T.C.

KAHRAMANMARAŞ SÜTÇÜ İMAM UNIVERSITY

GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCE

THE PLANT DIVERSITY OF SAKRAN AREA IN NORTHERN IRAQ

ALİ MALA KHEDİR GALALAEY

Ph.D. THESIS

DEPARTMENT OF BIOENGINEERING AND SCIENCES

KAHRAMANMARAŞ – TURKEY 2021

T.C.

KAHRAMANMARAŞ SUTCU IMAM UNIVERSITY

GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCE

The Plant Diversity of Sakran Area in Northern Iraq

Ali Mala Khedir GALALAEY

Thesis submitted in candidature for

The degree of Ph.D. in

Department of Bioengineering and Sciences

KAHRAMANMARAŞ - TURKEY 2021

DECLARATION

I hereby declare that all information in the thesis has been obtained and presented in accordance with academic rules and ethical conduct. I also declare that, as required by these rules and conduct, I have fully cited and referenced all material and results that are not original to this work.

Ali Mala Khedir GALALAEY

This study was supported by the Committee of Scientific Projects of Kahramanmaraş Sütçü İmam University with the project code number 2018 / 1-26 D

KUZEY IRAK SAKRAN BÖLGESİNİN BİTKİ ÇEŞİTLİLİĞİ
(DOKTORA TEZİ)

ALİ MALA KHEDİR GALALAEY

ÖZET

Bu çalışma, Hallgord-Sakran Milli Parkı'nın (HSNP) bir parçası olan Sakran bölgesindeki vasküler bitki biyoçeşitliliğinin ilk kapsamlı incelemesini yapmak için gerçekleştirilmiştir. Sakran bölgesi başkent Erbil'in yaklaşık 120 km kuzeydoğusunda ve Irak, İran ve Türkiye sınır üçgeninde yer almaktadır. Bu dağlık bölge, Kandil Sıradağları'nın (Zagros Sıradağlarının kuzey kısmı) bir parçasıdır ve Choman Bölgesi'nde yer almaktadır. En yüksek zirve olan Haji Ibrahim, 3587 m'ye ulaşır. Irak'ın kuzeyinde bulunan bölge, Zagros dağ bölgesinde 7051 hektar alana sahiptir. Dağın çoğu kısmı engebeli arazisi nedeniyle daha önce hiç keşfedilmemişti ve mayın arazileri ile yasak alanları olan keşfedilmemiş bu alanlar İran ile stratejik sınırda bulunuyor. Bu araştırma, 2015-2018 yıllarındaki saha çalışmalarına dayanmaktadır. Alan, 967 ile 3200 m arasındaki yüksek rakımlardaki ormanlar, nehir kıyısındaki bölgeler, alt alpin bölgelerden alpine değin genişleyen alanlardaki benzersiz orografik yapılarla ve çok çeşitli toprak kategorileri ve su kaynakları ile karakterize edilir.

Bu çalışma ile 439 cinse ve 87 familyaya ait toplam 867 bitki taksonu tespit edilmiş olup, türlerin 789'ı (%91,00) otsu bitki, 40'ı (%4,61) ağaç ve 38'i (%4,38) çalı olmak üzere üç ana bitki yaşam formu belirlenmiştir. Pteridofitler, 3 familya ve 7 takson içerir. Angiospermlere ait toplam 860 bitki taksonu kaydedilmiştir (84 familya, 430 cins, 788 tür, 44 alt tür, 35 varyete). Ayrıca 16 endemik takson tespit edilmiştir. Toplam kaydedilen en yüksek yüzdeye sahip en zengin bitki familyaları sırasıyla; 111 takson ile Asteraceae (%12,80), 85 takson ile Fabaceae (%9,80), 57 takson ile Poaceae (%6,57), 62 takson ile Brassicaceae (%7,15), 51 takson ile Lamiaceae (%5,88), 45 takson ile Apiaceae (%5,19), 40 takson ile Rosaceae (%4,61), 37 takson ile Caryophyllaceae (%4,27), 29 takson ile Boraginaceae (%3,34) ve 22 takson ile Ranunculaceae (%2,54)'dir. Yaklaşık 39 familya birden fazla türle temsil edilmiştir ve son olarak 31 familya tek bir türle temsil edilmektedir. En zengin vasküler bitki cinsleri sırasıyla; *Astragalus* spp. (19 takson), *Trifolium* spp. (15 takson), *Prunus* spp. (15 takson), *Silene* spp. (13 takson), *Allium* spp. (12 takson) *Salvia* spp. (11 takson), *Centaurea* spp. (10 takson), *Medicago* spp. (8 takson) ve *Euphorbia* spp. (7 takson)'dır.

Raunkiaer yaşam formlarına göre 333 taksonla (%38,41) en zengin form Hemikriptofitler'dir. Ardından sırasıyla; 271 taksonla (%31,26) Terofitler, 116 taksonla Geofitler (%13,38), 79 taksonla Fanerofitler (%9.11), 43 taksonla Kamefitler (%4,96) ve 11 taksonla Hidrofitler (%1,27) gelir. Ayrıca, parazit bitkilerde 9 takson (%1.04), Terofit & Yarı Terofit 3 takson (%0,35) ve sadece bir Epifit takson (%0,11) bulunmaktadır. Bitkilerin fitocoğrafik dağılımının bir sonucu olarak; 442 takson (%50.98) İran-Turan fitocoğrafik bölgesine özgüdür, 143 takson ise (16.49%) hem İran-Turan hem de Akdeniz bölgelerinde, 98 takson (%11,30) İran-Turan, Akdeniz ve Avrupa-Sibirya bölgelerinde bulunmaktadır. Ayrıca 22 takson (%2,54) sadece Akdeniz bölgesine aitken, 66 takson (%7,61) hem İran-Turan hem de Avrupa-Sibirya bölgelerinde bulunabilir. 51 takson ise (%5,85) çok bölgeli ve ayrıca 46 takson (%5,28) kozmopolittir.

Bu çalışmanın temel amacı, Kuzey Irak'ın en büyük beş dağından biri olan Sakran bölgesinin çeşitlilik açısından yeterince çalışılmamış vasküler florasını derinlemesine incelemekti. Çalışmanın sonuçları, bölgenin bitki türleri açısından zengin olduğunu ve aynı zamanda geçiş türleri için bir habitat sağladığını ortaya koydu. Ayrıca bu çalışma ile Irak florası için yeni bir kayıt olan relikt *Zelkova carpinifolia* (Pall.) Dippel ilk kez tespit edilmiştir.

Anahtar kelimeler: Bitki çeşitliliği, flora, taksonomi, Erbil, Kuzey Irak

Kahramanmaraş Sütçü İmam Üniversitesi
Fen Bilimleri Enstitüsü
Biyomühendislik ve Bilimler Anabilim Dalı, Şubat /2021

Danışman: Dr. Öğr. Üyesi Alper UZUN
Eş Danışman: Prof. Dr. M. Hakkı ALMA
Sayfa sayısı: 294

THE PLANT DIVERSITY OF SAKRAN AREA IN NORTHERN IRAQ (THE THESIS OF DOCTOR OF PHILOSOPHY)

ALİ MALA KHEDİR GALALAEY

ABSTRACT

This study was carried out to conduct the first comprehensive survey of vascular plant diversity in the Sakran region, which is part of the Hallgord-Sakran National Park (HSNP). Sakran area is situated about 120 km northeast of the capital city of Erbil and located on border triangle of Iraq, Iran and Turkey. This mountainous area is part of the Qandil Range (northern part of the Zagros Range) and located in Choman District. The highest peak, Haji Ibrahim, reaches 3587 m. The area located in the northern of Iraq has 7051 hectares area in the Zagros mountain zone. Most parts of the mountain have never been explored before, because of its rugid terrain, and those unexplored areas are located at the strategic border with Iran, having mine lands and prohibited areas. This research is based on the field studies of the author from 2015 to 2018. The area is characterized by a high altitude from 967 to 3200 m and unique orographic structures from forests, riparian zone, sub-alpine to the alpine region, with a wide range of soil categories and water resources.

A total of 867 plant taxa belonging to 439 genera and 87 families were identified, about three major plant life-forms were determined of which 789 (91.00%) of the species were herbs, 38 (% 4.38) were trees and 40 (4.61%) were shrubs. Pteridophytes include 3 families and 7 taxa. The total 860 plant taxa belonging to angiosperms were recorded (84 families, 430 genera, 781 species, 44 subspecies, 35 variety). Also, 16 endemic taxa were identified. The richest plant families with the highest percentages of the total recorded were Asteraceae (111 taxa, 12.80 %), Fabaceae (85 taxa, 9.80 %), Poaceae (57 taxa, 6.57 %), Brassicaceae (62 taxa, 7.15 %), Lamiaceae (51 taxa, 5.88 %), Apiaceae (45 taxa, 5.19%), Rosaceae (40 taxa, 4.61%), Caryophyllaceae (37 taxa, 4.27%), Boraginaceae (29 taxa, 3.34%) and Ranunculaceae (22 taxa, 2.54%) respectively. About 39 families were represented by more than one species, finally of the 31 families were represented by a single species. The richest vascular plant genera were *Astragalus* spp. (19 taxa), *Trifolium* spp. (15 taxa), *Prunus* spp. (15 taxa), *Silene* spp. (13 taxa), *Allium* spp. (12 taxa) *Salvia* spp. (11 taxa), *Centaurea* spp. (10 taxa), *Medicago* spp. (8 taxa) and *Euphorbia* spp. (7 taxa) respectively.

According to Raunkiaer life-forms, it was revealed that Hemicryptophytes were the richest with 333 taxa (38.41%), and followed by Therophytes with 271 taxa (31.26%), Geophytes with 116 taxa (13.38%), Phanerophytes with 79 taxa (9.11%), Chamaephytes with 43 taxa (4.96%), Hydrophyte with 11 taxa (1.27%) respectively. Also, parasite plants have 9 taxa (1.04%), Therophyte & Hemicryptophyte with 3 taxa (0.35%) and Epiphyte with only one taxon (0.11%). As a result of the phytogeographical distribution of plants; 442 taxa (50.98%) belong to the Irano-Turanian phytogeographical region, 143 taxa (16.49%) are pluregional or Unknown, 98 taxa (11.30%) to the Irano-Turanian and Mediterranean regions,

22 taxa (2.54%) to the Irano-Turanian, Mediterranean and Euro-Siberian. In addition, 66 taxa (7.61%) belong only to the Mediterranean region, 24 taxa (2.77%) belong to both Irano-Turanian and Euro-Siberian, and 33 taxa (3.81%) are cosmopolitan.

The main purpose of this study was to examine in depth the vascular flora of the Sakran region, one of the five largest mountains in Northern Iraq, which has not been sufficiently studied in terms of diversity. The results of the study revealed that the area is rich in plant species and also provides a habitat for transitional species. In addition, relict *Zelkova carpinifolia* (Pall.) Dippel, which is a new record for Iraqi flora, was identified for the first time with this study.

Keywords: Plant diversity, flora, taxonomy, Erbil, Northern Iraq

Kahramanmaraş Sütçü İmam University
Graduate School of Natural and Applied Sciences
Department of Bio-Engineering and Sciences, February /2021

Supervisor: Assist. Prof. Alper UZUN
Co-supervisor: Prof. Dr. M. Hakkı ALMA
Number of pages: 294

ACKNOWLEDGEMENTS

This study was supported by the Committee of Scientific Projects of Kahramanmaraş Sütçü İmam University with the project code number 2018 / 1-26 D and it was conducted by Assist. Prof. Dr. Alper UZUN. Therefore, we are grateful to them for their financial support.

The present study would not have been possible without the help of numerous individuals and institutions. I am deeply indebted to Assist. Prof. Dr. Alper UZUN for supervising this study. For providing the place and the necessary herbarium and library facilities during my studies at the Herbarium Laboratory of Forest Faculty-KSU. I am greatly obliged to Prof. Dr. M. Hakkı Alma, Assist. Prof. Dr. Seyran Palabaş-Uzun, Prof. Dr. Cuma Akbay and Prof. Dr. Hasan Serin.

I want to express my thanks to the Faculty of Forestry for allowing me to carry out and complete my research work. Also, my sincere gratitude goes to all the Kahramanmaras Sutcu Imam University staff. It is difficult to express my deep feeling of thanks to Assist. Prof. Dr. Alper Uzun and Prof. Dr. M. Hakkı Alma in words alone. All their support and dedication were greatly appreciated and above all their suggestions of the title of this current study, their supervision, valuable guidance and continuous help. Thank you for planning, supervising and advising me to coordinate my work.

My gratitude extends to the Field department, College of Agriculture Engineering Science of Salahaddin University for the funding opportunity to undertake my studies at the University of Kahramanmaras Sutcu Imam/Turkey. Additionally, I would like to express gratitude to Dr. Khalid Mahmood Zinwaey and Farhad Omer (PhD student), for those treasured support which was really influential in my study.

All my friends and colleagues have helped me in various ways: Ibrahim Khoshnow, Darwish Tahir, Mustafa Baqal, Dilshad Rashduury, Mr. Ramiyar Gasha, Mr. Reibaz Rashad, Reibaz Einaey, Wasta Karim Rasul, Mr.Omar Rasul, Mr. Daban Sabir, Sadiq Hassan, Hunar Hassan, Khalid Muhammad, Sulaiman Awlla, Mr. Diyar J. Dargalleay, Sarbaz Wardy, Mr. Karokh Sarnelly, Mr.Hemn Dilmany, Rashid Chomany, Mr. Handrein Ismael, Mr. Siyamand Khedir, Dr. Hemn Gaznaey, Dr.Saman Surchy, Dr. Tarq Farooq, Mr.Mohammad Abdullah, Soran Hassan, Dr. Rzgar A. Abdula, Dr. Ali Hallob, Dr.Dawud Rasooli, Dr.Wezha Baez, Dr.Badir Surchi, Abdulla H. Allanaey, Dr.Holem Balaky, Mr. Bahaddin Ahmed (PhD. student), Mr. Ibrahim Sherwany, Mr. Jarjees Ibrahim, and Baxtiyar Qadir. I would like to extend my thanks to my beloved friends for their great help, valuable suggestions, considerable advice and support in all step of my research. I should thank them for sharing their thoughts and feelings with me and being interested in my opinion.

Finally, I would like to give my deepest thanks, expressing all my love and appreciation to my mother. I would also like to thanks, my sister and my brother. This study is dedicated to my family (Khadijah my wife, my childrens Rasyan, Ranuu, and Radin) whose help, advice, patience, support, motivation, and love are undeniable and unforgettable. I want to thank for their understanding during the long time away from home and their worries during the field studies.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

tr:	Tree
sh:	Shrub
su:	Suffruticose
li:	Liana
fe:	Fern
semi-par:	Semi-parasitic
Ep:	Epiphyte
an:	Annual
bi:	Biennial
pe:	Perennial
Ph:	Phanerophyte
Hr:	Hemicryptophyte
Ch:	Chamaephyte
Th:	Therophyte
Cr:	Cryptophyte
HY:	Hydrophyte
G:	Geophyte
Cr-G:	Cryptophyte-Geophyte
Cr-Hl:	Cryptophyte-Helophytes
Msph:	Meso Phanerophyte
Mcph:	Micro Phanerophyte
Nnph:	Nano Phanerophyte
HSNP:	Hallgord Sakran National Park
IUCN:	International Union for Conservation of Nature
IT:	Irano-Turanian
ES:	Euro-Siberian
M:	Mediterranean
Cosm:	Cosmopolite
SS:	Saharo Sindian
Pl:	Palaeotropical
Scom:	Semi-Cosmopolite
SA-SI:	Saharo-Sindian
Z:	Zagrosian

1. INTRODUCTION

Northern Iraq belongs to Irano-Anatolian hotspot which harbours at least 6,000 plant species approximately 2,500 of them are endemic and is designated as a territory of high biological diversity values (Mittermeier et al., 2004). It is located on a key intersection between Mediterranean, Temperate, Arid and semi-arid biogeographical regions. As referred by Mittermeier et al. (2004), this region has served as both contact and tension zone favouring, therefore the hybridization, colonization and speciation process of species from varying origins. In addition, the number and diversity of local and regional endemism suggest a strong role of climatic and habitat refugia during Quaternary oscillations and Neolithic transition. Indeed, the wide range of bioclimatic zones (from hot semiarid to cold alpine for example. mean annual precipitation varies from about 200 to up 1500 mm; mean annual temperature is ranging between 0 to +25°C) and the topographic feature diversity (from Mesopotamia's plains to high mountains about 3600 m asl including north or south slopes, cliffs and gorges...) give rise to high biological diversity richness value. Thus, the area includes an important number of rare, endemic, threatened and remarkable plant and wild animal species originated from diverse biogeographic region for example. Irano-Anatolian, Mediterranean basin, Arabic peninsula. Furthermore, Northern Iraqis considered as one of the richest irreplaceable sources of natural resources of economic importance as crops, medicinal, aromatic and edible plants (Al-Rawi, 1964; Townsend & Guest, 1966-1985; Chakravarty, 1976; Koyuncu, 2002).

Despite its formidable floristic richness, it remains designated as a coldspot of scientific knowledge. The most likely causes of this coldspot status are poor recent floristic inventories on the field and the outdated and incomplete Flora of Iraq. A possible explanation for the non-achievement of these floristic investigations might be due to the chronic instability of the geopolitical situation in the region. Consequently, small territories, mostly in mountainous areas, are still mined and/or inaccessible. Indeed, the strong lack in taxonomists and/ or naturalists on the field cannot allow filling the gaps of floristic data on an unexplored area such as many mountainous areas and the border lines. However, some punctual advances have been made in the last decade insight of new contribution to the Flora of Iraq (National Report on Biodiversity in Iraq, 2010; Ahmad, 2013; Véla, et al., 2013; Shahbaz, et al., 2015; Youssef, et al., 2015; Ahmad, 2016; Youssef, et al., 2017 a & b; Youssef, et al., 2018). These interesting previous works should be perceived as spotlight intention on some aspect of the remarkable biological diversity and human connection with the particular natural ecosystem in Northern Iraq.

Biological variety presents the style of lifestyles on this planet and may be defined as the range among and between the residing organisms and species of surrounding ecosystems and ecological complexes of their life help. It’s been envisioned that one third of the worldwide plant species are threatened in exclusive stage in line with the Worldwide Union of Conservation of Nature (IUCN).

Conservation of biodiversity method safety of valuable herbal resources for destiny generations as well as well-being of eco-system function. Within beyond little a long time, numerous conservation strategies have been developed particularly in the methods of in situ and ex situ conservation coverage. Biodiversity conservation is based especially on in situ conservation wherein habitats, species and ecosystems are evidently present and preserved in herbal situation with none changes. Genetic variation an important for long time survival of plant species in natural habitat (Lande, 1988). Perhaps maintained with the aid of introducing new individuals will increase populace size and decrease inbreeding despair, genetic waft and extinction threat (Nybom, 2004). The gradual declining of plant species is the common phenomena of in situ renovation technique, due to natural habitat loss, fragmentation, modification even in reserve area with time (Fahrig, 1997).

The principal goal of this study is to thoroughly survey the vascular flora of Sakran area, one the five most diversified mountains in northern Iraq, which has not been studied adequately. As well as, the present study aimed to explore the plant diversity throughout the elevation change in Sakran area northern of Iraq and contribute some ecological notes with specimen’s study found in some Iraqi herbaria to add a small part to the Flora of Iraq. Some collaboration with international organizations and developed countries, there are attempts to introduce the regards flora and fauna. Most parts of the mountain have never been explored before, because of its rugid terrain, and those unexplored areas are located at the strategic border with Iran, having mine lands and prohibited areas. Plant information in this region is perhaps lost even befor it is discovered.

2. LITERATURE REVIEW

The descriptive Flora of Iraq started in 1965 as a joint project between the Royal Botanic Gardens, Kew and the Ministry of Agriculture, Baghdad. Nine volumes were planned and six were published between 1966 and 1985 (vols 1, 2, 3, 4 parts 1 & 2, 5 parts 1, 2, 6, 8 and 9; covering some 2800 species) edited by A. Al-Rawi (Iraq), C. C. Townsend (Kew) and Evan Guest (Iraq) with the collaboration of the Botany Directorate of the Ministry of Agriculture and Agrarian Reform, Baghdad. Progress on the Flora was interrupted by political change in Iraq.

Iraq's flora described many plant species but incomplete yet. Nonetheless, names of all species with their distribution within the exceptional physiographic districts of Iraq are data based (in BRAHMS) from understanding obtained from published sources and plant species in the central herbarium documented in National Herbarium of Iraq of the Ministry of Agriculture, Baghdad (Thiers, 2020). When the distribution pattern of plants in different physiographic regions and districts of Iraq is examined, it is seen that the mountainous areas in the northern regions and the alluvial plains of the Mesopotamian region are quite rich in terms of species richness (Youssef et al. 2019). Iraq is also influenced by using two main phytochoria, the Saharo-Sindian and the Irano-Turanian those are subdivided into regional phytochoria distinctive to the Middle East neighbourhood (Ghazanfar and McDaniel, 2016). Endemism is high in the Irano-Turanian neighbourhood of Iraq which occupies the mountains and foremost part of the upper plains and foothills areas. These regions additionally include the majority of the endemic species. According to biodiversity surveys implement by natural Iraq between 2005 and 2010, Iraq had 88 main key of biodiversity area (Bachmann, et al., 2011). The national record on Biodiversity in Iraq Convention on Biological Diversity (CBD) outlines the threats to biodiversity and habitats in Iraq and a country wide Biodiversity approach and action plan for the conservation of species-rich and diverse habitats (Anonymous, 2010).

2.1. Bioclimatic and biogeographic patterns of Zagros Mountains

As defined by Daget (1977 a, b) and Roumieux et al. (2010), The Mediterranean Climate Envelop includes the whole Middle-East, except the Pontic-Transcaucasian area and the South-Arabian one. The Middle-East area is naturally extending eastwards the Mediterranean basin itself, reaching the Turanian area (Turkestan). This envelope is defined mainly by the seasonality of rain: summer is the least rainy season, in which it differs from the continental temperate climates and the tropical ones. A second criterion is the global aridity of the summer, which also excludes the oceanic temperate climates in Europe. The Saharo-Sindian limits are generally correlated with the drastic dryness and dimming or even inversion of seasonality. The Köppen-Geiger climate classification (Kottek et al., 2006) is summarising in details this variation. The rainfall seasonality in the Middle East is dominated by winter followed by spring then autumn, while summer is usually completely dry. It differs from the Mediterranean coast where autumn is the second rainy season on the southern and eastern side and the first one on the north-western coast.

According to the bioclimatic forces and to the continental macroecology, the biogeography patterns of orchids and other vascular plants can be summarised as follow: a) The xerothermic Mesopotamian plains are dominated by strong steppic Irano-Turanian and/or Saharo-Sindian influences. The dominant vegetation is herbaceous, mainly annual and completely dry in summer. Some bulbous or rhizomatous geophytes can flower in late autumn, during winter or in early spring but generally without orchids. b) The accentuated Mediterranean zone which affects the Zagros slopes, foothills and valleys receive various Mediterranean and/or Paleotemperate influences. The vegetation is characterised by steppe-forests with an open tree cover with a dominant summer-dry herbaceous undergrowth. It hosts a lot of spring or autumn bulbous or rhizomatous plants, mainly eastern Mediterranean elements at lowest altitudes and Irano-Anatolian at higher altitude. In the densest forests with humus and litter, the undergrowth hosts some Eurasiatic element like mycoheterotrophic orchids. c) The oro-cryogenic Zagros summits are dominated by strong Irano-Anatolian and/or EuroSiberian influences. The dominant vegetation is perennial herbaceous mixed with thorny-cushion chamaephytes. A lot of herbaceous are hemicryptophytic or springleaved geophytes, including orchids, are growing on slopes, pastures, and spring swamps.

2.2. Conservation in Northern Iraq

In broad ecological terms, the protected area is generally understood to often mean natural land that is restricted from most development and is set aside for environmental protection (Hameed, 2017). The IUCN defines it as "defined geographical space, recognised, dedicated and managed, through legal or other effective means, to achieve the long- term conservation of nature with associated ecosystem services and cultural values"; while for the

CBD it is “A geographically defined area, which is designated or regulated and managed to achieve specific conservation objectives”. The World Database on Protected Areas uses both definitions to determine whether a site should be labelled as a protected area. While the worldwide number of protected areas increases, the northern Iraq currently still not widely applied an efficient protected area concept. Indeed, there isn’t a real active scientific regional/national program of work. Despite the ratification of the Convention on Biological Diversity in 2009, there is almost none elaborating regional/ national document on biodiversity conservation based on scientific principles. However, several wild animal protections exist such as wild Goat in addition to some areas locally protected and/or of natural interest.

2.3. Important Plant Areas (IPAs)

A basic field study has been carried out to identify key biodiversity areas in Iraqi territory (National Report on Biodiversity in Iraq, 2010). As a result of this study, various Important Plant Areas (IPA) in Northern Iraq were determined and their protection status was evaluated. [Accessed 11 August 2017]. However, the report has only been conducted in a small number of local areas and focused mostly on animals (mostly birds) and a small number of plant species (mostly common). In reality, not all anthropogenic threats are included. As a result, this report can be considered as a first step towards nature conservation, but there is still not enough field data for designated IPAs. In this context, there is a real need to create networks of more protected areas, national parks, nature reserves that need to be expanded and managed better. Moreover, biodiversity conservation strategies and action plans can offer an option for national / international cooperation and collaboration for better scientific progress.

2.4. Floristics

Iraq has a rich and diverse flora, with some ± 3300 species found in its deserts, plains and mountains. The number of genera is 908 in 136 families (monocots 512; dicots 2708). Asteraceae is considered most important family with > 400 species (50 monotypic genera), and accompanied by Fabaceae (393 spp.), Poaceae (264 spp., 35 monotypic genera), Brassicaceae (195 spp., 30 monotypic genera) and Apiaceae (155 spp.) respectively. Annuals make up more than a third of the plant life in Iraq. Endemism is very low with 181 endemic species recorded (5.6%), most of them in the northern mountains. A further 97 closes to endemic species are observed in the mountains of northern Iraq, SE Turkey and W Iran. Many of these species had been collected once or only some instances in Iraq.

An analysis of the distribution of species via physiographic regions and districts suggests that the northern regions are richness of plant species, and 40% of these plants are in mountain regions. It isn't always surprising that species richness is maximum inside the northern mountains as right here the weather is maximum equable for plant increase, the physiography is diverse and there's an overlap of Turkish and Iranian floras. This region additionally constitutes the richest arboreal plants of the Kurdo-Zagrosian System (Zohary, 1973). The primary Alluvial Plains inside the lower Mesopotamian region are also wealthy in species, and is wherein the general public of the halophytes, annuals and cosmopolitan species are located.

Figure 2.1. Physiographic districts of Iraq

M – Mountains Region : MAM, Amadiya District; MRO, Rowanduz District; MSU, Sulaimaniya District; MJS, Jabal Sinjar District; F – Upper Plains and Foothills Region : FUJ, Upper Jazira District; FNI, Nineveh District; FAR, Arbil District; FKI, Kirkuk District; FPF, Persian Foothills District; D – Desert Plateau Region : DLJ, Lower Jazira District; DGA, Ghurfa-Adhaim District; DWD, Western Desert District; DSD, Southern Desert District; L – Lower Mesopotamian Region : LEA, Eastern Alluvial Plains District; LCA, Central Alluvial Plains District; LSM, Southern Marsh District; LBA, Basra Estuarine District. From Guest & Al-Rawi (1966).

2.5. Vegetation structure

The vegetation structure of Iraqi territories was widely described, essentially on basis of visual observations, by Guest & Al-Rawi (1966) and then recently resumed by Ghazanfar & McDaniel (2016). So far, however, their descriptive vegetation analyses do not take into account the natural regeneration process (sensu Grubb, 1977) nor do they examine practical cases in large scale. Therefore, the main aspect of the vegetation community structure can be described as follow.

2.5.1. Steppe grassland communities

It uniformly consists of open plant communities limited by contrasted climatic conditions (arid and very hot in summer, rainy and cold in winter) and intense grazing activities concentrated during early spring. These sparse short grassland communities are essentially dominated by geophytes species (for example. *Muscari* spp., *Bellevalia* spp., *Prospero* spp., *Ornithogalum* spp., *Allium* spp., *Gagea* spp., *Anemone coronaria*, and etc.) and annual or annual like herbs (for example. *Carex* spp., *Poa bulbosa*, *Aegilops* spp., *Avena* spp., *Hordeum* spp., *Stipa* spp.) that disappear completely during the summer. While, perennials hemicryptophytes (*Salvia* spp.) including thistle-like spiny species (*Silybum marianum*, *Centaurea* spp.) and low size chamaephytes (for example. *Teucrium* spp., *Artemisia herba-alba*, *Achillea* spp., *Astragalus* spp., *Thymus* spp.) are found in particular micro-habitats localities (cf. Youssef, et al., 2018).

2.5.2. Segetal plant communities

Segetal plants are used here in its broad sense to refer to most annual weeds ("non-crop" plant species) found in cultivated areas, particularly which coexist with cereal winter crops. The local agricultural communities treated these species as undesirable weeds due to their "negative" effect on the precious cereal yield. In the cultivated area of northern Iraq, the most frequent segetal plants include: *Adonis* spp., *Aegilops* spp., *Allium noeanum*, *Centaurea* spp., *Galium* spp., *Gladiolus* spp., *Gundelia tournefortii*, *Hordeum* spp., *Lathyrus* spp., *Lolium* spp., *Loncomelos* spp., *Papaver* spp., *Poa* spp. Despite these segetal species have redoubtable plant life history strategies (for example, short lifespan, produce a huge amount of long-time viable seeds, deep bulb resisting to fragmentation), however, their diversity species has been dramatically reduced in intensive modern agricultural countries like Europe. Their rarefaction is associated with both the intensive cultivation methods and the uses of various herbicides treatments. Consequently, it has been recently demonstrated that these segetal plant species are increasingly among the most threatened plants (Storkey et al., 2012; Solé-Senan et al., 2014). To deal with this real risk, divers conservation strategies are therefore rising worldwide (Byfield and Wilson, 2005; Walker et al., 2007). Knowing that a major part of these segetal species in Europe and the Mediterranean are probably originated from the Middle East.

Figure 2.2. Mountain region

2.5.3. Open forest formation

A major part of vegetation community structure in northern Iraq consists largely of open forest with a dense ground cover of herbaceous species. This open forest formation mostly occurs in the foothill and mountainous areas. In favourable habitats, the oak trees form local close forests (*Quercus libani*), especially in relatively inaccessible places (deep valleys) where the soil is deep and moist (northern faces), and which still host wild animals like bears and wolves. However, in less favourable habitats (near villages, grazing areas, etc.) young oak trees may be scattered sparsely as an open forest with some vestiges of old oak trees. This mono-specific structure could indicate the original climax forest formation that has been lost as a result of anthropogenic disturbance (Townsend and Guest, 1966). The vegetation community transition between these two structures might be seen at several locations in this forested zone. The most frequent trees and shrub species found are: Oak (*Quercus brantii* and *Q. infectoria*), Pistachio (*Pistacia* sp.), Almond (*Prunus amygdalous*), Pine (*Pinus brutia*), prickly Juniper (*Juniperus oxycedrus*), Azarole Hawthorn (*Crataegus azarolus*), oriental Blackberry (*Rubus sanctus*), Briar Rose (*Rosa* sp.), Montpellier Ash (*Acer monspessulanum*) etc.. The Zagros region is well known under the name “the Pistachio-Almond territory” due to the wide ethnobotanical uses of both wild and cultivated almond and pistachio trees. These regional formations are original by the contrasting colours and living forms in each season. During winter and early spring, the undergrowth his completely green and covered by herbs and bulb flowers, while the canopy is completely defoliated which make it very inconspicuous. During summer and early autumn, the undergrowth is completely dried senescent which makes it yellowish brownish dominated, while the canopy is brightly green. From an ecological standpoint, the open forests can be classified into the following formations:

a) ***Mountain Riverain Forest***: The arborescent species commonly found alongside mountain streams in the forest zone are: *Salix* sp., *Platanus orientalis*, *Fraxinus syriaca*, *Populus euphratica* and *Juglans regia* (cultivated old walnut trees). Among the shrubs and herbaceous species, *Rubus sanctus*, *Rosa canina* s.l., *Nerium oleander*, *Mentha longifolia*, *Juncus* sp., *Carex* sp., *Typha domingensis*, *Phragmites australis*, *Arundo donax*, and *Cyperus longus* are also very common. Recently, the black poplar (*Populus nigra* s.l.) is being widely cultivated near streams throughout the northern mountains. These non-indigenous poplars produce high wood yields sold in the markets through the country (Shahbaz, 2010).

Figure 2.3. Riparian zone

b) ***Oak forests***: b1) Low sub-zone of the Oak forest: In the lowest and driest sub-zone of the forest, *Q. brantii* is the dominant tree. It is frequently associated with other trees such as *Pistacia* sp., *Prunus* sp., *Crataegus* sp.. b2) Medium sub-zone of the Oak forest: *Quercus infectoria* and *Q. brantii* are co-dominant in this association, while the first species is often locally dominant in this medium zone. It is worth noting that *Q. infectoria* is ecologically intermediate between *Q. libani* and *Q. brantii* and is usually found between the altitudes of 700-1400 m asl. b3) High sub-zone of the Oak forest: In the higher parts of the mountain forest zone, *Quercus libani* is the dominant tree species from 1200-1800 m a.s.l. Lebanon Oak is frequently associated with *Acer monspessulanum* and *Lonicera arborea* with a high herbaceous vegetation cover dominated by *Paeonia mascula*. On the other hand, *Quercus macranthera* constitutes a small population of about 4-5 hectares in Sari Hassan Bag (MRO). It founds at 1950- 2200 m altitude a.s.l., just below the thorn cushion zone.

Figure 2.4. Shrubland

c) Pine Forest: *Pinus brutia* forest occurs in a restricted locality around Zawita and Atruş towns of Duhok (MAM). This forest covers about 100 km^2 at altitudes of 700-1200 m a.s.l. (Muhamed et al., 2018). This Mediterranean pine constitutes a small population which found at the extreme eastern limit of the species. In Zawita area, it remains the dominant species associated with some oak and prickly juniper trees.

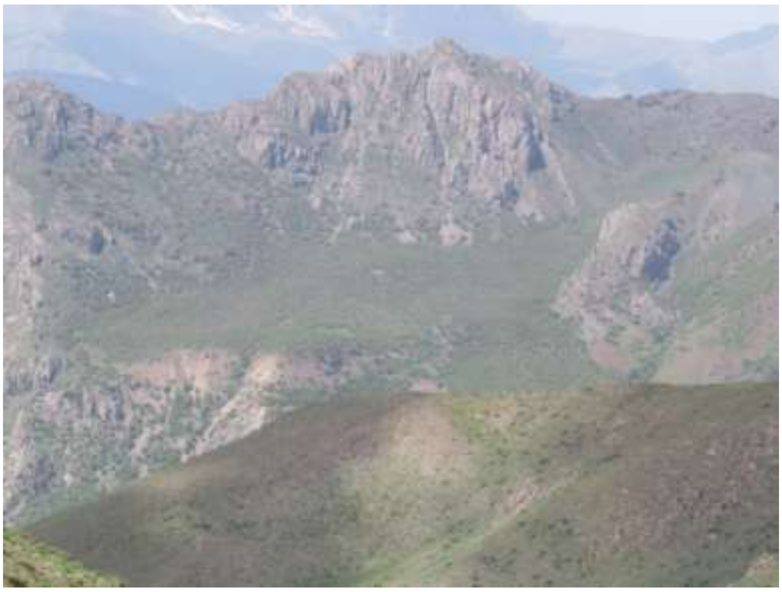


Figure 2.5. Oak forest area

2.5.4. Thorn-cushion zone

This sub-alpine zone is an open shrub formation characterized by the dominance of dwarf thorn-cushion vegetation forms such as *Astragalus* spp., *Onobrychis* spp. and *Acantholimon* spp. This formation occupies a clearly marked zone above the timberline in the mountains from about 1750 to 3000 m. These cushion species are frequently associated with erect shrubs characteristic of the higher parts of the forest zone such as (*Daphne acuminata*, *Lonicera arborea* and various species of *Cousinia* spp., and the famous edible herbaceous species *Rheum ribes* (“Reiwas”).

Figure 2.6. Sub-alpine zone

2.5.5. Alpine zone

This zone situated at high elevation and above the tree line often on the summit of the northern-eastern mountain chains. It founded on an altitudinal range from 2750 to 3610 m a.s.l. It is characterized by a typical vegetation “alpine plant community” which mainly include perennial grasses (for example. *Carex* spp.) dwarf and rupicolous plants (for example. species from Asteraceae, Brassicaceae, Fabaceae, Lamiaceae, and Plumbaginaceae, and etc.), mosses and lichens. These alpine plants are well adapted to the harsh environmental conditions (short growing season, low temperatures and high ultraviolet radiation).

Figure 2.7. Alpine region

2.6. Biodiversity of Hallgord-Sakran National Park

Hallgord-Sakran area is one of the most important sites within the Irano-Turanian region and the Irano-Anatolian sub-region, a critically endangered hotspot in the Zagros Mountain Steppe ecoregion. Hence, represent some of the most beautiful and biologically rich areas of northern Iraq and is worthy of protection.

This area is a biodiversity rich area with a high density of vegetation cover. It consists of three different plant zones: forest zone; which consists of two sub-zones (medium and high); sub-alpine zone; and alpine zone. Nature Iraq has been collecting botany data in Haji Omran, Sakran and Hallgord sites since 2008, with a total number of plant species of about 200 species and according to the flora of Iraq book and other resources a total number of about 450-550 plant taxa have been recorded in Hallgord-Sakran site. According to the final draft checklist done by the Royal Botanical Garden-Edinburgh (RBG) there are about 75 endemic species existing at Hallgord area, Sakran area, and Qandil range. Bird data has been collected for this area in the year of 2007, recording a total of 132 bird species in Haji Omran, Sakran area and Hallgord area altogether. Furthermore, this site is home of the most important biome-restricted species that make it meet the international criteria for Important Bird Areas (IBA) recognized by Birdlife International. Anecdotal information for mammals and the other fauna was collected during the botany and bird field surveys in the year of 2007 and more specifically during the year of 2010. The mammal species likely to exist in this area based on habitat preference are about up to 25 species of both small and large mammals. Information about reptiles and amphibians is scarce, but according to a checklist drafted Nature Iraq based on literature reviews show about 87 reptile species and 10 amphibians. Fish and invertebrate information were never collected at this site.

