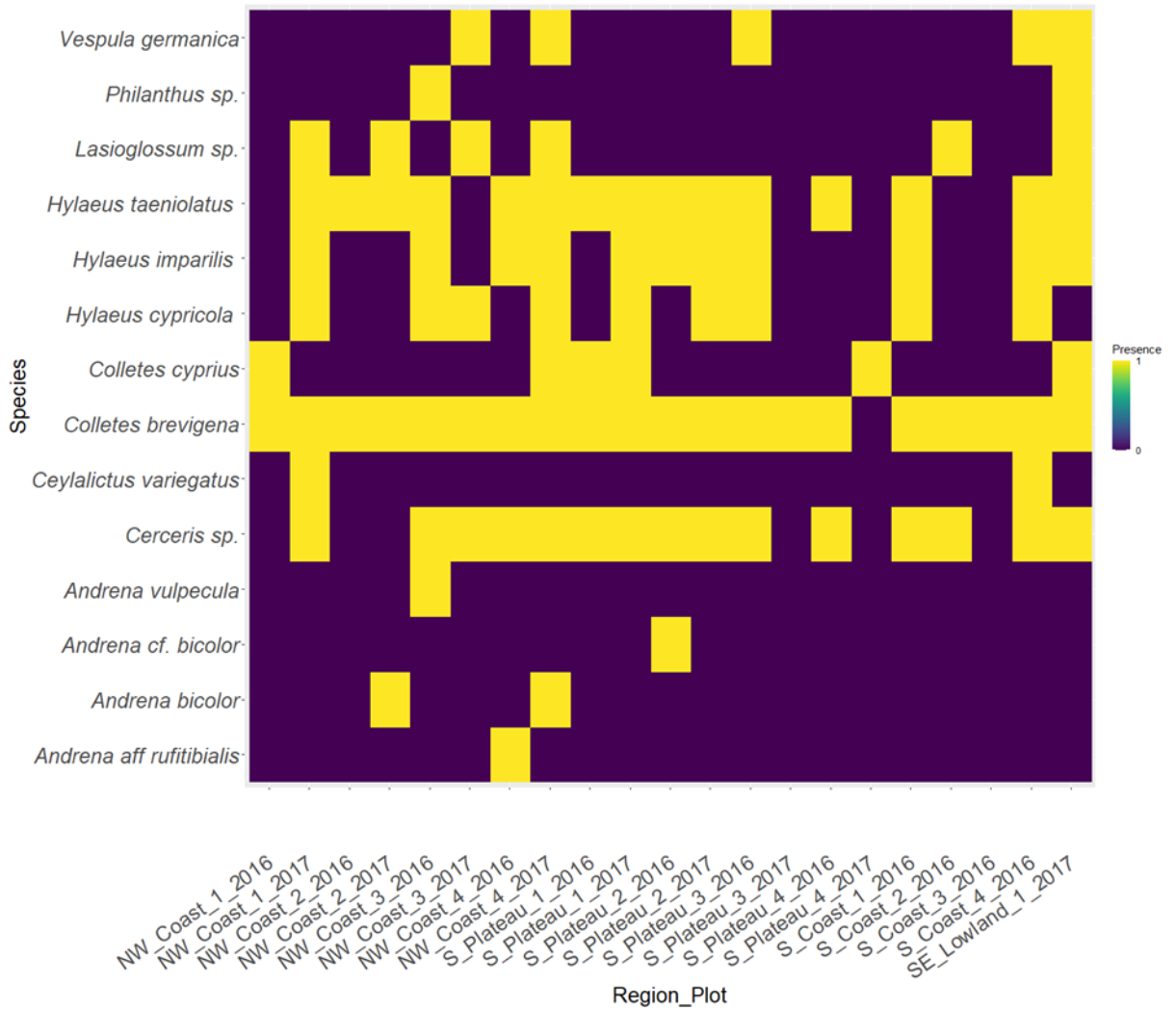


Figure 14. Heat map of wild bee and wasp species presence (1) – absence (0) collected from the carob groves in 2016 and 2017.

4.4.2 Carob pollination study

Table 7 shows the results of the analysis on the effect of treatment, region and their interaction on the number of pods produced per inflorescence in the open and wind pollination. There was a significant effect of treatment applied ($P < 0.001$) and a weaker effect of region ($P = 0.02$), with no significant interaction between the treatment and the region. The median number of pods per inflorescence was higher in the open than in the

wind pollination in all three regions and was higher in the S. Plateau followed by the NW Coast and the SE Lowlands (Figure 15a).

Table 8 shows the results of the analysis of the effect of open vs wind pollination and region on carob pod weight (Figure 15b). The median weight per pod was higher in open than in wind pollination with the exception of pods from SE Lowlands in wind pollination, where only five pods were produced from three trees. Median pod weight in open pollination was highest for SE Lowlands, followed by S. Plateau and NW Coast (Figure 15b). A similar trend was observed for pod length (Figure 15c), which was highly correlated with pod weight ($r^2 = 0.74$). Pods in the open pollination contained more seeds than those in the wind pollination (Figure 15d).

Table 7: Results of statistical analyses for the generalized mixed-effects model evaluating the effect of treatment, region and their interaction, and the number of individual inflorescences per inflorescence group on the number of pods produced in the open and wind pollination treatment.

Fixed Effects	df	χ^2 -value	<i>p</i> -value
Treatment (open or wind pollination)	1	56.38	<0.001
Region (NW Coast, S. Plateau, S. Coast)	2	8.33	0.006
Treatment: Region	2	1.50	0.47
No inflorescences per group	1	1.78	0.18
SD* for Random Effect of Tree ($n=60$)		0.003	
SD for Random Effect of Branch nested within Tree ($n=120$)		0.67	
Residual degrees of freedom		230	
Dispersion parameter for negative binomial family		3.08	

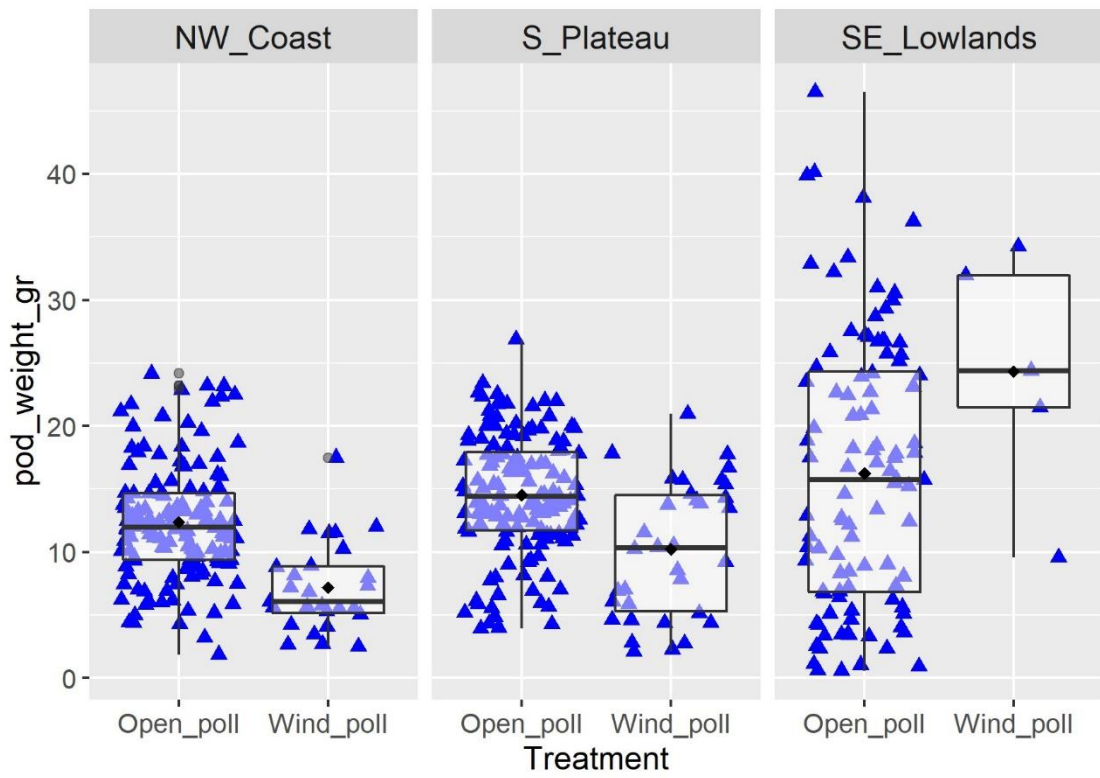
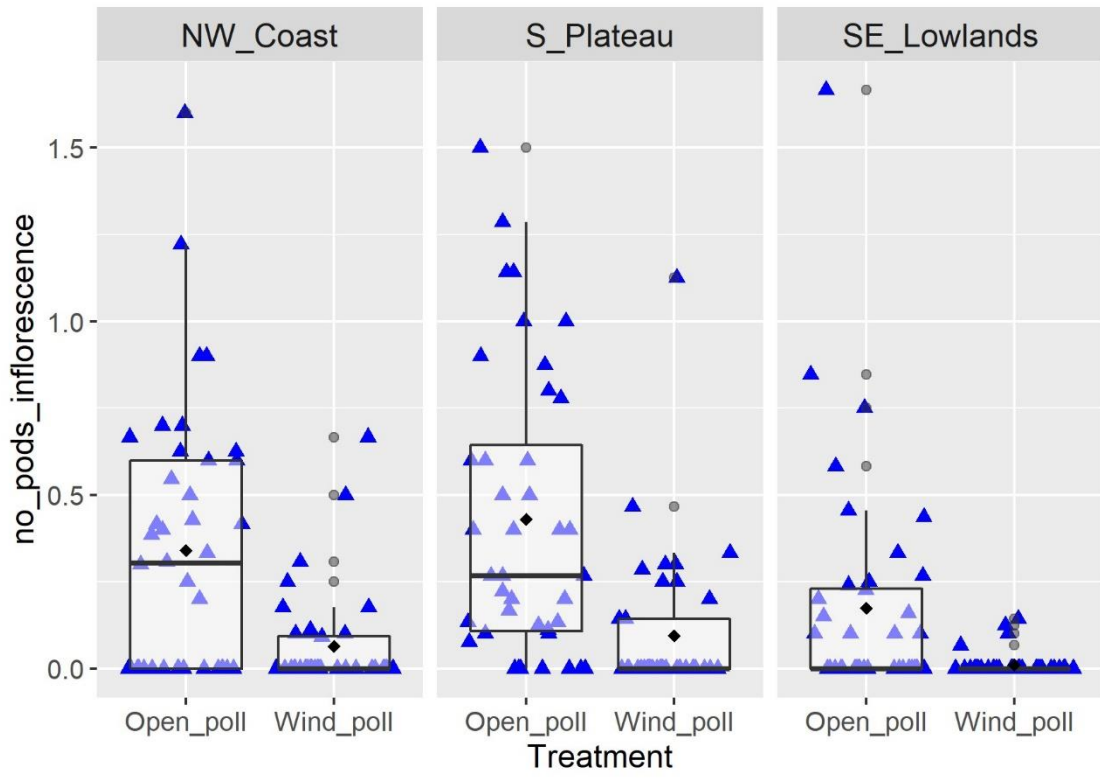
* SD: standard deviation. See Materials and Methods and Results for more information on statistical analyses.