Bornmueller had visited Sefin Mountains within his trip in 1982 to Iraq starting from the Shatt al-Arab to Mosul. Chapman had many trips between (1947-1949) into the forested mountainous areas in Ebil. Rashid (1990) was reported, Gillett also visited Sefin Mountains and Handren mountains in March 1948 when he was a director of the Iraqi National Herbarium. Zohary, (1946) who was the eminent botanist and also editor of the famous book named Geobotanical Foundations of the Middle-East, discovered many new plants in the mountains and subalpine zones of northern Iraq. German botanist Heinrich Carl Haussknecht (1830−1903) had visited northern Iraq and collected plants. Austrian botanist Karl Heinz Rechinger had visited to Hawraman Mountains between the years of 1906-1998. Another major set of collection was done by Ali Rawi and his assistants at Baghddad (BAG), and their duplicates were sent to Royal Botanical Garden Kew (K) for determinations. The American botanist (Fred A. Barkley, 1960) has visited Darbandikhan and areas close to Halabja. Some researchers completed field surveys such as; Xalaf surveyed to vascular plants in Sinjar Mountains and collected 3241 plants samples. (Xalaf, 1980). Al.Sawah, surveyed the genus *Scrophularia* L. in (Scrophulariaceae). The research has resulted 21 plant species within the genus Scrophularia. One species was new in Iraq (Scrophularia scopolii Hoppe ex Pers.). The following two new subspecies were recognized to be new to science: *Scrophularia pruinosa* Boiss. subsp. *aqransis* Sawah, *Scrophularia pruinosa* Boiss. subsp. *avromanica* Sawah. Fars (1983) surveyed to vascular plants in Piramagrun Mountains and collected 2549 plant. The research has resulted 13 plant species with in the genus *Papaver*. The study area has 8 annuals (*Papaver argemone* L., *P. bornmuelleri* Fedde. *P. decaisnei* Hochst. et Steud., *P. dubium* L., *P. glaucum* Boiss. et Hausskn., *P. hybridum* L., *P. macrostomum* Boiss. et Huet., *P. rhoeas* L.) while 5 biennials (*P. acrochaetum* Bornm., *P. armeniacum* (L) DC., *P. curviscapum* Nab., *P. fugax* Poir., *P. persicum* Lindl.). The research has resulted with 3 genera and 7 species in this family. Shexa 2007 prepared a master taxonomic thesis of taxonomic study of the genus *Pterocephalus* Vaill. ex Adans. (Dipsacaceae) of Northern Iraq.

The list of botanists who's visited Hallgord-Sakran area in past: L. Rauwolf: 1574-1575, Pierre M. Aucher-Eloy: 1830-1838, Carl G. T. Kotschy: 1841, Heinrich Carl Haussknecht: 1865-1867, Joseph F. N. Bornmueller: 1892-93 (92), Frantisek Nabelek: 1909-1910, Heinrich R. E. Handel-Mazzetti: 1910, Evan Guest: 1928-33, 52-58 (32, 56), Jan B. Gillett: 1946-49 (47), Ali Rawi: 1949-1970 (57), Herbert F. Mooney: 1951, Karl Heinz Rechinger: 1956-57 (57), Richard Wheeler Haines 1955-62 (60), Andrew D.Q. Agnew: 1958-1963 (60), Emil Hadac 1959-61: (60), Faisal A. Q. Sakri: 1960.

3. MATERIAL AND METHOD

3.1. Study Area

Study area is located in Sakran area included by Erbil city in northern Iraq. It is part of the extensive Zagros Mountain Steppe ecoregion (World Wildlife, 2007) and the Kurdo-Zagrosian ecoregion (Zohary, 1973). Sakran area is situated about 120 km northeast of the capital city of Erbil and located on border triangle of Iraq, Iran and Turkey, between the coordinates 36º35’26” N and 44º59’10” E. This mountainous area is part of the Qandil Range (northern part of the Zagros Range) and located in Choman District. The highest peak, Haji Ibrahim, reaches 3587 m and is surrounded by several other mountains, including Şêx Nasîr, Sekrê Sekran, Kodo, Qelatî Qeredê, Koxe, Warê Şêxan, Kîçê Kafri.

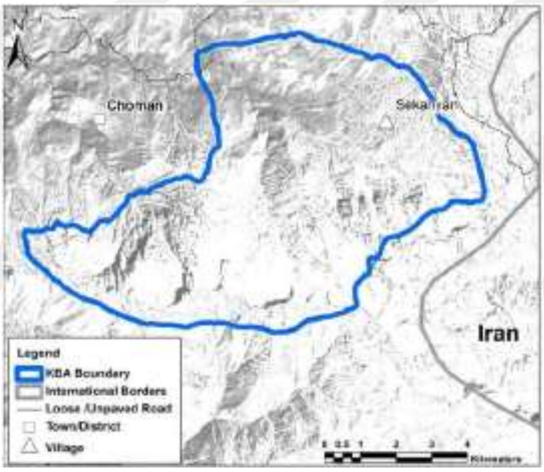


Figure 3.1. The location map of the Sakran area

The mountain peaks over 3000 m are covered in snow year-round. There are several streams and small rivers throughout the area. The mountain contains oak woodlands, mountain riverine forest and thorn-cushion vegetation (subalpine area) and habitats. The sedimentary limestone and sandy clay soil type are observed in most of the area.

Villages include Weza, Sakran, Basan, Ene, Shiwalok, Naw Barga, Goronia, Wallash, Meirga, Resh Duur, Prdei Zard, NowPrdan and Qasrei (sub-district). Due to its location close to the Iranian border, there are still minefields in many areas of the land. Therefore, botanical visits were required to be coordinated with official representatives. The existence of unsafe working conditions is a hindrance for both local people and researchers.

Hasare-i- Roste^ and Hasare-i- Sakran Mountains are among the most unspoilt regions of Northern Iraq. Until now, it has not been deeply affected and degraded by heavy land use or settlements. Due to the high altitude up to the summit of Hallgord Peak, snow covers large areas until June. That is why the streams and the mountain rivulets of the region give life to vegetation in the area with their pristine waters. The mountain landscape of the study area comprises a colourful mosaic of specific diverse oak forests, high rocky peaks, mountains with and attractive mountain pastures. The region also hides several habitat types and shelters of rare and endangered animal and plant species. Sakran area is one of the most important plant areas in northern Iraq, and belong to Irano-Turanian phytogeographical region. Its mountains run along the Persian frontier 5 km northeast of Choman District (Guest and Rawi, 1966) and occupies an area of about 5,739 ha in Iraq. Sakran area is surrounded by diverse topographic areas: Kodo Mountain to the east (2907 m), Hasarei Rostei chains including Hallgord peak (3607 m) on the west, Qandil Mountain range on the west (3400 m) and Mama Root Mountains (1385 m) to the south.

Sakran area is one of five major mountains in Northern Iraq that are rather poorly explored botanically (the others are Hasarei Rustei Mountains including (Hallgord peak), Hawraman mountain, Qandil range, and Gara mountain). The vast majority of Sakran collections were made from Wallash village or Sakran valley, both of which were accessible by road to earlier botanists. However, the remote areas and higher elevations of the mountain from above 2000 meter have a little been surveyed. All prior collections made by foreign botanists were done in the spring and early summer and from tiny portions of this vast mountain ranges. Indeed, late summer and autumn flora of the mountain were totally unknown that is another priority of this research.

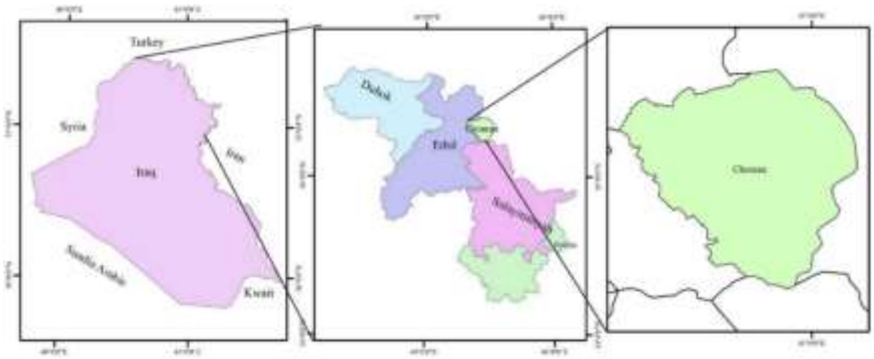


Figure 3.2. The location map of the study area

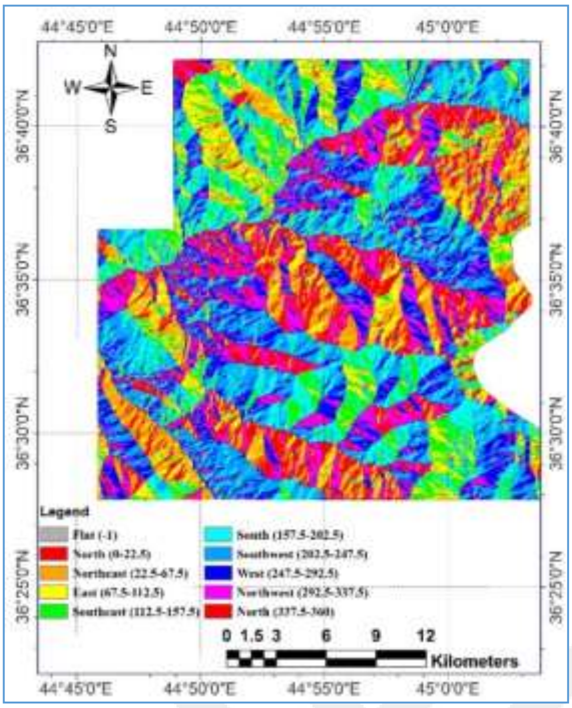


Figure 3.3. The map of aspect ratio of the study area

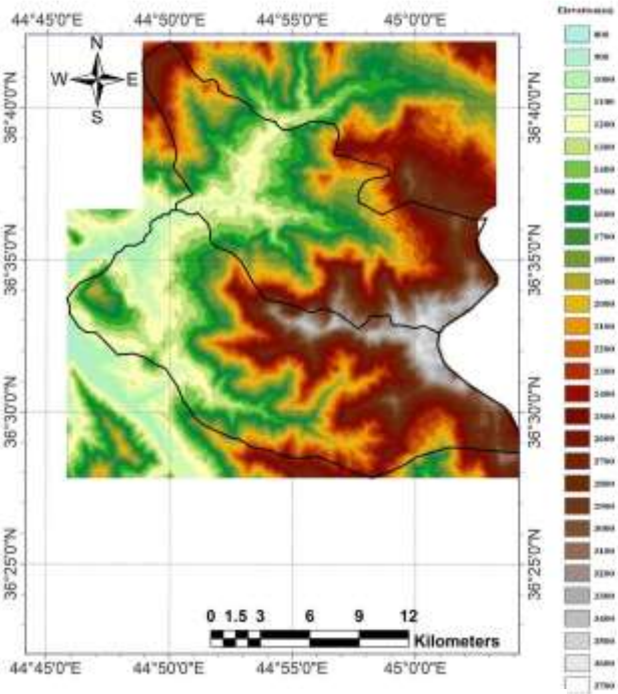


Figure 3.4. Topographic map of the study area

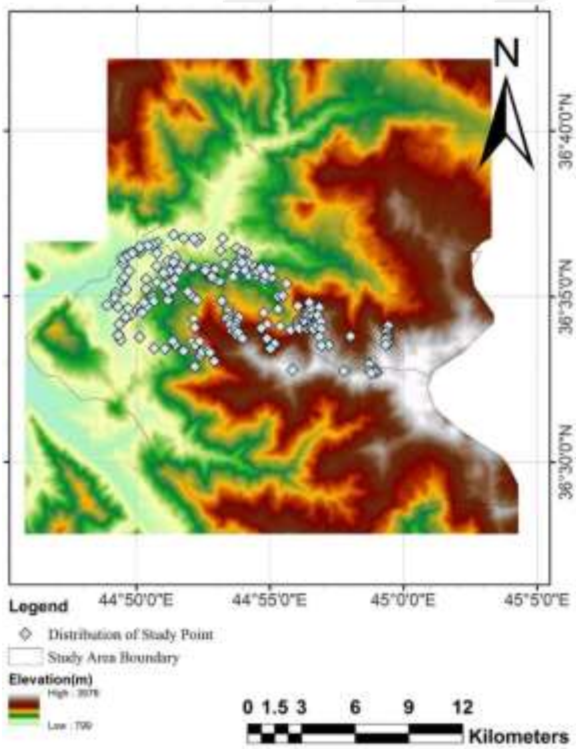


Figure 3.6. The distribution of sample plots according to elevation

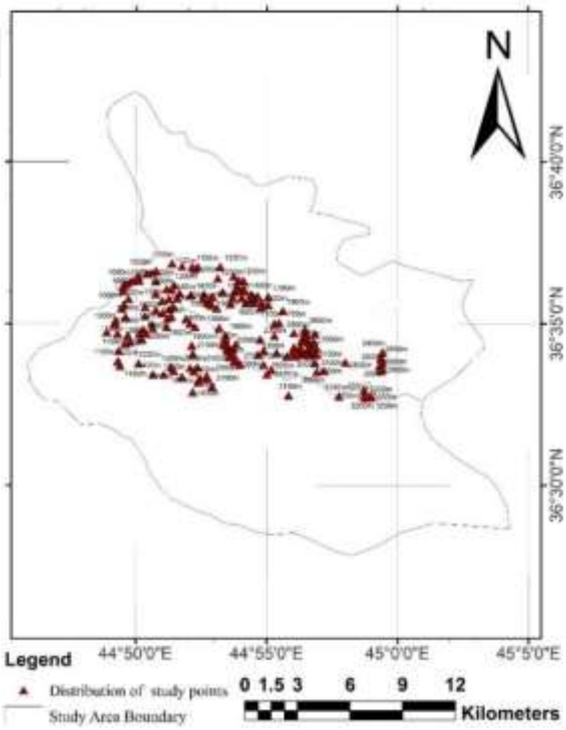


Figure 3.5. The distribution of sample plots in the study area

3.2. Climate

The climate of the Northern Iraq mainly shares with Irano-Turanian in the east and closely Mediterranean in the north, with the arid and semi-arid in the south and west (Zohary, 1973). This makes Northern Iraq weather very hot and dry in summer, the average of temperature being between 39-45 degrees. Conversely, it is very cold and wet in winter, the average temperature between 0-15 degrees sometimes below zero, with an annual rainfall between 375-725 mm (KRG, 2014). According to the bioclimatic classification (Gaznayee and Al-Quraishi, 2019; Youssef, 2019) the Mediterranean basin, like the Middle East, the thermic continentality is very strong but the rainfall seasonality is conserved. This kind of bioclimate is generally called “accentuated Mediterranean”. Emberger (1955) then Sauvage (1963) have developed a useful index for classifying the variation of Mediterranean bioclimates. In the Mesopotamian-Zagrosian context, the mediterraneity of climate is strongly constraint by two extremes: southwards in the plain, the rarity and weakness of rainfall bring the bioclimate into the Saharian categories; northwards with altitude, the intensity and duration of the cold season bring the bioclimate into the Mountainous categories. Within these two limits, temperatures and precipitations vary concomitantly in relation to altitude. Thus, bioclimate follows a continuum but it is possible to summarise dividing it into three to five main categories:

1) Below 500 m alt., the annual rainfall is generally under 400 mm, the summer is very hot (mean daily max over 40°C) and the frost is rare and nocturnal: this bioclimate can be named Xero-thermo-Mediterranean and correspond to the BSh sensu Köppen (arid – steppe – hot arid);

2) Between 500 and 2000 m alt., the rainfall can reach or exceed 1000 mm/year, the summer is lesser and lesser hot and the winter begins to be more and more snow covered: these bioclimates can be named as Mediterranean and correspond to the Csa sensu Köppen (warm temperate – summer dry – hot summer); - 500-1000 m: annual rainfall between 400 and 700 mm; winter mean daily min around 0°C; snow infrequent; mean daily max under 40°C; the bioclimate is semi-arid with fresh winter sensu Emberger & Sauvage. - 1000-1500 m, annual rainfall around 1000 mm; winter mean daily min above 0°C; snow-cover frequent; mean daily max under 35°C; the bioclimate is subhumid with cold winter sensu Emberger & Sauvage. - 1500-2000 m, annual rainfall around 1000 mm; winter mean daily between -5

and -10°C; several months snow-covered; mean daily max under 30°C; the bioclimate is humid with very cold winter sensu Emberger & Sauvage.

3) Above 2000 m alt., the rainfall decreases below 700 mm/year and the summer max around 25°C: the bio climate can be named oro-cryo Mediterranean and correspond to the Dsb sensu Köppen (snow – summer dry – warm summer).

Table 3.1. Meteorological data of Choman district during (2005-2020)

Months	**Humidity**	**Av. Temp**	**Min. Temp**	**Max. Temp**	**Precipitation**
	%	°C	°C	°C	mm/monthly
January	76.1	4.3	0.0	8.7	138.9
February	75.0	6.5	2.0	10.9	134.6
March	68.0	11.4	6.3	16.6	143.4
April	67.8	16.2	10.6	21.7	89.9
May	61.1	21.7	15.4	28.0	37.9
June	50.5	28.4	21.3	35.5	1.5
July	48.7	31.9	24.6	39.2	0.0
August	49.0	31.8	24.2	39.4	0.0
September	50.2	27.0	19.4	34.7	3.6
October	61.1	20.4	13.4	27.3	65.1
November	69.1	12.3	6.9	17.8	90.8
December	73.4	6.4	1.5	11.3	111.0

Choman area was established as a National Park named Hallgord-Sakran National Park in 2009. The highest peak is Hallgord which is located in the Hassarost Mountain with the height of (3607) m. This region receives a considerable amount of rainfall compared to other regions and the total precipitation is calculated or recorded as 951.7 mm and sometimes is more than 1000 mm (Figure 3.7).

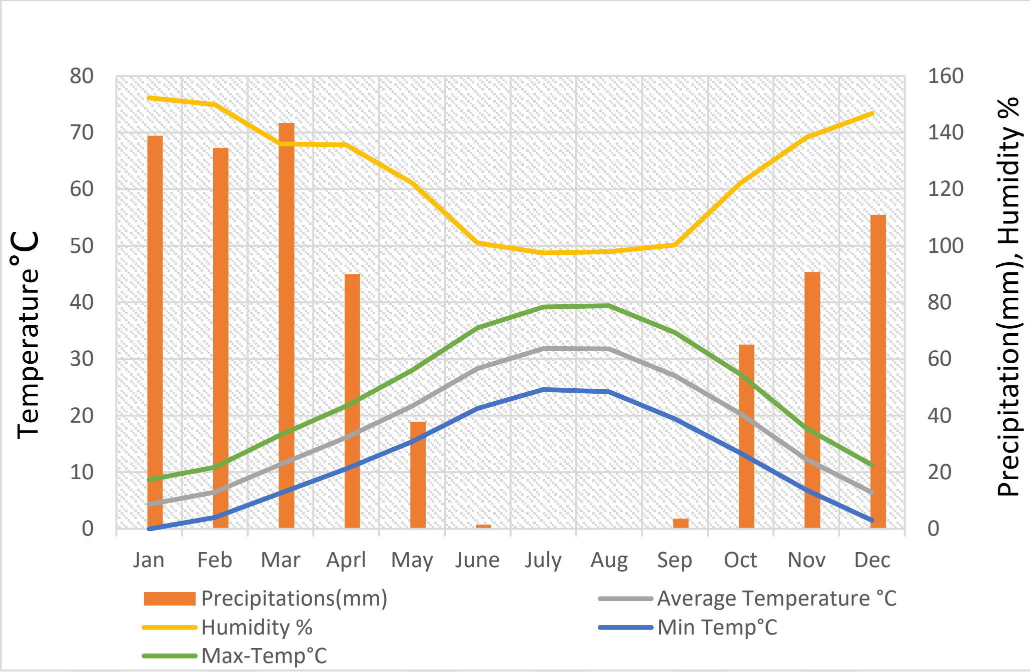


Figure 3.7. Meteorological data of Choman district during (2005-2020)

3.3. Geology

Northern Iraq is situated on the north eastern edge of the Arabian Plate, being part of the Zagros Mountain belt. The NW-trending Zagros Orogenic Belt extends about 2,000 km from the Anatolian Fault of south-eastern Turkey to the Makran Zone in southern Iran, and is part of the Alpine-Himalayan Mountain Chain. The belt resulted from the Late Cretaceous and Cenozoic convergence of the Iranian terranes and the Arabian Plate, when the intervening Neo-Tethys Ocean went through a succession of subduction, obduction and collision stages (Alavi, 1994; Sharland et al., 2001; Agard et al., 2005).

The north-eastern margin of the Arabian Plate was initially formed by the Mid-Permian rifting and the Triassic break-up of Pangaea and the opening of the Neo-Tethys Ocean. As a result, an extraordinary wide and shallow marine shelf developed over the north-eastern Mesozoic Arabian passive margin (Beydoun, 1991).

The present-day tectonic configuration of the area resulted from the final closure of the Neo-Tethys Ocean and continental collision between the Arabian Plate margin and Eurasia (Sanandaj-Sirjan Block) during Early to Mid-Miocene (Jassim and Buday, 2006).

The studied area is located within the Imbricated and Thrust zones, which are extremely distorted, and characterized by asymmetric anticlines and accompanying narrow synclines. The core of these anticlines contains Jurassic and Cretaceous rocks, mostly limestone, whereas their flanks are covered by Tertiary limestones and clastic sedimentary rocks (Ameen, 1992; Jassim and Buday, 2006). Rock units of this area exhibit displacement and crustal and includes the Cenozoic sedimentary-volcanic unit (Walash Group); the metamorphosed sedimentary unit (Naupordan Series); and the Cretaceous limestone.

The area is located between the high ridges of Hasar-i-Sakran Mountain on the Iraq – Iranian border. Different glacial features are found including cirques, moraine loops, glacial valley, and glacial sediments (Abdula et al., 2020). An abundance of rock fragments (plucks) that are usually produced by the friction of the glacier with the bed rocks during the glacial movement can be found throughout the area (Abdula et al., 2020).

3.4. Soil properties

Physiographically, the mountainous area is a part of Zagros Mountain, separated by broad valleys. Most of the region is rough broken and stony lands covered by shallow soils. The soils are variable due to differences in exposure, runoff, slope, parent materials, soil depth and maturity (Buringh, 1960). The existing soils have been either completely removed or so truncated such that the diagnostic horizons of all orders than either than Entisoils are absent, particularly on steep slopes. The dominant soil groups are Xerothents and Rendolls that are overlying stony materials in the mountain area, Chromoxererts and calcixerolls in the intermountain valleys and Torrifluvents adjacent to the main streams (Hussien, 2016) (Figure 3.8.). Scattered spots of chalky, blue marl and red mud can also observe over the study area. The major soil types are silty clay loam, clay loam and silty clay soils. With a few exceptions, all the existing soils are calcareous and non-saline. The soil reaction is slightly to mildly alkaline (Aziz et al., 2001).

Generally, the agricultural potential of the existing soils in the mountain area is limited. The limiting factors encompass steep slopes, rockiness, stoniness and soil depth. Conversely, the soils of intermountain valleys are deep and fertile and thereby have a high agricultural potential. Of 12 million ha is the total land area in northern Iraq. One third has a serious erosion problem and mainly located in the mountainous area (Hussein, 1998). The rangelands in this region are usually overgrazed and subjected to moderate to severe erosion depending on topography. On the other hand, water erosion on the croplands is slight to moderate depending on topography. Additionally, the inhabitants have a lack of capital to conserve soil and water resources.

Choman area consists mostly of rough broken and stony and rough mountainous land. According to the morphological, physical and chemical properties, the soil of the region is mainly in Inceptisols order. Inceptisols include a wide variety of soils. In some areas these soils have minimal development, whereas in other areas these soils have diagnostic horizons that merely fail the criteria of other soil orders. They have many kinds of diagnostic horizons and epipedons. The most common horizon sequence is ochric epipedon over a cambic horizon (Keya, 2020).

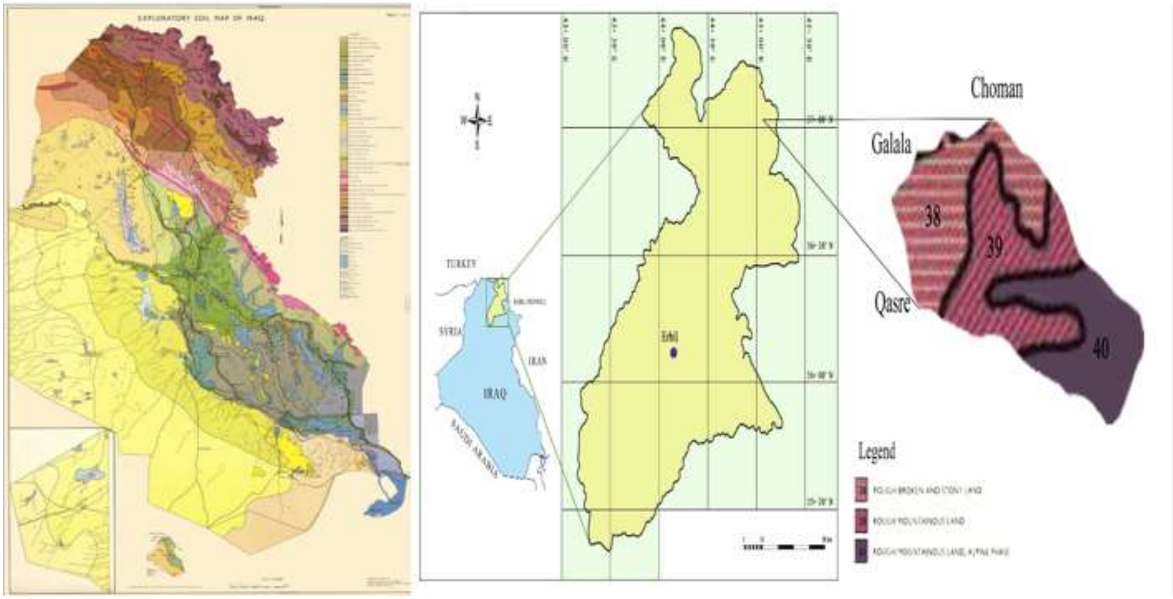


Figure 3.8. Soil classification of Iraq

3.5. Material

This investigation covers the 867 vascular plant species identified from 2000 plant specimens which collected within the 251 sample plots. Plant information and frequency in sample plots were recorded. The study also covered additional information, such as local names, life forms and chorotypes.

In addition to the standard references about the flora of Iraq (Guest & Rawi, 1966; Townsend & Guest, 1974, 1980; Townsend et al., 1966, 1968, 1985). Iraq and Iran (Rechinger, 1963-2012), Syria (Post, 1932), and Turkey (Davis, 1964-1988; Güner et al., 2000), several unpublished thesis (for example, Abd-Al-aziz, 2012; Al-Sindy, 2011; Amer, 2003; Babashekh, 2006; Faris, 1983; Haeder, 2003; Khalaf, 1980) were consulted.

3.5.1. Collecting plants

Plant samples are the materials of this study which collected and dried according to the standard herbarium techniques (Bridson and Forman, 1998; Maden, 2004). Almost 2000 vascular plant specimens were collected from Sakran area in seven field seasons. 251 sample-points were placed in the terrain between 2015-2018. Plant samples were collected from various habitat types and photographed. Also; GPS coordinates and the elevations for each taxon were recorded.

3.5.2. Determination of plant species and constitude a systematic list

All plant samples or parts (for tree and shrubs) were collected from the fields and pressed in wooden trellis and then identified using the following references. As the main flora works; Flora of Iraq by Towsend and Guest (1966-1985), Ghazanfar and Edmondson (2013), Ghazanfar and Edmondson (2016), and Bor and Guest (1968), Flora of Iranica by Rechinger (1963-2012) and Flora of Turkey by Davis (1965-85), Davis et al. (1988) and Güner et al. (2000) were used intensly. The other works; Rawi (1964), Schönbeck-Temesy and Ehrendorfer (1977), Rashed (1990), Sardar (2003), Shahbaz (2007), Dusky (2001), Al Doskey (2002), Haedar (2003), Tavakoli and Assadi (2006), Ranjbar (2006), Saeed (2007), Al-Musawi and Al-Jbuuri (2009), Al-Dabbagh (2010), Muhammed, (2010), Al-Bayati, et al. (2011), Pahlevani et al. (2011), Reveal et al. (2011), Sodagar (2012), Salmaki et al. (2012), Fritsch and Abbasi (2013), Vela et al. (2013), Zare et al. (2013), Saeed (2013), Pour et al. (2013), Palani (2013), AL-Jibouri et al. (2013), Al-Sherif et al. (2013), Ali (2014), Al-Doskey (2014), Al-Hadeethy et al. (2014), Bakr and Saeed (2014), AL-Zubaedy et al. (2014), Feizi et al. (2014), Naghavi et al. (2014), Haidari et al. (2014), Miller et al. (2015), Moradkhani and Milan (2015), Sardar et al. (2015), AL-Zubaedy et al. (2016), Haloob (2016), Moazzeni et al. (2016), Nejati et al. (2016), Darwesh (2017), Saeed (2017), Sardar (2017), Sardar and Edharim (2017), Moazzeni et al. (2018), Al-Mayah and Al-Asadi (2018), Sardar (2018), Al-Edhari et al. (2019), Ghazanfar et al. (2019), Hamad et al. (2019), Hasan and Sardar (2019), Sardar (2019), Al-Dabbagh and Saeed (2019a), Al-Dabbagh and Saeed (2019b), Youssef et al. (2019), Abdulrahman (2020), Aun and Haloob (2020), Hamakhan et al. (2020) were also consulted.

To know the geographical distribution of plants in the study area in terms of life forms and chorotypes, following references were consulted; Solecki (1971), Takhtajan (1986), Asri (2000), Myers et al. (2000), Aziz et al. (2001), Bredenkamp and Brown (2001), Akhani and

Ziegler (2002), Ejtehadi et al. (2003), Akbarinia et al. (2004), Eren et al. (2004), Kashipazha et al. (2004), Snogerup (2004), Marvi Mohadjer (2005), Prance and Nesbitt (2005), Saeidi (2005), Turki and Shayeb (2005), Vural and Aytaç (2005), Akhani (2006), Dogan and Dogan (2006), Khoshbakht (2006), Naghinezhad et al. (2006), Saeidi (2006), Soltanipour (2006), Akhani (2007), Aedo et al. (2007), Carvalho et al. (2007), Malekmohammadi et al. (2007), Sohrabi (2007), Zarezadeh et al. (2007), Amiri et al. (2008), Mehregan and Kadereit (2008), Pourreza et al. (2008), Ramezani et al. (2008), Akhalkatsi (2009), Atashgahi et al. (2009), Bachmann (2009), Ararat et al. (2010), Rajaei and Mohamadi (2012), Shabanian et al. (2013), Asem et al. (2014), Azizi and Keshavarzi (2014), Dehshiri and Jozipoor (2014), Gurgin et al. (2014), Hassani et al. (2014), Mahmoodi et al. (2015), Azizi and Keshavarzi (2015), Azizi et al. (2015), Azizi and Keshavarzi (2016), Ghelichnia (2014), Jalali et al. (2016), Tabad et al. (2016), Van Zeist and Bottema (2016), Ahvazi and Akbarzadeh (2017), Keshavarzi et al. (2017), Veiskarami et al. (2017), Al-Zubaidy and Tobakari (2018), Ismael et al. (2018), Moazzeni et al. (2018), Moradi and Attar (2019), Wolfslehner et al. (2019), Galalaey et al. (2021). The categories of taxa identified are given in a systematic list, while taxa belonging to ferns and fern allies are given according to PPG I (2016), gymnosperms according to Farjon (1998; 2nd ed. 2001) and angiosperms (subsections, classes, orders and families) are listed according to "Angiosperm Phylogeny Group" APG IV 2016 system (Chase et al., 2016). The genera and taxa were ordered alphabetically in the present flora list. The author citations of plant names were standardized following the Rec. 46A Note 1 of the ICN (McNeill et al. 2012), i.e. according to IPNI (2012 onwards). Furthermore, the floristic list was updated using the taxonomic databases such as Euro+Med. Plant Base (2006 onwards) and The Plant List (2013 onwards). The accepted names were given with their synonyms or basionyms that in bracket. This list is also provided habitat features, altitude range, GPS data, chorotype, life form, and collection date and ID for each species.

3.5.3. Herbarium

The samples were deposited in KASOF herbarium of Forestry Faculty of Kahramanmaraş Sütçü İmam University (KSU), Voucher numbers were assigned for each plant samples under the collection of A. Galalaey.

3.5.4. Sampling

In this study, in addition to the general flora surveys, sample plots were established using the systematic sampling method in order to determine the diversity pattern of plant species. Sample plots were created between 2015-2018 and laid along line transects which were established horizontally from south to north direction as systematically at every 100 m interval along 23 counter lines between 1000 to 3200 meters. The sizes of nested quadrates were chosen as 10×2 m for trees, 5×5 m for shrubs and 0.5×0.5 m for herbaceous plants. We tried to stay away from forbidden places and mine lands marked with warning signs in the field. The number of sample plots was determined under the influence of the above-mentioned restrictors and the horizontal length of the intervals. As a result, 251 sample plots were systematically established to collect information about plant species and for documentation of herbs, trees, and shrubs.

Table 3.2. The elevations and the number of sample plots in study area

Elevation (m)	**Number of sample plots**	**Elevation (m)**	**Number of sample plots**
1000	19	**2100**	9
1100	20	**2200**	7
1200	17	**2300**	7
1300	19	**2400**	7
1400	22	**2500**	9
1500	16	**2600**	7
1600	12	**2700**	7
1700	19	**2800**	5
1800	12	**2900**	3
1900	10	**3000**	5
2000	8	**3100**	6
		3200	5
		Totally	251

The following habitat characteristics were recorded in each sample plots: altitude, topographical position, geology, soil (in general for all study areas), type of rocks (in general for all study areas). Five main different habitat types were found in the study area, as riparian zone, oak forest, timberline, subalpine and alpine region. These were recorded in each sample plots to obtain a first evaluation of the plant species in the elevation gradients, relevés were then classified using Bray-Curtis Cluster Analysis (Hill, 1979).

3.5.5. Data analysis and diversity indices

In order to determine the plant species diversity values of elevation gradients, the plant speies identified from the sample plots (as subquadrates) were listed as presence / absence data. Afterward, Shannon-Wiener indices were calculated using a package program “BioDiversity Pro 2” (McAleece et al. 1997). Floristic similarities of sample plots and elevations were determined with the help of Sorensen Index (Sorensen, 1948) by using presence / absence data of the plant species. Later, Bray-Curtis Cluster Analysis was performed to group the waypoints at each elevation zones (McAleece et al. 1997). Hyerarchical clustering technique was used in Bray-Curtis Cluster Analysis. This technique is the sequential joining process of clusters, groups or subgroups which are combined only once in a hierarchical order (Fırat, 1997). Here, hierarchical results are shown as tree diagrams (Lorr, 1983).

Diversity indices

A diversity index is a mathematical measure of species diversity in a community, and there are many indices currently used to calculate diversity. The most commonly used of these are the alpha diversity index as; Shannon (1948), Simpson (1949), Margalef (1951) and Berger and Parker (1970) diversity indices (Magurran, 2004).

Alpha Diversity

In this study, the most widely used Shannon index was used to calculate alpha diversity. Compared to Simpson, this index is more sensitive to the occurrence of rare taxa in the habitat, giving more accurate results. Simpson index gives more reliable results when a single dominant stand type or species is examined (Doğan and Doğan, 2006). The Shannon index is the most widely used diversity index that examines community characteristics in detail. This index assumes that individuals are randomly sampled from extremely large communities and samples representing all species, and gives the average degree of uncertainty whether a randomly selected individual from a given community is in the same category or the same species as another individual chosen from the same community (Magurran, 1988). Uncertainty increases both as the number of species increases and when individuals belonging to existing species show a more even distribution. If measured correctly (H') always gives a value between "0" (low community complexity) and "4" (high community complexity). That is, diversity reaches its maximum value when all species are equally distributed (Seaby and Henderson, 2006).

$$H' = -\sum pi \log(pi) \quad (1)$$

H' = Species diversity value

pi = Abundance of each plant species (The "ni" of the number of individuals belonging to each species calculated by proportioning "N" to the total number of individuals)

ni = Individual number of “i”th plant species (abundance)

N = Total number of individuals or total abundance

$$pi = \frac{ni}{N} \quad (2)$$

Sorensen similarity index

The similarity index of Sorensen (1948) was applied for the succession phases in which the variation change was calculated. The data obtained in the comparisons are presented in tables.

Sorensen index = 2C /A+B (3)

A= Total number of taxa in the first community

B= Total number of taxa in the second community

C= Taxa number that are common in both communities

4. RESULTS

4.1. Systematic plant list

Pteridophyta

I. Equisetales

1. Equisetaceae

1. *Equisetum* L.

1. *E. ramosissimum* Desf.

(PL, Hemicryptophyte), (1000, 1100, 1200, 1300 and 1400 m), N36.590922, E44.854584, by (and in) streams, irrigation channels, in shady ditches on mountain seepages, 14.05.2017, A. Galalaey 0397, (KASOF 3397).

2. Aspleniaceae

2. *Asplenium* L.

2. *A. viride* Huds.

(Cosm, Cryptophyte-Geophyte (rhizome)) (1800 and 2400 m), N36.568817, E44.990514, rock crevices and ledges, rocky hill sides, damp shady cliffs, 06.08.2016. A. Galalaey 0092, (KASOF 3074).

Figure 4.1. *Asplenium viride*

3. *Ceterach* L.

3. C. *officinarum* DC.

(PL, Cryptophyte-Geophyte (rhizome), (1000, 1100, 1200, 1400, 1700 and 1800 m), N36.575228, E44.929432, rock crevices and ledges, rocky hill sides, damp shady cliffs, moist places on stone walls, usually abundant on but not restricted to limestone, in oak forest, 17.05.2017. A. Galalaey 0093, (KASOF 3075).

Figure 4.2. *Ceterach officinarum*

II. Filicales

3. Adiantaceae (Pteridaceae)

4. *Anogramma* Link.