Table 8: Results of statistical analyses for the linear mixed-effects model evaluating the effect of treatment and carob grove on carob pod weight.

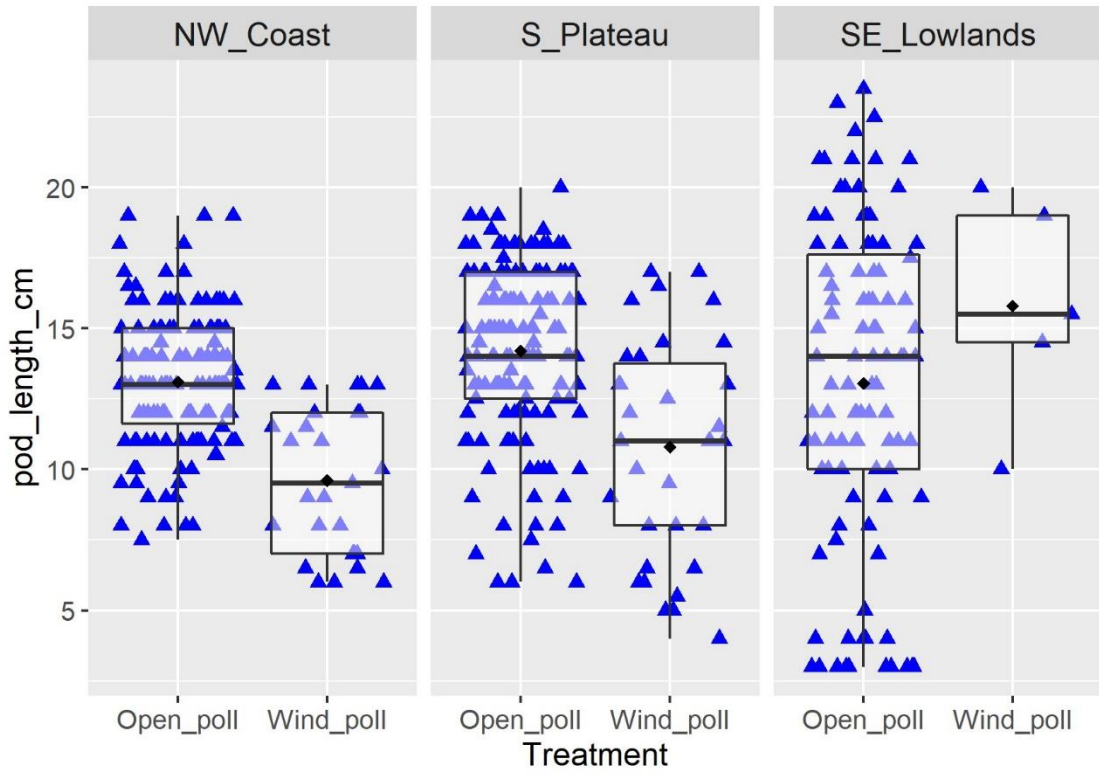
Fixed Effects	df	<i>F</i> -value	<i>p</i> -value
Treatment (open vs wind pollination)	1	51.87	28.96 < 0.001
Carob grove (NW Coast vs S_Plateau)	1	45.77	6.43 0.01
Treatment: Carob grove interaction	1	51.87	0.32 0.57
SD for Random Effect of Carob Tree (<i>n</i> =38)		1.04	
SD for Random Effect of Branch nested within Carob Tree (<i>n</i> =60)		0.89	
SD for Random Effect of Inflorescence nested within Branch within Carob Tree (<i>n</i> =78)		2.50	
SD Residual		3.88	

* SD: standard deviation. See Materials and Methods and Results for more information on statistical analyses.

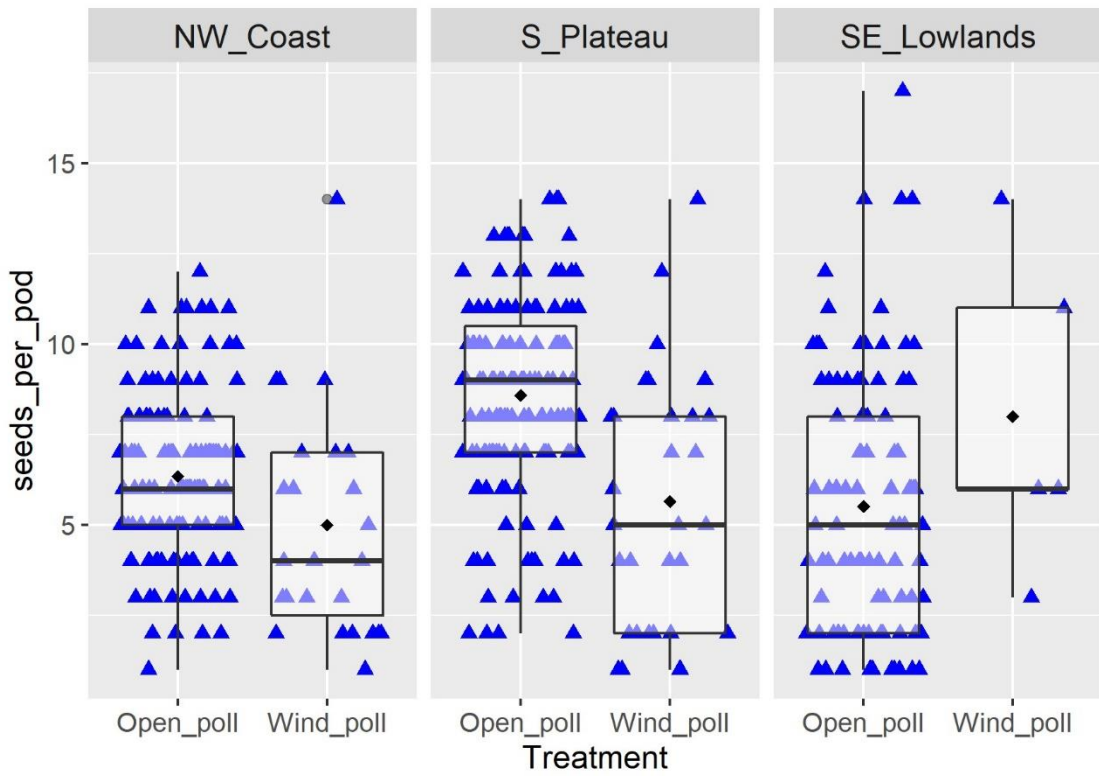
a)



b)



c)



d)

Figure 15. Carob pod number (a), weight (b), length (c), and seeds per pod (d) in the open and wind pollination treatments in the three regions. Boxplots show the median for each treatment, box boundaries show the 25th and 50th percentile, while whiskers extend to 1.5 times the interquartile range (IQR). Points beyond 1.5 times the IQR are plotted individually. Diamonds show the mean. Individual data points are shown with blue triangles. Horizontal jittering was used to allow visualization of all data points.

Figure 16 shows the presence of pollen in pollen traps placed in one male and in four female trees located at distances ranging from 12 to 172 m from the male tree. All traps placed in the male tree collected pollen (Figure 16), and there was a trend of a lower probability of collecting pollen as the distance from the male tree increased.