4. *A. leptophylla* (L.) Link

(Cosm, Hemicryptophyte), 1200 m, N36.600744, E44.856233, shaded overhanging rocky ledges, damp limestone fissures in shady gulleys, 12.05.2017, A. Galalaey 0738, (KASOF 3717).

5. *Cheilanthes* (L.) Sw.

5. *C. fragrans* (L. f.) Sw.

(IT, Hemicryptophyte), (1100, 1400, 3100 and 3200 m), N36.591848, E44.913070, shady cliffs and crevices in limestone rocks, overhanging rock ledges, south facing stony limestone hillsides, 30.04.2016 and 12.05.2017, A. Galalaey 0739, (KASOF 3718).

6. *C. persica* (Bory) Mett. ex Kuhn.

(IT, Hemicryptophyte), (1400, 1600, 1700, 2000, 2100 and 2400 m), N36.570029, E44.933799, cliffs and crevices in limestone rocks, shady cliffs, overhanging rock ledges, south facing stony limestone hillside, 11.05.2017, A. Galalaey 0740, (KASOF 37179).

6. *Adiantum* L.

7. A. *capillus-veneris* L.

(Cosm, Neophyte), (1000 and 1700 m), N36.583858, E44.924626, very damp, shady places, 10.05.2017, A. Galalaey 0741, (KASOF 3720).

MESANGIOSPERMS

MAGNOLIIDS

Canellales Cronq.

4. Aristolochiaceae Juss.

7. *Aristolochia* L.

8. *A. bottae* Jaub. & Spach.

(IT, Hemicryptophyte), (1000, 1100, 1300, 1400, 1500 and 1800 m), N36.581661 E44.852825, mountain slopes in oak forest, rocky hillsides, denuded hills and degraded forest, 25 04 2016, A. Galalaey 0077, (KASOF 3059).

MONOCOTS

Alismatales R.Br. ex Bercht. & J.Presl

5. Araceae Juss.

8. *Arum* L.

9. *A. conophalloides* Kotschy ex Schott

(IT, Cryptophyte-Geophyte (tuber), (1100, 1200, 1400, 1500, 1600, 1700, 1800, 2000, 2100 and 2500 m), mountain and in dense oak forest on a steep slope, 05.05.2016, A. Galalaey 0076, (KASOF 3058).

Figure 4.3. *Arum conophalloides*

Dioscoreales Mart.

6. Dioscoreaceae R.Br.

9. *Dioscorea* Plum. ex L.

10. *Dioscorea communis* (L.) Caddick & Wilkin (**syn.** *Tamus communis* L.)

(IT.M.ES, Cryptophyte-Geophyte), (1000, 1200, 1400, 1600 and 1700 m), N36.593074 E44.917639, in the lower mountains and on steppic plains and hills, by streams. 15.05.2015, 10.05.2016 and 28.04.2017, A. Galalaey 0394, (KASOF 3376).

Figure 4.4. *Dioscorea communis*

Liliales Perleb

7. Colchicaceae DC.

10. *Colchicum* L.

11. *C. crocifolium* Boiss.

(IT, Cryptophyte-Geophyte (bulb), (1100 and 1200 m), N36.600744, E44.856233, in the lower mountains, open places in oak scrub, 12.05.2017 and 09.03.2017, A. Galalaey 0363, (KASOF 3345).

Figure 4.5. *Colchicum crocifolium*

12. *C. kotschyi* Boiss.

(IT, Cryptophyte-Geophyte (bulb), (1100 and 2300 m), N36.567538, E44.911081, mountain slopes, rocky and stony, 11.05.2017 and 22.08.2016, A. Galalaey 0364, (KASOF 3346).

Figure 4.6. *Colchicum kotschyi*

13. *C. kurdicum* (Born.) Stefan

(IT, Cryptophyte-Geophyte (bulb), (2400, 2500, 2600, 2800, 3000 and 3200 m), N36.569723, E44.942896, moist silty pockets in igneous rock and limestone above the tree line, near melting snow, 28.06.2017, A. Galalaey 0365, (KASOF 3346).

Figure 4.7. *Colchicum kurdicum*

14. *C. autumnale* L.

(IT.M, Cryptophyte-Geophyte (bulb), (1500, 1600, 1700, 1900, 2100 and 2400 m), N36.587163, E44.904584, in the mountains, in denuded oak forest, 17.05.2016, A. Galalaey 0366, (KASOF 3347).

8. Liliaceae Juss.

11. *Fritillaria* Tourn. ex L.

15. *F. crassifolia* Boiss. & Reut. subsp. *kurdica* (Boiss. & Noe) Rix

(IT, Cryptophyte-Geophyte (bulb), (1300 and 1400 m), N36.592240, E44.857150, mountains, on screes, 14.05.2017, A. Galalaey 0587, (KASOF 3561), **Endemic**, IUCN: VU.

Figure 4.8. *Fritillaria crassifolia* subsp. *kurdica*

16. *F. imperialis* L.

(IT, Cryptophyte-Geophyte (bulb), (1500, 1900, 2000, 2100, 2200, 2300, 2400, 2500 and 2700 m), N36.568771, E44.943951, in the mountains, on coarse screes recently uncovered from snow, 06.08.2016, A. Galalaey 0588, (KASOF 3562).

Figure 4.9. *Fritillaria imperialis*

17. *F. straussii* Bornm

(IT, Cryptophyte-Geophyte (bulb), 1700 m, N36.588951, E44.880196, grassland area, 15.05.2016, A. Galalaey 0589, (KASOF 3563).

Figure 4.10. *Fritillaria straussii*

12. *Gagea* Salisb.

18. *G. anisanthos* C. Koch

(IT, Cryptophyte-Geophyte (bulb), 1300, 1600, 1900, 2100 and 2400 m), N36.559969, E44.871204, grassy mountain slopes, near melting snow, 07.05.2017, A. Galalaey 0590, (KASOF 3564).

19. *G. confusa* A. Terr

(IT, Cryptophyte-Geophyte (bulb), 2500, 2600 and 3000 m), N36.569723, E44.942896, near melting snow, 28.06.2017, A. Galalaey 0591, (KASOF 3565).

Figure 4.11. *Gagea confusa*

20. *G. gageoides* (Zuss) Vved.

(IT, Cryptophyte-Geophyte (bulb), 1100, 1200 and 1900 m), N36.600744, E44.856233, rocky place, 12.05.2017, A. Galalaey 0592, (KASOF 3566).

Figure 4.12. *Gagea gageoides*

13. *Tulipa* L.

21. *T. biflora* Pall

(IT.ES, Cryptophyte-Geophyte (bulb), 1600 m), N36.583503, E44.867661, near melting snow, 25.04.2016, A. Galalaey 0593, (KASOF 3567).

Figure 4.13. *Tulipa biflora*

22. *T. systola* Stapf

(IT, Cryptophyte-Geophyte (bulb), 1400, 1500, 1600, 1700, 1900, 2000, 2100, 2400 and 2500 m), N36.571382, E44.934025, mountain slopes, 11.05.2016, A. Galalaey 0594, (KASOF 3568).

9. Orchidaceae

14. *Anacamptis* Rich.

23. *A. collina* (Banks & Sol. ex Russell) R.M. Bateman, Pridgeon & M.W. Chase

(IT.M, Cryptophyte-Geophyte (tuber), 1000, 1300 and 1600 m), N36.596177, E44.854155, open forest with moist place, 10.04.2017, A. Galalaey 0627, (KASOF 3589).

24. *A. laxiflora* (Lam.) R.M.Bateman, Pridgeon & M.W.Chase

(M, Cryptophyte-Geophyte (tuber), 1400, 1600, 1700, 1900 and 2000 m), N36.599860, E44.895818, high in the mountains, in moist places in oak forest, 23.04.2016, A. Galalaey 0628, (KASOF 3590).

Figure 4.14. *Anacamptis laxiflora*

15. *Androrchis* D.Tyteca & E.Klein

25. *A. mascula* (L.) D. Tyteca & E. Klein

(IT, Cryptophyte-Geophyte (tuber), 1000 and 1100 m), N36.605258, E44.845887, in the mountains among oak woods, 16.04.2016 and 12.05.2017, A. Galalaey 0624, (KASOF 3591).

Figure 4.15. *Androrchis mascula*

16. *Cephalanthera* Rich.

26. *C. kurdica* Bornm. ex Krae

(IT, Cryptophyte-Geophyte (tuber), 1000, 1300 and 1400 m), N36.598312, E44.868557, among oak trees, 27.04.2017, A. Galalaey 0614, (KASOF 3592).

Figure 4.16. *Cephalanthera kurdica*

17. *Dactylorhiza* Neck. ex Nevski.

27. *D. umbrosa* (Kar. et Kir.) Nevski var. *longibracteata* Renz

(IT, Cryptophyte-Geophyte (tuber), 2000 and 2100 m), N36.570916, E44.891682, wet place (over Xendan Spring), 10.05.2016, A. Galalaey 0615, (KASOF 3593).

18. *Epipactis* Zinn.

28. *E. helleborine* (L.) Crantz

(IT, Cryptophyte-Geophyte (tuber), 1200 and 1300 m), N36.594109, E44.903336, under shade of oak trees, 14.05.2017, A. Galalaey 0616, (KASOF 3594).

Figure 4.17. *Epipactis helleborine*

29. *E. veratrifolia* Boissier & Hohenacker

(IT, Cryptophyte-Geophyte (tuber), 1300 m), N36.602108, E44.897430, wet place, road between Goronia and Nawbarga (villages), 04.05.2017, A. Galalaey 0617, (KASOF 3595).

19. *Himantoglossum* Spreng.

30. *H. comperianum* (Steven) P. Delforge

(IT, Cryptophyte-Geophyte (tuber), 1000, 1300 and 1500 m), N36.594109, E44.903336, oak forest, 14.05.2016, A. Galalaey 0618, (KASOF 3596).

Figure 4.18. *Himantoglossum comperianum*

20. *Limodorum* Boehm.

31. *L. abortivum* (L.) Sw. var *abortivum*

(IT, Cryptophyte-Geophyte (tuber), (1200 and 1300 m), N36.556059, E44.862555, dry forest aea and grassy places in the mountains, 07.05.2016 and 20.04.2017, A. Galalaey 0619, (KASOF 3597).

Figure 4.19. *Limodorum abortivum* var. *abortivum*

21. *Ophrys* L.

32. *O. reinholdii* H. Fleischm. subsp. *straussii* (H. Fleischm. & Bornm.) E. Nelson

(IT, Cryptophyte-Geophyte (tuber), (1300, 1400, 1600 and 1700 m), N36.596914, E44.904888, rocky place, 30.04.2016, A. Galalaey 0620, (KASOF 3598).

Figure 4.20. *Ophrys reinholdii* subsp. *straussii*

33. *O. schulzei* Bornm. & Fleischm.

(IT, Cryptophyte-Geophyte (tuber), (1300 and 1700 m), N36.596914, E44.904888, rocky place, 30.04.2016, A. Galalaey 0626, (KASOF 3599).

34. *O. umbilicata* Desf.

(IT, Cryptophyte-Geophyte (tuber)), 1000 m, N36.608115, E44.835073, vineyards, 20.04.2016, A. Galalaey 0622, (KASOF 3600).

35. *O. mammosa* subsp. *mouterdeana* B. Baumann & H. Baumann

(IT, Cryptophyte-Geophyte (tuber)), (1300, 1400, 1600 and 1700 m), N36.559220, E44.864182, 07.05.2017, A. Galalaey 0621, (KASOF 3601).

22. *Anacamptis* Rich.

36. *Anacamptis coriophora* (L.) R.M. Bateman, Pridgeon & M.W. Chase

(IT, Cryptophyte-Geophyte (tuber), 1200 m, N36.598764, E44.845838, wet place, 21.04.2017, A. Galalaey 0623, (KASOF 3602).

Figure 4.21. *Anacamptis coriophora*

23. *Orchis* Tourn. ex L.

37. *O. simia* Lam.

(IT, Cryptophyte-Geophyte (tuber), 1000 m, N36.582762, E44.818982, open area, 24.04.2017, A. Galalaey 0624, (KASOF 3603).

Figure 4.22. *Orchis simia*

10. Ixioliriaceae Nakai (as Ixiolirionaceae)

24. *Ixiolirion* Fisch. ex Herb.

38. *I. tataricum* (Pall) J.A & J.H Schultes

(COSM, Cryptophyte-Geophyte (bulb), (1000, 1100, 1300, 1400, 1600, 1900, 2000, 2100, 2200, 2300, 2500 and 3100 m), N36.573131, E44.891203, in the mountains on rocky summits, dry grassy slopes on stony and gravelly soil, among oak trees on limestone, 03.05.2017, A. Galalaey 0530, (KASOF 3505).

Figure 4.23. *Ixiolirion tataricum*

11. Iridaceae Juss.

25. *Crocus* L.

39. *C. biflorus* Miller.

(IT.M, Cryptophyte-Geophyte (bulb), 2300 m, N36.567538, E44.911081, rocky mountain slope, 11.05.2017, A. Galalaey 0519, (KASOF 3494).

40. *C. cancellatus* Herb

(IT.M, Cryptophyte-Geophyte (bulb), (1000, 1100, 1300, 1400, 1500, 1600 and 1700 m), N36.593360, E44.880103, in the mountains on stony slopes and earthy screes, on hill slopes, 19.04.2016 and 23.04.2017, A. Galalaey 0520, (KASOF 3495).

Figure 4.24. *Crocus cancellatus*

26. *Gladiolus* L.

41. *C. atroviolaceus* Boiss.

(IT.M, Cryptophyte-Geophyte (bulb), (1000, 1100, 1300, 1400, 1500, 1600 and 1700 m), N36.596914, E44.904888, on stony floor of oak woodland, 30.04.2016, A. Galalaey 0521, (KASOF 3496).

42. *G. italicus* Mill.

(IT.M, Cryptophyte-Geophyte (bulb), (1700, 1900, 2000 and 2600 m), N36.573131, E44.891203, near stream, 03.05.2017, A. Galalaey 0522, (KASOF 3497).

Figure 4.25. *Gladiolus italicus*

27. *Moraea* Mill. (**syn.** *Gynandriris* Parl)

43. *M. sisyrinchium* (L.) Ker Gawl. (**syn.** *Gynandriris sisyrinchium* (L.) Parl.)

(IT.M. SS, Cryptophyte-Geophyte (bulb), (1100 and 1300 m), N36.602108, E44.897430, open mountain slopes and grassy steppic hills and plains, 04.05.2017, A. Galalaey 0523, (KASOF 3498).

Figure 4.26. *Moraea sisyrinchium*

28. *Iris* L.

44. *I. persica* L.

(IT, Cryptophyte-Geophyte (bulb), (1000 and 1100 m), N36.593265, E44.825577, mountain slopes, in coppiced oak on limestone, 29.04.2017, A. Galalaey 0524, (KASOF 3501).

Figure 4.27. *Iris persica*

45. *I. reticulata* M.Bieb. var. *reticulata*

(IT, Cryptophyte-Geophyte (bulb), 1600 m, N36.583503, E44.867661, near melting snow, 25.04.2016, A. Galalaey 0525, , (KASOF 3504).

46. *I. reticulata* M.Bieb. var. *bakeriana* (Foster) B. Mathew & Wendelbo

(IT, Cryptophyte-Geophyte (bulb), (2000, 2100 and 2500 m), N36.566615, E44.929495, mountain slope, 11.05.2016, A. Galalaey 0529, (KASOF 3503).

Figure 4.28. *Iris reticulata* var. *bakeriana*

47. *I. aucheri* (Baker) Sealy

(IT, Cryptophyte-Geophyte (bulb), (1300 and 1400 m), N36.593360, E44.880103, oak forest, 19.04.2016 and 23.04.2017, A. Galalaey 0526, (KASOF 3499).

48. *I. caucasica* Hoffm.

(IT, Cryptophyte-Geophyte (bulb), (2300 and 2400 m), N36.575349, E44.912545, mountain slope, 11.05.2017, A. Galalaey 0527, (KASOF 3500).

49. *I. pseudocaucasica* Grossh.

(IT, Cryptophyte-Geophyte (bulb), (1800 and 1900 m), N36.570688, E44.925488, open grass land area, 04.05.2017, A. Galalaey 0528, (KASOF 3502).

Figure 4.29. *Iris pseudocaucasica*

12. Asphodelaceae Juss.

29. *Eremurus* M. Bieb.

50. *E. spectabilis* M. Bieb.

(IT, Cryptophyte-Geophyte (tuber)), 1700 m, N36.547463, E44.875503, mountain rocky place, 20.04.2017, A. Galalaey 0872, (KASOF 3850).

Figure 4.30. *Eremurus spectabilis*

13. Amaryllidaceae J.St.-Hil.

30. *Allium* L.

51. *A. stamineum* Boiss.

(IT, Cryptophyte-Geophyte (bulb), Pr), (1100 and 1400 m), N36.573026, E44.826413, oak coppices, 15 04 2016, A. Galalaey 0005, (KASOF 2987).

52. *A. akaka* Gmelin

(IT, Cryptophyte-Geophyte (bulb), Pr), (1000, 1100, 1400, 1700, 1900, 2000, 2300, 2400, 2700 and 2900 m), N36.560945, E44.872566, rocky place, 07.05.2017, A. Galalaey 0006, (KASOF 2988).

Figure 4.31. *Allium akaka*

53. *A. jesdianum* Boiss. & Buhse

(IT, Cryptophyte-Geophyte (bulb), Pr), (1700, 1900 and 2100 m), N36.587630, E44.856569, mountain slopes, 17.05.2016, A. Galalaey 0007, (KASOF 2989).

54. A. *myrianthum* Boiss.

(IT, Cryptophyte-Geophyte (bulb), Pr), 1200 m, N36.603261, E44.857452, oak forest, 05.05.2016, A. Galalaey 0008, (KASOF 2990).

55. A. *paniculatum* L.

(IT, Cryptophyte-Geophyte (bulb), Pr), (1100, 1400 and 1700 m), N36.597749, E44.867689, rocky mountain, 15.05.2017, A. Galalaey 0009, (KASOF 2991).

Figure 4.32. *Allium paniculatum*

56. A. *longisepalum* Bertol.

(IT, Cryptophyte-Geophyte (bulb), Pr), (1000, 1100, 1200 and 1400 m), N36.582832 E 44.819651, field, 20.04.2016, A. Galalaey 0010, (KASOF 2992).

57. *A. rotundum* L.

(IT, Cryptophyte-Geophyte (bulb), Pr), (1000, 1100, 1200 and 1700 m), N36.594109, E44.903336, rocky place and open oak forest, 12.05.2017, A. Galalaey 0011, (KASOF 2993).

58. *A. fedtschenkoi* Nábělek

(IT, Cryptophyte-Geophyte (bulb), (1700, 1900, 2000 and 2200 m), N36.575821, E44.890204, in the mountains, on limestone, 15.05.2016, A. Galalaey 0012, (KASOF 2994).

Figure 4.33. *Allium fedtschenkoi*

59. *A. subakaka* Razyfard & Zarre

(IT, Cryptophyte-Geophyte (bulb), (2000 and 2100 m), N36.555248, E44.879177, rocky place, 07.05.2017, A. Galalaey 0013, (KASOF 2995).

Figure 4.34. *Allium subakaka*

60. *A. stipitatum* Rege

(IT, Cryptophyte-Geophyte (bulb), 1700 m, N36.592011, E44.921365, open oak forest, 14.05.2017, A. Galalaey 0014, (KASOF 2996).

61. *Allium anacoleum* Hand.-Maz. (Sect. Scorodon s.lat.)

(IT, Cryptophyte-Geophyte (bulb), (2700 and 3100 m), N36.559099, E44.953227, high mountain slopes, 07.08.2016, A. Galalaey 0015, (KASOF 2997).

Figure 4.35. *Allium anacoleum*

31. *Sternbergia* Waldst. & Kit.

62. *S. lutea* (L.) Ker Gawl. ex Spreng.

(IT, Cryptophyte-Geophyte (bulb), 1200 m, N36.592113, E44.839148, mountain, under *Crataegus* trees (near Meirga spring), 05 05 2016. A. Galalaey 0016, (KASOF 2998).

Figure 4.36. *Sternbergia lutea*

14. Asparagaceae

32. *Asparagus* Tourn. ex L.

63. *A. verticillatus* L.

(IT, Hemicryptophyte), 1300 m, N36.595239, E44.850090, in oak forest, beneath the trees, 23.04.2016, A. Galalaey 0078, (KASOF 3060).

33. *Bellevalia* Lapeyr.

64. *B. decolorans* Bornm

(IT, Cryptophyte-Geophyte (bulb), (1200, 1400, 1700, 2100, 2200 and 2300 m), N36.549899, E44.873637, stony mountainsides, limestone area with open oak forest, 07.05.2017, A. Galalaey 0080, (KASOF 3061).

65. *B. kurdistanica* Feinbr

(IT, Cryptophyte-Geophyte (bulb), (1000, 1100 and 1300 m), N36.579034, E44.814706, hillside, rocky places among degraded oak forest, 20.04.2016, A. Galalaey 0085, (KASOF 3062).

34. *Muscari* Mill.

66. *M. tenuiflorum* Tausch

(IT, Cryptophyte-Geophyte (bulb), (1300, 1400 and 1600 m), N36.593074, E44.917639, foot-hills of the mountains 15.05.2015, 10.05.2016 and 28.04.2017, A. Galalaey 0081, (KASOF 3063).

67. *M. comosum* (L.) Mill

(IT, Cryptophyte-Geophyte (bulb), (1100 and 1400 m), N36.573026, E44.826413, on the lower mountainsides, in oak forest on limestone, 15 04 2016, A. Galalaey 0087, (KASOF 3064).

68. *M. inconstricum* Rech

(IT, Cryptophyte-Geophyte (bulb), (1300, 1500 and 1700 m), N36.592832, E44.881817, stony mountain slopes and gravelly hillsides, 22.05 2016, A. Galalaey 0088, (KASOF 3065).

35. *Ornithogalum* L.

69. *O. arcuatum* Stev.

(IT, Cryptophyte-Geophyte (bulb), (1400, 1500, 1600, 1900, 2000, 2100, 2200, 2400, 2500 and 3000 m), N36.578339, E44.941832, on mountain slopes, below snowline; 24.06.2018, A. Galalaey 0089, (KASOF 3067).

70. *O. cuspidatum* Bertol.

(IT, Cryptophyte-Geophyte (bulb), (1100, 1300 and 1400 m), N36.563964, E44.821983, lower mountain slopes in oak scrub, 15 04 2016, A. Galalaey 0079, (KASOF 3068).

71. *O. kurdicum* Bornm.

(IT, Cryptophyte-Geophyte (bulb), (1000, 1100, 1300 and 1400 m), N36.600476, E44.902540, in the mountains, on a stony waste between vineyards, 23.04.2016, 28.04.2017, and 14.07.2018, A. Galalaey 0090, (KASOF 3069), **Endemic**, IUCN: LC.

72. *O. persicum* Hausskn. ex Bornm.

(IT, Cryptophyte-Geophyte (bulb), (1800 and 1900 m), N36.575228, E44.929432, in the mountains by streams, open forest on clay, 08.05. 2017, A. Galalaey 0082, (KASOF 3070).

36. *Puschkinia* Adams

73. *P. scilloides* Adams

(IT, Cryptophyte-Geophyte (bulb), (1800, 1900, 2000, 2100, 2200, 2500, 2600, 2900, 3000 and 3200 m), N36.567431, E44.939683, high mountain slopes and summits, in melting snow, 24 06 2018, A. Galalaey 0091, (KASOF 3073).

Figure 4.37. *Puschkinia scilloides*

37. *Scilla* L.

74. *S. persica* Hausskn.

(IT, Cryptophyte-Geophyte (bulb), (1000 and 1300 m), N36.602586, E44.824746, in the mountains, in damp grassy places, marshy ground in denuded oak forest on limestone, in valley, 27.04.2017, A. Galalaey 0083, (KASOF 3071).

75. *S. kurdistanica* Speta

(IT, Cryptophyte-Geophyte (bulb), (1600 and 1900 m), N36.583503, E44.867661, mountain rocky slope, near melting snow, 25.04.2016, A. Galalaey 0084, (KASOF 3072), **Endemic**, IUCN: LC.

Figure 4.38. *Scilla kurdistanica*

Poales Small

15. Typhaceae Juss.

38. *Typha* L.

76. *T. lugdunensis* Chab. ex Ser.

(PL, Helophyte), (1100, 1200, 1300 and 1400 m), N36.597056, E44.882068, in a mountain stream, wet place, 15.05.2015, A. Galalaey 0854, (KASOF 3833).

16. Juncaceae Juss.

39. *Juncus* L.

77. *J. bufonius* L.

(IT.ES, Therophyte), (1100, 1200, 1400, 2200 and 2300 m), N36.573131, E44.891203, sub-alpine open area, 03.05.2017, A. Galalaey 0532, (KASOF 3507).

78. *J. inflexus* L.

(Cosm, Cryptophyte-Geophyte (Corm)), 1800 m, N36.581536, E44.926221, wet place, 14.05.2016, A. Galalaey 0533, (KASOF 3508).

79. *J. articulatus* L.

(Cosm, Cryptophyte-Geophyte (Corm), (1200, 1400 and 1900 m), N36.568484, E44.922968, on a rocky mountain slope in oak forest, on metamorphic rock by wet place; 14.05.2016, A. Galalaey 0534, (KASOF 3509).

17. Cyperaceae Juss.

40. *Blysmus* Panz. ex Schult.

80. *B. compressus* (L.) Panz. ex Link

(IT.ES, Cryptophyte-Geophyte (Rhizome), 1300 m, N 36.590557, E 44.845937, in the mountains in damp places by streams, 23.04.2016, A. Galalaey 0393, (KASOF 3345).

41. *Carex* L.

81. *C. distans* L.

(Cosm, Hemicryptophyte), (1000, 1300 and 1400 m), N36.580440, E44.837788, marshy places in valleys, 23.04.2016, A. Galalaey 0383, (KASOF 3365).

82. *C. divisa* Huds

(IT.M.ES, Cryptophyte-Geophyte (Corm)), (1000, 1100 and 1200 m), N36.609051, E44.840214, on the plain on the edge of water seepages from irrigation canals, 18.04.2017, A. Galalaey 0384, (KASOF 3366).

83. *C. oreophila* C.A mey.

(IT, Therophyte), (2600 m), N36.562440, E44.989504, alpine region, 06.08.2016, A. Galalaey 0386, (KASOF 3367).

84. *C. otrubae* Podp.

(IT.M.ES, Hemicryptophyte), (1700, 1800 and 2300 m), N36.583858, E44.924626, by shady streams in rocky places in the mountains, 10.05.2017, A. Galalaey 0385, (KASOF 3368).

42. *Cyperus* L.

85. *C. glaber* L.

(IT.M, Cryptophyte-Geophyte (Corm), (1200 and 1400 m), N36.581042, E44.843990, streams in rocky places in the mountains, also in marshy places among summer crops fields, 08.05.2017, A. Galalaey 0387, (KASOF 3369).

86. *C. esculentus* L.

(Cosm, Cryptophyte-Geophyte (Corm), (1200 and 1100 m), N36.592113, E44.839148, nr. spring and damp grassy places, on the plain on the edge of water seepages from irrigation canals, 14.05.2016, A. Galalaey 0388, (KASOF 3370).

87. C. *longus* L.

(IT.M, Cryptophyte-Geophyte (Corm), 1000 m, N36.603386 E44.825778, damp shady places in the mountains nr. spring, 27.04.2017, A. Galalaey 0389, (KASOF 3371).

43. *Eleocharis* R.Br.

88. *E. palustris* (L.) Roemer & J.A. Schultes

(PL, Helophyte), 1000 m, N36.603386, E44.825778, marshy places, swamps, 27.04.2017, A. Galalaey 0390, (KASOF 3372).

89. *E. quinqueflora* (Hartmann) O. Schwarz

(PL, Helophyte), (1400 and 1500 m), N36.597228, E44.881666, in the mountains, in damp places. 19.04.2016, A. Galalaey 0391, (KASOF 3373).

44. *Scirpoides* Ség.

90. *S. holoschoenus* (L.) Soják

(IT.M.ES, Cryptophyte-Geophyte (Rhizome)), (1000, 1200, 1400 and 1500 m), N36.557303, E 44.844181, channels of irrigation, 08.05.2017, A. Galalaey 0392, (KASOF 3374).

18. Poaceae Barnhart (= Gramineae Juss.)

45. *Aegilops* L.

91. *A. tauschii* Coss.

(IT, Therophyte), (1000, 1100 and 1200 m), N36.601187, E 44.852861, oak forest, 10.04.2017, A. Galalaey 0663, (KASOF 3642).

92. *A. triuncialis* L.

(IT.M, Therophyte), (1000, 1100 and 1300 m), N36.557165, E44.850957, hillsides, 03.05.2017, A. Galalaey 0665, (KASOF 3643).

93. *A. umbellata* Zhuk.

(IT, Therophyte), (1000, 1100 and 1400 m), N36.598725, E44.876665, denuded oak forest, grassy steppe land on lower mountain slopes, dry hill slopes, 04.05.2017, A. Galalaey 0666, (KASOF 3644).

94. *A. cylindrica* Host

(IT, Therophyte), (1000, 1100, 1200, 1300 and 1700 m), N36.583858, E44.924626, open area degraded forest, 10.05.2017, A. Galalaey 0664, (KASOF 3645).

46. *Agrostis* L.

95. *A. utriculatus* Banks et Sol.

(IT, Hemicryptophyte), (1000, 1300 and 1400 m), N36.578277, E44.821573, hillsides, 29.04.2017, A. Galalaey 0692, (KASOF 3646).

47. *Alopecurus* L.

96. *A. myosuroides* Huds.

(IT.M.ES, Therophyte), (1300 and 1400 m), N36.599791, E44.888460, forest clearings, 04.05.2017, A. Galalaey 0704, (KASOF 3647).

48. *Arundo* Tourn. ex L.

97. *A. donax* L.

(Cosm, Cryptophyte-Geophyte (Rhizome), (1100 and 1200 m), N36.581437, E44.828822, river and irrigation channel banks, 09.05.2016, A. Galalaey 0717, (KASOF 3648).

49. *Avena* L.

98. *A. eriantha* Dur

(PL, Therophyte), (1300 and 1500 m), N36.560929, E44.855877, on steep calcareous sandstone, 02.05.2016, A. Galalaey 0670, (KASOF 3649).

99. *A. fatua* L.

(Cosm, Therophyte), (1000, 1100, 1300 and 1400 m), N36.572977, E44.826598, steppic foothills, 26.04.2017 and 12.05.2017, A. Galalaey 0671, (KASOF 3650).

50. *Brachypodium* P. Beauv.

100. *B. sylvaticum* (Huds.) P. Beauv.

(PL, Cryptophyte), (1200 and 1300 m), N36.606780, E44.885390, damp shady places in the mountains, by a stream under trees, 20.05.2016, 27.04.2016 and 11.05.2017, A. Galalaey 0711, (KASOF 3651).

Figure 4.39. *Brachypodium sylvaticum*

51. *Briza* L.

101. *B. humilis* M.B.

(IT, Therophyte), (1000, 1400, 1700 and 1800 m), N 36.581536, E 44.926221, rocky places on mountain slopes, in oak scrub, 14.05.2016, A. Galalaey 0698, (KASOF 3652).

Figure 4.40. *Briza humilis*

52. *Bromus* Scop.

102. *B. brachystachys* Horn.

(IT.ES, Therophyte), 1200 m, N36.601187, E44.852861, in drier parts of a mountain marsh among oak trees, 10 04 2017 and 20.04.2016, A. Galalaey 0674, (KASOF 3653).

103. *B. danthoniae* Trin.

(IT, Therophyte), (1000, 1100, 1400, 1500, 1700, 1900, 2000 and 2300 m), N36.575324, E44.836646, oak forest in hill side under shrubs, 29 04 2017, A. Galalaey 0676, (KASOF 3654).

104. *B. diandrus* Roth.

(IT.M, Therophyte), (1300 and 1400 m), N36.597749, E44.867689, dry grassy and rocky slopes in hillsides, 23.04.2016, A. Galalaey 0675, (KASOF 3655).

105. *B. lanceolatus* Roth

(IT.M, Therophyte), (1000, 1100 and 1400 m), N36.581861, E44.828837, grassy mountain slopes, 20.04.2016, A. Galalaey 0677, (KASOF 3656).

106. *B. scoparius* L.

(IT.M.ES, Therophyte), (1000, 1300, 1400, 1500 and 1600 m), N36.585862, E44.865201, a ruderal of cultivated and irrigated places, 10.05.2017, A. Galalaey 0678, (KASOF 3657).

107. *B. sterilis* L.

(IT, Therophyte), (1000, 1200, 1300 and 1500 m), N36.578277, E44.821573, mountain slopes, wasteland and fields on the steppe, sandy and gravel depression in the desert, 29.04.2017, A. Galalaey 0680, (KASOF 3658).

108. *B. tectorum* L.

(IT, Therophyte), (1000, 1100, 1300, 1400, 1500, 1600 and 1700 m), N36.587630, E44.856569, in open oak forest on limestone, on disturbed grassland, 17.05.2016, A. Galalaey 0679, (KASOF 3659).

53. *Catabrosa* P. Beauv.

109. *C. aquatica* (L.) P. Beauv.

(PL, Helophyte), (1000, 1100, 1200, 1400 and 1900 m), N36.581042, E44.843990, streams, ditches, marshy hollows, muddy places, shallow pools and in moist places generally, 08.05.2017, A. Galalaey 0682, (KASOF 3660).

54. *Cynodon* Rich. in Pers.

110. *C. dactylon* (L.) Pers.

(Cosm, Cryptophyte-Geophyte (Rhizome), (1000, 1100, 1200 and 1400 m), N36.581437, E44.828822, generally in moist places, 27.04.2017, A. Galalaey 0705, (KASOF 3661).

55. *Cynosurus* L.

111. *C. elegans* Desf.

(M, Therophyte), 1000 m, N36.608115, E44.835073, shady limestone rocks, 20.04.2016, A. Galalaey 0688, (KASOF 3662).

56. *Dactylis* L.

112. *D. glomerata* L. subsp. *hispanica* (Roth) Nym.

(Cosm, Cryptophyte-Geophyte), (1100, 1400, 1600, 1700 and 2400 m), N36.553555, E44.873176, rocky hillsides, 07.05.2017, A. Galalaey 0695, (KASOF 3663).

57. *Digitaria* Haller.

113. *D. sanguinalis* (L.) Scop.

(Cosm, Therophyte), 1200 m, N36.598764, E44.845838, wet places, 21.04.2017, A. Galalaey 0696, (KASOF 3664).

58. *Echinaria* Desf

114. *E. capitata* (L.) spach

(IT.M, Therophyte), (1000, 1100, 1400, 1500, 1600 and 1700 m), N36.560929, E44.855877, stony hillsides, on calcareous clay and gravel, clearings in forest, 02.05.2016, A. Galalaey 0683, (KASOF 3665).

59. *Echinochloa* P. Beauv.

115. *E. crus-galli* (L.) P. Beauv.

(Cosm, Therophyte), (1000, 1200, 1300, 1400 and 1800 m), N36.557303, E44.844181, water channels, 08.05.2017, A. Galalaey 0699, (KASOF 3666).

60. *Elymus* L.

116. *E. hispidus* (Opiz) Melderis

(IT, Hemicryptophyte), (1700, 1900 and 2000 m), N36.5576158, E44.872630, sub-alpine open area, 07.05.2017, A. Galalaey 0667, (KASOF 3667).

117. *E. repens* (L.) Gould

(IT, Hemicryptophyte), (1000, 1100 and 1600 m), N36.610575, E44.846088, grassy mountain slopes, on limestone, in coppiced oak scrub in oak forest, 16.04.2016 and 12.05.2017, A. Galalaey 0669, (KASOF 3668).

118. *E. nodosus* (Nevski) Melderis

(IT, Hemicryptophyte), (2400, 2500, 2700, 2800 and 2900 m), N36.571083, E44.945398, mountains and rocky areas, 07 08 2016, A. Galalaey 0668, (KASOF 3669).

61. *Festuca* L.

119. *F. pratensis* Huds.

(PL, Hemicryptophyte), 1400 m, N36.583229, E44.843418, mountain and coppiced oak scrub on limestone, stony or rocky slopes, 20.04.2016, A. Galalaey 0681, (KASOF 3670).

62. *Gastridium* P. Beauv.

120. *G. phleoides* Nees et Mey C.E. Hubband.

(IT.M, Therophyte), (1100 and 1400 m), N36.581437, E44.828822, open forest area, 09.05.2016, A. Galalaey 0700, (KASOF 3671).

63. *Heteranthelium* Hochst. ex Jaub. & Spach

121. *H. piliferum* (Banks & Sol.) Hochst.

(IT.M, Therophyte), (1000, 1100, 1400, 1600, 1700 and 1800 m), N36.548223, E44.869623, among coppiced oak on limestone and dry stony hills, 26.04.2016, A. Galalaey 0719, (KASOF 3672).

64. *Hordeum* L.

122. *H. glaucum* L.

(IT.M, Therophyte), (1000, 1100 and 1200 m), N36.600109, E44.824846, fields near open forest, 27.04.2017, A. Galalaey 0701, (KASOF 3673).

123. *H. spontaneum* C. Koch

(IT, Therophyte), (1000, 1100, 1300, 1400 and 1700 m), N36.595239, E44.850090, dry hillsides, 23.04.2016, A. Galalaey 0702, (KASOF 3674).

124. *H. bulbosum* L.

(PL, Cryptophyte-Geophyte (Bulb)), (1200, 1300, 1400, 1500, 1600, 1700, 1900, 2200, 2400, 2700 m), N36.567430, E44.934673, mountain rocky place, 11.05.2017, A. Galalaey 0703, (KASOF 3675).

65. *Imperata* Cirillo

125. *I. cylindrica* (L.) P. Beauv.

(IT.M.ES.SS, Cryptophyte-Geophyte (Rhizome), (1000, 1100, 1200, 1300, 1400, 1500 and 1800 m), N36.581536, E44.926221, mountain and coppiced oak scrub on limestone, rocky slopes, 14.05.2016, A. Galalaey 0697, (KASOF 3676).

66. *Lolium* L.

126. *L. perenne* L.

(IT.M.ES, Hemicryptophyte), (1000, 1100, 1400, 1500 and 1700 m), N36.597228, E44.881666, damp shady places, in a mountain orchard, 19.04.2016, A. Galalaey 0684, (KASOF 3677).