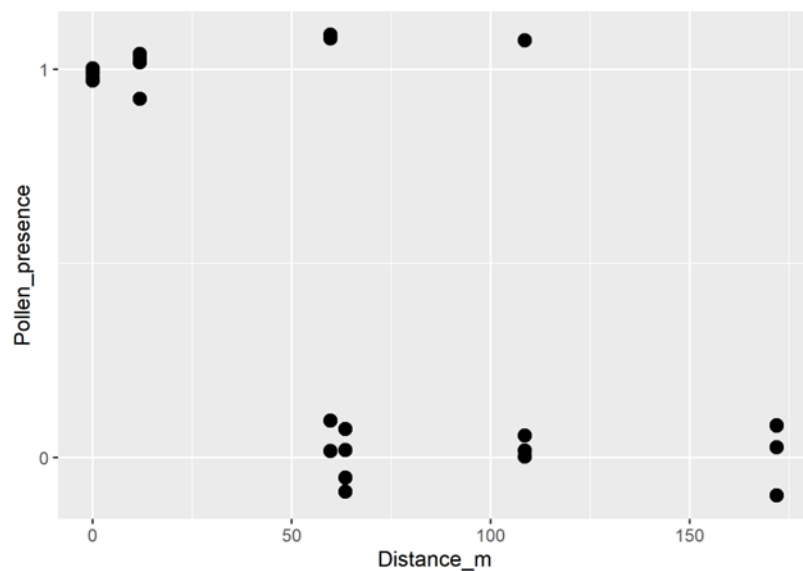


Figure 16. Presence (1) or absence (0) of pollen in pollen traps placed on one male (distance = 0 m) and five female trees. Four pollen traps were placed in each tree for a 24-hour period. Random vertical jitter was added to allow visualization of all data points. See Materials and Methods for more details on the methodology.

4.5 Discussion

The Mediterranean Basin is considered a biodiversity hotspot for wild bees as well as plants relying on them for pollination (Herrera, 2020). Studies conducted so far in this area have also shown that wild bees are very effective pollinators for both cultivated and wild plants (Herrera, 2020). Although the carob tree is a historical crop in the Mediterranean basin, only a few studies investigated the impact of animal pollination to carob production, with little emphasis placed on wild bees (Linskens and Scholten, 1980; Ortiz et al., 1996; Arista et al., 1999; Dafni et al., 2012; AL-Ghzawi et al., 2014). The current work investigated the diversity of pollinators visiting carob flowers during the daytime, as well as the contribution of pollinators to carob pod production.

Bees represented the majority of diurnal pollinators visiting carob flowers during blooming, followed by wasps in both experimental years (Figure 12). *Apis mellifera* was the most frequent floral visitor, for both male and female trees (Figure 12 and Figure 13). This finding agrees with the results of studies conducted in neighbouring Israel (Dafni et al., 2012), Jordan (AL-Ghzawi et al., 2014), Spain (Ortiz et al., 1996) and Portugal (Linskens and Scholten, 1980). Honey bee hives exist in large numbers in Cyprus, which explains the high visitation rates by honeybees. In contrast, Retana et al. 1990 found that flies were the most frequent visitors to carob flowers. In the current study Diptera (Syrphidae) and Lepidoptera (butterflies) visits to carob flowers were negligible (data not shown). Although carob flowers are visited by nocturnal insect species belonging to Lepidoptera and Neuroptera (Dafni et al., 2012), the current work assessed only diurnal insect visitors.

Wild bees were the second most frequent visitor to carob flowers, especially on male trees (Figure 12). Wild bees visiting carob flowers comprised 10 species (Figure 14), as follows: *Andrena bicolor*, *A. vulpecula*, *A. aff rufitibialis*, *Colletes brevigena*, *C. cyprius*, *Ceylalicthus variegatus*, *Hylaeus cypricola*, *H. imparilis*, *H. taeniolatus*, *Lasioglossum sp.*. Two species, *C. brevigena* and *H. taeniolatus* were the dominant, being recorded in all study regions (Figure 14). Only one relevant work has reported two species of wild bees (*Halictus sp.* and *Amegilla sp.*) on carob pollination (Dafni et al., 2012).

A companion study of our group showed that a total of seven species of wild bees were collected from carob trees in Cyprus in the past: *Lasioglossum anellum*, *Ceylalicthus*

variegatus, *Colletes brevigena*, *C. creticus*, *C. cyprius*, *Hylaeus cypricola* and *H. imparilis*. *C. brevigena* was collected from March to December, *C. cyprius* from February to October while *H. imparilis* collected from April to October, with the latter two periods falling outside carob blooming (Varnava et al., 2020). Therefore, the current study reports for the first time 5 wild bee species associated with carob pollination: *A. bicolor*, *A. rufitibialis*, *A. vulpecula*, *H. taeniolatus* and *Lasioglossum sp.*. *C. brevigena* seems to rely heavily on carob flowers as well as neighboring habitats, as it was very common in all regions in the current study (Figure 14) and was recorded from carob trees in several regions both during and outside the carob blooming period in the past (Varnava et al., 2020).

Wasps visiting carob flowers were represented by three species: *Cerceris sp.*, *Philanthus sp.* and *Vespula germanica* (Figure 14). Dafni et al. (2012) recorded two species of wasps, *Vespula germanica* and *Vespa orientalis*, while Arista et al., 1999 recorded *Vespula sp.* and Al-Ghzawi et al. 2014 recorded *Vespa orientalis* and *Polistes dominulus*.

An earlier study found that male carob trees were more attractive to *A. mellifera* and wasp species than female trees, due to pollen production (Ortiz et al., 1996), in agreement with the findings of the current study (Figure 12 and Figure 13). Male trees were more attractive to bees, probably due to the higher availability of inflorescences and pollen (Dafni et al., 2012). Carob pollen grains were more likely to be present in pollen traps closer to a male tree (Figure 16). The results suggest that insects are indispensable to carob pollination, as some female trees might not receive adequate pollen loads from wind alone. However, we noted that the pollen transfer study in the current work lasted for 24 h, a very short time period. According to Ortiz et al. (1999), the low production of fruits is very common in carob trees and did not depend only on the distance from the nearest pollen source but also on blooming phenology. Pollinators of *C. siliqua* prefer to pollinate the flowers close to the apex of the raceme first and consequently, the fruit set is lower in basal flowers (Arista et al., 1999; Ortiz et al., 1996).

The open pollination treatment resulted in significantly higher production of pods than wind pollination as described by Dafni et al. (2012), with the increase ranging from 4x to 16x higher production (Figure 15), as also described. Open-pollinated inflorescences produced pods with a significantly higher weight and length, and higher

seed numbers per pod, than wind pollinated flowers (Figure 15b-d). A previous work reported that open-pollinated flowers produced heavier seeds with higher germination rates than bagged flowers (Al-Ghzawi et al. 2014). The production of pods was higher in the S. Plateau area followed by the NW Coast and the SE Lowlands and the differences in pod production between the study areas are probably the result of carob landrace / agro-environmental factors as discussed by Kyratzis et al., 2021.

The positive effect of open pollination is not limited to carobs, for instance Nasare et al. (2019) recorded heavier shea kernels under open pollination compared with bagged inflorescences. Several studies reported that open-pollination can benefit fruit-set, and increase weight and quality (e.g. Mallinger and Gratton, 2015; Blitzer et al., 2016; Garratt et al., 2014; Saunders and Luck, 2016). Open pollination in kiwifruit resulted in higher fruit set due to insect and especially bee visitation (Miñarro and Twizell, 2015). Several studies on avocado, argan, litchi, longan and guava trees highlighted the importance of open pollination to fruit set (Halder et al., 2019; Ajerrar et al., 2020; Dymond et al., 2021). According to Wietzke et al., 2018, self-pollination in strawberries showed a considerably lower fruit set compared to those hand- and open-pollinated. Insect pollination is important for the higher production of the phytohormone IAA (indole-3-acetic acid) that leads to enhancement of yield and marketable fruit quality (Wietzke et al., 2018). Accordingly, tomatoes from non-bagged flowers were larger, heavier, and with more seeds compared with those produced by bagged flowers (Silva Neto et al., 2013).

Farmers are highly dependent on pollinators, reinforcing the fact that pollinator conservation is an anthropogenic pursuit (Breeze et al., 2019; Hall and Martins, 2020). Bee hive renting is common to enhance the pollination of apple trees and other crops (Pardo and Borges, 2020). The results of the present study suggest that management to enhance bee populations within or around carob fields could significantly increase pod yield. Wild bees represent an alternative solution, as they inhabit agricultural landscapes and can use pollen and nectar from cultivated crops for their nutrition, simultaneously pollinating the flowers they visit (Pardo and Borges, 2020). At the same time, carob trees are important for wild bee nutrition. The current study shows that at least 10 wild bee species rely on carobs for nutrition (Figure 14), which is especially important given that carob flowers bloom in the autumn when floral resources are generally scarce in the Mediterranean. Ameliorated understanding of how pollination services can be

manipulated, could lead to additional practical management guidelines for building sustainability into agricultural systems to protect both, pollinators, and crops.

Ceratonia siliqua shows great tolerance to arid and semi-arid climates, an increasingly important trait for environmental, economic, and social reasons because of the changing climate. The current work highlighted the importance of insect pollination in maintaining high production of carobs, as well as better fruit quality. Taking into consideration the pollination biology of carob trees, further research needs to focus on the identification as well as the contribution of night visitors to carob pollination. Further work on pollen dispersal by wind will improve our understanding of the contribution of wind to carob pollination and can lead to practical recommendations for the density of female vs male trees to maximize production, especially in areas with low pollinator abundance.

4.6 Conclusions

The results of the study highlight the important role of insects in *C. siliqua* pollination, fruit set and improved quality of carob pods. Pollination by wind alone results in poor yield that is of lower quality. In addition to the most abundant pollinator, the honeybee *Apis mellifera*, we report for the first time ten different species of wild bees visiting carob flowers, and potentially providing pollination services. We also note the importance of carob flowers as a feeding source for wild bees, especially during periods of low floral availability. Future research needs to investigate in detail wind dispersal of pollen from male to female trees, as well as the contribution of night visiting animal pollinators to improve our understanding of carob pollination biology.