127. *L. temulentum* L.

(Cosm, Therophyte), (1100 and 1200 m), N36.592113, E44.839148, on hillsides and in valleys in the mountains, 05.05.2016, A. Galalaey 0685, (KASOF 3678).

128. *L. rigidum* Gaudin

(IT.M, Therophyte), (1000, 1100, 1500, 1600, 1900 and 2000 m), N36.556059, E44.862555, open places in oak forest and scrub in the mountains, 07.05.2016 and 20.04.2017, A. Galalaey 0686, (KASOF 3679).

67. *Melica* L.

129. *M. persica* L.

(PL, Therophyte (Hemicryptophyte), (1500, 1700, 2000, 2600, 2700, 3000, 3100 and 3200 m), N36.591298, E44.921851, rocky mountain slopes, on limestone, 10.05.2017, A. Galalaey 0706, (KASOF 3680).

68. *Piptatherum* (M. Bieb.) Roem. & Schult.

130. *P. holciforme* (M. Bieb.) Roem. & Schult.

(IT.M, Hemicryptophyte), 1500 m, N36.591188, E44.884840, rocky and stony mountainsides, 22.05.2016, A. Galalaey 0693, (KASOF 3681).

69. *Pennisetum* Rich.

131. *P. orientale* Rich.

(IT, Cryptophyte-Geophyte (Rhizome), 1100 m, N36.611237, E44.870634, among oak scrub, 13.04.2016, A. Galalaey 0713, (KASOF 3682).

70. *Phalaris* L.

132. *P. brachystachys* Link.

(IT, Therophyte), (1200 and 1300 m), N36.601187, E44.852861, open oak forest, 04.05 2017, A. Galalaey 0707, (KASOF 3683).

71. *Phragmites* Adans.

133. *P. australis* (Cav.) Trin. ex Steud.

(Cosm, Cryptophyte-Geophyte (Rhizome), (1000, 1100, 1200, 1300 and 1400 m), N36.612723, E44.886962, riparian zone, 24.06.2018, A. Galalaey 0714, (KASOF 3684).

72. *Poa* L.

134. *P. annua* L.

(IT.M.ES, Cryptophyte), (1000, 1100 and 1200 m), N36.563003, E44.835044, hillsides and valleys in the mountains; 16.04.2017, A. Galalaey 0708, (KASOF 3685).

135. *P. bulbosa* L.

(IT.M.ES, Cryptophyte-Geophyte (Bulb), (1000, 1100, 1200, 1300, 1400, 1500, 1600, 1700, 1800, 1900, 2000, 2200 and 2300 m), N36.571382, E44.934025, mountain rocky slopes on limestone ledges, 11.05.2016, A. Galalaey 0709, (KASOF 3686).

73. *Polypogon* Desf.

136. *P. monspeliensis* (L.) Desf.

(IT.M.ES, Therophyte), (1000, 1100 and 1200 m), N36.611237, E44.870634, mountains rocky places, by streams, 13.04.2016, A. Galalaey 0712, (KASOF 3687).

74. *Psathyrostachys* Nevski ex Roshev.

137. *P. fragilis* (Boiss.) Nevski

(IT.ES, Cryptophyte-Geophyte (Rhizome), (2300, 2500 and 3100 m), N36.564022, E44.895885, rocky alpine summit, high mountain ranges and open hillsides on limestone, 15.05.2017, A. Galalaey 0715, (KASOF 3688).

75. *Sclerochloa* P. Beauv.

138. *S. dura* (L.) P. Beauv.

(IT.M.ES, Therophyte), (1000 and 1300 m), N36.602586, E44.824746, wet waste land, 27.04.2017, A. Galalaey 0687, (KASOF 3689).

76. *Setaria* P. Beauv.

139. *S. viridis* (L.) P. Beauv.

(PL, Therophyte), 1200 m, N36.592113, E44.839148, in oak forest by stream (surrounding Kani meirga), 05.05.2016, A. Galalaey 0691, (KASOF 3690).

77. *Sorghum* Moench

140. *S. halepense* (L.) Pers.

(Cosm, Cryptophyte-Geophyte (Rhizome), (1200 and 1300 m), N36.580440, E44.837788, noist waste places, 23.04.2016, A. Galalaey 0716, (KASOF 3691).

78. *Stipa* L.

141. *S. barbata* Desf.

(IT.ES, Hemicryptophyte), (1000, 1100, 1300, 1400, 1500, 1600, 1700, 2000 and 2500 m), N36.566615, E44.929495, dry, stony or rocky mountain slopes, 11.05.2016, A. Galalaey 0710, (KASOF 3692).

79. *Taeniatherum* Nevski

142. *T. caput-medusae* (L.) Nevski

(IT.M.ES, Therophyte), (1100 and 1500 m), N36.582410, E44.827072, hill side, 20.04.2016, A. Galalaey 0718, (KASOF 3693).

143. *T. crinitum* (Schreb.) Nevski

(IT.M, Therophyte), (1000, 1100, 1400, 1600 and 1700 m), N36.597646, E44.910874, oak forest, 10.05.2016, A. Galalaey 0694, (KASOF 3694).

80. *Triticum* L.

144. *T. boeoticum* Boiss.

(IT, Therophyte), (1000 and 1300 m), N36.608115, E44.835073, vineyards, 20.04.2016, A. Galalaey 0672, (KASOF 3695).

145. *T. dicoccoides* (Körn. ex Asch. & Graebn.) Schweinf.

(M, Therophyte), (1000, 1300, 1400 and 1500 m), N36.596511, E44.876153, open grassy places in coppiced oak scrub, 14.07.2018, A. Galalaey 0673, (KASOF 3696).

81. *Vulpia* C.C. Gmel.

146. *V. ciliata* Danth. Ex Lam.

(IT.M.ES, Therophyte), (1000, 1100 and 1500 m), N36.596578, E44.908644, dry hill slopes, 29.04.2017, A. Galalaey 0689, (KASOF 3697).

147. *V. myuros* (L.) C.C. Geml.

(Cosm, Therophyte), (1100, 1200 and 1300 m), N36.561543, E44.823259, open forest, 22.04.2017, A. Galalaey 0690, (KASOF 3698).

EUDICOTS

Ranunculales Juss. ex Bercht. & J.Presl

19. Papaveraceae Juss.

82. *Corydalis* (Sm.) DC

148. *C. rutifolia* (Sm.) DC

(IT, Cryptophyte-Geophyte (Tuber), (1700, 1800, 2000, 2100, 2200, 2300, 2600, 2800 and 3000 m), N36.587163, E44.904584, oak forest or coppiced oak, 17.05.2016, A. Galalaey 0500, (KASOF 3614).

Figure 4.39. *Corydalis rutifolia*

149. *C. verticillaris* DC.

(IT, Cryptophyte-Geophyte (Tuber), (1600, 2200, 2300, 2600 and 3200 m), N36.545872, E44.982902, alpine region, 06/07.08.2016, A. Galalaey 0501, (KASOF 3615).

83. *Fumaria* L.

150. *F. parviflora* Lam.

(PL, Therophyte), (1000, 1100 and 1200 m), N36.608115, E44.835073, vineyards, 20.04.2016, A. Galalaey 0502, (KASOF 3616).

151. *F. asepala* boiss

(IT.M.ES, Therophyte), (1400 and 1700 m), N36.583858, E44.924626, open area, degraded forest, 10.05.2017, A. Galalaey 0503, (KASOF 3617).

152. *F. vaillantii* Loisel.

(IT, Therophyte), (1000, 1100 and 1200 m), N36.563964, E44.821983, near field of summer crops, 15.04.2016, A. Galalaey 0504, (KASOF 3618).

84. *Papaver* L.

153. *P. cylindricum* Cullen

(IT.M.ES, Therophyte), 1500 m, N36.581661, E44.852825, open oak forest, 25 04 2016, A. Galalaey 0639, (KASOF 3619).

154. *P. glaucum* Boiss. et Hausskn.

(IT, Therophyte), (1000, 1100 and 1300 m), N36.578277, E44.821573, steppic hillsides, 29.04.2017, A. Galalaey 0641, (KASOF 3620).

155. *P. persicum* Lind. Lam

(IT., Therophyte), (1500, 1700, 1900, 2000, 2100, 2500 and 2600 m), N36.571492, E44.943820, in the mountains, among rocks, 07.08.2017. A. Galalaey 0640, (KASOF 3621).

156. *P. fugax* Poir.

(IT, Hemicryptophyte), (1700 and 1900 m), N36.577395, E44.890403, in the mountains on shady limestone ledges, 03.05.2017, A. Galalaey 0642, (KASOF 3622).

157. *P. rhoeas* L.

(PL, Therophyte), (1100 and 1300 m), N36.564203, E44.821978, mountain slopes and rocky hillsides, 22.04.2017, A. Galalaey 0643, (KASOF 3623).

85. *Roemeria* Medik.

158. *R. hybrida* (L.) DC. subsp. *dodecandra* (Forskál) Maire.

(PL, Therophyte), (1000, 1100 and 1200 m), wp N36.578399, E44.835497, stony foothills in open oak forest, 09.05.2016, A. Galalaey 0644, (KASOF 3624).

20. Berberidaceae Juss.

86. *Bongardia* C. A. Mey.

159. *B. chrysogonum* (L.) Spach

(IT.M, Cryptophyte-Geophyte (Corm), (1000 and 1200 m), N36.601187, E44.852861, rocky mountain slopes and screes, in oak forest, 10 04 2017, A. Galalaey 0206, (KASOF 3139).

Figure 4.40. *Bongardia chrysogonum*

21. Ranunculaceae Juss.

87 *Adonis* L

160. *A. aestivalis* L.

(IT, Therophyte), (1000, 1300, 1600 and 1700 m), N36.594109, E44.903336, rocky place and open oak forest, 29.04.2017, A. Galalaey 0742, (KASOF 3721).

161. *A. annua* L.

(Scosm, Therophyte), (1000, 1100 and 1200 m), N36.604044, E44.827745, open forest high density of *Q. infectoria*, 22.04.2016, A. Galalaey 0743, (KASOF 3722).

88. *Anemone* L.

162. *A. coronaria* L.

(IT.M, Cryptophyte-Geophyte (Tuber), (1000, 1100, 1200, 1300 and 1400 m), N36.583229, E44.843418, open forest, 20.04.2016, A. Galalaey 0744, (KASOF 3723).

89. *Caltha* L.

163. *C. palustris* L.

(Scosm, Helophyte), 2600 m, N36.570141, E44.943320, wet place, 07.08.2016, A. Galalaey 0745, (KASOF 3724).

Figure 4.41. *Caltha palustris*

90. *Ceratocephala* Moench

164. *C. falcata* (Linnaeus) Persoon

(IT.M.ES, Therophyte), (1000, 1100, 1300, 1400, 1600 and 1700 m), N36.587190, E44.923528, open forest, 03.5.2017, A. Galalaey 0746, (KASOF 3725).

91. *Consolida* (DC) Gray

165. *C. oliveriana* (DC.) Schrödinger

(IT, Therophyte), 1200 m, N36.606780, E44.885390, forest, Nawbarga. 20.05.2016, A. Galalaey 0747, (KASOF 3726).

92. *Delphinium* L.

166. *D. macrostachyum* Boiss. ex Huth

(IT, Hemicryptophyte), 1700 m, N36.591298, E44.921851, mountain, under steep cliffs in light oak scrub, 10.05.2017, A. Galalaey 0748, (KASOF 3727).

Figure 4.42. *Delphinium macrostachyum*

167. *D. peregrinum* L.

(IT, Hemicryptophyte), 1900 m, N36.574348, E44.938952, mountain slopes, by a stream, 19.05.2015. A. Galalaey 0749, (KASOF 3728).

Figure 4.43. *Delphinium peregrinum*

93. *Eranthis* Salisb.

168. *E. hyemalis* Salisb.

(IT.ES, Cryptophyte-Geophyte (Tuber), (1600, 1800, 1900, 2000, 2100 and 2400 m), N36.571580, E44.940763, on mountain slopes, in moist places, 18.07.2018, A. Galalaey 0750, (KASOF 3729).

Figure 4.44. *Eranthis hyemalis*

94. *Ficaria* Guett.

169. *F. fascicularis* K. Koch

(IT, Cryptophyte-Geophyte), (1900, 2000, 2100, and 2200 m), N36.570438, E44.895356, by the snowline, in moist places recently uncovered from snow, 15.05.2016, A. Galalaey 0761, (KASOF 3740).

95. *Nigella* L.

170. *N. arvensis* L.

(IT.M, Therophyte), 1200 m, N36.606780, E44.885390, oak forest near field, 02.05.2017, A. Galalaey 0751, (KASOF 3730).

96. *Ranunculus* L.

171. *R. arvensis* L.

(IT.M, Therophyte), (1000, 1100, 1200, 1300 and 1400 m), N36.588884, E44.850145, mountains region, on limestone, 08.05.2017, A. Galalaey 0752, (KASOF 3731).

172. *R. asiaticus* L.

(IT.M, Cryptophyte-Geophyte (Tuber), (1000 and 1100 m), N36.561543, E44.823259, lower mountain slopes, stony steppic hills and plains, 22.04.2017, A. Galalaey 0753, (KASOF 3732).

173. *R. brachylobus* Boiss. et Hoh

(IT.ES, Hemicryptophyte), (1400, 1900, 2000, 2100, 2300, 2400, 2500, 2600 and 2800 m), N36.565320, E044.896907, high in the mountains in wet grassy places by a spring, 03.07.2017, A. Galalaey 0754, (KASOF 3733).

174. *R. macrorhynchus* Boiss. var. *leiocarpus* (Zoh.) C.C. Townsend

(IT, Hemicryptophyte), (1300, 1400, 1700 and 2200 m), N36.587163, E44.904584, mountain slopes on limestone, 17.05.2016, A. Galalaey 0755, (KASOF 3734).

175. R. *macrorhynchus* Boiss var. *macrorhynchus*

(IT, Hemicryptophyte), (1500, 1600) m., N36.593074, E44.917639, oak forest with rocky place, 15.05.2015, 10.05.2016, and 28.04.2017, A. Galalaey 0756, (KASOF 3735).

176. *R. millefolius* Banks et Sol

(IT, Hemicryptophyte), (1500, and 1700) m., N36.586012, E44.853338, oak forest, 04.05.2017, A. Galalaey 0757, (KASOF 3736).

177. *R. pinardii* (Steven) Boiss.

(IT.M, Therophyte), (1400 and 1700 m), N36.592011, E44.921365, mountain slope, 14.05.2017, A. Galalaey 0758, (KASOF 3737).

178. *R. sericeus* Banks et Sol.

(IT, Therophyte), 1000 m., N36.603386, E44.825778, oak forest, in damp places, 27.04.2017, A. Galalaey 075, (KASOF 3739).

179. *R. diversifolius* Boiss. et Kotschy

(IT, Therophyte), (3000, and 3200) m., N36.545023, E44.979782, near melting snow, in moist places recently uncovered from snow, 06.08.2016 and 07.08.2016, A. Galalaey 0760, (KASOF 3738).

97. *Thalictrum* Tourn. ex L.

180. *T. sultanabadense* Stapf

(IT, Hemicryptophyte), (1000, 1100 and 1800 m), N36.581536, E44.926221, in the mountains, on grassy slopes, 14.05.2016. A. Galalaey 0763, (KASOF 3741).

181. *T. isopyroides* C.A. Mey.

(IT.M, Hemicryptophyte), (1400, 1700, 1800 and 2100 m), N36.570029, E44.933799, stony mountain slopes, on screes where snow has recently melted, 11.05.2017, A. Galalaey 0762, (KASOF 3742).

Figure 4.45. *Thalictrum isopyroides*

Proteales Juss. ex Bercht. & J.Presl.

22. Platanaceae T.Lestib.

98. *Platanus* L.

182. *P. orientalis* L.

(PL, Phenarophyte, Mgph), (1100 and 1200 m), N36.612723, E44.886962, riparian zone, 24.06.2018, A. Galalaey 0658, (KASOF 3637).

SUPERROSIDS

Saxifragales Bercht. & J.Presl

23. Saxifragaceae Juss.

99. *Saxifraga* L.

183. *S. sibirica* L.

(IT.ES, Hemicryptophyte), (2800, 2900, 3000, 3100 and 3200 m), N36.560227, E44.990455, 07.08.2016, 20.07.2018, and 18.06.2017. A. Galalaey 0835, (KASOF 3814).

Figure 4.46. *Saxifraga sibirica*

24. Crassulaceae J.St.-Hil.

100. *Rosularia* (DC) Stapf.

184. *R. libanotica* (Lab.) Muirhead

(M, Hemicryptophyte), 1100 m, N36.612892, E44.862690, rocky place, 21.04.2017. A. Galalaey 0371, (KASOF 3358).

185. *R. elymaitica* (Boissier & Haussknecht) A. Berger

(IT, Hemicryptophyte), (1400, 1600 and 1700 m), N36. 585662, E44.900485, rocky place, 22.05.2015. A. Galalaey 0376, (KASOF 3361).

Figure 4.47. *Rosularia elymaitica*

186. *R. sempervivum* (Bieb.) subsp. *sempervivum*

(IT, Therophyte), (1200, 1400, 1900 and 2200 m), N 36.567430 E 44.934673, rocky place (shad place), 11.05.2017. A. Galalaey 0374, (KASOF 3359).

187. *R. sempervivum* (Bieb.) subsp. *kurdica* Eg

(IT, Therophyte), (1600, 2000 and 2100 m), N 36.577203 E 44.921605, rocky place, 25.04.2016. A. Galalaey 0375, (KASOF 3360).

101 *Sedum* L.

188. *S. caespitosum* (Cav.) DC

(IT, Therophyte), (1000, 1300, 1500, 1600 and 1700 m), N36.581661, E44.852825, open oak forest (shad place), 25 04 2016. A. Galalaey 0373, (KASOF 3357).

Figure 4.48. *Sedum caespitosum*

189. *S. hispanicum* L.

(IT. M. ES, Therophyte), (1100, 1200, 1200, 1300, 1400, 1600 and 1700 m), N36.600744, E44.856233, rocky place, 12.05.2017. A. Galalaey 0372, (KASOF 3356).

Figure 4.49. *Sedum hispanicum*

102. *Umbilicus* DC.

190. *U. intermedius* Boiss

(IT.M, Cryptophyte), 1000 m, N 36.604044 E 44.827745, open forest high density of *Q. infectoria* 22.04.2016. A. Galalaey 0378, (KASOF 3363).

191. *U. tropaeolifolius* Boiss.

(IT, Cryptophyte), 1700 m, N 36. 556054 E 44.870320, rocky place / shady place, 07.05.2017. A. Galalaey 0377, (KASOF 3362).

25. Haloragaceae R.Br.

103. *Myriophyllum* L.

192. *M. spicatum* L.

(Cosm, Hydrophyte), 1000 m., N36.603386, E44.825778, wet place, 27.04.2017, A. Galalaey 0515, (KASOF 3490).

ROSIDS

Vitales Juss. ex Bercht. & J.Presl

26. Vitaceae Juss.

104. *Vitis* L.

193. *V. vinifera* L.

(Cosm, Phanerophyte), (1100, 1200 and 1500 m), N36.594195, E44.878319, open forest area, and in riparian zone, 10.07.2015. A. Galalaey 0867, (KASOF 3847).

194. *V. sylvestris* C.C. Gmel

(IT.ES, Phanerophyte), 1200 m., N36.612723, E44.886962, riparian zone, 24.07.2018, A. Galalaey 0867, (KASOF 3848).

Zygophyllales Link

27. Zygophyllaceae R.Br.

105. *Tribulus* L.

195. *T. terrestris* subsp. *orientalis* (A. Kern.) Dostál

(Cosm, Therophyte), (1000, 1100 and 1200 m), N36.611237, E44.870634, in the Mountains on barren patches of soil, 13.04.2016, A. Galalaey 0869, (KASOF 3849).

Fabales Bromhead

28. Fabaceae Lindl. (= Leguminosae Juss.)

106. *Alhagi* Gagnebin

196. *A. graecorum* Boiss

(IT. M. SS, Hemicryptophyte), (1000, 1100 and 1200 m), N36.605458, E44.901800, lower mountain valley sides, in open forest area. 08.05.2017, A. Galalaey 0410, (KASOF 3392).

107. *Astragalus* L.

197. *A. gudrunensis* Boiss. et Hausskn. ex Boiss.

(IT, Chamaetophyte), (1300, 1400, 1500 and 1700 m), N36.597018, E44.894935, mountain slopes, in oak forest, 23 04 2016, A. Galalaey 0411, (KASOF 3393).

198. *A. adscendens* Boiss

(IT. SS, Chamaephyte), (1500, 1900, 2200, 2500 and 2900 m), N36.590037, E44.926952, rocky mountain slopes, 04.05.2017, A. Galalaey 0412, (KASOF 3394).

199. *A. aegobromus* Boiss. & Hoh.

(IT, Hemicryptophyte), (1700, 1900, 2300, 2800, 3000, 3100 and 3200 m), N36.568896, E44.946053, high rocky mountains, on serpentine, limestone, 06-07.08.2016, A. Galalaey 0413, (KASOF 3395).

200. *A. kurdicus* Boiss.

(IT, Hemicryptophyte), (1500, 1600, 1700, 1900 and 2000 m), N36.568896, E44.946053, Dry rocky mountains, on serpentine, limestone, 07.05.2016, A. Galalaey 0414, (KASOF 3396).

Figure 4.50. *Astragalus kurdicus*

201. *A. brachystachys* DC

(IT, Chamaephyte), (1000, 1500 and 1600 m), N36.560929, E44.855877, open oak forest, dry steppic hillsides, 02.05.2016, A. Galalaey 0415, (KASOF 3397).

202. *A. carduchorum* Boiss

(IT, Chamaephyte), (1900 and 2700 m), N36.568097, E44.943149, rocky mountain slopes, 07.07.2018, A. Galalaey 0416, (KASOF 3398).

203. *A. echinops* Auch.

(IT, Hemicryptophyte), 1700 m, N36.583858, E44.924626, grassy area mountain slopes, destroyed forest (grassland), 10.05.2017, A. Galalaey 0418, (KASOF 3400).

204. *A. emarginatus* Labill

(IT, Hemicryptophyte), (1000 and 1400 m), N36.598492, E44.906846, rocky mountainside, among oak forest, 12.05.2017, A. Galalaey 0417, (KASOF 3399)

205. *A. gummifer* Labill

(M, Chamaephyte), (1300, 1400, 1700, 2300 and 2400 m), N36.586012, E44.853338, dry subalpine slopes and valleys, 04.05.2017, A. Galalaey 0419, (KASOF 3401).

Figure 4.51. *Astragalus gummifer*

206. *A. hamosus* L.

(PL, Therophyte), (1000, 1200 and 1300 m), N36.601187, E44.852861, lower mountain slopes, steppic foothills and plains, 10 04 2017 and 20.04.2016, A. Galalaey 0420, (KASOF 3402).

207. *A. macrocephalus* Willd.

(IT, Hemicryptophyte), 1000 m, N36.38194, E44.499140, rocky mountain sides, among oak forest, 20.04.2016, A. Galalaey 0421, (KASOF 3403).

208. *A. michauxianus* Boiss.

(IT, Hemicryptophyte), (2100, 2200, 2300 and 2400 m), N36.574348, E44.938952, high rocky mountain slopes, 19.05.2015, A. Galalaey 0429, (KASOF 3404).

209. *A. mollis* M.B.

(IT.PL, Hemicryptophyte), (1000, 1400, 1700 and 1800 m), N36.598492, E44.906846, stony mountain slopes, in oak forest, 30.04.2016, and 12.05.2017, A. Galalaey 0423, (KASOF 3405).

Figure 4.52. *Astragalus mollis*

210. *A. ovinus* Boiss.

(IT, Hemicryptophyte), (1800, 1900, 2000 and 2100 m), N36.575821, E44.890204, mountain slopes, in oak forest, coppiced oak, grassy places, calcareous scree on limestone, 15.05.2016, serpentine, A. Galalaey 0428, (KASOF 3406).

211. *A. pinetorum* Boiss

(IT, Chamaephyte), 1600 m, N36.597646, E44.910874, high rocky mountain slopes, 10.05.2016, A. Galalaey 0425, (KASOF 3407).

212. *A. russelii* Banks & Sol.

(IT. SS, Chamaephyte), (1100, 1200 and 1400 m), N36.578399, E44.835497, coppiced oak scrub or clearings in oak forest, 09 05 2016, A. Galalaey 0427, (KASOF 3408).

213. *A. cretaceus* Boiss. et Kotschy in Boiss,

(IT, Hemicryptophyte), 1300 m, N36.578347, E44.839785, rocky limestone slopes, dry hillsides, 05.5.2017. A. Galalaey 0426, (KASOF 3409).

214. *A. amblolepis* Fisch.

(IT, Chamaephyte), (1100, 1300 and 1600 m), N36.598971, N44.861230, rocky limestone slopes, dry hillsides, 10.04.2017, A. Galalaey 0424, (KASOF 3410).

215. *A. macropelmatus* Bunge.

(IT, Hemicryptophyte), (1600 and 1800 m), N36.593074, E44.917639, mountain slopes, in oak forest, coppiced oak, grassy places, calcareous scree on limestone, 15.05.2015, 10.05.2016, and 28.04.2017, A. Galalaey 0423, (KASOF 3411).

Figure 4.53. *Astragalus macropelmatus*

108. *Cicer* L.

216. *C. arietinum* L.

(Scosm, Therophyte), (1000 and 1800 m), N36.606226, E44.833240, coppiced oak, 09 05.2017, A. Galalaey 0430, (KASOF 3412).

109. *Colutea* L.

217. *C. cilicica* Boiss. et Bal.

(M, Phanerophyte), (1200, 1300, 1400, 1500 and 1800 m), N36.586012, E44.853338, open places in oak forest, among oak scrub on a dry bank, 04.05.2017, A. Galalaey 0431, (KASOF 3413).

110. *Coronilla* L.

218. *C. scorpioides* (L.) W.D. J. Koch

(IT.ES.SS, Therophyte), (1000, 1100, 1200 and 1300 m), N36.605258, E44.845887, mountain stream, 16 04 2016 and 12.05.2017, A. Galalaey 0432, (KASOF 3414).

219. *C. varia* L.

(IT.ES, Hemicryptophyte), (1000, 1500 and 1800 m), N36.581285, E44.886266, damp places on mountain slopes, 03.05.2017, A. Galalaey 0433, (KASOF 3415).

111. *Glycyrrhiza* L.

220. *G. glabra* L.

(IT.M.ES, Hemicryptophyte), (1000, 1100, 1200, 1400 and 1800 m), N36.597056, E44.882068, on a mountain slopes and in valleys, along the banks of canals, 15.05.2015, A. Galalaey 0434, (KASOF 3416).

112. *Hippocrepis* L.

221. *H. unisiliquosa* L.

(M, Therophyte), (1000, 1100 and 1200 m), N36.593265, E44.825577, stony mountainsides in degraded oak forest, 29.04.2017, A. Galalaey 0435, (KASOF 3417).

113. *Hymenocarpos* L.

222. *H. circinnatus* (L.) Savi

(M, Therophyte), (1000 and 1100 m), N36.573026, E44.826413, lower mountain slopes, rocky places, 15 04 2016, A. Galalaey 0436, (KASOF 3418).

114. *Lathyrus* L.

223. *L. annuus* L.

(M.ES, Therophyte), (1000, 1100, 1400, 1500, 1600 and 1700 m), N36.587190, E44.923528, open forest area, in hillsides, 03.5.2017, A. Galalaey 0437, (KASOF 3419).

224. *L. aphaca* L.

(M.ES, Therophyte), (1000, 1100, 1300, 1400, 1500 and 1900 m), N36.581774, E44.928259, on mountain slopes and Forest area, 10.05.2016, A. Galalaey 0438, (KASOF 3420).

225. *L. cicera* L.

(PL, Therophyte), (1100, 1300 and 1400 m), N36.612547, E44.869024, open forest area, 13 04 2016, A. Galalaey 0439, (KASOF 3421).

226. *L. inconspicuus* L.

(M.ES, Therophyte), (1500 and 1700 m), N36.593360, E44.880103, forest area, 19.04.2016, and 23.04.2017, A. Galalaey 0440, (KASOF 3422).

115. *Lens* Boiss.

227. *L. orientalis* (Boiss.) Hand. - Mazz

(IT.M, Therophyte), (1600, 1700 and 1800 m), N36.587630, E44.856569, timber line area, 17.05.2016, A. Galalaey 0441, (KASOF 3423).

116. *Lotus* L.

228. *L. cornieulatus* L.

(Cosm, Hemicryptophyte), (1200, 1900, 2000, 2300 and 2700 m), N36.569285, E44.944681, wet place in high rocky mountain, 07.08.2016. A. Galalaey 0443, (KASOF 3424).

229. *L. gebelia* Vent var. *gebelia*

(IT, Hemicryptophyte), (1000 and 1200 m), N36.605251, E44.830575, open forest area, 22.04.2016. A. Galalaey 0444, (KASOF 3425).

230. *L. gebelia* Vent var. *hirsutissimus* (Ledeb.) Dinsm

(IT, Hemicryptophyte), (1100, 1300, 1200, 1400, 1500 and 1600 m), N36.594154, E44.913521, rocky place on limestone, 07.05.2017, A. Galalaey 0445, (KASOF 3426).

117. *Medicago* L.

231. *M. constricta* Dur

(M, Therophyte), (1000, 1400 and 1600 m), N36.548223, E44.869623, among coppiced oak on limestone, 26.04.2016, A. Galalaey 0447, (KASOF 3427).

232. *M. lupulina* L.

(Cosm, Therophyte), (1500 and 1600 m), N36.581661, E44.852825, open oak forest, 25 04 2016. A. Galalaey 0448, (KASOF 3428).

233. *M. minima* (L.) Bartal.

(Cosm, Therophyte), (1000, 1100, 1200 and 1300 m), N36.580440, E44.837788, grassy places on lower mountain slopes, 23.04.2016. A. Galalaey 0449, (KASOF 3429).

234. *M. orbicularis* (L.) Bartal.

(PL, Therophyte), (1000, 1100, 1200 and 1300 m), N36.575919, E44.836606, lower mountain slopes and valleys, in open forest, 24.04.2016, A. Galalaey 0450, (KASOF 3430).

235 *M. polymorpha* L.

(IT.M.ES, Therophyte), (1000, 1100 and 1300 m), N36.575324, E44.836646, oak forest hillside, 23.04.2016. A. Galalaey 0451, (KASOF 3431).

236. *M. radiata* L.

(IT.M, Therophyte), (1000, 1100, 1200, 1300 and 1400 m), N36.599860, E44.895818, open pure *Q. infectoria* forest, 23 04 2016, A. Galalaey 0452, (KASOF 3432).

237. *M. rigidula* (L.) All.

(IT.M, Therophyte), (1000, 1100 and 1300 m), N36.600476, E44.902540, lower mountain slopes and valleys, dry foothills, 28.04.2017 and 14.07.2018. A. Galalaey 0453, (KASOF 3433).

238. *M. sativa* L.

(Cosm, Hemicryptophyte), (1000, 1100, 1200, 1300, 1400 and 1900 m), N36.577395, E44.890403, sub-alpine region, 03.05.2017, A. Galalaey 0454, (KASOF 3434).

118. *Melilotus* L.

239. *M. albus* Medik.

(IT.ES, Hemicryptophyte), (1100 and 1200 m), N36.563003, E44.835044, moist foothill side, 16 04 2017, A. Galalaey 0455, (KASOF 3435).

240. *M. officinalis* (L.) Pall.

(IT.ES, Hemicryptophyte), (1100, 1200, 1300 and 1500 m), N36.594195, E44.878319, rocky sub-alpine slopes, on damp banks of an irrigated field, 10.07.2015. A. Galalaey 0456, (KASOF 3436).

119. *Onobrychis* Mill.

241. *O. crista-galli* (L.) Lam.

(IT.M. SS, Therophyte), (1000 and 1100 m), N36.591341, E44.824195, dry grassy slopes, 29.04.2017. A. Galalaey 0458, (KASOF 3437).

242. *O. cornuta* (L.) Desv

(IT. SS, Chamaephyte), (2200, 2600, 3000 and 3200 m), N36.545872, E44.982902, rocky mountain summits, dry rocky subalpine slopes, 06/07.08.2016. A. Galalaey 0459, (KASOF 3438).

243. O. *kotschyana* Fenzl

(M, Therophyte), (1000 and 1500 m), N36.596511, E44.876153, grassy land area on mountain slopes, on limestone, in open coppiced oak scrub, 14.07.2018, A. Galalaey 0457, (KASOF 3439).

120. *Ononis* L.

244. *O. sicula* Guss.

(IT, Therophyte), (1000 and 1100 m), N36.579034, E44.814706, stony mountain slope, 20.04.2016. A. Galalaey 0460, (KASOF 3440).

245. *O. spinosa* L. subsp. *leiosperma* (Boiss.) Sirj

(IT, Chamaephyte), (1100, 1200, 1900 and 2300 m), N36.574488, E44.940654, mountain slopy near spring and wet place, 07.08.2016. A. Galalaey 0461, (KASOF 3441).

121. *Oxytropis* DC.

246. *O. savellanica* Bunge ex Boiss

(IT, Hemicryptophyte), (3100 and 3200 m), N36.558749, E 44.948712, high mountain region, 06/07.08.2016, A. Galalaey 0462, (KASOF 3442).

Figure 4.54. *Oxytropis savellanica*

122. *Vavilovia (*Steven) Al.Fed.).

247. *V. formosa* (Steven) Al.Fed.

(IT.ES, Hemicryptophyte), 3200 m, N36.545023, E44.979782, rocky alpine slopes, on a serpentine scree, 07.08.2016, 20.07.2018, and 18.06.2017. A. Galalaey 0463, (KASOF 3443), **Endemic**, IUCN: VU.

Figure 4.55. *Vavilovia formosa*

248. *P. sativum* L.

(Scosm, Therophyte), (1300, 1400, 1500 and 1700 m), N 36.553555 E 44.873176, grassy mountain slopes, on limestone, 07.05.2017, A. Galalaey 0464, (KASOF 3444).

123. *Prosopis* L.

249. *P. farcta* (Banks & Sol.) J.F. Macbr.

(IT.M.ES, Chamaephyte), (1000, 1100 and 1200 m), N36.582832, E44.819651, field, 20.04.2016, A. Galalaey 0465, (KASOF 3445).

124. *Robinia* L.

250. *R. pseudoacacia* L.

(IT, M., Microphanerophytes), 1000 m, N36.609493, E44.843427, riparian zone, 29.04.2017, A. Galalaey 0466, (KASOF 3446).

125. *Scorpiurus* L.

251. *S. muricatus* L.

(IT.M, Therophyte), 1300 m, N36.600476, E44.902540, in lower forest zone, 28.04.2017, 14.07.2018 and 23.04.2016, A. Galalaey 0467, (KASOF 3447).

126. *Securigera* L.

252. *S. securidaca* (L.) Degen & Dorfl.

(IT, Therophyte), (1000 and 1200 m), N36.598764, E44.845838, damp places in the mountains; 21.04.2017, A. Galalaey 0468, (KASOF 3448).

127. *Trifolium* L.

253. *T. angustifolium* L.

(IT.M.ES, Therophyte), (1000, 1100 and 1200 m), N36.573026, E44.826413, oak copies, 15.04.2016, A. Galalaey 0469, (KASOF 3449).

254. *T. arvense* L.

(IT.M.ES, Therophyte), (1000, 1200 and 1700 m), N36.592113, E44.839148, open forest, 05.05.2017, A. Galalaey 0470, (KASOF 3450).

255. *T. campestre* Schreb.

(IT.M.ES, Therophyte), (1000 and 1100 m), N36.569520, E44.822409, damp places, 15.04.2016, A. Galalaey 0471, (KASOF 3451).

256. *T. fragiferum* L.

(IT.M.ES, Cryptophyte), (1000 and 1700 m), N36.604044, E44.827745, open forest high density of *Q. infectoria*, 22.04.2016, A. Galalaey 0472, (KASOF 3452).

257. *T. grandiflorum* schrei

(IT.M.ES, Cryptophyte), (1000, 1100, 1300 and 1700 m), N36.587333, E44.839055, rocky mountain slopes, oak forest and coppiced oak, 05.05.2017, A. Galalaey 0473, (KASOF 3453).

258. *T. hybridum* L.

(IT.M.ES, Hemicryptophyte), (1100, 1700 and 1800 m), N36.587190, E44.923528, open forests, 03.5.2017, A. Galalaey 0474, (KASOF 3454).

259. *T. nigrescens* viv.

(IT.M.ES, Therophyte), 1100 m, N36.582410, E44.827072, grassy mountain slopes, 20.04.2016, A. Galalaey 0475, (KASOF 3455).

260. *T. pilulare* Boiss.

(IT.M.ES, Hemicryptophyte), (1000 and 1700 m), N36.606226, E44.833240, lower mountain slopes, in coppiced oak on limestone, 09 05.2017, A. Galalaey 0476, (KASOF 3456).

261. *T. pratense* L.

(PL, Hemicryptophyte), (1400, 1500, 1600 and 2600 m), N36.570141, E44.943320, damp sub-alpine meadows, by mountain streams, 15.05.2017, A. Galalaey 0477, (KASOF 3457).

262. *T. purpureum* Lois.

(IT.M.ES, Therophyte), (1000, 1100, 1400, 1500 and 1700 m), N36.596511, E44.876153, grassy places in degraded oak forest, in hillside, 14.07.2018. A. Galalaey 0478, (KASOF 3458).

263. *T. repens* L.

(IT.M.ES, Hemicryptophyte), (1100, 1200, 1900, 2000, 2100 and 2200 m), N36.570916, E44.891682, wet place in mountain, 10.05.2016. A. Galalaey 0479, (KASOF 3459).

264. *T. resupinatum* L.

(IT.M.ES, Therophyte), (1000, 1100 and 1200 m), N36.563964, E44.821983, moist places on lower mountain slopes, 15 04 2016, A. Galalaey 0480, (KASOF 3460).

265. *T. spumosum* L.

(IT.M, Therophyte), (1000, 1100 and 1200 m), N36.564597, E44.839771, lower mountain slopes, moist pastures, 16.04.2017, A. Galalaey 0481, (KASOF 3461).

266. *T. stellatum* L.

(IT.M, Therophyte), (1000, 1200 and 1400 m), lower mountain slopes, grassy places, N36.598725, E44.876665, 04.05.2017, A. Galalaey 0482, (KASOF 3462).