4.7 References

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CHAPTER 5

5 Chapter 5: General Conclusions / Future Perspectives

The current Dissertation makes a significant addition to our knowledge of the wild bees of Cyprus. Chapter 2 which constitutes the first modern checklist of bee species in Cyprus provides an important baseline for future studies of wild bee diversity on the island and neighbouring regions. Overall, 369 verified wild bee species have been recorded on the island, with eleven species reported from Cyprus for the first time. The island hosts all six of the globally widespread bee families, with Apidae represented by 110 species, Megachilidae with 91, Andrenidae with 76, Halictidae with 72, Colletidae with 19, and Melittidae with one. Twenty-one of the recorded bee species are endemic (i.e., 5.7% endemism rate) and Cyprus ranks third after Lesvos and Sicily in known bee species richness among the Mediterranean islands. The endemic species have been reported to forage on many plant species, some of which are endemic to the island, including *Onobrychis venosa*, *Teucrium cyprium*, and *Nepeta troodi* (Edwards et al. 2016). Previously unpublished records from various locations on Cyprus for 156 previously reported bee species are also provided in the study. The bee fauna of Cyprus shows similarity to that of southern Europe and the Middle East (Levant). The value of the 32 insect-pollinated crops grown in Cyprus exceeds €37 million euros annually (Agricultural Statistics 2015), underlining the importance of taking measures to conserve both honeybee and wild bee populations.

Chapter 3, constitutes the first comprehensive work after the Mavromoustakis collection that explored changes in wild bee assemblages in Cyprus by using historical data of species richness records after almost 100 years from when he began sampling. New insights were provided into the causes of bee species declines, as the sampling design allowed the direct comparison of two neighbouring areas, with different land uses. Changes in land use categories were mild and relatively similar in the two areas, with urban development more scattered in CC_Asomatos. We detected a substantial species turnover, with 43 species collected only in historical samples, 77 only in recent samples, while 42 persisted in both periods. There was a statistically significant difference in the frequency of species extinctions, with CC_Asomatos losing species at twice the rate of Akrotiri, at ca. 75 and 35% respectively. We also found that 18 species that were present in CC_Asomatos in historical samples were detected only in Akrotiri in recent samples. The 13 new reports of species, 10 in Akrotiri and five in CC_Asomatos, as well as the

three species new to science highlight the importance of the region for wild bee conservation.

Agricultural intensification and artificial constructions which lead to land cover changes are among the most important threats to bees, affecting species richness and abundance (Senapathi et al., 2015). Even though urban development was similar between the two areas, it has affected almost all sampling locations for CC_Asomatos. The Akrotiri area retains large and uninterrupted areas of seminatural vegetation. Wild bee abundance varies among several habitats and depends on land-use pressures. Species react differently to land-use practices according to their vulnerability and ecological traits (De Palma et al., 2015). An analysis of the ecological traits of extinct species in the current work can provide useful insights into extinction drivers.

A greater richness of flower species was recorded in the Akrotiri area than in CC_Asomatos, with plants belonging to the Asteraceae family recording the most visits (Figure 10b). These findings are similar to Martins et al. (2013) and Nichols et al. (2019) who found that Asteraceae were the most visited plant family and vital for wild bee diversity. Polylectic bees were more abundant in both areas than oligolectic bees. There was also a significant relationship between host plant diversity and species richness. Similarly, Ebeling et al., 2008 observed that species richness was affected by flowering plant diversity. Plant-pollinator network studies are essential to explain species loss and co-occurrence (Ollerton et al., 2011; Burkle et al., 2013).

Comparing historical records with recent sampling enables the study of changes in bee populations over time (Turley et al., 2022). Positive or negative variations in species richness and abundance compared to historical records were observed in previous studies (Grixti and Packer, 2006; Bartomeus et al., 2013; Mathiasson and Rehan, 2019; Graham et al., 2021). Our study agrees with, Grixti and Packer (2006) who revisited a study area after 34 years and recorded more species than in the past, which they attributed to habitat heterogeneity. Zattara et al., 2021, who gathered information from the Global Biodiversity Information Facility (GBIF) showed that 25% fewer species were reported between 2006 to 2015 compared to pre-1990. They highlight the need for the establishment of monitoring programs to fill the data gap on global bee decline.

Historical and present sampling may result in different species richness estimates for several reasons, including different temporal coverage, sampling frequency, differences

in methodology, and collector bias, when past collecting focused on species of interest to the collector (Rasmussen et al., 2022). Hence, past and recent samplings may not have targeted the same species or habitats (Vray et al., 2019). The restricted number of sampling sites to represent the areas sampled by Mavromoustakis in the past is another factor that could have affected the results of the current work. In addition, no information on wild bee abundance from Mavromoustakis samplings is available. Limitations on bee taxonomy are important as few species remain unidentified and separated into morphospecies. While the morphospecies could not affect the main conclusions of the work in a substantial manner, future work will focus on their determination. Changes in the climate between the two periods were not taken into account in the current work. However, the small distance between the two areas suggests that any climate change effects would have been similar. However, further studies on climate change, bee pathogens and diseases are necessary to identify the major threats to bee populations (Cameron et al., 2011).

The Mediterranean Basin is considered a biodiversity hotspot for wild bees as well as plants relying on them for pollination (Herrera, 2020). Studies conducted so far in this area have also shown that wild bees are very effective pollinators for both cultivated and wild plants (Herrera, 2020). The carob tree is a traditional crop for Cyprus, but only a few studies investigated the impact of animal pollination on carob production in the Mediterranean region, with little emphasis placed on wild bees (Linskens and Scholten, 1980; Ortiz et al., 1996; Arista et al., 1999; Dafni et al., 2012; AL-Ghzawi et al., 2014).

Chapter 4 assessed the diversity of wild bees and other pollinators relying on carob flowers, as well as the contribution of animal pollination to carob production on the island for the first time. Honey bees and wild bees represented the majority of the pollinators during carob blooming followed by wasps. *Apis mellifera* was the most dominant floral visitor, in both male and female trees. This finding agrees with the results of studies conducted in Israel (Dafni et al., 2012), Jordan (AL-Ghzawi et al., 2014), Spain (Ortiz et al., 1996) and Portugal (Linskens and Scholten, 1980). The current study was the first to investigate and identify the specific species of wild bees visiting carob flowers and identified 10 species belonging to five genera using carob floral resources (*Andrena*, *Colletes*, *Ceylalictus*, *Hylaeus*, *Lasioglossum*). The only previous relevant work reported

two species of wild bees (*Halictus sp.* and *Amegilla sp.*) from carob trees (Dafni et al., 2012).

Animal and wind pollinated flowers produced significantly more pods, with the benefit ranging from 4 to 16 times higher production, depending on the region. In addition, animal and wind pollination led to pods with greater weight, length and number of seeds compared to pods derived from wind-only pollination. The differences in pod production between the study areas are probably the result of carob landrace / agro-environmental factors as discussed by Kyratzis et al., 2021. A previous work reported that open-pollinated flowers produced heavier seeds with higher germination rates than bagged flowers (Al-Ghzawi et al. 2014). The positive effect of open pollination is not limited to carobs, for instance Nasare et al. (2019) recorded heavier shea kernels under open pollination compared with bagged inflorescences. Several studies reported that open-pollination can benefit fruit-set, and increase weight and quality (Mallinger and Gratton, 2015; Blitzer et al., 2016; Garratt et al., 2014; Saunders and Luck, 2016).

The results of the carob pollination study suggest that management to enhance bee populations within or around carob fields could significantly increase pod yields. Wild bees represent an alternative / complementary service provider to honeybees, as they inhabit agricultural landscapes and can use pollen and nectar from cultivated crops for their nutrition, simultaneously pollinating the flowers they visit (Pardo and Borges, 2020). At the same time, carob trees are important for wild bee nutrition.

Future studies that result from Chapter 2, need to document the impact of urban development on bee conservation and the potential value of anthropogenic habitats for wild bee conservation and establish a long-term monitoring program to determine the status of wild bees throughout the island. As a result of the work in Chapter 3, three specific targets for future work have emerged: a) The digitization of the Mavromoustakis collection, which will help future studies with the availability of the details on species recorded in the past, b) the exploring of the past plant-pollinator networks using historical records from the island, to compare with recent studies and pollination interactions, and c) the study of genetic diversity of bee species beginning with the creation of a barcoding library for the species of the island. Finally, future work related to Chapter 4, including the evaluation of the interaction between honey bees and wild bees will help us develop a better understanding of the effect of *Apis mellifera* on wild bee populations and the

relationship between wild and managed species. In addition, the determination of pollen transfer from male to female trees by analysing pollen samples collected from the body of bees will aid in identifying the specific contribution of different species to carob pollination.

In conclusion, the current Thesis adds new knowledge on the field of wild bee conservation, focusing specifically on the Mediterranean island of Cyprus, but with wider implications, because of the historic nature of Mavromoustakis bee collections. A study covering the whole island could provide information and cover several important regions, as many important/endemic plant species also exist in the northern part of the island, which was not sampled for the current work. Furthermore, the current Thesis creates a baseline on which future samplings can be developed, given the planned establishment of an EU Pollinator Monitoring Scheme (Potts et al., 2020). Monitoring programs in natural and agricultural areas are crucial for wild bee conservation to ensure the provisioning of uninterrupted pollination services and safeguard the global food supply.

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