267. *T. tomentosum* L.

(IT.M.ES, Therophyte), (1000, 1100, 1200 and 1300 m), N36.601118, E44.901636 rocky hill-slopes, grassy mountain pastures, 23.04.2016, A. Galalaey 0483, (KASOF 3463).

128. *Trigonella* L.

268. *T. caelesyriaca* Boiss

(M, Therophyte), 1700 m, N36.583858, E44.924626, grassy places in the lower mountains, on a limestone ridge in oak forest, 10.05.2017, A. Galalaey 0484, (KASOF 3464).

269. *T. monantha* C.A. Mey.

(IT, Therophyte), (1000, 1200 and 1300 m), N36.605458, E44.901800, mountain slopes, in denuded oak forest, 12.05.2016, A. Galalaey 0485, (KASOF 3465).

270. *T. monspeliaca* L.

(IT.M, Therophyte), (1000 and 1400 m), N36.598492, E44.906846, lower mountain slopes of forest on limestone, 30.04.2016, and 12.05.2017, A. Galalaey 0486, (KASOF 3466).

271. *T. strangulata* Boiss.

(IT, Therophyte), 1700 m, N36.587190, E44.923528, mountain slopes in denuded oak forest, on grassy limestone slope, stony hillside, 03.5.2017, A. Galalaey 0487, (KASOF 3467).

129. *Vicia* L.

272. *V. canescens* subsp, *gregaria* (Boiss. et Heldr.) P. H. Davis

(IT, Hemicryptophyte), (2500, 3100 and 3200 m), N36.546021, E44.962715, alpine region, 07.08.2016, 20.07.2018, and 18.06.2017, A. Galalaey 0488, (KASOF 3468), **Endemic**, IUCN: VU.

273. *V. ervilia* (L.) Willd.

(M, Therophyte), (1000, 1100, 1300 and 1700 m), N36. 591298, E44.921851, sub-alpine, 17.05.2016, A. Galalaey 0489, (KASOF 3469).

274. *V. hirsuta* (L.) S.F. Grey

(Cosm, Therophyte), 1100 m, N36.574045 E44.829556, open forest, 26.04.2017, A. Galalaey 0490, (KASOF 3470).

275. *V. hybrida* L.

(IT, Therophyte), (1000, 1100 and 1300 m), N36.590557, E44.845937, oak forest, 23.04.2016. A. Galalaey 0491, (KASOF 3471).

276. *V. narbonensis* L.

(IT.M.ES, Therophyte), (1100, 1300 and 1600 m), N36.548223, E44.869623, among coppiced oak on limestone, 26.04.2016, A. Galalaey 0493, (KASOF 3472).

277. *V. sativa* L.

(Pl, Therophyte), (1000, 1300, 1500 and 1600 m), N36.597646, E44.910874, oak forest, 10.05.2016, A. Galalaey 0494, (KASOF 3473).

278. *V. sericocarpa* Fenzl

(IT, Therophyte), (1300, 1400, 1600 and 1700 m), N36.598492, E44.906846, rocky mountain, 30.04.2016 and 12.05.2017, A. Galalaey 0492, (KASOF 3474).

279. *V. tenuifolia* Roth

(IT.M.ES, Hemicryptophyte), (1000, 1100, 1300, 1500, 1700 and 1900 m), N36.597018, E44.894935, rocky mountain, slopes, in coppiced oak scrub, 23.04.2016, A. Galalaey 0495, (KASOF 3475).

280. *V. villosa* Roth

(IT, Therophyte), (1300, 1700, 1900, 2000, 2200 and 2300 m), N36.571382, E44.934025, sub-alpine open area, 11.05.2016, A. Galalaey 0496, (KASOF 3476).

Rosales Bercht. & J.Presl

29. Rosaceae Juss.

130. *Agrimonia* L.

281. *A. eupatoria* L.

(IT, Hemicryptophyte), (1000, 1100, 1200, 1400 and 1800 m), N36.581285, E44.886266, near wet land Goroniya village, 03.05.2017, A. Galalaey 0768, (KASOF 3747).

131. *Alchemilla* L.

282. *A. kurdica* Rothm.

(IT, Hemicryptophyte), (1800, 2400, 2500 and 2800 m), N36.562440, E44.989504, by water on metamorphic rock, 06.08.2016, A. Galalaey 0769, (KASOF 3748), **Endemic**, IUCN: EN

Figure 4.56. *Alchemilla kurdica*

132. *Cotoneaster* Medik.

283. *C. racemiflorus* (Desf.) K. Koch

(IT, Phanerophyte), (1000, 1200, 1300, 1400, 1500, 1600, 1700, 1800, 1900, 2000, 2200 and 2300 m), N36.560945, E44.872566, rocky slopes and ravines, limestone, metamorphic rock, in oak forest, 07.05.2017, A. Galalaey 0770, (KASOF 3749).

133. *Crataegus* Tourn. ex L.

284. *C. azarolus* var. *pontica* (Kock) Christensen

(IT.M, Phanerophyte, Mcph), (1300, 1400, 1600, 1700 and 1800 m), N36.555502, E44.874002, in oak forest, on hillsides and rocky slopes, limestone and serpentine rocks, in valleys, 09.05.2016, A. Galalaey 0771, (KASOF 3750).

Figure 4.57. *Crataegus azarolus* var. *pontica*

285. *C. monogyna* Jacq

(IT, Phanerophyte, Mcph), 1300 m, N36.599791, E44.888460, in oak forest, on hillsides and rocky slopes, limestone and serpentine rocks, in valleys, 04.05.2017, A. Galalaey 0772, (KASOF 3751).

Figure 4.58. *Crataegus monogyna*

286. *C. azarolus* L. var. a*ron*ia L.

(IT.M, Phanerophyte, Mcph), (1000, 1300, 1600 and 1700 m), N 36.548223 E 44.869623, in oak forest, on hillsides and rocky slopes, limestone and serpentine rocks, in valleys, 26.04.2016, A. Galalaey 0773, (KASOF 3752).

Figure 4.59. *Crataegus azarolus* var. *aronia*

287. *C. meyeri* Pojark.

(IT.M, Phanerophyte, Mcph), 1500 m, N 36.593360 E 44.880103, in oak forest, on hillsides and rocky slopes, limestone and serpentine rocks, in valleys, 23.04.2017, 19.04.2016, A. Galalaey 0775, (KASOF 3753).

Figure 4.60. *Crataegus meyeri*

288. *C. pentagyna* Waldst. & Kit. ex Willd.

(IT.M, Phanerophyte, Mcph), 1400 m, N36.597056, E44.882068, wet place, 15.05.2015, A. Galalaey 0774, (KASOF 3754).

Figure 4.61. *Crataegus pentagyna*

134. *Cydonia* Mill.

289. *C. oblonga* Mill

(IT, Phanerophyte, Mcph), 1200 m, N36.606780, E44.885390, oak forest (near field), 02.05.2017, A. Galalaey 0776, (KASOF 3755).

135. *Eriobotrya* Lindl.

290. *E. japonica* (Thunb.) Lindl.

(Cosm, Phanerophyte, Mcph), 1200 m, N36.606780, E44.885390, oak forest (near field), 02.05.2017, A. Galalaey 0777, (KASOF 3756).

136. *Geum* L.

291. *G. urbanum* L.

(IT.M.ES, Hemicryptophyte), (1200 and 1400 m), N36.605458, E44.901800, shady places in valleys in the forest, 16.05.2017, A. Galalaey 0778, (KASOF 3757).

137. *Potentilla* L.

292. *P. kurdica* Boiss. et Hoh. ex Boiss.,

(IT, Hemicryptophyte), (2000, 2400, 2500 and 2600 m), N36.577116, E44.941034, 07.07.2016, A. Galalaey 0779, (KASOF 3758).

293. *P. reptans* L.

(IT.ES, Hemicryptophyte), (1000, 1100, 1800, 1900 and 2000 m), N36.581285, E44.886266, wet places, by mountain streams, 03.05.2017, A. Galalaey 0780, (KASOF 3759).

294. *P. supina* L.

(IT, Therophyte), (1000 and 1200 m), N36.603386, E44.825778, damp waste ground, 27.04.2017, A. Galalaey 0781, (KASOF 3760).

295. *P. hirta* L.

(IT.M, Hemicryptophyte), (1100 and 1200 m), N36.606780, E44.885390, damp rocky places, by streams, 20.05.2016, A. Galalaey 0782, (KASOF 3761).

Figure 4.62. *Potentilla hirta*

138. *Prunus* L.

296. *P. microcarpa* C. A. Mey.

(IT.M, Phanerophyte, Mcph), (1000, 1100, 1200, 1300, 1500, 1600, 1700 and 2100 m) m., N36.587687, E44.923439, undershrub of the oak forest, or coppiced or degraded woodland, 10.05.2017, A. Galalaey 0783, (KASOF 3762).

297. *P. arabica* (Oliv.) Meikle

(IT, Phanerophyte, Mcph), (1000, 1100 and 1300 m), N36.594109, E44.903336, dry stony places on overgrazed eroded mountain slopes in open coppiced oak forest, 14.05.2017, A. Galalaey 0784, (KASOF 3763).

298. *P. argentea* (Lam.) Rehd. var. *argentea*

(IT, Phanerophyte, Mcph), (1000, 1300 and 1500 m), N36.593360, E44.880103, on exposed rocky limestone slopes in coppiced oak forest, 19.04.2016 and 23.04.2017, A. Galalaey 0785, (KASOF 3764).

299. *P. armeniaca* L.

(IT, Phanerophyte, Mcph), 1200 m., N36.606780, E44.885390, cultivated in orchards in the mountain, 20.05.2016, A. Galalaey 0786, (KASOF 3765).

300. *P. kotschyi* (Boiss. & Hohen. ex Spach) Meikle

(IT, Phanerophyte, Mcph), (1300, 1500, 2100 and 2200 m), N36.550884, E44.881866, rocky places and screes above the tree line, 16.05.2017, 24.07.2017 and 6/7.08.2016, A. Galalaey 0787, (KASOF 3772).

301. *P. brachypetala* (Boiss.) Walp. var. *bornmuelleri* Scheid.

(IT, Phanerophyte, Mcph), (2700, 2800 and 3100 m), N36.577701, E44.942265, rocky places and screes above the tree line, 24.07.2017, A. Galalaey 0788, (KASOF 3766).

Figure 4.63. *Prunus brachypetala* var. *bornmuelleri*

302. *P. brachypetala* var. *brachypetala*

(IT, Phanerophyte, Mcph), (2100, 2200 and 2500 m), N36.568896, E44.946053, rocky places and screes above the tree line, 07.08.2016, A. Galalaey 0789, (KASOF 3767).

Figure 4.64. *Prunus brachypetala* var. *brachypetala*

303. *P. domestica* L. subsp. *insititia* (L.) C.K.Schneid.

(IT.ES, Phanerophyte, Mcph), 1200 m, N36.606780, E44.885390, cultivated in orchards in the mountain, 11.05.2017, A. Galalaey 0790, (KASOF 3768).

304. *P. domestica* L. subsp *domestica*

(IT.ES, Phanerophyte, Mcph), 1200 m, N36.606780, E44.885390, cultivated in orchards in the mountain, 27.04.2016, A. Galalaey 0791, (KASOF 3769).

305. *P. dulcis* (Mill.) D.A.Webb var. *dulcis*

(IT.M, Phanerophyte, Mcph), (1600 and 1700 m), N36.553555, E44.873176, slopy mountain (near old orchard), 07.05.2017, A. Galalaey 0792, (KASOF 3770).

Figure 4.65. *Prunus dulcis* var. *dulcis*

306. *P. dulcis* (Mill.) D.A.Webb var. *spontanea* (Korz.) Buchheim.

(IT.M, Phanerophyte, Mcph), (1500 and 1800 m), N36.575993, E44.929089, open forest, rare tree, 14.05.2016, A. Galalaey 0793, (KASOF 3771).

307. *P. carduchorum* (Bornm.) Meikle

(IT, Phanerophyte), (1400, 1800, 2000, 2100, 2200, 2300 and 2400 m), N36.571678, E44.929423, on rocks and screes, in degraded oak forest, 12.05.2017. A. Galalaey 0794, (KASOF 3773).

Figure 4.66. *Prunus carduchorum*

308. *P. mahaleb* (L.) Mill

(IT.M, Phanerophyte, Msph), (1500, 1600, 1800 and 2000 m), N36.560945, E44.872566, rocky place. 12.05.2018, A. Galalaey 0795, (KASOF 3774).

Figure 4.67. *Prunus mahaleb*

309. *P. persica* (L.) Batsch

(IT.ES, Phanerophyte), 1200 m, N36.606780, E44.885390, cultivated in orchards in the mountain, 20.05.2016, A. Galalaey 0796, (KASOF 3775).

310. *P. cerasifera* Ehrh.

(IT, Phanerophyte), 1200 m, N36.606780, E44.885390, cultivated in orchards in the mountain, 20.05.2016, 27.04.2016, 11.05.17, A. Galalaey 0797, (KASOF 3776).

139. *Pyrus* L.

311. *P. communis* L.

(IT.ES, Phanerophyte), (1200 and 1800 m), N36.563003, E44.835044, foothill side, 16.04.2017, A. Galalaey 0798, (KASOF 3777).

312. *P. syriaca* Bioss.

(IT., Phanerophyte), (1000, 1300, 1400, 1500, 1700 and 1800 m), N36.596511, E44.876153, hillside, 14.07.2018, A. Galalaey 0799, (KASOF 3778).

140. *Rosa* L.

313. *R. canina* L.

(IT.M.ES, Phanerophyte, Mcph), (1000, 1100, 1200, 1300, 1400, 1500 and 1700 m), N36.588884, E44.850145, oak forest, 08.05.2017, A. Galalaey 0800, (KASOF 3779).

314. *R. heckeliana* Tratt.

(PL, Phanerophyte, Mcph), (2200, 2500, 2600, 2800, 2900 and 3000 m), N36.580531, E44.941096, among rocks, on cliffs, in shady places, 07 08 2017, A. Galalaey 0801, (KASOF 3780).

Figure 4.68. *Rosa heckeliana*

315. *Rosa* x *damascena* Mill

(IT.M, Phanerophyte, Mcph), 1200 m, N36.606780, E44.885390, cultivated in orchards in the mountain, 11.05.2017, A. Galalaey 0802, (KASOF 3781).

Figure 4.69. *Rosa x damascene*

141. *Rubus* L.

316. *R. caesius* L.

(IT.ES, Champhyte, Mcph), (1000, 1100, 1300 and 1700 m), N36.580440, E44.837788, rocky places near water stream, 23.04.2016, A. Galalaey 0803, (KASOF 3782).

317. *R. sanctus* Schreber

(IT, Phanerophyte, Mcph), (1000, 1100, 1300 and 1400 m), N36.602586, E44.824746, shady places by springs or mountain streams, in rocky clefts under cliffs, 27.04.2017, A. Galalaey 0804, (KASOF 3783).

142. *Sanguisorba* L.

318. *S. minor* Scop.

(IT.M.ES, Hemicryptophyte), (1000, 1100, 1200, 1300, 1400, 1500, 1600 and 1700 m), N36.597192, E44.917537, occasional, throughout forest zone, 10.05.2017, A. Galalaey 0805, (KASOF 3784).

143. *Sibbaldia* L.

319. *S. parviflora* Willd

(ES-IT, Hemicryptophyte), 2400 m, N36.588544, E44.989099, rocky slope cliffs, 06.08.2016, A. Galalaey 0806, (KASOF 3785).

Figure 4.70. *Sibbaldia parviflora*

144. *Sorbus* L.

320. *S. umbellata* (Desf.) Fritsch ex Kerner

(IT.M.ES, Phanerophyte, Msph), (1900 and 2200 m), N36.559969, E44.871204, oak scrub, near a stream, in a rocky valley; 07.05.2017, A. Galalaey 0807, (KASOF 3786).

Figure 4.71. *Sorbus umbellata*

30. Elaeagnaceae Juss.

145. *Elaeagnus* L.

321. *E. angustifolia* L. var. *orientalis* (L.) Kuntze.

(IT.ES, Phenarophyte), (1000, 1100, 1200 and 1400 m), N36.603261, E44.857452, riparian zone, 05.05.2016, A. Galalaey 0396, (KASOF 3378).

Figure 4.72**.** *Elaeangnus angustifolia* var. *orientalis*

31. Rhamnaceae Juss.

146. *Paliurus* Mill.

322. *P. spina-christi* Mill.

(IT.M, Phanerophyte, Mcph), (1000, 1200, 1300 and 1400 m), N36.587333, E44.839055, mountain streams in forest, 05.05.2017. A. Galalaey 0765, (KASOF 3744).

147. *Ziziphus* Mill.

323. *Z. spina-christi* (L.) Desf.

(PL, Phanerophyte, Mcph), 1200 m, N36.606780, E44.885390, open forest area, 20.05.2016. A. Galalaey 0766, (KASOF 3745).

Figure 4.73. *Ziziphus spina-christi*

148. *Rhamnus* L.

324. *R. cornifolia* Boiss. & Hohen.

(IT, Phanerophyte, Mcph), (2000, 2200, 2300, 2500, 2700 and 2900 m), N36.570732, E44.948380, alpine region, among rocks, on cliffs, in shady places, 06.07.2018, A. Galalaey 0765, (KASOF 3746).

Figure 4.74. *Rhamnus cornifolia*

32. Ulmaceae Mirb.

149. *Ulmus* L.

325. *U. densa* Litv.

(IT, Phanerophyte), (1200, 1300, 1400 and 1500 m), N36.594195, E44.878319, riparian zone, 24.06.2018, A. Galalaey 0856, (KASOF 3834).

Figure 4.75. *Ulmus densa*

150. *Celtis* L.

326. *C. tournefortii* Lam

(M, Phanerophyte (nPh), (1200, 1300, 1400 and 1700 m), N36.547463, E44.875503, valley near Kani Bast waterfalls, 20.04.2017, A. Galalaey 0855, (KASOF 3835).

151. *Zelkova* Spach.

327. *Zelkova carpinifolia* (Pall.) Dippel

(ES, Phanerophyte (nPh), 1200 m, N 36.59 6914 E 44.904888, riperian zone in Sakran area opposite of Kaprakani Sakaran, 10.07.2015 & 30.04.2016. A. Galalaey 0556, (KASOF 3836), New record for the flora of Iraq.

Figure 4.76. *Zelkova carpinifolia*

33. Moraceae Gaudich.

152. *Ficus* L.

328. *F. carica* L. var. *carica*

(PL, Phenarophyte, Mcph), (1400, 1700, and 2100 m), N36.546486, E44.930547, rocky place, 11.05.2017, A. Galalaey 0606, (KASOF 3580).

Figure 4.77. *Ficus carica* var. *carica*

153. *Morus* L.

329. *M. alba* L.

(PL, Phenarophyte, Mcph), 1000 m, N36.605780, E44.835202, moist places on the mountains, 29.04.2017, A. Galalaey 0607, (KASOF 3581).

330. *M. nigra* L.

(IT.M.ES, Phenarophyte, Mcph), 1200 m, N36.605458, E44.901800, oak forest, 12.05.2016 and 08.05.2017, A. Galalaey 0608, (KASOF 3582).

34. Urticaceae Juss.

154. *Parietaria* L.

331. *P. alsinifolia* Del.

(IT. SS, Hemicryptophyte), (1000, 1200, and 1700) m., N36.612723, E44.886962, riparian zone, 24.06.2018, A. Galalaey 0857, (KASOF 3837).

332. *P. judaica* L.

(IT.M.ES.SS, Hemicryptophyte), (1400, 1800, 2000 m), N36.575228, E44.929432, valley near water stream / hillside, 08.05.2017, A. Galalaey 0858, (KASOF 3838).

333. *P. lusitanica* L.

(IT, Therophyte), (1000, and 1200 m), N36.600744, E44.856233, east of Pashqalatan rocky place, 12.05.2017, A. Galalaey 0859, (KASOF 3839).

155. *Urtica* L.

334. *U. dioica* L.

(Scosm, Hemicryptophyte), (1600, 1900, 2000, 2100, 2200, 2300, 2400, 2500, 2600, 2700 and 3000 m), N36.559337, E44.988854, wetland place, 06-07.08.2016, A. Galalaey 0860, (KASOF 3840).

335. *U. pilulifera* L.

(IT.M.ES, Therophyte), (1000, 1100, 1200, 1400 and 1500 m), N36.605458, E44.901800, among limestone rocks in a gorge, 16.05.2017, A. Galalaey 0861, (KASOF 3841).

Fagales Engl.

35. Fagaceae Dumort.

156. *Quercus* L.

336. *Q. brantii* Lindl.

(IT, Phanerophyte, Mcph), (1000, 1100, 1200, 1300, 1400, 1500, 1600, and 1700 m), N36.597646, E44.910874, mountain slopes, 10.05.2016, A. Galalaey 0497, (KASOF 3477).

337. *Q. infectoria* G. Olivier subsp. *veneris* (A.Kern.) Meikle

(IT, Phanerophyte, Mcph), (1000, 1100, 1200, 1300, 1400, 1500, 1600, 1700, 1800 m), N36.575993, E44.929089, mountain slopes, 14.05.2016, A. Galalaey 0498, (KASOF 3478).

338. *Q. libani* Olivier

(M, Phanerophyte, Mcph), (1300, 1500, 1600, 1700, 1800, and 1900 m), N36.590037, E44.926952, rocky place (Sakran area), 04.05.2017, A. Galalaey 0499, (KASOF 3479).

36. Juglandaceae DC. ex Perleb

157. *Juglans* L.

339. *J. regia* L.

(PL, Phenarophyte (Mgph), (1400 and 1600 m), N36.583641, E44.921596, mountain moist places, among open oak forest, 28.04.2017, A. Galalaey 0531, (KASOF 3506), (KASOF 3187).

37. Betulaceae Gray

158. *Corylus* L.

340. *C. avellana* L.

(ES, Phanaerophyte (MCPH), 1200 m, N36.606780, E44.885390, forest area (Orchand) Nawbarga, 20.05.2016, 27.04.2016, 11.05.2017, A. Galalaey 0205.

Cucurbitales Juss. ex Bercht. & J.Presl

38. Cucurbitaceae Juss.

159. *Bryonia* L.

341. *B. multiflora* Boiss. & Heldr

(IT, Hemicryptophyte), (1300, 1400, 1500, 1600, 1700 and 1900 m), N36.556059, E44.862555, oak forest, 07.05.2016 and 20.04.2017, A. Galalaey 0379, (KASOF 3364).

Figure 4.78. *Bryonia multiflora*

Malpighiales Juss. ex Bercht. & J.Presl

39. Hypericaceae Juss.

160. *Hypericum* L.

342. *H. perforatum* L.

(COSM, Hemicryptophyte), (1000, 1400 and 1700 m), N36.582762, E44.818982, open area, 20.04.2016, A. Galalaey 0516, (KASOF 3491).

343. *H. scabrum* L.

(IT, Hemicryptophyte), (1400, 1500, 1700, 1800, 2000 and 2200 m), N36.566615, E44.929495, damp situations in the mountains, 11.05.2016, A. Galalaey 0517, (KASOF 3492).

Figure 4.79. *Hypericum scabrum*

344. *H. lysimachioides* Boiss. & Noë

(IT, Hemicryptophyte), 1500 m, N36.581661, E44.852825, open oak forest and stony places in the mountains, 25 04 2016, A. Galalaey 0518, (KASOF 3493).

40. Violaceae Batsch

161. *Viola* L.

345. *V. arvensis* Murr.

(IT.ES, Hemicryptophyte), (1200, 1300 and 2100 m), N36.570029, E44.933799, mountain slope, 11.05.2017, A. Galalaey 0864, (KASOF 3844).

346. *V. modesta* Fenzl.

(IT.M, Therophyte), 1500 m, N36.596270, E44.908627, wet place in a stream, 18.07.2015, A. Galalaey 0865, (KASOF 3845).

347. *V. odorata* L.

(IT, Therophyte), 1700 m., N36.591298, E44.921851, open area, 10.05.2017, A. Galalaey 0866, (KASOF 3846).

41. Salicaceae Mirb.

162. *Populus* L.

348. *P. alba* L. var *alba*

(Cosm, Phanerophyte, Msph), 1200 m, N36.592113, E44.839148, wet place, 21.04.2017, A. Galalaey 0826, (KASOF 3805).

349. *P. alba* L. var *pyramidallis* Bunge

(Cosm, Phanerophyte, Msph), 1500 m, N36.596270, E44.908627, wet place, 18.07.2015, A. Galalaey 0827, (KASOF 3806).

350. *P. euphratica* Olivier

(IT, Phanerophyte, Msph), 1200 m, N36.598764, E44.845838, wet place, 21.04.2017, A. Galalaey 0828, (KASOF 3807).

351. *P. nigra* L. var. *nigra*

(Cosm, Phanerophyte, Msph), 1200 m, riparian zone, N36.605458, E44.901800, 12.05.2016, A. Galalaey 0829, (KASOF 3808).

352. *P. nigra* L. var. *thevestina* (Dode) Bean

(Cosm, Phanerophyte, Msph), 1100 m, N36.611237, E44.870634, wet place, 19.04.2016, A. Galalaey 0830, (KASOF 3809).

163. *Salix* L.

353. *S. acmophylla* Boiss.

(IT.M, Phanerophyte), 1100 m, N36.611237, E44.870634, wet place, 19.04.2016, A. Galalaey 0831, (KASOF 3810).

354. *S. aegyptiaca* L.

(IT.M.ES, Phanerophyte), 1200 m, N36.592113, E44.839148, near spring, 05.05.2016, A. Galalaey 0832, (KASOF 3811).

355. *S. alba* L.

(IT.M.ES, Phanerophyte), (1100, 1200 and 1300 m), N36.569520, E44.822409, near spring of Makosan village, 15 04 2016, A. Galalaey 0833, (KASOF 3812).

356. *S. babylonica* L.

(Plu, Phanerophyte), 1300 m, N36.602108, E44.897430, wet place, 04.05.2017, A. Galalaey 0834, (KASOF 3813).

42. Euphorbiaceae Juss.

164. *Andrachne* L.

357. *A. telephioides* L.

(IT.M.ES, Hemicryptophyte), (1000 and 1200 m), N36.381940, E44.499140, near wheat field, 20.04.2016, A. Galalaey 0398, (KASOF 3380).

165. *Euphorbia* L.

358. *E. aleppica* L.

(IT.M, Therophyte), (1000, 1100 and 1200 m), N 36.586898 E 44.826617, hill sides, on stony slopes, 05.05.2017, A. Galalaey 0399, (KASOF 3382).

359. *E. aucheri* Boiss

(IT, Hemicryptophyte), (1500, 2400 and 2500 m), N36.559775, E44.919444, among metamorphic rocks on steep dry alpine slopes, 06.08.2016. A. Galalaey 0400, (KASOF 3383).

360. *E. falcata* L.

(IT.M, Therophyte), (1100, 1200 and 1400 m), rocky hillsides, on limestone, sandstone, 21.04.2017. A. Galalaey 0401, (KASOF 3384).

361. *E. helioscopia* L.

(PL, Therophyte), (1000, 1100 and 1200 m), N36.605258, E44.845887, mountains on steppic grassland, 16 04 2016 and 12.05.2017. A. Galalaey 0402, (KASOF 3385).

362. *E. heteradena* Jaub. et Spach.

(IT, Hemicryptophyte), (1500 and 1600 m), N36.593074, E44.917639, mountain slopes, on screes, 15.05.2015, 10.05.2016 and 28.04.2017. A. Galalaey 0403, (KASOF 3386).

363. *E. orientalis* L.

(IT.M.ES, Hemicryptophyte), (1900, 2000 and 2400 m), N36.572830, E44.888718, high mountain slopes, on metamorphic rock, 15.05.2016, A. Galalaey 0404, (KASOF 3387).

364. *E. petiolata* Banks & Sol.

(IT.M, Therophyte), 1000 m, N36.585092, E44.820284, hillside, on limestone, 30.07.2018. A. Galalaey 0405, (KASOF 3388).

365. *E. phymatosperma* Boiss. & Gaill.

(IT, Therophyte), 1000 m, N36.608115, E44.835073, vineyard, 20.04.2016. A. Galalaey 0406, (KASOF 3389).

366. *E. szovitsii* Fisch. & C.A. Mey

(IT.ES.SS, Therophyte), (1000, 1100 and 1800 m), N36.593265, E 44.825577, grassy places, in coppiced oak, 29.04.2017, A. Galalaey 0407, (KASOF 3390).

367. *E. denticulata* Lam.

(IT, Chamaephyte), (1300, 1400, 1600, 1700, 1900, 2000, 2100, 2200, 2300 and 2500 m), N36.566615, E44.929495, rocky mountain slopes, on limestone, red loam and clay, in oak forest and scrub, 11.05.2016, A. Galalaey 0409, (KASOF 3391).

166. *Chrozophora* Neck. ex A. Juss.

368. *C. tinctoria* (L.) A. Juss

(IT, Therophyte), (1000, 1100 and 1200 m), N36.564597, E44.839771, in the mountains on rocky slopes, in vineyards, on disturbed soil, 16 04 2017, A. Galalaey 0408, (KASOF 3381).

43. Linaceae DC. ex Perleb

167. *Linum* L.

369. *L. nodiflorum* L.

(IT.M.ES, Therophyte), (1100, 1400 and 1500 m), N36.605258, E44.845887, open forest, 16.04.2016 and 12.05.2017, A. Galalaey 0595, (KASOF 3569).

Figure 4.80. *Linum nodiflorum*

370. *L. bienne* Mill.

(IT.M, Therophyte), 1000 m, N36.609051, E44.840214, open forest, 10.04.2017, A. Galalaey 0596, (KASOF 3570).

371. *L. strictum* L.

(IT. SS, Therophyte), (1000, 1100, 1200, 1300 and 1600 m), N36.601118, E44.901636, in the mountains, on limestone with coppiced oak, 23.04.2016, A. Galalaey 0597, (KASOF 3571).

44. Geraniaceae Juss.

168. *Erodium* Aiton

372. *E. ciconium* (L.) L'Hér.

(IT.M, Therophyte), (1000, 1100, 1200 and 1300 m), N36.581861, E44.828837, rocky mountain slope, among coppiced oak, on hillside, 20.04.2016, A. Galalaey 0513, (KASOF 3488).

373. *E. cicutarium* (L.) L'Hér.

(IT.M, Therophyte), (1000, 1200, 1300, 1400, 1500, 1600 and 1700 m), N 36.588951 E 44.880196, on a rocky mountain slope in oak forest, and grassy land, 15.05.2016, A. Galalaey 0514, (KASOF 3489).

169. *Geranium* L.

374. *G. pusillum* L

(PL, Therophyte), (1100, 1300 and 1700 m), N36.605258, E44.845887, open forest, 16.04.2016 and 12.05.2017, A. Galalaey 0509, (KASOF 3484).

375. *G. stepporum* Davis

(IT.ES, Cryptophyte-Geophyte), (1400, 1500, 1600 and 1700 m), N36.586012, E44.853338, mountain streams, in moist places, in oak forest, 04.05.2017, A. Galalaey 0510, (KASOF 3485).

376. G. *purpureum* Vill.

(IT.M, Therophyte), (1000 and 1400 m), N36.604044, E44.827745, open forest high density of *Q. infectoria*, 22.04.2016. A. Galalaey 0511, (KASOF 3486).

377. *G. tuberosum* L.

(IT.M.ES, Cryptophyte-Geophyte (Tuber)), (1000, 1100, 1500, 1600, 1900, 2000, 2100 and 2400 m), N36.577395, E44.890403, 03.05.2017, mountain slopes, on limestone and in damp clearing in forest and among coppiced oak, 03.05.2017. A. Galalaey 0512, (KASOF 3487).

Myrtales Juss. ex Bercht. & J.Presl

45. Lythraceae J.St.-Hil.

170. *Lythrum* L.

378. *L. salicaria* L.

(IT, Chamaephyte), (1000, 1100, 1200 and 1400 m), N36.597056, E44.882068, damp mountain slopes, gorges, rocky water streams, river banks, 15.05.2015, A. Galalaey 0599, (KASOF 3573).

Figure 4.81. *Lythrum salicaria*

171. *Punica* L.

379. *P. granatum* L.

(Scosm, Phenarophyte, Mcph), (1000 and 1200 m), N36.610575, E44.846088, vineyard, 11.05.2017, A. Galalaey 0600, (KASOF 3574).

46. Onagraceae Juss.

172. *Epilobium* L.

380. *E. hirsutum* L.

(PL, Hemicryptophyte), (1000 and 1200 m), N36.605458, E44.901800, streams, 12.05.2016 and 08.05.2017, A. Galalaey 0611, (KASOF 3586).

381. *E. parviflorum* Schreb

(PL, Hemicryptophyte), 1200 m., N36.605458, E44.901800, damp shady places by streams, 16.05.2017, A. Galalaey 0612, (KASOF 3587).

382. *E. obscurum* Schreber

(PL, Hemicryptophyte), 2400 m, N36.559775, E44.919444, rocky mountain streams, 10.07.2016. A. Galalaey 0613, (KASOF 3588).

Figure 4.82. *Epilobium obscurum*

47. Myrtaceae Juss.

173. *Myrtus* L.

383. *M. communis* L.

(IT, Phenarophyte), 1200 m., N36.603261, E44.857452, riparian zone, 15.05.2015, A. Galalaey 0870, (KASOF 3583).

Sapindales Juss. ex Bercht. & J.Presl

48. Biebersteiniaceae Schnizl.

174. *Biebersteinia* DC.

384. *B. multifida* DC.

(IT, Hemicryptophyte), (1900, 2000, 2100, 2300 and 2700 m), N36.568097 E44.943149, high mountain sides, rocky slopes, 24.07.2018. A. Galalaey 0207, (KASOF 3189).

Figure 4.83. *Biebersteinia multifida*

49. Anacardiaceae R.Br.

175. *Pistacia* L.

385. *P. eurycarpa* Yalt.

(IT, Phanaerophyte, Msph), (1100, 1200, 1300, 1400, 1500, 1600 and 1700 m), N36.553555, E44.873176, rocky places in oak forest on limestone, 07.05.2017, A. Galalaey 0024, (KASOF 3006).

386. *P. khinjuk* Stocks

(IT.M, Phanaerophyte, Mcph), (1000, 1100, 1300 and 1400 m), N36.590922, E44.854584, rocky places in the mountains, 14.05.2017, A. Galalaey 0025, (KASOF 3007).

176. *Rhus* L.

387. *R. coriaria* L.

(IT.M, Phanaerophyte, Mcph), (1000, 1100 and 1500 m), N36.559051, E44.857471, mountains rocky places in oak forest, often on limestone, 02.05.2016, A. Galalaey 0026, (KASOF 3008).

50. Sapindaceae Juss.

177. *Acer* L.

388. *A. monspessulanum* L. subsp. *assyriacum* (Pojark.) Rech.

(IT, Phanerophyte), (1000, 1100, 1200, 1300, 1400, 1500, 1600, 1700, and 1800) m, N44.552972, E44.875862, mountain slopes, in oak forest, 09.05.2016, A. Galalaey 0002, (KASOF 2984).

51. Rutaceae Juss.

178. *Ruta* Poir. Juss.

389. *R. buxbaumii* Poir. Juss.

(IT.M, Chamaephyte), 1500 m, N36.581661, E44.852825, open oak forest, 25.04.2016, A. Galalaey 0825, (KASOF 3804).

Malvales Juss. ex Bercht. & J.Presl

52. Malvaceae Juss.

179. *Alcea* L.

390. *A. rufescens* (Boiss.) Boiss

(IT, Hemicryptophyte), 1100 m, N36.574045, E44.829556, open forest, 26.04.2017, A. Galalaey 0601, (KASOF 3575).

Figure 4.84. *Alcea rufescens*

391. *A. kurdica* (Schlecht) Alef.

(IT, Hemicryptophyte), (1000, 1200, 1300, 1500 and 1700 m), N36.583858 E44.924626, open area destroyed forest, 10.05.2017, A. Galalaey 0602, (KASOF 3576).

180. *Hibiscus* L.

392. *H. trionum* L.

(IT.M.ES, Therophyte), 1200 m, N36.603261, E44.857452, open oak forest, 05.05.2016, A. Galalaey 0603, (KASOF 3577).

Figure 4.85. *Hibiscus trionum*

181. *Malva* L.

393. *M. neglecta* Wallr

(PL, Hemicryptophyte), (1900, 2000 and 2500 m), N36.578339, E44.941832, alpine region, 27.06.2018, A. Galalaey 0604, (KASOF 3578).

394. *M. nicaeensis* All.

(IT, Hemicryptophyte), 1000 m, N36.593265, E44.825577, oak copies, 29.04.2017, A. Galalaey 0605, (KASOF 3579).

53. Thymelaeaceae Juss.

182. *Daphne* L.

395. *D. mucronata* Royle

(IT.ES., Phanerophyte), (1300, 1400, 1600, 1700, 1900, 2000, 2100, 2200, 2300, 2500, and 3200) m, N36.575349, E44.912545, open rocky high mountain slopes and valleys, 11.05.2017, A. Galalaey 0852, (KASOF 3831).

Figure 4.86. *Daphne mucronata*

183. *Thymelaea* Mill.

396. *T. passerina* (L.) Coss

(IT.M.ES, Therophyte), (1100, 1200 and 1300 m), N36.585180, E44.826974, lower mountain slopes, in oak forest, 26.04.2017, A. Galalaey 0853, (KASOF 3832).

54. Cistaceae Juss.

184. *Helianthemum* Mill.

397. *H. ledifolium* (L.) Mill. var. *lasiocarpum* (Willk.) Stoj. & Stef.

(IT, Therophyte), 1100 m, N36.605258, E44.845887, open forest, 16.04.2016 and 12.05.2017, A. Galalaey 0359, (KASOF 3341).

398. *H. ledifolium* (L.) Mill. var. *ledifolium*

(IT.M, Therophyte), (1100, 1300, 1400, 1500, 1600 and 1700 m), N36.553555, E44.873176, slopy mountain, 07.05.2017, A. Galalaey 0360

399. *H. salicifolium* (L.) Mill.

(PL, Chamaephyte), 1000 m, N36.609493, E44.843427, open forest. 29.04.2017, A. Galalaey 0361, (KASOF 3343).

Brassicales Bromhead

55. Resedaceae Martinov

185. *Reseda* L.

400. *R. lutea* L. var. *lutea*

(IT.M.ES, Hemicryptophyte), (1000, 1100 and 1200 m), N36.563964, E44.821983, degraded steppe on limestone, 15.04.2016, A. Galalaey 0764, (KASOF 3743).

56. Capparaceae Juss.

186. *Capparis* L.

401. *C. spinosa* L. var. *spinosa*

(IT.M. SS, Chamaephyte & Phanearophyte), (1100 and 1200 m), N36.612723, E44.886962, riparian zone, 24.06.2018, A. Galalaey 0308, (KASOF 3290).

57. Cleomaceae Bercht. & J.Presl

187. *Cleome* L.

402. *C. iberica* DC.

(IT.M. KO, Therophyte), (1200, 1300 and 1600 m), N36.594154, E44.913521, in the mountains, on rocky slopes in oak forest, 07.05.2017, A. Galalaey 0362, (KASOF 3344).

Figure 4.87. *Cleome iberica*

58. Brassicaceae Burnett (= Cruciferae Juss.)

188. *Aethionema* L.

403. *A. arabicum* (L.) Andrz. ex DC.

(IT, Therophyte), (1000 and 1200 m), N36.607816, E44.895649, rocky place, 05.05.2017, A. Galalaey 0237, (KASOF 3219).

404. *A. carneum* (Banks et Sol.) B. Fest

(IT, Therophyte), (1000, 1200 and 1800 m), N36.578399, E44.835497, open oak forest, 09.05.2016, A. Galalaey 0238, (KASOF 3220).

Figure 4.88. *Aethionema carneum*

405. *A. fimbriatum* Boiss

(IT, Hemicryptophyte), (1900, 2200 and 2500 m), N36.564022, E44.895885, subalpine region, 15.05.2017, A. Galalaey 0239, (KASOF 3221).

406. *A. grandiflorum* Boiss et Hoh.

(IT, Hemicryptophyte), (1000, 1100, 1200, 1600, 1900, 2000 and 2100 m), N36.566615, E44.929495, mountain slope, 11.05.2016, A. Galalaey 0240, (KASOF 3222).

Figure 4.89. *Aethionema grandiflorum*

407. *A. speciosum* Boiss. Et Huet

(IT, Hemicryptophyte), 2300 m, N36.568365, E44.894837, stony mountain slopes, 15.05.2016, A. Galalaey 0248, (KASOF 3223).

Figure 4.90. *Aethionema speciosum*

408. *A. trinervium* (DC.) Boiss

(IT, Therophyte), (2400, 2700 and 3000 m), N36.559099, E44.953227, alpine zone, grassland area, 07.08.2016, A. Galalaey 0241, (KASOF 3224).

409. *A. cordatum* (Desf.) Boiss.

(IT, Hemicryptophyte), 1900 m, N36.5576158, E44.872630, timber line open area, 07.05.2017, A. Galalaey 0280, (KASOF 3225).

189. *Alliaria* L.

410. *A. petiolata* (M. Bieb.) Cavara & Grande

(IT.M.ES, Hemicryptophyte), (1100 and 1500 m), N36.593360, E44.880103, in the mountains (shady places), 23.04.2017 and 19.04.2016, A. Galalaey 0242, (KASOF 3226).

190. *Alyssum* L.

411. *A. contemptum* Schott et Ky.

(IT, Therophyte), (1900 and 2200 m), N36.569132, E44.891798, sub-alpine region, 15.05.2016, A. Galalaey 0243, (KASOF 3227).

412. *A. minus* (L.) Rothm var. *micranthum* (C. A. Mey.) Dudley

(IT.M, Therophyte), 1100 m, N36.573026 E44.826413, oak copies, 15.04.2016, A. Galalaey 0244, (KASOF 3228).

413. *A. stapfii* Vierh.

(IT, Therophyte), (1300, 1400 and 1800 m), N36.598492, E44.906846, rocky mountain slopes, 30.04.2016 and 12.05.2017, A. Galalaey 0245, (KASOF 3229).

414. *A. strigosum* Banks & Sol.

(IT.M, Therophyte), (1000, 1100, 1300 and 1500 m), N36.586012, E44.853338, oak forest, 04.05.2017, A. Galalaey 0246, (KASOF 3230).

415. *A. strictum* Willd.

(IT, Therophyte), (1000, 1100, 1500 and 2100 m), N36.567890, E44.869589, open area (grassland area), 08.05.2017, A. Galalaey 0281, (KASOF 3231).

191. *Anchonium* DC.

416. *A. elichrysifolium* (DC.) Boiss.

(IT, Hemicryptophyte), (2600, 2700 and 2900 m), N36.571083, E44.945398, mountains and rocky areas, 06.07.2018, A. Galalaey 0247, (KASOF 3235).

Figure 4.91. *Anchonium elichrysifolium*

192. *Arabis* L.

417. *A. aucheri* Boiss.

(IT, Therophyte), 1100 m, N36.563964, E44.821983, degraded steppe on limestone 15.04.2016, A. Galalaey 0282, (KASOF 3232).

418. *A. auriculata* Lam.

(IT, Therophyte), (1200 and 1500 m), N36.564597, E44.839771, near spring stream, 16 04 2017, A. Galalaey 0283, (KASOF 3233).

419. *A. caucasica* Willd.

(IT.ES, Hemicryptophyte), (1400, 1600, 1700, 2000, 2100, 2200, 2300, 2500, 2600, 2700 and 2800 m), N36.567021, E44.943700, in the mountains, on rocky slopes, cliffs and ledges, 07.08.2016, A. Galalaey 0284, (KASOF 3234).

193. *Barbarea* W.T. Aiton

420. *B. vulgaris* W.T. Aiton

(IT, Hemicryptophyte), 1600 m, N36.585862, E44.865201, grassland area, 10.05.2017, A. Galalaey 0249, (KASOF 3236).

194. *Biscutella* L.

421. *B. didyma* L.

(IT.M, Therophyte), (1000, 1200, 1300, 1400 and 1600 m), N36.596393, E44.9066601, open rocky slopes, 30.04.2016 and 02.05.2017, A. Galalaey 0250, (KASOF 3237).

195. *Brassica* L.

422. *B. nigra* (L.) W.D.J. Koch

(IT.M. SS, Therophyte), (1000, 1100 and 1300 m), N36.585092, E44.820284, open area, 20.04.2017, A. Galalaey 0285, (KASOF 3238).

196. *Calepina* Adans.

423. *C. irregularis* Thell

(IT.M, Therophyte), (1000, 1100 and 1300 m), N36.609493, E 44.843427, in denuded forest on limestone, 29.04.2017, A. Galalaey 0251, (KASOF 3239).

197. *Capsella* L.

424 *C. bursa-pastoris* (L.) Medik.

(Cosm, Therophyte), (1000, 1100, 1200, 1300 and 1700 m), N36.609051, E44.840214, damp places by springs and streams in the mountains, 18.04.2017, A. Galalaey 0286, (KASOF 3240).

198. *Cardamine* L.

425. *C. hirsuta* L.

(IT.M.ES, Therophyte), (1200, 1400 and 1700 m), N36.557303, E44.844181, water channels, 08.05.2017, A. Galalaey 0287, (KASOF 3241).

426. *C. uliginosa* M. Bieb

(IT, Therophyte), (2000, 2100, 2200, 2300, 2600 and 2700 m), N36.568091, E44.941546, mountain streams, 22.07.2017, A. Galalaey 0252, (KASOF 3242).

199. *Clastopus* (Desv.) Boiss.

427. *C. vestitus* (Desv.) Bois

(IT, Chamaephyte), 1900 m, N36.590037, E44.926952, rocky place, 04.05.2017, A. Galalaey 0253, (KASOF 3243).

Figure 4.92. *Clastopus vestitus*

200. *Clypeola* L.

428. *C. aspera* (Grauer) Turrill

(IT. SS, Therophyte), (1000, 1100, 1300, 1600 and 1700 m), N36.556059, E44.862555, dry stony hilltops and slopes on sandstone, 07.05.2016 and 20.04.2017, A. Galalaey 0288, (KASOF 3246).

429. *C. jonthlaspi* L.

(IT.M.ES, Therophyte), (1000, 1100, 1300 and 1400 m), N36.592240, E44.857150, mountains on dry slopes in oak forest, 14.05.2017. A. Galalaey 0289, (KASOF 3247).

201. *Coluteocarpus* L.

430. *C. vesicaria* (L.) Holmboe

(IT, Hemicryptophyte), 3000 m, N36.546021, E44.962715, alpine zone, 06.08. 2016 and 07.08.2016, A. Galalaey 0254, (KASOF 3244).

202. *Conringia* Heist. ex Fabr.

431. *C. perfoliata* (C. A. Mey.) N. Busch

(IT.ES, Therophyte), (1000, 1100, 1400, 1500 and 1800 m), N36.598725, E44.876665, mountain slopes, 04.05.2017, A. Galalaey 0290, (KASOF 3245).

203. *Crambe* L.

432. *C. orientalis* L.

(IT, Hemicryptophyte), (1000 and 1100 m), N36.582832, E44.819651, on a steep limestone slope, 20.04.2016, A. Galalaey 0291, (KASOF 3248).

204. *Descurainia* Webb & Berthel.

433. *D. sophia* (L.) Webb ex Prantl

(IT.M.ES, Therophyte), (1400 and 1800 m), N36.581285, E44.886266, waste places, 03.05.2017, A. Galalaey 0255, (KASOF 3249).

205. *Didymophysa* Boiss.

434. *D. aucheri* Boiss.

(IT, Hemicryptophyte), (2500, 2700 and 3100 m), N36.571083, E44.945398, alpine summits, on limestone, 06.08.2016, A. Galalaey 0256, (KASOF 3250).

206. *Draba* Steven

435. *D. bruniifolia* Steven.

(IT., Therophyte), 3200 m, N36.545023, E44.979782, mountain summits (alpine region), 07.08.2016, 20.07.2018 and 18.06.2017, A. Galalaey 0292, (KASOF 3252).

207. *Drabopsis* L.

436. *D. nuda* (Bel.) Stapf

(IT, Therophyte), (2000, 2200 and 2500 m), N36.556571, E44.878380, in an open loamy valley, 05.05.2016, A. Galalaey 0257, (KASOF 3251).

208. *Erophila* L.

437. *E. minima* C.A. Mey.

(IT.M.ES, Therophyte & Hemicryptophyte), (1000 and 1100 m), N36.581861, E44.828837, grassy mountain slopes and grazed foothills, 20.04.2016, A. Galalaey 0258, (KASOF 3253).

438. *E. verna* (L.) DC.

(IT.ES, Hemicryptophyte), (1000, 1100, 1400 and 1700 m), N36.583229, E44.843418, grazed foothills and steppic plains, 20.04.2016, A. Galalaey 0259, (KASOF 3254).

209. *Erysimum* L.

439. *E. filifolium* Boiss. et Hausskn

(IT, Hemicryptophyte), 1000 m, N36.606226, E44.833240, coppiced *Quercus*, 09.05.2017, A. Galalaey 0260, (KASOF 3255), **Endemic**, IUCN: LC.

440. *E. alpestre* Ky. ex Boiss

(IT, Hemicryptophyte), (2700, 2800, 2900, 3100 and 3200 m), N36.568097, E44.943149, alpine zone on limestone, 07.07.2018, A. Galalaey 0261, (KASOF 3256).

441. *E. gladiiferum* Boiss. et Haussk.

(IT, Hemicryptophyte), (1700, 2100 and 2200 m), N36.569932, E44.856831, degraded oak forest, on limestone, 09.05.2016, A. Galalaey 0262, (KASOF 3257), **Endemic**, IUCN: NE.

442. *E. repandum* L.

(IT.ES, Therophyte), 1100 m, N36.563964, E44.821983, hillside, degraded steppe on limestone, 15.04.2016, A. Galalaey 0293, (KASOF 3258).

210. *Euclidium* L.

443. *E. syriacum* (L.) R.

(IT, Therophyte), (1000, 1100 and 1300 m), N36.609051, E44.840214, on the plains on banks of irrigation channels, 18.04.2017, A. Galalaey 0263, (KASOF 3259).

211. *Fibigia* Medik.

444. *F. clypeata* (L.) Medik. subsp. *macroptera* (Ky. et Boiss. ex Fourn.) Bornm

(IT.M.ES, Hemicryptophyte), (1100, 1500, 1700 and 1900 m), N36.570241, E44.938870, rocky mountain place, 17.05.2017, A. Galalaey 0264, (KASOF 3260).

445. *F. macrocarpa* Boiss

(IT.ES, Hemicryptophyte), (1600 and 2000 m), N36.556571, E44.878380, in an open loamy valley, 05.05.2016, A. Galalaey 0294, (KASOF 3261).

Figure 4.93. *Fibigia macrocarpa*

446. *F. suffruticosa* (Vent.) Sweet

(IT, Hemicryptophyte), (1400, 1700, 1900, 2300 and 2600 m), N36.571492, E44.943820, rocky mountain slopes, 07.08.2017, A. Galalaey 0295, (KASOF 3262)

212. *Hesperis* L.

447. *H. kurdica* F. Dvorák & Hadac

(IT, Hemicryptophyte), (1700 and 2000 m), N36.566615, E44.929495, mountain slope, 11.05.2016. A. Galalaey 0296, (KASOF 3264), **Endemic**, IUCN: EN.

448. *H. stranii* Bornm.

(IT, Hemicryptophyte), 1600 m, N36.593074, E44.917639, oak forest with rocky place, 15.05.2015, 10.05.2016 and 28.04.2017, A. Galalaey 0265, (KASOF 3263).

213. *Hirschfeldia* L.

449. *H. incana* (L.) Lagr. -Foss.

(IT.M, Therophyte), 1000 m, N36.596211, E44.828586, on the plains, 20.04.2016, A. Galalaey 0266, (KASOF 3265).

214. *Isatis* L.

450. *I. cappadocica* Desv.

(IT.ES, Hemicryptophyte), (1700, 1900, 2200, 2600 and 2700 m), N36.568097, E44.943149, rocky mountain slopes, 07.07.2018, A. Galalaey 0267, (KASOF 3266).

451. *I. cochlearis* Boiss.

(Cosm, Hemicryptophyte), (1100, 2100, 2200, 2300, 2400 and 2700 m), N36.571342, E44.937868, 15.05.2017, A. Galalaey 0297, (KASOF 3267).

452. *I. tinctoria* L.

(IT.M.ES, Therophyte), 1100 m, N36.612666, E44.872589, open area near field crops, 22.04.2016, A. Galalaey 0268, (KASOF 3268).

215. *Lepidium* L.

453. *L. draba* L.

(Cosm, Hemicryptophyte), (1100, 1200, 1300, 1400, 1900 and 2200 m), N36.5576158 E44.872630, loose stony mountain soil, on limestone, 07.05.2017, A. Galalaey 0298, (KASOF 3269).

216. *Myagrum* L.

454 *M. perfoliatum* L.

(IT.ES, Therophyte), 1100 m, N36.573026, E44.826413, by roadside and on edge of neglected field near a village. 15.04.2016, A. Galalaey 0269, (KASOF 3270).

217. *Nasturtium* L

455. *N. officinale* R.Br.

(PL, Neophyte), (1000, 1100, 1200, 1400 and 1700 m), N36.583858, E44.924626, wet place, 10.05.2017, A. Galalaey 0270, (KASOF 3271).

218. *Neslia* Desv.

456. *N. apiculata* Fisch., C.A. Mey. & Avé-Lall.

(IT.ES, Therophyte), (1000 and 1100 m), N36.605780, E44.835202, in fields and by roadsides, 29.04.2017, A. Galalaey 0271, (KASOF 3272).

219. *Physoptychis* Boiss

457. *P. ganphalodes* (DC.) Boiss

(IT, Hemicryptophyte), (2900 and 3000 m), N36.548629, E44.975679, high in the mountains, on rocky cliffs and slopes, 07.08.2016, A. Galalaey 0272, (KASOF 3274).

220. *Rorippa* L.

458. *R. amphibia* (L.) Boiss.

(IT.M.ES, Hemicryptophyte), (1300 and 1400 m), N36.602108, E44.897430, stagnant water, mudflats and other wet places, 04.05.2017, A. Galalaey 0273, (KASOF 3273).

221. *Sameraria* L.

459. *S. stylophora* (Jaub. et Sp.) Boiss

(IT, Therophyte), (1000, 1400, 1600 and 1700 m), N36.556059, E44.862555, oak forest, 20.04.2017, A. Galalaey 0274, (KASOF 3275).

222. *Sinapis* L.

460. *S. arvensis* L.

(IT.M.ES, Therophyte), (1000, 1100, 1200 and 1300 m), N36.601187, E44.852861, oak forest, 23 04 2017. A. Galalaey 0275, (KASOF 3276).

223. *Sisymbrium* L.

461. *S. irio* L.

(PL, Therophyte), (1000, 1100, 1200 and 1300 m), N36.605780, E44.835202, roadsides, along irrigation channels and ditches, 29.04.2017, A. Galalaey 0276, (KASOF 3277).

462. *S. loeselii* L.

(IT, Therophyte), (1900, 2000, 2200 and 2300 m), N36.566267, E44.892759, high mountain sides, rocky slopes, 15.05.2017, A. Galalaey 0277, (KASOF 3278).

224. *Thlaspi* L.

463. *T. kurdicum* Hedge

(IT, Chamaephyte), (2300, 3000 and 3100 m), N36.545511, E44.982085, alpine, 07.08.2018, A. Galalaey 0278, (KASOF 3279).

464. *T. perfoliatum* L.

(PL, Therophyte), (1000, 1100, 1300, 1400, 1500, 1700 and 1800 m), N36.597018, E44.894935, rocky slopes, 23.04.2016, A. Galalaey 0279, (KASOF 3280).

SUPERASTERIDS

Santalales R.Br. ex Bercht. & J.Presl

59. Loranthaceae Juss.

225. *Loranthus* Jacq., nom. Cons.

465. *L. europaeus* Jacq.

(IT, Epipyphyte), (1300, 1400, 1500, and 1600) m., N36.593360, E44.880103, oak forest, 23.04.2017 and 19.04.2016, A. Galalaey 0598, (KASOF 3572).

Figure 4.94. *Loranthus europaeus* on *Q. infectoria*

Caryophyllales Juss. ex Bercht. & J.Presl

60. Tamaricaceae Link

226. *Tamarix* L.

466. *T. ramosissima* Ledeb.

(Cosm, Phanerophyte), (1000, 1100, 1300 and 1400 m), N36.557303, E44.844181, water channels, 08.05.2017, A. Galalaey 0851, (KASOF 3830).

Figure 4.95. *Tamarix ramosissima*

61. Plumbaginaceae Juss.

227. *Acantholimon* Boiss.

467. *A. caryophyllaceum* Boiss.

(IT, Chamaephyte, caespitose shrublet), (1600 and 2700 m), N36.568097, E44.943149, alpine region, 07.07.2018, A. Galalaey 0660, (KASOF 3638).

468. *A. genistioides* (Jaub. & Spach) Boiss

(IT, Chamaephyte, caespitose shrublet), (2000, 3000, 3100 and 3200 m), N36.545023, E44.979782, surrounding some snow melting, 06.08.2016, A. Galalaey 0659, (KASOF 3639).

Figure 4.96. *Acantholimon genistioides*

469. *A. latifolium* Boiss

(IT, Chamaephyte, caespitose shrub let), (1000, 1300, 1400, 1500 and 2100 m), N36.596914, E44.904888, rocky place, 30.04.2016, A. Galalaey 0661, (KASOF 3640).

Figure 4.97. *Acantholimon latifolium*

228. *Plumbago* L.

470. *P. europaea* L.

(IT, Hemicryptophyte), (1100 and 1200 m), N36.598764, E44.845838, dry hillside, 21.04.2017, A. Galalaey 0662, (KASOF 3641).

62. Polygonaceae Juss.

229. *Atraphaxis* L

471. *A. billardieri* subsp. *tournefortii* (Jaub. & Spach) Lovelius

(IT, Phanerophyte), (1500, 1600 and 1700 m), N36.593385, E44.893436, timber line, 14.5.2017, A. Galalaey 0733, (KASOF 3712).

Figure 4.98. *Atraphaxis billardieri* subsp. *tournefortii*

230. *Oxyria* Hill.

472. *O. digyna* (L.) Hill

(IT, Hemicryptophyte), (2500, 2600, 2800, 2900, 3000, 3100 and 3200 m), N36.549280, E44.978736, alpine zone, 07.08.2016, A. Galalaey 0720, (KASOF 3699).

231. *Persicaria* Mill.

473. *P. amphibia* (L.) Delarbre

(IT.M.ES, Hemicryptophyte), (1400 and 1700 m), N36.585662, E44.900485, rocky place, 22.05.2015, A. Galalaey 0721, (KASOF 3700).

474. *P. maculosa* Gray.

(PL, Hemicryptophyte), (1000 and 1100 m), N36.602586, E44.824746, wet place, 27.04.2017, A. Galalaey 0722, (KASOF 3701).

475. *P. hydropiper* (L.) Delarbre

(Scosm, Therophyte), (1000, 1100 and 1200 m), N36.603386, E44.825778, wet place, 27.04.2017, A. Galalaey 0723, (KASOF 3702).

232. *Polygonum* L.

476. *P. aviculare* L.

(Cosm, Therophyte), (1200, 1500, 2000, 2500 and 2700 m), N36.565320, E044.896907, sub-alpine, 03.07.2017, A. Galalaey 0724, (KASOF 3703).

477. *P. cognatum* Meisn

(IT, Hemicryptophyte), (2500, 3000, 3100 and 3200 m), N36.559337, E44.988854, alpine region, 07.08.2016, A. Galalaey 0725, (KASOF 3704).

478. *P. patulum* M. Bieb.

(IT.ES, Therophyte), (1000, 1100, 1300 and 1500 m), N36.381940 E44.499140, open area near wheat cultivar, 20.04.2016, A. Galalaey 0726, (KASOF 3705).

479. *P. persicaria* L.

(PL, Therophyte), 1200 m, N36.592113, E44.839148, open forest, 05.05.2016, A. Galalaey 0727, (KASOF 3706).

233. *Rumex* L.

480. *R. conglomeratus* Murray

(IT.ES, Hemicryptophyte), (1000, 1200, 1400, 1500 and 1800 m), N36.573635, E44.922549, rocky place, 06.05.2016, A. Galalaey 0728, (KASOF 3708).

481. *R. crispus* L.

(Cosm, Hemicryptophyte), (1600 and 1800 m), N36.581536, E44.926221, open forest area, 14.05.2016, A. Galalaey 0729, (KASOF 3709).

Figure 4.99. *Rumex crispus*

482. *R. tuberosus* L. subsp. *turcomanicus* (Rech. f.) Rech. f.

(IT, Hemicryptophyte), (100, 1400, 1500, 1900, 2000, 2100, 2200 and 2700 m), N36.569132, E44.891798, open area, 15.05.2016, A. Galalaey 0730, (KASOF 3710).

483. *R. scutatus* L.

(IT, Hemicryptophyte), (1700 and 2100 m), N36.547463, E44.875503, valley, rocky and stony ground, 20.04.2017, A. Galalaey 0731, (KASOF 3711).

Figure 4.100. *Rumex scutatus*

234. *Rheum* L.

484. *R. ribes* L.

(IT, Hemicryptophyte), (1300, 1400, 1500, 1600, 1700, 1900, 2000, 2100, 2200 and 2500 m), N36.560945, E44.872566, rocky place, 07.05.2017, A. Galalaey 0732, (KASOF 3707).

63. Caryophyllaceae Juss.

235. *Agrostemma* L.

485. *A. githago* L.

(PL, Therophyte), 1600 m, N36.585862, E44.865201, grassland area, 10.05.2017, A. Galalaey 0322, (KASOF 3304).

Figure 4.101. *Agrostemma githago*

236. *Arenaria* L.

486. *A. serpyllifolia* L.

(PL, Therophyte), (1300, 1400, 1600, 2300, 2700 and 3000 m), N36.559337, E44.988854, wet land place, 07.08.2016, A. Galalaey 0323, (KASOF 3305).

237. *Cerastium* L.

487. *C. dichotomum* L.

(IT.M.ES.SS, Therophyte), (1300, 1400, 1500, 1600, 1900 and 2200 m), N36.568816, E44.936617, mountain slope, 08.05.2017, A. Galalaey 0324, (KASOF 3306).

488. *C. cerastoides* (L.) Britton

(IT.M, Hemicryptophyte), (1700, 2600, 2800, 3000, 3100 and 3200 m), N36.562440, E44.989504, rocky place, alpine region, 06.08.2016, A. Galalaey 0325, (KASOF 3307).

489. *C. perfoliatum* L.

(Cosm, Therophyte), (1000, 1100 and 1200 m), N36.609051, E44.840214, wet place, 18.04.2017, A. Galalaey 0326, (KASOF 3308).

238. *Dianthus* L.

490. *D. strictus* Banks & Soland

(IT, Hemicryptophyte), (1200, 1500 and 2300 m), N36.566267, E44.892759, high mountain sides, rocky slopes, 15.05.2016, A. Galalaey 0327, (KASOF 3309).

491. *D. siphonocalyx* Blakelock

(IT, Hemicryptophyte), 2000 m, N36.556571, E44.878380, Kani bast area, rocky place, 05.05.2016, A. Galalaey 0328, (KASOF 3310).

492. *D. orientalis* Adams

(IT, Hemicryptophyte), (1900, 2500, 2600 and 2700 m), N36.568097, E44.943149, alpine zone, rocky place, 07.07.2018, A. Galalaey 0329, (KASOF 3311).

239. *Holosteum* L.

493. *H. umbellatum* L.

(IT, Therophyte), (1100, 1300, 1600 and 1700 m), N36.592011, E44.921365, open area, 14.05.2017, A. Galalaey 0330, (KASOF 3316).

240. *Minuartia* L.

494. *M. hamata* (Hausskn.) Mattf.

(IT.M, Therophyte), (1200, 1300, 1700, 1900, 2000 and 2100 m), N36.577395, E44.890403, sub-alpine open area, Goronia area, 03.05.2017, A. Galalaey 0331, (KASOF 3317).

495. *M. hybrida* (Vill.) Schischkin

(IT.M, Therophyte), (1100, 1200 and 1300 m), N36.601187, E44.852861, oak forest, 10 04 2017, A. Galalaey 0332, (KASOF 3318).

496. *M. meyeri* (Boiss.) Bornm.

(PL, Therophyte), (1700, 2500 and 3100 m), N36.585662, E44.900485, rocky place, 22.05.2015, A. Galalaey 0333, (KASOF 3319).

497. *M. subtilis* (Fenzl.) Hand-mazz

(IT, Hemicryptophyte), (1500 and 1700 m), N36.553555, E44.873176, slopy mountain, 07.05.2017, A. Galalaey 0334, (KASOF 3320).

241. *Scleranthus* L.

498. *S. uncinatus* Schur

(IT, Therophyte), (1100, 1300, 1400, 1500, 1600 and 2000 m), N36.566615, E44.929495, mountain slope, 11.05.2016, A. Galalaey 0335, (KASOF 3321).

Figure 4.102. *Scleranthus uncinatus*

242. *Silene* L.

499. *S. rhynchocarpa* Boiss.

(M, Therophyte), (2300, 2700, and 3100 m), N36.598492, E44.906846, rocky mountain, 06.08.2016, A. Galalaey 0336, (KASOF 3333).

500. *S. aegyptiaca* (L.) L.subsp. *ruderalis* Coode & Cullen

(M, Therophyte), (M, Therophyte), (1000, 1100, 1200, 1300, 1400 and 1700 m), N36.598492, E44.906846, rocky mountain, 30.04.2016, 12.05.2017, A. Galalaey 0337, (KASOF 3322).

501. *S. ampullata* Boiss

(IT, Hemicryptophyte), (1300, 1400 and 2000 m), N36.571382, E44.934025, sub-alpine open area, 11.05.2016, A. Galalaey 0349, (KASOF 3323).

502. *S. longipetala* Vent

(IT, Hemicryptophyte), (1000, 1300, 2200 and 2400 m), N36.566234, E44.895117, mountain place, 20.06.2018, A. Galalaey 0338, (KASOF 3329).

503. *S. odontopetala* Fenzl

(IT, Chamaephyte), (1900, 2400, 3000, 3100 and 3200 m), N36.549280, E44.978736, alpine zone, 07.08.2016, A. Galalaey 0339, (KASOF 3332).

Figure 4.103. *Silene odontopetala*

504. *S. microphylla* Boiss.

(IT, Hemicryptophyte), (2600, 2700 and 3100 m), N36.571083, E44.945398, mountains and rocky areas, 07.08.2016, A. Galalaey 0340, (KASOF 3330).

505. *S. dichotoma* Ehrh

(IT, Hemicryptophyte), (1200 and 1500 m), N36.596511, E44.876153, hill side, 14.07.2018, A. Galalaey 0341, (KASOF 3326).

506. *S. latifolia* Poir. subsp. *alba* (Mill.) Greuter & Burdet

(IT.M.ES, Hemicryptophyte), 1000 m. N36.605251, E44.830575, open forest, 22.04.2016, A. Galalaey 0342, (KASOF 3328).

507. *S. spergulifolia* (Desf.) Bied.

(IT, Therophyte), 1500 m, N36.591188, E44.884840, stony and rock mountain slopes, 22.05.2016, A. Galalaey 0343, (KASOF 3335).

508. *S. eriocalycina* Boiss.

(IT, Hemicryptophyte), (1400, 1700, 1900, 2000 and 2700 m), N36.568097, E44.943149, alpine zone, 07.07.2018, A. Galalaey 0345, (KASOF 3327).

509. *S. conoidea* L.

(IT, Therophyte), 1500 m, N36.594195, E44.878319, open area, 10.07.2015, A. Galalaey 0344, (KASOF 3325).

510. *S. chlorifolia* Sm.

(IT, Hemicryptophyte), 1500 m, N36.559051, E44.857471, mountain area, 02.05.2016, A. Galalaey 0347, (KASOF 3324).

511. *S. retinervis* Ghaz

(IT, Hemicryptophyte), (3000 and 3100 m), N36.549280, E44.978736, alpine zone, 07.08.2016, A. Galalaey 0346, (KASOF 3334), **Endemic**, IUCN: NE.

Figure 4.104. *Silene retinervis*

512. *S. microsperma* Fenzl

(IT.M.ES, Hemicryptophyte), 1400 m, N36.598492, E44.906846, rocky mountain, 30.04.2016, A. Galalaey 0348, (KASOF 3331).

243. *Stellaria* L.

513. *S. media* (L.) Vill.

(Cosm, Therophyte), (1400 and 1500 m), N36.596270, E44.908627, wet place, 18.07.2015, A. Galalaey 0350, (KASOF 3336).

514. *S. pallida* (Dumort.) Crép.

(IT.ES, Therophyte), (1000 and 1200 m), N36.605458, E44.901800, oak forest, 16.05.2017, A. Galalaey 0351, (KASOF 3337).

244. *Gypsophila* L.

515. *G. polyclada* Fenzl ex Boiss.

(IT, Hemicryptophyte), (1100, 1200, 1800 and 1900 m), N44.552972, E44.875862, rocky mountain, 09.05.2016, A. Galalaey 0352, (KASOF 3314).

516. *G. nabelekii* Schischk.

(IT, Chamaephyte), (2500, 2700, 2800, 3000 and 3200 m), N44.552972, E44.875862, rocky mountain, 09.05.2016, A. Galalaey 0355, (KASOF 3313).

Figure 4.105. *Gypsophila nabelekii*

517. *G. caricifolia* Boiss.

(IT, Hemicryptophyte), 2300 m, N36.568365, E44.894837, rocky mountain slopes, 15.05.2016, A. Galalaey 0358, (KASOF 3312).

245. *Vaccaria* wolf.

518. *V. hispanica* (Miller) Rauschert

(Cosm, Therophyte), (1000, 1200 and 1300 m), N36.575919, E44.836606, oak forest area, 24.04.2016, A. Galalaey 0353, (KASOF 3338).

519. *V. pyramidata* medic

(IT, Therophyte), (1100 and 1200 m), N36.581437, E44.828822, open foerst area, 09.05.2016, A. Galalaey 0354, (KASOF 3339).

246. *Herniaria* L.

520. *H. glabra* L.

(PL, Hemicryptophyte), 1800 m, N36.573635, E44.922549, rocky place, near mine land to road Cholparistan, 06.05.2016, A. Galalaey 0356, (KASOF 3315).

247. *Velezia* L.

521. *V. rigida* L.

(IT.M, Therophyte), (1300, 1600 and 1700 m), N36.548223, E44.869623, among coppiced oak on limestone, 26.04.2016, A. Galalaey 0357, (KASOF 3340).

Figure 4.106. *Velezia rigida*

64. Amaranthaceae Juss.

248. *Amaranthus* L.

522. *A. hybridus* subsp. *cruentus* (L.) Thell

(PL, Therophyte), 1000 m, N36.602586, E44.824746, wet place (Merga), 27.04.2017, A. Galalaey 0017, (KASOF 2999).

523. *A. retroflexus* L.

(IT.M, Therophyte), (1100 and 1300 m), N36.611237, E44.870634, shade of *Quercus infectoria* by a stream, 19.04.2016, A. Galalaey 0018, (KASOF 3000).

249. *Atriplex* L.

524. *A. lasiantha* Boiss.

(IT, Therophyte), (1000, and 1200 m), N36.609051, E44.840214, moist place in open forest, 18.04.2017, A. Galalaey 0019, (KASOF 3001).

250. *Bassia* All.

525. *B. scoparia* (L.) A. J. Scott

(IT.M, Therophyte), 1600 m, (only in Sakran village, N36.583641, E44.921596

28.04.2017, A. Galalaey 0020, (KASOF 3002).

251. *Blitum* L.

526. *Blitum virgatum* L. (**syn.** *Chenopodium foliosum* Asch)

(IT, Therophyte), (1900, 2000, 2200, 2300, 2500, 3000, 3100 and 3200 m), N36.545872, E44.982902, high mountain region, 06-07.08.2016, A. Galalaey 0021, (KASOF 3003).

Figure 4.107. *Blitum virgatum*

252. *Chenopodium* L.

527. *C. album* L. subsp. *album*

(IT.M, Therophyte), (1000, 1100, 1200 and 1500 m), N36.596270, E44.908627, wet place near Sakran village, 18.07.2015, A. Galalaey 0022, (KASOF 3004).

528. *C. urbicum* L.

(IT, Therophyte), 1200 m, N36.563003, E44.835044, degraded hillsides, 16 04 2017, A. Galalaey 0023, (KASOF 3005).

65. Portulacaceae Juss.

253. *Portulaca* L.

529. *P. oleracea* L.

(Cosm, Therophyte), 1200 m, N36.603261, E44.857452, oak forest, 05.05.2016, A. Galalaey 0734, (KASOF 3713).

ASTERIDS

Cornales Link

66. Cornaceae Bercht. & J.Presl

.**254. *Cornus* L.**

530. *C. sanguinea* L. subsp. *australis* (C.A. Mey.) Jáv.

(IT.ES, Phanerophyte (nPh), 1200 m) N36.564597, E44.839771, near spring stream, 16.04.2017, A. Galalaey 0370, (KASOF 3355).

Ericales Bercht. & J.Presl

67. Ebenaceae Geurke

255. *Diospyros* L.

531. *D. kaki* L.

(Cosm, Phenarophyte), 1200 m, N36.606780, E44.885390, oak forest (near field), 02.05.2017, A. Galalaey 0395, (KASOF 3377).

68. **Primulaceae** Batsch ex Borkh.

256. *Androsace* L.

532. A. *maxima* L.

(IT.M.ES.SS, Therophyte), (1000 and 1100 m), N36.591341, E44.824195, open hillside, 29.04.2016, A. Galalaey 0735, (KASOF 3714).

257. *Primula* L.

533. *P. auriculata* Lam

(IT, Hemicryptophyte), (1800, 1900, 2000, 2100, 2300, 2500, 2600 and 2800 m), N36.562440, E44.989504, in wet places on marshy turf, wet grassy places by a spring, 19.06.2018. A. Galalaey 0736, (KASOF 3715).

Figure 4.108. *Primula auriculata*

258. *Anagallis* L.

534. *A. arvensis* L.

(Cosm. Therophyte), (1000, 1100, 1200 and 1600 m), N36.581437, E44.828822, open forest area, 09.05.2016, A. Galalaey 0737, (KASOF 3716).

69. Actinidiaceae Gilg & Werderm.

259. *Actinidia* Lindl

535. *A. deliciosa* (A. Chev.) C.F. Liang & A.R. Ferguson

(Scom, Phanaerophyte (MSPH), 1600 m, N36.556059, E44.862555, orchard (open forest area), 07.05.2016 and 20.04.2017, A. Galalaey 0003, (KASOF 2985).

Figure 4.109. *Actinidia deliciosa*

Gentianales Juss. ex Bercht. & J.Presl

70. Rubiaceae Juss.

260. *Asperula* L.

536. *A. arvensis* L.

(IT, Therophyte), (1000, 1100, 1200, 1300, 1400 and 1500 m), N36.585092, E44.820284, lower mountain slopes and valleys, in a heavy on calcareous soil, 20.04.2017, A. Galalaey 0808, (KASOF 3787).

537. *A. glomerata* (M. Bieb.) Griseb

(IT, Champhyte), (1200, 1300 and 1400 m), N36.598725, E44.876665, rocky mountain slopes and scree, 04.05.2017, A. Galalaey 0810, (KASOF 3789).

538. *A. laxiflora* Boiss.

(IT, Therophyte), (2600 and 2700 m), N36.573613, E44.943473, in the mountains, on rocky limestone cliffs, stony places in dry stream, 06.08.2016, A. Galalaey 0809, (KASOF 3788).

539. *A. orientalis* Boiss. et Hoh.

(IT, Therophyte), 1700 m, N36.569932, E44.856831, open forest, 09.05.2016, A. Galalaey 0811, (KASOF 3790).

261. *Callipeltis* Steven

540. *C. cucullaria* (L.) DC.

(IT, Therophyte), (1000, 1100, 1300, and 1600 m), N36.577203, E44.921605, rocky place, 25.04.2016, A. Galalaey 0812, (KASOF 3791).

262. *Crucianella* L.

541. *C. gilanica* Trin. subsp. *glauca* (A. Rich, ex DC.) Ehrend

(IT, Hemicryptophyte), (1700, and 2300 m), N36.575349, E44.912545, rocky mountain slopes, on limestone, 11.05.2017, A. Galalaey 0813, (KASOF 3792).

263. *Cruciata* Mill.

542. *C. taurica* (Pallas ex. Willd.) subsp. *pérsica* (DC.) Ehrend.

(IT, Hemicryptophyte), (1300, 1500, 1700, 2000, 2400, and 2700 m), N36.574522, E44.941584, in the mountains, on rocky slopes, on limestone, in oak forest, 23.07.2018, A. Galalaey 0814, (KASOF 3793).

264. *Galium* L.

543. *G. aparine* L.

(IT.M.ES, Therophyte), (1000, 1100, 1300, 1500, and 1600 m), N36.585092, E44.820284, under shade in oak forest, among coppiced oak on limestone, 20.04.2017, A. Galalaey 0815, (KASOF 3794).

544. *G. consanguineum* Boiss.

(IT, Hemicryptophyte), (2400 and 2300 m), N36.570241, E44.938870, in the mountains, on rocky limestone cliffs, 11.05.2017, A. Galalaey 0816, (KASOF 3795).

545. *G. kurdicum* Boiss. & Hoh

(IT.M.ES, Hemicryptophyte), 2400 m, N36.559775, E44.919444, shady limestone cliffs, crannies in limestone crags above the tree line, on a rocky slope by waterfall, near spring, 19.07.2017, A. Galalaey 0817, (KASOF 3796).

546. *G. mite* Boiss. & Hoh.

(IT, Champhyte), (2000 and 1500 m), 36.597018, E44.894935, in the mountains in destroyed oak forest on limestone slopes, 23.04.2016, A. Galalaey 0818, (KASOF 3797).

547. *G. setaceum* Lam.

(IT, Hemicryptophyte), (1000, 1100, 1300, 1500, 1600 and 1800 m), N36.577203, E44.921605, in the mountains, on damp shady limestone rocks, on cliffs in gorges in the mountains, 25.04.2016, A. Galalaey 0819, (KASOF 3798).

548. *G. spurium* L. subsp. *spurium*

(IT. SS, Therophyte), (1000, 1500, and 1800 m), N36.575228, E44.929432, valley near water stream, hillside, 08.05.2017, A. Galalaey 0820, (KASOF 3799).

549. *G. tricornutum* Dandy

(IT, Hemicryptophyte), (1000, 1300, and 1600 m), N36.599791, E44.888460, oak forest area, 04.05.2017, A. Galalaey 0821, (KASOF 3800).

550. *G. psilophyllum* Ehrend. & Schönb.-Tem.

(IT, Hemicryptophyte), 2400 m, N36.588544, E44.989099, rocky mountain slopes and screes, near a stream, in a rocky valley, 06.08.2016, A. Galalaey 0823, (KASOF 3801).

265. *Rubia* L.

551. *R. tinctorum* L.

(IT, Cryptophyte-Geophyte (rhizome), (1400, and 1600 m), N36.596393, E44.9066601, in orchard hedges and ditches on the lower mountains, 30.04.2016 and 02.05.2017, A. Galalaey 0822, (KASOF 3802).

266. *Sherardia* L.

552. *S. arvensis* L.

(IT.M, Therophyte), (1000, 1100 and 1300 m), N36.582410, E44.827072, in the lower mountains, in meadows and on grassy slopes, 20.04.2016, A. Galalaey 0824, (KASOF 3803).

71. Gentianaceae Juss.

267. *Centaurium* Hill.

553. *C. pulchellum* (Sw) Druce

(PL, Therophyte), 1300 m, N36.602108, E44.897430, mountain slopes, moist place near water. 04.05.2017, road between Goronia and Nawbarga wet place, A. Galalaey 0507, (KASOF 3480).

268. *Gentiana* L.

554. *G. olivieri* Griseb.

(IT, Cryptophyte-Geophyte), (1000, 1100, 1200, 1300, 1400 and 1700 m), N36.594109, E44.903336, on rocks, in damp alpine pastures near mountain summits, 29.04.2016, A. Galalaey 0508, (KASOF 3481).

555. *G. verna* L.

(IT, Cryptophyte-Geophyte), 3000 m, N36.548603, E44.975657, on rocks, in damp alpine pastures near mountain summits, 07.08.2016, A. Galalaey 0505, (KASOF 3482).

269. *Swertia* L.

556. *S. longifolia* Boiss

(IT, Hydrophyte), (2300, 2600 and 2800 m), N36.568091, E44.941546, rocky mountain slopes, near stream, 22.07.2017, A. Galalaey 0506, (KASOF 3483).

Figure 4.110. *Swertia longifolia*

72. Apocynaceae Juss.

270. *Nerium* L.

557. *N. oleander* L.

(IT, Phanaerophyte, Mcph), (1000, 1100 and 1200 m), N36.605848, E44.898752, in mountain valleys by streams, 03.05.2017, A. Galalaey 0073, (KASOF 3055).

271. *Periploca* Tourn. ex. L.

558. *P. graeca* L.

(IT.M.ES, Phanaerophyte, Lian), (1100, 1200 and 1300 m), N36.599791, E44.888460, in the mountains, climbing over bushes and plane trees along stream-sides, 04.05.2017, A. Galalaey 0074, (KASOF 3056).

Figure 4.111. *Periploca graeca*

272. *Vinca* L.

559. *V. herbacea* Waldst. et Kit.

(IT.M.ES, Hemicryptophyte), (1000, 1100, 1200, 1600 and 1700 m), N36.585662, E44.900485, rocky mountainsides, on limestone with coppiced oak, 22.05.2015, A. Galalaey 0075, (KASOF 3057).

Boraginales Juss. ex Bercht. & J.Presl

73. Boraginaceae Juss.

273. *Alkanna* Tausch.

560. *A. trichophila* Hub.-Mor. var. *trichophila*

(IT, Hemicryptophyte), 1100 m, N36.612547, E44.869024, on the mountains, on rocky slopes, in rocky ravine, 13 04 2016, A. Galalaey 0208, (KASOF 3190).

274. *Anchusa* L.

561. *A. aucheri* A.DC

(IT, Therophyte), (1200, 1300 and 1400 m), N36.592240 E44.857150, stony hillsides, in oak forests, 14.05.2017, A. Galalaey 0211, A. Galalaey 0211, (KASOF 3193).

562. *A. azurea* Mill.

(IT.M.ES, Hemicryptophyte), (1000, 1200 and 1400 m), N36.601187, E44.852861, in the mountains among coppiced oak on limestone, 10.04.2017, A. Galalaey 0209, (KASOF 3191).

563. *A. strigosa* Labill. subsp. *macrophylla* (Bornm.) H. Riedl

(PL, Hemicryptophyte), (1000, 1100, 1200, 1300 and 1500 m), N36.594195, E44.878319, rocky mountain slopes and screes, in forest clearings, on stony red soil and clay, 10.07.2015, A. Galalaey 0210, (KASOF 3192).

275. *Asperugo* L.

564. *A. procumbens* L.

(PL, Therophyte, weed), (1000, 1100, 1300 and 1400 m), N36.600109, E44.824846, moist place, under trees in forest, 27.04.2017, A. Galalaey 0212, (KASOF 3194).

276. *Brunnera* Steven

565. *B. orientalis* (Schenk) I.M. Johnst.

(IT.M, Hemicryptophyte), (1100 and 1600 m), N36.593074, E44.917639, oak forest with rocky shady place, 15.05.2015, 10.05.2016 and 28.04.2017, A. Galalaey 0213, (KASOF 3195).

277. *Cerinthe* L.

566. *C. minor* L.

(IT.ES, Hemicryptophyte), 1500 m, N36.597018, E44.894935, rocky mountains, on limestone, 23 04 2016, A. Galalaey 0214, (KASOF 31906).

278. *Cynoglossum* L.

567. *C. creticum* Mill.

(IT.M.ES, Hemicryptophyte), 1100 m, N36.605258, E44.845887, open forest, 16.04.2016 and 12.05.2017, A. Galalaey 0215, (KASOF 3197).

279. *Echium* L.

568. *E. italicum* L. var. *italicum*

(IT.M.ES, Hemicryptophyte), (1000, 1100, 1200, 1300 and 1400 m), N36.597228, E44.881666, coppiced oak, on limestone, 19.04.2016, A. Galalaey 0216, (KASOF 3198).

Figure 4.112. *Echium italicum* var. *italicum*

280. *Heliotropium* L.

569. *H. lasiocarpum* Fisch. & C.A. Mey.

(IT, Hemicryptophyte), 2100 m, N36.578727 E44.934033, stony place of overgrazed slopes near village, 20.05.2017, A. Galalaey 0217, (KASOF 3199).

570. *H. noeanum* Boiss. var. *noeanum*

(IT, Therophyte), (1000, 1100 and 1200 m), N36.582410, E44.827072, on the lower mountains, in valleys, among denuded *Quercus* forest, 15.07.2015, A. Galalaey 0218, (KASOF 3200).

281. *Lappula* (Ledeb.) Gürke.

571. *L. microcarpa* (Ledeb.) Gürke.

(IT.SS, Therophyte), 1700 m, N36.588951, E44.880196, rocky mountain sides, 15.05.2016, A. Galalaey 0219, (KASOF 3201).

282. *Lithospermum* L.

572. *L. arvense* L.

(IT.ES, Hemicryptophyte, weed), 1100 m, N36.561543, E44.823259, open forest area, 22.04.2017, A. Galalaey 0220, (KASOF 3202).

283. *Myosotis* L.

573. *M. alpestris* F.W. Schmidt

(IT.ES, Hemicryptophyte), (2800, 2900 and 3200 m), N36.561820, E44.988564, high mountain grassy and rocky place, 06-07.08.2016, A. Galalaey 0221, (KASOF 3203).

574. *M. minutiflora* Boiss. et Reuter

(M, Therophyte), (2000 and 2200 m), N36.573131, E44.891203, mountain slope in wet places on marshy turf, wet grassy places, 03.05.2017, A. Galalaey 0222, (KASOF 3204).

Figure 4.113. *Myosotis minutiflora*

575. *M. diminuta* Grau ex H. Riedl.

(IT.ES, Therophyte), (2600, 2800, 3000 and 3100 m), N36.549280, E44.978736, wet place on rocky mountain slope, 06-07.08.2016, A. Galalaey 0223, (KASOF 3205).

284. *Nonea* Medik.

576. *N. persica* Boiss.

(IT, Hemicryptophyte), 1100 m, N36.581861, E44.828837, oak forest, 20.04.2016, A. Galalaey 0224, (KASOF 3206).

577. *N. pulla* (L.) DC. subsp. *macrantha* H. Ried

(IT.M.ES, Hemicryptophyte), 2100 m, N36.568653, E44.934139, rocky mountain slope, 11.05.2017, A. Galalaey 0225, (KASOF 3207).

578. *N. pulla* (L.) DC. subsp. *monticola* Rech.

(IT.M.ES, Hemicryptophyte), 2900 m, N36.570732, E44.948380, high rocky mountain, 07.08.2017, A. Galalaey 0226, (KASOF 3208).

285. *Omphalodes* Mill.

579. *O. luciliae* Boiss. subsp. *kurdica* Rech

(IT, Hemicryptophyte), (2400 and 2800 m), N36.588544, E44.989099, rocky mountain slope cliffs, 06.08.2016, A. Galalaey 0227, (KASOF 3209).

Figure 4.114. *Omphalodes luciliae* subsp. *kurdica*

286. *Onosma* L.

580. *O. albo-roseum* Fisch. & C.A.Mey. var. *albo-roseum*

(IT, Hemicryptophyte), (1100, 1200, 1400 and 1500 m), N36.600688, E44.899043, rocky mountain slopes, in oak forest and scrub, on limestone, 29.04.2017, A. Galalaey 0228, (KASOF 3210).

581. *O. haussknechtii* Bornm.

(IT, Hemicryptophyte), (1900 and 2100 m), N36.546486, E44.930547, dry stony and rocky mountain slopes, in oak forest and scrub, on limestone. 11.05.2017, A. Galalaey 0229, (KASOF 3211), **Endemic**, IUCN: NE.

582. *O. orientale* (L.) L.

(IT.M, Hemicryptophyte), 1900 m, N36.579510, E44.927564, rocky place, 10.05.2017, A. Galalaey 0230, (KASOF 3212).

287. *Paracaryum* Hausskn. ex Bornm.

583. *P. sintenisii* Hausskn. ex Bornm.

(IT, Hemicryptophyte), 1400 m, N36.590922, E44.854584, hillside, 14.05.2017, A. Galalaey 0231, (KASOF 3213).

288. *Phyllocara* Gușul.

584. *P. aucheri* (A. DC.) Guşul.

(IT.M.ES, Hemicryptophyte), 1400 m., N36.598725, E44.876665, rocky mountain slopes, on limestone, 04.05.2017, A. Galalaey 0232, (KASOF 3214).

Figure 4.115. *Phyllocara aucheri*

289. *Rochelia* Roem. & Schult.

585. *R. cardiosepala* Bunge

(IT.ES, Therophyte), (1900 and 2300 m), N36.568365, E44.894837, rocky mountain slope, 15.05.2016, A. Galalaey 0233, (KASOF 3215).

586. *R. disperma* (L.f.) K. Koch

(IT, Therophyte), 1300 m, N36.575324, E44.836646, oak forest hillside, 23.04.2017, A. Galalaey 0234, (KASOF 3216).

Figure 4.116. *Rochelia disperma*

290. *Solenanthus* Ledeb.

587. *S. circinatus* Ledeb.

(IT, Hemicryptophyte), (`1900, 2000, 2100 and 2300 m), N36.571382, E44.934025, grassy places on rocky mountain slopes, in denuded forest on limestone, 08.06.2017, A. Galalaey 0235, (KASOF 3217).

291. *Symphytum* L.

588. *S. kurdicum* Boiss. & Hausskn.

(IT, Hemicryptophyte), (1300, 1500, 1600, 1700 and 2100 m), N36.559220, E44.864182, rocky mountain slopes, in denuded forest on limestone, under the shade of a sandstone ledge in a valley, 07.05.2017, A. Galalaey 0236, (KASOF 3218).

Solanales Juss. ex Bercht. & J.Presl

74. Convolvulaceae Juss.

292. *Calystegia* R.Br.

589. *C. sepium* (L.) R.Br.

(Scosm, Cryptophyte-Geophyte (Rhizome), 1200 m, N36.612723, E44.886962, riparian zone, 24.06.2018, A. Galalaey 0367, (KASOF 3349).

Figure 4.117. *Calystegia sepium*

293. *Convolvulus* L.

590. *C. arvensis* L.

(Cosm, Hemicryptophyte), (1000, 1400 and 1500 m), N36.596270, E44.908627, lower mountain valley sides, wasteland by fields, orchards, ditches and canal banks, 18.07.2015, A. Galalaey 0368, (KASOF 3350)..

591. *C. scammonia* L.

(IT.M, Hemicryptophyte), 1200 m, N36.605458, E44.901800, moist places, rock-cleft by spring, shady thicket by stream, 12.06.2018, A. Galalaey 0369, (KASOF 3351).

294. *Cuscuta* L.

592. *C. kurdica* Engelm.

(IT, Therophyte), (1200 and 1400 m), N36.598725, E44.876665, in the lower mountains and on hills, 04.05.2017, A. Galalaey 0367, (KASOF 3352).

593. *C. kotschyana* Boiss.

(IT, Therophyte), 1000 m, N36.593265, E44.825577, oak coppies, 29.07.2018, A. Galalaey 0368, (KASOF 3353).

594. *C. babylonica* Aucher ex Choisy

(IT, Therophyte), 1000 m, N36.609493, E44.843427, open forest / among denuded *Quercus* forest near water. 29.04.2017, A. Galalaey 0369, (KASOF 3354).

75. Solanaceae Juss.

295. *Datura* L.

595. *D. stramonium* L.

(Scom, Therophyte), (1100 and 1200 m), N36.611237, E44.870634, waste places, by roadsides, among ruins and near habitations, 19.04.2016, A. Galalaey 0846, (KASOF 3825).

296. *Hyoscyamus* L.

596. *H. reticulatus* L.

(IT, Therophyte), (1500, 1900, 2000, 2400, 2500, and 2700) m., N36.565320, E44.896907, in the mountains on stony slopes, on clay between rocks, 03.07.2017, A. Galalaey 0847, (KASOF 3826).

Figure 4.118. *Hyoscyamus reticulatus*

297. *Physalis* L.

597. *P. divaricata* D. Don

(IT, Therophyte), (1200 and 1300 m), N36.606780, E 44.885390, under shade in oak forest, among coppiced oak on limestone, 20.05.2016, A. Galalaey 0848, (KASOF 3827).

298. *Solanum* L.

598. *S. luteum* Mill.

(IT, Therophyte), 1200 m, N36.605458, E44.901800, near streams in oak forest.12.05.2016 and 08.05.2017, A. Galalaey 0849, (KASOF 3828).

599. *S. nigrum* L.

(Cosm, Therophyte), (1200 and 1500 m), N36.596270, E44.908627, wet place, 18.07.2015, A. Galalaey 0850, (KASOF 3829).

Lamiales Bromhead

76. Oleaceae Hoffmanns. & Link

299. *Fraxinus* L.

600. *F. syriaca* tom

(IT.M, Phenarophyte, Msph), (1100, 1200 and 1300 m), N36.587333, E44.839055, riparian zone, 05.05.2017, A. Galalaey 0609, (KASOF 3584).

300. *Olea* L.

601. *O. europaea* L.

(PL, Phenarophyte, Mcph), 1200 m, N36.606780, E44.885390, open forest area, 20.05.2016, 27.04.2016 and 11.05.17, A. Galalaey 0610, (KASOF 3585).

77. Plantaginaceae Juss.

301. *Linaria* Mill.

602. *L. chalepensis* (L.) Mill.

(IT, Hemicryptophyte), (1000, 1100, 1300 and 1700 m), N36.549899, E44.873637, on a rocky mountain slope in oak forest, 24.04.2016, A. Galalaey 0656, (KASOF 3635).

603. *L. kurdica* Boiss. & Hohen.

(IT, Hemicryptophyte), (1700, 2200 and 2400 m), N36.587190, E 44.923528, rocky mountain slopes, in oak scrub, 03.5.2017, A. Galalaey 0657, (KASOF 3636).

Figure 4.119. *Linaria kurdica*

302. *Plantago* L.

604. *P. atrata* Hoppe

(IT.ES, Hemicryptophyte), (2700, 2900, 3000, 3100 and 3200 m), N36.545872, E44.982902, high mountain alpine region, surrounding BeiKodian lake, 06.08.2016, 07.08.2016, 20.07.2018 and 18.06.2017, A. Galalaey 0645, (KASOF 3625).

605. *P. lanceolata* L.

(PL, Hemicryptophyte), (1000, 1100, 1200, 1500 and 1800 m), N36.581661, E44.852825, open forest area, 25 04 2016, A. Galalaey 0646, (KASOF 3626).

606. *P. major* L.

(Cosm, Hemicryptophyte), (1000, 1100, 1200 and 1300 m), N36.605458, E44.901800, by mountain streams in shady forested valleys, 08.05.2017 and 12.05.2016, A. Galalaey 0647, (KASOF 3627).

607. *P. lagopus* L.

(IT.ES.SS, Therophyte), 1000 m, N36.593265, E44.825577, lower mountain slopes on limestone, stony foothills, 29.04.2017, A. Galalaey 0648, (KASOF 3628).

303. *Veronica* L.

608. *V. beccabunga* L.

(IT, Hemicryptophyte), (1900, 2300, 2600, 2800, 2900, 3000, 3100 and 3200 m), N36.545415, E44.983497, high rocky mountain slopes, often by springs or streams, 06.08.2026, A. Galalaey 0649, (KASOF 3629).

Figure 4.120. *Veronica beccabunga*

609. *V. davisii* M.A. Fischer

(IT, Hemicryptophyte), (2400 and 2700 m), N36.569285, E44.944681, high rocky mountain slopes, wet place, 07.08.2016, A. Galalaey 0652, (KASOF 3630).

Figure 4.121. *Veronica davisii*

610. *V. dillenii* Crantaz

(IT, Therophyte), 1400 m, N36.597228, E44.881666, mountain place in open area of forest, 19.04.2016, A. Galalaey 0650, (KASOF 3631).

611. *V. orientalis* Miller

(IT, Hemicryptophyte), (1400, 1500, 1900, 2000 and 2800 m), N36.572218, E44.868935, mountain slopes, in oak forest or scrub, on limestone, 7.05.2017, A. Galalaey 0651, (KASOF 3632).

612. *V. persica* L.

(IT, Therophyte), (1000 and 1700 m), N36.597192, E44.917537, rocky mountain slope in open forest, 10.05.2017, A. Galalaey 0654, (KASOF 3633).

613. *V. anagallis-aquatica* L.

(Cosm, Helophyte), (1100, 1300, 1400 and 1600 m), N36.583503, E44.867661, mountain place, near melting snow, 25.04.2016, A. Galalaey 0653, (KASOF 3634).

614. *V. viscosa* Boiss

(IT.M, Therophyte), (1300, 1500 and 2000 m), N36.596578, E44.908644, open oak forest, 29.04.2017 and 05 07 2015, A. Galalaey 0655, (KASOF 3635).

78. Scrophulariaceae Juss.

304. *Scrophularia* L.

615. *S. gracilis* Blakelock

(SS, Chamaphyte), 1700 m, N36.573903, E44.924952, rocky mountain slopes and screes, 11.5.2016, A. Galalaey 0836, (KASOF 3815).

616. *S. catariifolia* Boiss. et Heldr.

(IT, Hemicryptophyte), 1200 m., N36.605458, E44.901800, oak forest, 16.05.2017, A. Galalaey 0837, (KASOF 3816).

617. *S. pruinosa* Boiss

(IT., Hemicryptophyte), (1900, 2100, 2200 and 2400 m), N36.572218, E44.868935, sub-alpine open area, 02.05.2017, A. Galalaey 0838, (KASOF 3817).

618. *S. desertii* Delile

(SS, Chamaphyte), (1100 and 1200 m), N36.601187, E44.852861, hillside on limestone, 10 04 2017 and 20.04.2016, A. Galalaey 0844, (KASOF 3818).

619. *S. xylorrhiza* boiss. & Haurkan

(IT., Hemicryptophyte), 1600 m, N36.593074, E44.917639, oak forest with rocky place, 15.05.2015, 10.05.2016 and 28.04.2017, A. Galalaey 0839, (KASOF 3819).

620. *S. crenophila* Bmss.

(IT., Hemicryptophyte), (2000, 2200 and 2300 m), N36.572360, E44.889335, rocky place Khandan spring / Goronia area, 15.05.2016, A. Galalaey 0845, (KASOF 3820).

305. *Verbascum* L.

621. *V. pulverulentum* Vill

(IT.M, Hemicryptophyte), (1400 and 1500 m), N36.591848, E44.913070, oak forest, 12.05.2017 and 30.04.2016, A. Galalaey 0840, (KASOF 3821).

622. *V. denisiflorum* Vill.

(IT.ES, Hemicryptophyte), (1800 and 2000 m), N36.572830, E44.888718, in the mountains, in grassy slopes, on limestone, 15.05.2016, A. Galalaey 0841, (KASOF 3822).

623. *V. blattaria* L.

(IT, Hemicryptophyte), (1400, 1500 and 1600 m), N36.577203, E44.921605, in the mountains, on a rocky limestone cliff, 25.04.2016, A. Galalaey 0842, (KASOF 3823).

624. *V. macrocarpum* Boiss.

(IT, Hemicryptophyte), (1400 and 1600 m), N36.598492, E44.906846, rocky mountain slope, 12.05.2017 and 30.04.2016, A. Galalaey 0843, (KASOF 3824).

79. Acanthaceae Juss.

306. ***Acanthus*** **L**.

625. *A. dioscoridis* L.

(IT, Hemicryptophyte), (1500, 1700, 1800, 1900, 2000, 2200, 2300 and 2700 m), N36.571382, E44.934025, in the mountains, on rocky slopes, under *Quercus* forest, among *Quercus* scrub, 11.05.2016, A. Galalaey 0001, (KASOF 2983).

Figure 4.122. *Acanthus dioscoridis*

80. Verbenaceae J.St.Hil.

307. ***Verbena*** **L.**

626. *V. officinalis* L.

(Scosm, Hemicryptophyte), 1900 m, N36.570514, E44.931923, wet place, 07.08.2016, A. Galalaey 0862, (KASOF 3842).

308. ***Vitex*** **L.**

627. *V. pseudo-negundo* (Hausskn. ex Bornm.) Hand-Mazz.

(IT. SS, Phanerophyte), (1100, 1200 and 1300 m), N36.581437, E44.828822, by mountain springs, forest rivulets, water channels, 09.05.2016, A. Galalaey 0863, (KASOF 3843).

81. Lamiaceae Martinov (= Labiatae Juss.)

309. *Ajuga* L.

628. *A. chamaepitys* (L.) Schreb.

(IT, Chamaephyte), 1500 m, N36.559051, E44.857471, rocky place, 02.05.2016, A. Galalaey 0535, (KASOF 3510).

310. *Ballota* L.

629. *B. nigra* L.

(IT, Hemicryptophyte), 1700 m, N36.597192, E44.917537, damp mountain slopes, rocky water streams, 10.05.2017, A. Galalaey 0536, (KASOF 3511).

311. *Clinopodium* L.

630. *C. vulgare* L.

(IT.M.ES, Hemicryptophyte), 1200 m, N36.606780, E44.885390, mountains, grassland in oak and forest, 20.05.2016, A. Galalaey 0537, (KASOF 3512).

Figure 4.123. *Clinopodium vulgare*

312. *Eremostachys* Bunge

631. *E. molucelloides* Bunge

(IT, Hemicryptophyte), (1300, 1600 and 1700 m), N36.578347, E44.839785, dry hillside, mountain sides, between oak trees, on stony ground and between limestones. 05.5.2017, A. Galalaey 0538, (KASOF 3513).

Figure 4.124. *Eremostachys molucelloides*

632. *E. laevigata* Bunge

(IT, Hemicryptophyte), (1000, 1800, 1900 and 2000 m), N36.571382, E44.934025, sub-alpine open area, rocky mountain slopes and screes, 11.05.2016, A. Galalaey 0539, (KASOF 3514).

313. *Lallemantia* Fisch. & C.A. Mey.

633. *L. iberica* Fisch. & A.C. Mey

(IT.M.ES, Therophyte), 1300 m, N36.578347, E44.839785, in the mountains, on limestone scree, 05.05.2017, A. Galalaey 0540, (KASOF 3515).

634. *L. peltata* Fisch. & A.C. Mey

(IT, Therophyte), (1600, 1700 and 1800 m), N36.560615, E44.867797, rocky mountain slopes and screes, 09.05.2016, A. Galalaey 0541, (KASOF 3516).

Figure 4.125. *Lallemantia peltata*

314. *Lamium* L.

635. *L. album* L. subsp. *crinitum* (Montbret & Aucher) Mennema

(IT.ES, Hemicryptophyte), (1700, 1800, 1900, 2000 and 2300 m), N36.5576158, E44.872630, sub-alpine open area, timber line, 07.05.2017, A. Galalaey 0542, (KASOF 3517).

636. *L. amplexicaule* L.

(PL, Therophyte), (1000, 1100, 1200, 1300, 1400, 1500, 1600 and 1700 m), N36.597018, E44.894935, in the mountains, on rocky limestone cliffs, valley bottoms in deep oak shade, stony places in dry stream bed, 23 04 2016, A. Galalaey 0543, (KASOF 3518).

637. *L. garganicum* L. subsp. *pictum* (Boiss. & Heldr.) P.W. Ball

(IT.M, Cryptophyte), (1900, 2000, 2100, 2200, 2600, 2700 and 3000 m), N36.570438, E44.895356, in the mountains, on rocky limestone cliffs, 15.05.2016, A. Galalaey 0545, (KASOF 3519).

638. *L. tomentosum* Willd.

(IT, Hemicryptophyte), (1900, 2700, 2800, 3000 and 3100 m), N36.560227, E44.990455, in the mountains, on rocky limestone cliffs, 06-07.08.2016. A. Galalaey 0544, (KASOF 3520).

Figure 4.126. *Lamium tomentosum*

639. *L. macrodon* Boiss. & A. Huet

(IT, Therophyte), (1400, 1500, 1600, 1800, 1900, 2000, 2100, 2200, 2300, 2500 and 2600 m), N36.568816, E44.936617, rocky mountain slopes and screes, 08.05.2017, A. Galalaey 0546, (KASOF 3521).

315. *Marrubium* L.

640. *M. cuneatum* Banks & Sol.

(IT, Hemicryptophyte), (1000 and 1100 m), N36.605251, E44.830575, in the mountains in destroyed oak forest on limestone slopes, among forest trees, 22.04.2016, A. Galalaey 0549, (KASOF 3524).

641. *M. astracanicum* Jacq.

(IT, Hemicryptophyte), (2600 and 3100 m), N36.563277, E44.947345, rocky alpine slopes, on a serpentine scree, 06-07.08.2016, 14.07.2017 and 29.06.2018, A. Galalaey 0548, (KASOF 3522).

Figure 4.127. *Marrubium astracanicum*

642. *M. crassidens* Boiss. (**syn**. *Marrubium parviflorum* Fisch. & C.A. Mey.)

(IT, Hemicryptophyte), (1500, 1700, 1900 and 2200 m), N36.572218, E44.868935, rocky mountain slopes, on limestone, sometimes in open oak forest, 07.05.2017, A. Galalaey 0547, (KASOF 3523).

316. *Melissa* L.

643. *M. officinalis* L.

(PL, Hemicryptophyte), 1200 m, N36.564597, E44.839771, wet place (spring), 16.04.2017, A. Galalaey 0550, (KASOF 3525).

317. *Mentha* L.

644. *M. longifolia* (L.) L.

(PL, Hemicryptophyte), (1000, 1200, 1300, 1400, 1700, 1900, 2000, 2100, 2300 and 2600 m), N36.573131, E44.891203, by streams, on river banks, in moist places, in oak forest, muddy seepages. 03.05.2017, A. Galalaey 0551, (KASOF 3526).

318. *Micromeria* Benth.

645. *M. juliana* Sasal

(IT.M, Hemicryptophyte), 1700 m, N36.559220, E44.864182, in crevices of rocks and cliffs, on slopes of limestone mountains, 07.05.2017, A. Galalaey 0552, (KASOF 3527).

646. *M. myrtifolia* Boiss. & Hohen.

(IT, Hemicryptophyte), (1400 and 1600 m), N36.577203, E44.921605, mountain rocky slope, 25.04.2016, A. Galalaey 0553, (KASOF 3528).

319. *Nepeta* L.

647. *N. racemosa* Lam. subsp. *haussknechtii* (Bornm.) A.L.Budantsev

(IT, Hemicryptophyte), 2400, 2700 and 2800 m), N36.568771, E44.943951, high rocky mountain slopy, 06.08.2016, A. Galalaey 0554, (KASOF 3529).

Figure 4.128. *Nepeta racemosa* subsp. *haussknechtii*

648. *N. nuda* L.

(IT, Chamaephyte), 2500 m, N36.567431, E44.939683, sub-alpine region, 24.06.2018, A. Galalaey 0555, (KASOF 3530).

Figure 4.129. *Nepeta nuda*

649. *N. menthoides* Boiss. & Buhse

(IT, Hemicryptophyte), (2400, 2500 and 2700 m), N36.559775, E44.919444, rocky mountain slope, 10.07.2018, A. Galalaey 0557, (KASOF 3531).

320. *Origanum* L.

650. *O. vulgare* L.

(PL, Hemicryptophyte), (1200, 1700, 1800, 1900 and 2200 m), N36.571678, E44.929423, mountain slopes and valleys, sometimes in oak forest, damp grassy places by springs and streams, 04.05.2016, A. Galalaey 0558, (KASOF 3532).

Figure 4.129. *Origanum vulgare*

321. *Phlomis* L.

651. *P. lanceolata* Boiss. & Hohen.

(IT, Hemicryptophyte), (2400 and 2800 m), N36.568896, E44.946053, rocky mountain slope, 07.08.2016, A. Galalaey 0562, (KASOF 3533).

652. *P. kurdica* Rech.f.

(IT, Hemicryptophyte), 1500 m, N36.596270, E44.908627, open mountain slopes and grassy steppic hills, 18.07.2015, A. Galalaey 0559, (KASOF 3534).

Figure 4.130. *Phlomis kurdica*

653. *P. rigida* Labill.

(IT, Hemicryptophyte), 1200 m, N36.601187, E44.852861, open area in forest, 10.04.2017. A. Galalaey 0560, (KASOF 3535).

Figure 4.131. *Phlomis rigida*

322. *Phlomoides* L.

654. *P. laciniata* (L.) Kamelin & Makhm.

(IT, Hemicryptophyte), (1400, 2100, 2200 and 2300 m), N36.570029, E44.933799, rocky mountain slopy, 11.05.2017, A. Galalaey 0561, (KASOF 3536).

323. *Prunella* L.

655. *P. vulgaris* L.

(PL, Hemicryptophyte), (1800, 2000 and 2300 m), N36.573131, E44.891203, open mountain slopes and grassy hillsides, 03.05.2017, A. Galalaey 0563, (KASOF 3537).

324. *Salvia* L.

656. *S. candidissima* Vahl.

(IT, Hemicryptophyte), 1300 m, N36.578347, E44.839785, rocky hillside, on limestone, 5.05.2017, A. Galalaey 0564, (KASOF 3538).

657. *S. bracteata* Banks & Sol.

(IT, Hemicryptophyte), (1000, 1400, 1600 and 1700 m), N36.597646, E44.910874, in the mountains, on rocky slopes in oak forest, 10.05.2016, A. Galalaey 0565, (KASOF 3539).

658. *S. indica* L.

(IT.M, Hemicryptophyte), 1000 m, N36.605251, E44.830575, mountain slopes and valleys, rocky hillsides, on limestone, in oak forest, under oak shade, 11.05.2016, A. Galalaey 0566, (KASOF 3540).

659. *S. microstegia* Boiss. & Balansa

(M, Hemicryptophyte), (1900, 2000, 2100, 2200, 2300 and 2600 m), N36.568365, E44.894837, mountain slopes, on grassy limestone slope, stony hillside, 15.05.2016, A. Galalaey 0567, (KASOF 3541).

Figure 4.132. *Salvia microstegia*

660. *S. multicaulis* Vahl

(IT, Hemicryptophyte), (1000, 1100, 1300, 1400, 1500 and 1600 m), N36.574045, E44.829556, mountain slopes, in denuded oak forest, on limestone, 26.04.2017, A. Galalaey 0568, (KASOF 3542).

661. *S. palaestina* Benth.

(IT.M. SS, Hemicryptophyte), (1100 and 1200 m), N36.582410, E44.827072, mountain place, in hillside on limestone, 20.04.2016, A. Galalaey 0569, (KASOF 3543).

Figure 4.133. *Salvia palaestina*

662. *S. syrica* L.

(IT.M, Hemicryptophyte), 1300 m, N36.590557, E44.845937, oak forest, in open area, 23.04.2016, A. Galalaey 0582, (KASOF 3544).

663. *S. trichoclada* Benth.

(IT.M, Cryptophyte), (1000, 1400, 1500, 1700 and 1900 m), N36.600688, E44.899043, in the mountains, on limestone with coppiced oak, 29.04.2017, A. Galalaey 0570, (KASOF 3545).

664. *S. atropatana* Bunge

(IT.ES, Hemicryptophyte), 1900 m, N36.575821 E44.890204, mountain rocky place, on limestone, 15.05.2016, A. Galalaey 0572, (KASOF 3546).

665. *S. verbenaca* L.

(M, Hemicryptophyte), (1300 and 1700 m), N36.587687, E44.923439, grassy places on open hillsides, 10.05.2017, A. Galalaey 0583, (KASOF 3547).

666. *S. poculata* Nab

(IT, Hemicryptophyte), (2600 and 2800 m), N36.573983, E44.946355, rocky mountain slope, 07.08.2016, A. Galalaey 0571, (KASOF 3548).

325. *Scutellaria* L.

667. *S. bornmuelleri* Hausskn. ex Bornm

(IT, Hemicryptophyte), (1600, 1700, 1800 and 2100 m), N36.558832, E44.870104, dry hillside, mountain sides, between oak trees, on stony ground and between limestones, 09.05.2016, A. Galalaey 0573, (KASOF 3549).

Figure 4.134. *Scutellaria bornmuelleri*

668. *S. pinnatifida* A. Ham. subsp. *alpina* (Boiss.) Rech.f.

(IT, Hemicryptophyte), (2200, 2600 and 3100 m), N36.571492, E44.943820, rocky mountain slopes and screes, 06.08.2016, A. Galalaey 0574, (KASOF 3550).

Figure 4.135. *Scutellaria pinnatifida* subsp. *alpina*

669. *S. condensata* Rech.

(IT, Hemicryptophyte), 1400 m, N36.596779, E44.900584, in the mountains, on open rocky slopes, among oak scrub, 27.04.2017, A. Galalaey 0575, (KASOF 3551).

326. *Sideritis* L.

670. *S. montana* L.

(IT.M.ES, Therophyte), 1200 m., N36.603261, E44.857452, oak forest, 05.05.2016, A. Galalaey 0576, (KASOF 3552).

Figure 4.136. *Sideritis montana*

327. *Stachys* L.

671. *S. kurdica* Boiss.

(IT, Hemicryptophyte), (1700, 2000, 2400 and 2700 m), N36.572360, E44.889335, rocky mountain slopes, on limestone, 15.05.2016, A. Galalaey 0577, (KASOF 3553).

672. *S. lavandulifolia* Vahl

(IT, Chamaephyte), (1300, 1600, 1700, 1900, 2200 and 2500 m), N36.580531, E44.941096, stony mountain slopes, on metamorphic rocks, 15.05.207, A. Galalaey 0578, (KASOF 3554).

673. *S. annua* (L.) L. (**syn.** *Stachys pubescens* Ten)

(IT.M, Hemicryptophyte), (1500, 1800 and 1900 m), N36.571678, E44.929423, rocky place, 04.05.2016, A. Galalaey 0579, (KASOF 3555).

328. *Teucrium* L.

674. *T. lamiifolium* d'Urv.

(M, Therophyte), (1000 and 2100 m), N36.604044, E44.827745, open forest high density of *Q. infectoria*, 22.04.2016, A. Galalaey 0584, (KASOF 3556).

675. *T. polium* L var. *tonsum* Stapf

(IT.M, Hemicryptophyte), (1000, 1100, 1500, 1700 and 2000 m), N36.560929, E44.855877, hillsides and valleys in the mountains, 02.05.2016, A. Galalaey 0585, (KASOF 3557).

329. *Thymus* L.

676. *T. eriocalyx* (Ronniger) Jalas

(IT.M, Chamaephyte), (1800, 2000, 2100, 2300, 2400, 2500 and 2700 m), N36.573131, E44.891203, mountain slopes, sub-alpine summit, 03.05.2017, A. Galalaey 0586, (KASOF 3558).

330. *Ziziphora* L.

677. *Z. capitata* L. subsp. *orientalis* Rech. f.

(IT, Therophyte), (1000, 1100, 1200, 1300, 1400, 1600, 1700 and 2100 m), N36.600688, E44.899043, 09.04.2017, A. Galalaey 0580, (KASOF 3559).

678. *Z. clinopodioides* Lam. subsp. *kurdica* (Rech.f.) Rech.f.

(IT, Hemicryptophyte), (1900, 2000, 2100, 2400, 2600, 2900 and 3100 m), N36.550884, E44.881866, rocky mountain slope, on limestone, 16.05.2017, A. Galalaey 0581, (KASOF 3560).

82. Orobanchaceae Vent.

331. *Euphrasia* L.

679. *E. pectinata* Ten.

(IT.M.ES, Therophyte), (2300, 2400 and 2600 m), N36.574488, E44.940654, near spring and wet place, 07.08.2016, A. Galalaey 0638, (KASOF 3613).

332. *Orobanche* L.

680. *O. armena* Tzvelev

(IT, Parasitic), 2600 m, N36.565409, E44.989938, high rocky mountain slope, 06.08.2016, A. Galalaey 0633, (KASOF 3608).

681. *O. aegyptiaca* Pers.

(IT, Parasitic), 1000 m, N36.578277, E44.821573, hillside, on limestone, 29.04.2017, A. Galalaey 0629, (KASOF 3604).

682. *O. anatolica* Boiss. & Reut.

(IT.M.ES, Parasitic). (2700 and 3100 m), N36.568771, E44.943951, high rocky mountain, 07.08.2016, A. Galalaey 0631, (KASOF 3606).

683. *O. kurdica* Boiss. & Hausskn.

(IT, Parasitic), (1000, 1300, 1700, 1800 and 1900 m), N36.598971, E44.861230, mountain, oak forest coppices, on limestone, 10.04.2017, A. Galalaey 0632, (KASOF 3607).

684. O. *ramosa* L.

(IT.M.ES, Parasitic), 1200 m, N36.605458, E44.901800, oak forest coppices, on limestone, 12.05.2016 and 08.05.2017, A. Galalaey 0630, (KASOF 3605).

333. *Parentucellia* Viv.

685. *P. latifolia* Caruel subsp. *flaviflora* (Boiss.) Hand.Mzr

(IT.M, Semi-parasitic), (1000, 1100, 1300, 1400, 1500, 1700 and 1900 m), N36.588951, E44.880196, mountain rocky slope, 15.05.2016, A. Galalaey 0635, (KASOF 3610).

334. *Pedicularis* L.

686. *P. pycnantha* Boiss.

(IT.ES, Hemicryptophyte), (2000, and 2200) m., N36.566615, E44.929495, rocky mountain slopes, shady rocks, 11.05.2016, A. Galalaey 0634, (KASOF 3609).

Figure 4.137. *Pedicularis pycnantha*

335. *Rhynchocorys* Griseb.

687. *R. elephas* (L.) Griseb. subsp. *carduchorum* Burbidge & Richardson

(IT, Hemicryptophyte), (1900, 2600 and 2800 m), N36.571492, E44.943820, on the high mountains, by streams and springs, and in other moist places, 22.07.2017, A. Galalaey 0636, (KASOF 3611). **Endemic**, IUCN: EN.

Figure 4.138. *Rhynchocorys elephas* subsp. *carduchorum*

688. *R. odontophylla* Burbidge & Richardson

(IT, Hemicryptophyte), (2300, 2400, 2500 and 2600 m), N36.570141, E44.943320, rocky mountain slopy, in wet places, on limestone, 07.08.2016. A. Galalaey 0637, (KASOF 3612).

Figure 4.139. *Rhynchocorys odontophylla*

Asterales Link

83. Campanulaceae Juss.

336. *Asyneuma* Griseb. & Schenk

689. *A. limonifolium* (L.) Janchen

(IT, Cryptophyte), (2300, 2400, 2600, 2700 and 2800 m), N36.571492, E44.943820, in the mountains, on high rocky slopes, 07.08.2017, A. Galalaey 0299, (KASOF 3281).

Figure 4.140. *Asyneuma limonifolium*

337. *Campanula* L.

690. *C. involucrata* Auch. ex DC.

(IT.ES, Hemicryptophyte), (1500, 1700 and 1900 m), N36.597192, E44.917537, in the mountains, among oak trees on limestone, on stony red soil, 10.05.2017, A. Galalaey 0300, (KASOF 3282).

691. *C. sclerotricha* Boiss.

(IT.M, Hemicryptophyte), 1500 m, N36.596270, E44.908627, on the mountains in damp shady places, by streams, under *Populus* sp. shade by stream, 18.07.2015, A. Galalaey 0301, (KASOF 3283).

692. *C. stevenii* Bieb.

(IT.ES, Hemicryptophyte), (1900, 2200 and 2500 m), N36.577701, E44.942265, high mountain sides, 07.08.2017, A. Galalaey 0302, (KASOF 3284).

Figure 4.141. *Campanula stevenii*

693. *C. reuteriana* Boiss. & Balansa

(IT, Therophyte), (1100, 1200 and 1400 m), N36.606226, E44.833240, rocky mountain slopes, in oak forest and coppiced oak, on limestone, 09 05.2017, A. Galalaey 0303, (KASOF 3285).

694. *C. glomerata* L.

(IT.ES, Hemicryptophyte), 2300 m, N36.575349, E44.912545, mountain rocky slope, 11.05.2017, A. Galalaey 0304, (KASOF 3286).

695. *C. flaccidula* Vatke

(IT, Therophyte), (1400 and 1700 m), N36.591848, E44.913070, rocky slopes in the mountains, on moist shady limestone cliffs, in rock clefts and crannies, 30.04.2016, A. Galalaey 0305, (KASOF 3287).

338. *Legousia* Durande

696. *L. falcata* (Ten.) Fritsch ex Janch.

(PL, Therophyte), 1200 m, N36.606780, E44.885390, lower mountain slopes, in oak forest, 20.05.2016, A. Galalaey 0306, (KASOF 3288).

339. *Michauxia* L'Hér.

697. *M. laevigata* Vent.

(IT.ES, Hemicryptophyte), (1200, 1400, 1600, and 2000 m), N36.556571, E44.878380, rocky slopes and stony mountainsides, in oak forest, on limestone, on ledges of a limestone cliff, 05.05.2016, A. Galalaey 0307, (KASOF 3289).

Figure 4.142. *Michauxia laevigata*

84. Asteraceae Bercht. & J.Presl (= Compositae Giseke)

340. *Achillea* L.

698. *A. aleppica* DC.

(IT, Hemicryptophyte), 1500 m, N36.594195, E44.878319, rocky mountain slopes, 10.07.2015, A. Galalaey 0096, (KASOF 3078).

699. *A. arabica* Kotschy

(IT, Hemicryptophyte), (1200 and 1300 m), N36.578399, E44.835497, open oak forest, 09.05.2016, A. Galalaey 0095, (KASOF 3077).

700. *A. filipendulina* Lam.

(IT, Hemicryptophyte), (1800 and 2200 m), N36.581666, E44.871036, on mountains, on igneous and metamorphic rock, 15.05.2017, A. Galalaey 0094, (KASOF 3076).

701. *A. millefolium* L.

(IT, Hemicryptophyte), (1400 and 2300 m), N36.597228, E44.881666, wet place, 19.04.2016, A. Galalaey 0105, (KASOF 3079).

702. *A. vermicularis* Trin.

(IT.ES, Hemicryptophyte), (1500, 1900, 2000, 2400, 2500, 2700 and 2800 m), N36.568097, E44.943149, rocky place, 07.07.2018, A. Galalaey 0106, (KASOF 3080).

341. *Acroptilon* L.

703. *A. repens* (L.) DC. subsp. *australe* (Iljin) Rech.

(IT, Cryptophyte-Geophyte (rhizome), (1300 and 1400 m), N36.594109, E44.903336, mountain slopes in oak forest, rocky hillsides, 12.05.2017, A. Galalaey 0097, (KASOF 3081).

342. *Anthemis* L.

704. *A. hyalina* DC.

(IT.ES, Therophyte), 1000 m, N36.596211, E44.828586, steppic hills and plains, often in fields, 20.04.2016, A. Galalaey 0098, (KASOF 3082).

705. *A. odontostephana* Boiss.

(IT.M, Hemicryptophyte), 1200 m, N36.607816, E44.895649, rocky place, 05.05.2017, A. Galalaey 0107, (KASOF 3083).

706. *A. pseudocotula* Boiss

(IT.M, Hemicryptophyte), (1000, 1400 and 1600 m), N36.556059, E44.862555, oak forest, 07.05.2016 and 20.04.2017, A. Galalaey 0108, (KASOF 3084).

707. *A. tinctoria* L.

(IT, Hemicryptophyte), (1500, 2000 and 3100 m), N36.555248, E44.879177, rocky mountain slopes, 07.05.2017, A. Galalaey 0109, (KASOF 3085).

343. *Arctium* L.

708. *A. lappa* L.

(IT.ES, Chamaephytes), (1200 and 1500 m), N36.593360, E44.880103, oak forest, 23.04.2017 and 19.04.2016, A. Galalaey 0110, (KASOF 3086).

Figure 4.143. *Arctium lappa*

344. *Artemisia* L.

709. *A. splendens* Willd.

(IT, Chamaephytes), (2900 and 3100 m), N36.560227, E44.990455, high mountain slopes and summits, 06.08.2016, A. Galalaey 0168, (KASOF 3088).

345. *Atractylis* L.

710. *A. cancellata* L.

(M, Therophyte), 1000 m, N36.585180, E44.826974, in the mountains and rocky hillsides, 26.04.2017, A. Galalaey 0111, (KASOF 3087).

346. *Bellis* L.

711. *B. perennis* L.

(IT.M.ES, Hemicryptophyte), (1000, 1100 and 1200 m), N36.602586, E44.824746, wate place, 27.04.2017, A. Galalaey 0112, (KASOF 3089).

Figure 4.144. *Bellis perennis*

347. *Bombycilaena* (DC.) Smoljan.

712. *B. discolor* (Pers.)-M. Lainz

(IT., Therophyte), (1100, 1300 and 1600 m), N36.585862, E44.865201, mountain slopes in oak forest, rocky hillsides, 10.05.2017, A. Galalaey 0113, (KASOF 3090).

348. *Calendula* L.

713. *C. arvensis* M. Bieb

(IT.M, Hemicryptophyte), (1000, 1200 and 1700 m), N36.588951, E44.880196, in the mountains and foothills, often by springs or streams, 15.05.2016, A. Galalaey 0114, (KASOF 3096).

349. *Carduus* L.

714. *C. pycnocephalus* L. subsp. *arabicus* (Jacq. ex Murray) Nyman

(IT.M, Therophyte), (1000, 1100, 1200, 1300, 1400 and 1700 m), N36.598492, E44.906846, rocky mountain, 30.04.2016 and 12.05.2017, A. Galalaey 0116, (KASOF 3095).

350. *Carthamus* L.

715. *C. dentatus* Vahl.

(IT, Therophyte), 1100 m, N36.585092, E44.820284, in the lower mountains, in dry roadsides, 20.04.2016, A. Galalaey 0099, (KASOF 3091).

716. *C. glaucus* M. Bieb.

(IT, Therophyte), (1100, 1300 and 1700 m), N 36.600476, E44.902540, in the lower mountains, foothills and upper plains, 23.04.2016, 28.04.2017 and 14.07.2018, A. Galalaey 0117, (KASOF 3092).

717. *C. lanatus* L.

(IT, Therophyte), (1000 and 1200 m), N36.585092, E44.820284, cultivated hillsides and dry roadsides, 20.04.2017, A. Galalaey 0118, (KASOF 3093).

718. *C. oxycantha* M. Bieb.

(IT. SS, Therophyte), (1000, 1100, 1200 and 1300 m), N36.593265, E44.825577, oak copies, stony hillsides, on limestone slopes, 29.04.2017, A. Galalaey 0119, (KASOF 3094).

351. *Cephalorrhynchus* (Steven) Schchian.

719. *C. tuberosus* (Steven) Schchian.

(IT.M, Hemicryptophyte), (1100, 1400, 1500 and 2000 m), N36.581861, E44.828837, mountain rocky places, 05.05.2017, A. Galalaey 0115, (KASOF 3097).

352. *Centaurea* L.

720. *C. aggregata* Fisch. & C. A. Mey.

(IT, Hemicryptophyte), (1100 and 1900 m), N36.579510, E44.927564, dry place on hillside, open oak forest, 10.05.2016, A. Galalaey 0120, (KASOF 3098).

721. *C. behen* L.

(IT, Hemicryptophyte), (1000, 1400, 1500, 1800 and 1900 m), N36.592832, E44.881817, foothills, 07.05.2017, A. Galalaey 0123, (KASOF 3102).

722. *C. benedicta* (L.) L.

(IT.M.ES, Therophyte), (1100 and 1300 m), N36.580440, E44.837788, oak forest, 23.04.2016, A. Galalaey 0137, (KASOF 3099).

723. *C. iberica* Trev. ex Sprengel

(IT.M.ES, Hemicryptophyte), (1000, 1100, 1200 and 2400 m), N36.578399, E44.835497, fields and near water channels, 09.05.2016, A. Galalaey 0121, (KASOF 3100).

724. *C. koeieana* Bornm

(IT, Hemicryptophyte), 1400 m, N36.598492, E44.906846, rocky mountain, 30.04.2016 and 12.05.2017, A. Galalaey 0128, (KASOF 3107).

725. *C. regia* Boiss.

(IT, Hemicryptophyte), 1600 m, N36.593074, E44.917639, rocky mountain sides, dry hills, 24.07.2015, (Jazhnii ramazan), A. Galalaey 0125, (KASOF 3104).

726. *C. solstitialis* L.

(IT.M.ES, Therophyte), (1000, 1100, 1200, 1300 and 1500 m), N36.580440, E44.837788, lower slopes of foothills and mountain, 23.04.2016, A. Galalaey 0122, (KASOF 3101).

727. *C. urvillei* DC.

(IT, Hemicryptophyte), 1600 m, N36.559051, E44.857471, rocky mountain places on limestone, 02.05.2016, A. Galalaey 0127, (KASOF 3106).

728. *C. virgata* Lam.

(IT.M.ES, Hemicryptophyte), 1100 m, N36.612547, E44.869024, on lower mountainsides in oak forest on limestone, 13.04.2016, A. Galalaey 0124, (KASOF 3103).

729. *C. persica* Boiss.

(IT, Hemicryptophyte), 2200 m, N36.574348, E44.938952, mountain sides, 24.05.2015, A. Galalaey 0126, (KASOF 3105).

353. *Chardinia* Desf.

730. *C. orientalis* (L.) Kuntze

(IT, Therophyte), (1000, 1100, 1200, 1300, 1400, 1500, and 1600 m), N36.583229, E44.843418, in the mountains and valleys on limestone, in oak forest, 20.04.2016, A. Galalaey 0129, (KASOF 3108).

354. *Chondrilla* L.

731. *C. juncea* L.

(IT.M.ES, Hemicryptophyte), (1000, 1100, 1200, 1300 and 1500 m), N36.596578, E44.908644, on mountain slopes and stony hillsides, 25.05.2017 and 29.04.2017, A. Galalaey 0130, (KASOF 3109).

355. *Cichorium* L.

732. *C. intybus* L.

(PL, Hemicryptophyte), (1200 and 1400 m), N36.592113, E44.839148, disturbed areas, along roadsides, 05.05.2016, A. Galalaey 0131, (KASOF 3110).

733. *C. pumilum* Jacq.

(IT.M, Therophyte), 1000 m, N36.605251, E44.830575, fields and meadows in hills, 22.04.2016, A. Galalaey 0132, (KASOF 3111).

356. *Cirsium* Mill.

734. *C. pseudobracteosum* P.H. Davis & Parris

(IT, Hemicryptophyte), (2700 and 2900 m), N36.563503, E44.990035, high rocky mountain slopes, 07.08.2016, A. Galalaey 0134, (KASOF 3113).

735. *C. sorocephalum* Fisch & C. Meyer ex DC

(IT, Hemicryptophyte), (1800 and 1700 m), N44.552972, E44.875862, rocky mountain slopes, 09.05.2016, A. Galalaey 0135, (KASOF 3114).

736. *C. vulgare* (Savi) Ten.

(PL, Hemicryptophyte), (1000 1200 and 1300 m), N36.602108, E44.897430, in the mountains, in moist grassy places by streams, in oak forest, 04.05.2017, A. Galalaey 0133, (KASOF 3112).

737. *C. lappaceum* (M. Bieb.) Fisch.

(IT, Hemicryptophyte), (1800, 1900, 2000, 2100, 3100 and 3200 m), N36.573131, E44.891203, rocky mountain slopes, 03.05.2017, A. Galalaey 0136, (KASOF 3115).

357. *Conyza* Less.

738. *C. canadensis* (L.) Cronquist

(Cosm (Neophyta), Therophyte), (1000, 1100 and 1200 m), N36.569520, E44.822409, fields, orchards, riparian zones and as a weed of roadsides, 15.04.2016, A. Galalaey 0138, (KASOF 3116).

358. *Cousinia* Cass.

739. *C. kurdica* C. Winkl. & Bornm.

(IT, Hemicryptophyte), (1100, 1400 and 2200 m), N36.569132, E44.891798, mountains, on stony slopes and oak forest.15.05.2016, A. Galalaey 0140, (KASOF 3118), **Endemic**, IUCN: EN.

Figure 4.145. *Cousinia kurdica*

740. *C. rawandunensis* Mehregan

(IT, Hemicryptophyte), (1900 and 2300 m), N36.568365, E44.894837, rocky mountain slopes, 15.05.2016, A. Galalaey 0139, (KASOF 3117), **Endemic**, IUCN: EN.

741. *C. algurdina* Rech.f.

(IT, Hemicryptophyte), (3200, 3000 and 2700 m), N36.545023, E44.979782, rocky alpine summit, 07.08.2016, 20.07.2018 and 18.06.2017, A. Galalaey 0141, (KASOF 3119), **Endemic**, IUCN: EN.

Figure 4.146. *Cousinia algurdina*

742. C. *stenocephala* Boiss

(IT, Hemicryptophyte), (1000 and 1900 m), N36.579034, E44.814706, stony hillsides, 24.06.2016, A. Galalaey 0142, (KASOF 3120).

359. *Crepis* L.

743. *C. alpina* L.

(IT.M.ES, Therophyte), (1200, 1400 and 1500 m), N36.599860, E44.895818, oak forest, 23.04.2016, A. Galalaey 0143, (KASOF 3121).

Figure 4.147. *Crepis alpina*

744. *C. pulchra* L.

(IT, Therophyte), 2200 m, N36.567430, E44.934673, forest and mountain slopes, 11.05.2017, A. Galalaey 0144, (KASOF 3122).

745. *C. sahendi* Boiss. & Buhse

(IT, Therophyte), (2900 and 3100 m), N36.560227, E44.990455, stony mountain slopes in alpine region, 07.08.2016, 20.07.2018 and 18.06.2017, A. Galalaey 0145, (KASOF 3123).

360. *Crupina* (Pers.) DC.

746. *C. crupinastrum* (Moris) Vis.

(IT.M, Therophyte), (1000, 1100, 1200, 1300, 1400, 1500, 1600, 1700 and 1800 m), N36.560929, E44.855877, open forest, 02.05.2016, A. Galalaey 0146, (KASOF 3124).

361. *Cyanus* Hall.

747. *C. triumfettii* (All.) Dostál ex Á. Löve & D. Löve

(IT, Hemicryptophyte), (1600, 1800, 1900 and 2000 m), N36.560615, E44.867797, open oak forest and scrub, 09.05.2016, A. Galalaey 0148, (KASOF 3126).

Figure 4.148. *Cyanus triumfettii*

362. *Cymbolaena* Smoljan

748. *C. griffithii* (A. Gray) Wagenitz

(IT.M, Therophyte), (1000 and 1600 m), N36.585862, E44.86520, stony mountain slopes and hillsides, 10.05.2017, A. Galalaey 0147, (KASOF 3125).

Figure 4.149. *Cymbolaena griffithii*

363. *Echinops* L.

749. *E. orientalis* Trautv.

(IT.M, Hemicryptophyte), (1300, 1600 and 2000 m), N36.593074, E44.917639, oak forest with rocky place, 15.05.2017, A. Galalaey 0100, (KASOF 3128).

750. *E. inermis* Boiss. & Hausskn.

(IT, Hemicryptophyte), (1000, 1100, 1300 and 1700 m), N36.574045, E44.829556, in the mountains among coppiced oak on limestone, 14.05.2017, A. Galalaey 0149, (KASOF 3127).

751. *E. heterophyllus* P.H. Davis

(IT, Hemicryptophyte), 2000 m, N36.556571, E44.878380, rocky and stony mountain slopes, 05.05.2016, A. Galalaey 0101, (KASOF 3129).

364. *Filago* Loefl. ex L.

752. *F. arvensis* L.

(IT, Therophyte), (1000, 1100 and 1600 m), N36.581861, E44.828837, mountain slopes, 20.04.2016, A. Galalaey 0150, (KASOF 3130).

365. *Garhadiolus* Jaub. & Spach

753. *G. angulosus* Jaub. & Spach

(IT.M, Therophyte), 1300 m, N36.557165, E44.85095, mountains among coppiced oak on limestone, 03.05.2017, A. Galalaey 0204, (KASOF 3131).

366. *Gundelia* L.

754. *G. tournefortii* L.

(IT.M, Cryptophyte-Geophyte (rhizome), 1000 m, N36.596211, E44.828586, dry steppe and hills, 20.04.2016, A. Galalaey 0152, (KASOF 3133).

755. *G. rosea* M. Hossain & Al-Taey

(IT, Cryptophyte-Geophyte (rhizome), (1100, 1200, 1300 and 1400 m), N36.596177, E44.854155, stony mountain slopes and hillsides, 23.05.2017, A. Galalaey 0153, (KASOF 3134).

Figure 4.150. *Gundelia rosea*

756. *G. purpurascens* (Bornm) Firat.

(IT, Cryptophyte-Geophyte (rhizome)), 1800 m, N36.581536, E44.926221, open forest area, 14.05.2016, A. Galalaey 0154, (KASOF 3135).

367. *Hedypnois* (L.) F.W. Schmidt

757. *H. rhagadioloides* (L.) F.W. Schmidt

(PL, Therophyte), (1100, 1300 and 1600 m), N36.605258, E44.845887, 16.04.2016 and 12.05.2017, A. Galalaey 0202, (KASOF 3136).

368. *Helichrysum* Mill.

758. *H. armenium* DC. var. *glanduliferum* Sch.Bip

(IT.ES, Hemicryptophyte), (2400, 2600, 2700, 2800 and 2900 m), N36.573613, E44.943473, high mountain slopes, 06.08.2016, A. Galalaey 0155, (KASOF 3137).

Figure 4.151. *Helichrysum armenium* var *glanduliferum*

759. *H. plicatum* subsp. *pseudoplicatum* (Nábělek) P.H. Davis & Kupicha

(IT.M, Chamaephytes), (1400, 1500 and 1900 m), N36.597749, E44.867689, open oak forest, 15.05.2017, A. Galalaey 0157, (KASOF 3139).

Figure 4.152. *Helichrysum plicatum* subsp. *pseudoplicatum*

760. *H. psychrophilum* Boiss

(IT, Hemicryptophyte), (3000, 3100 and 3200 m), N36.567244, E44.948633, high alpine rocks and cliffs, 07.08.2016, A. Galalaey 0156, (KASOF 3138).

Figure 4.153. *Helichrysum psychrophilum*

369. *Iranecio* B. Nord.

761. *I. paucilobus* (DC.) B. Nord.

(IT, Hemicryptophyte), (2200, 2300, 2400, 2700, 2800 and 2900 m), N36.566234, E44.895117, mountain slopes and among metamorphic rocks, 06.08.2016, A. Galalaey 0158, (KASOF 3140).

Figure 4.154. *Iranecio paucilobus*

370. *Klasea* Cass.

762. *K. cerinthifolia* (Sm.) Greuter & Wagenitz

(IT, Hemicryptophyte), 1300 m, N36.575324, E44.836646, oak forest and hillsides, 23.04.2017, A. Galalaey 0184, (KASOF 3141).

371. *Lactuca* L.

763. *L. aculeata* Boiss. & Kotschy

(IT.SS, Hemicryptophyte), (2900 and 2700 m), N36.562326, E44.899438, high mountain, 26.06.2018, A. Galalaey 0159, (KASOF 3142).

764. *L. orientalis* (Boiss.) Boiss

(IT, Hemicryptophyte), (1200, 1600, 1800 and 2000 m), N36.566615, E44.929495, mountain slopes, 11.05.2016, A. Galalaey 0160, (KASOF 3143).

765. *L. scarioliodes* Boiss

(IT, Therophyte), (1500, 1600, 2000, 2100, 2200, 2300 and 2400 m), N36.578727, E44.934033, rocky mountain slopes, 20.05.2017, A. Galalaey 0161, (KASOF 3144).

766. *L. serriola* L.

(IT.M.ES, Hemicryptophyte), (1100, 1400, 1500 and 2000 m), N36.596511, E44.876153, hillsides and oak forest, 14.07.2018, A. Galalaey 0162, (KASOF 3145).

767. *L. tuberosa* Jacq.

(IT.M, Hemicryptophyte), (1100, 1400, 1500 and 2000 m), N36.556571, E44.878380, mountain rocky places, 05.05.2017, A. Galalaey 0163, (KASOF 3146).

372. *Lapsana* L.

768. *L. communis* L.

(IT.M.ES, Hemicryptophyte), (1200, 1600, 1800 and 1900 m), N36.583641, E44.921596, rocky mountain slopes and valleys, 28.04.2017, A. Galalaey 0164, (KASOF 3147).

373. *Notobasis* Cass.

769. *N. syriaca* (L.) Cass.

(IT.M, Therophyte), (1000, 1100 and 1700 m), N36.592011, E44.921365, rocky mountain slopes and hillsides, 14.05.2017, A. Galalaey 0165, (KASOF 3148).

374. *Onopordum* L.

770. *O. illyricum* L.

(IT.M, Hemicryptophyte), 1200 m, N36.605458, E44.901800, on slopes of limestone hills and open oak forest, 12.05.2016 and 08.05.2017, A. Galalaey 0166, (KASOF 3149).

Figure 4.155. *Onopordum illyricum*

375. *Pallenis* Cass.

771. *P. spinosa* (L.) Cass.

(IT.M, Therophyte), 1400 m, N36.581042, E44.843990, water channels, 08.05.2017, A. Galalaey 0197, (KASOF 3150).

376. *Phagnalon* Cass.

772. *P. kotschyi* Boiss.

(IT, Chamaephytes), (1100 and 1600 m), N36.612892, E44.862690, rocky place, 21.04.2017, A. Galalaey 0167, (KASOF 3155).

377. *Picnomon* Adans.

773. *P. acarna* (L.) Cass.

(IT.M, Therophyte (Hemicryptophyte), (1000, 1100, 1200 and 1300 m), N36.580440, E44.837788, oak forest and hillsides, 23.04.2016, A. Galalaey 0169, (KASOF 3151).

378. *Picris* L.

774. *P. pauciflora* Willd.

(IT.M, Hemicryptophyte), (1200 and 1300 m), N36.600476, E44.902540, water channels near Sakran road / oak forest, 28.04.2017 and 14.07.2018, A. Galalaey 0170, (KASOF 3152).

775. *P. strigosa* M. Bieb.

(IT, Hemicryptophyte), (1100, 1300, 1400, 1500 and 1600 m), N36.560929, E44.855877, on dry mountain slopes in oak forest, 02.05.2016, A. Galalaey 0171, (KASOF 3153).

379. *Pilosella* L.

776. *P. verruculata* (Link) Soják

(IT, Hemicryptophyte), 1700 m, N36.597192, E44.917537, open forest, 10.05.2017, A. Galalaey 0172, (KASOF 3154).

380. *Psychrogeton* Boiss.

777. *P. amorphoglossus* (Boiss.) Novopokr.

(IT, Hemicryptophyte), (3200 and 2900 m), N36.547921, E44.982429, high rocky mountain place, 06.08.2016, A. Galalaey 0174, (KASOF 3157).

Figure 4.156. *Psychrogeton amorphoglossus*

381. *Rhagadiolus* Juss.

778. *R. stellatus* (L.) Gaertn.

(IT.M, Therophyte), (1100, 1300, 1400 and 1500 m), N36.605258, E44.845887, open forest, 16 04 2016 and 12.05.2017, A. Galalaey 0175, (KASOF 3158).

382. *Scorzonera* L.

779. *S. lanata* M. Bieb.

(IT, Cryptophyte-Geophyte (tuber), (1400 and 1600 m), N36.548223, E44.869623, among coppiced oak on limestone, 24.04.2016, A. Galalaey 0177, (KASOF 3159).

780. *S. papposa* DC.

(IT, Cryptophyte-Geophyte (tuber), (1300 and 1400 m), N36.598312, E44.868557, rocky valleys in coppiced oak forest, 27.04.2017, A. Galalaey 0178, (KASOF 3160).

781. *S. phaeopappa* (Boiss.) Boiss.

(IT, Cryptophyte-Geophyte (tuber), 1100 m, N36.574045, E44.829556, mountain slopes in oak scrub, 26.04.2017, A. Galalaey 0179, (KASOF 3161).

782. *S. semicana* DC.

(IT, Cryptophyte-Geophyte (tuber), (1300, 1400, 1500 and 1600 m), N36.600476, E44.902540, rocky mountain and coppiced of forest trees, 23.04.2016, 28.04.2017 and 14.07.2018, A. Galalaey 0180, (KASOF 3162).

383. *Podospermum* C.A. Mey.

783. *P. canum* C.A. Mey.

(IT, Cryptophyte-Geophyte (tuber), (1100, 1300, 1600, 1700, 1900, 3000, 3100 and 3200 m), N36.546021, E44.962715, high mountain rocky places and open forest area. 07.08.2016, 20.07.2018 and 18.06.2017, A. Galalaey 0176, (KASOF 3156).

384. *Senecio* L.

784. *S. glaucus* L.

(IT, M., Therophyte), 1100 m, N36.612547, E44.869024, riparian zone, 13.04.2016, A. Galalaey 0183, (KASOF 3165).

785. *S. leucanthemifolius* Poir

(IT.M.ES, Therophyte), (1000, 1100, 1200, 1300, 1400, 1500, 1600, 1700 and 1800 m), N36.547463, E44.875503, grassy places among coppiced oaks, fields and vineyards. 20.04.2017, A. Galalaey 0182, (KASOF 3163).

786. *S. paucilobus DC.*

(IT, Hemicryptophyte), (2100, 2400, 2800 and 2900 m), N36.578727, E44.934033, rocky mountain, 20.05.2017, A. Galalaey 0181, (KASOF 3164).

Figure 4.157. *Senecio paucilobus*

385. *Silybum* Vaill.

787. *S. marianum* (L.) Gaertn.

(Cosm, Hemicryptophyte), 1000 m, N36.605251, E44.830575, mostly a weed in fields and roadsides, 20.04.2016, A. Galalaey 0185, (KASOF 3166).

386. *Sonchus* L.

788. *S. asper* (L.) Hill.

(IT, Therophyte), (1000, 1100 and 1200 m), N36.603261, E44.857452, wet place, 05.05.2017, A. Galalaey 0186, (KASOF 3167).

387. *Steptorhamphus* Bunge

789. *S. tuberosus* (Jacq.) Grossh.

(IT, Cryptophyte), 1400 m, N36.598725, E44.876665, rocky mountain slopes and oak forest, 04.05.2017, A. Galalaey 0173, (KASOF 3168).

388. *Tanacetum* L.

790. *T. kotschyi* (Boiss.) Grierson

(IT, Hemicryptophyte), (2500, 3000, 3100 and 3200 m), N36.545023, E44.979782, on rocky mountain slopes and cliffs, 07.08.2016, 20.07.2018 and 18.06.2017, A. Galalaey 0189, (KASOF 3171).

Figure 4.158. *Tanacetum kotschyi*

791. *T. parthenium* (L.) Sch.Bip.

(PL, Hemicryptophyte), (2500, 2600, and 2800 m), N36.567431, E44.939683, rocky mountain slopes, 24.06.2018, A. Galalaey 0187, (KASOF 3169).

Figure 4.159. *Tanacetum parthenium*

792. *T. polycephalum* Sch.Bip.

(IT.M.ES, Hemicryptophyte), (1000, 1200, and 2000 m), N36.573131, E44.891203, sub-alpine open area, 03.05.2017, A. Galalaey 0188, (KASOF 3170).

793. ***T.** balsamita* (L.) Sch. Bip.

(IT, Hemicryptophyte), 3000 m, N36.567244, E44.948633, shady place under rocks, alpine region, 07.08.2016, A. Galalaey 0190, (KASOF 3171).

Figure 4.160. *Tanacetum balsamita*

389. *Taraxacum* F.H. Wigg.

794. *T. montanum* (C. A. Mey.) DC.

(IT, Hemicryptophyte), (1000, 1100, 1500 and 2000 m), N36.593360, E44.880103, 19.04.2016 and 23.04.2017, A. Galalaey 0102, (KASOF 3173).

795. *T. assemanii* Boiss.

(IT, Hemicryptophyte), 2600 m, N36.568091, E44.941546, wet place, 22.07.2017, A. Galalaey 0103, (KASOF 3174).

Figure 4.161. *Taraxacum assemanii*

796. *T. nevskii* Juz.

(IT, Hemicryptophyte), (1300 and 1600 m), N36.593074, E44.917639, open forest area and mountain rocky places, 15.05.2015, 10.05.2016 and 28.04.2017, A. Galalaey 0104, (KASOF 3175).

Figure 4.162. *Taraxacum nevskii*

390. *Tragopogon* L.

797. *T. bornmuelleri* Ownbey & Rech

(IT, Hemicryptophyte), (1100, 1500 and 2100 m), N36.559051, E44.857471, rocky mountain slopes, 02.05.2016, A. Galalaey 0191, (KASOF 3176).

798. *T. buphthalmoides* (DC.) Boiss.

(IT, Cryptophyte-Geophyte (tuber), 1000 m, N36.3819.40, E44.499140, degraded forest, 20.04.2016, A. Galalaey 0192, (KASOF 3177).

799. *T. coelesyriacus* Boiss

(IT.M, Hemicryptophyte), (1000, 1300, 1500 and 1800 m), N36.593360, E 44.880103, open oak forest, 19.04.2016, 23.04.2017, A. Galalaey 0193, (KASOF 3178).

800. *T. reticulatus* Boiss. et Huet in Boiss

(IT.ES, Hemicryptophyte), (1400, 1900, 2000, 2200 and 2300 m), N36.575821, E44.890204, sub-alpine open area (grassy land slopes), 15.05.2016, A. Galalaey 0194, (KASOF 3179).

391. *Geropogon* L.

801. *G. hybridus* (L.) Sch.Bip.

(IT., and M, Therophyte), (1000, 1300 and 1400 m), N36.610575, E44.846088, in the mountains on limestone, in oak forest, on rocky slopes, 22.04.2016, A. Galalaey 0150, (KASOF 3132).

392. *Tripleurospermum* Sch.Bip.

802. *T. disciforme* (C. A. Mey.) Sch.Bip

(IT, Hemicryptophyte), (2600 and 3000 m), N36.570141, E44.943320, wet place, 07.08.2016, A. Galalaey 0195, (KASOF 3180).

803. *T. caucasicum* (Willd.) Hayek

(IT.M.ES, Hemicryptophyte), (3100 and 3200 m), N36.563277, E44.947345, alpine region, 07.08.2016, 14.07.2017 and 29.06.2018, A. Galalaey 0196, (KASOF 3181).

393. *Urospermum* Scop.

804. *U. picroides* (L.) Scop.

(PL, Therophyte), 1300 m, N36.599791, E44.888460, rocky hill slopes in degraded oak forest, 04.05.2017, A. Galalaey 0197, (KASOF 3182).

394. *Xanthium* L.

805. *X. strumarium* L.

(Cosm, Therophyte), (1100 and 1200 m), N36.603261, E44.857452, rocky mountain slopes and steppe hills near springs, 05.05.2016, A. Galalaey 0199, (KASOF 3183).

395. *Xeranthemum* L.

806. *X. annuum* L.

(M, Therophyte), (1400 and 1500 m), N36.559051, E44.857471, mountain slopes in open forest area, 02.05.2016, A. Galalaey 0200, (KASOF 3184).

807. *X. cylindraceum* Sm

(IT.M, Therophyte), (1000, 1200 and 1500 m), N36.605458, E44.901800, oak forest, 08.05.2017, A. Galalaey 0201, (KASOF 3185).

396. *Zoegea* L.

808. *Z. leptaurea* L.

(IT, Therophyte), (1300 and 1600 m), N36.597646, E44.910874, oak forest area, 10.05.2016, A. Galalaey 0203, (KASOF 3186).

Dipsacales Juss. ex Bercht. & J.Presl

85. Adoxaceae E.Mey. (= Viburnaceae Raf. prop.)

397. *Sambucus* L.

809. *S. nigra* L.

(IT, Phanaerophyte), (1400 and 1500 m), N36.594102, E44.908089, moist shady in riparian zone, 30.04.2016, A. Galalaey 0004, (KASOF 2986).

Figure 4.163. *Sambucus nigra*

86. Caprifoliaceae Juss.

398. *Cephalaria* Schrad. ex Roem. & Schult.

810. *C. microcephala* Boiss.

(IT, Hemicryptophyte), 2700 m, N36.578040, E44.947332, mountain rocky slopes, 27.07.2017, A. Galalaey 0310, (KASOF 3291).

811. *C. syriaca* (L.) Schard.

(IT.M, Therophyte), (1000, 1100, 1200 and 1300 m), N36.582832, E44.819651, field, 20.04.2016, A. Galalaey 0311, (KASOF 3293).

812. *C. setosa* Boiss. & Hohen.

(IT.M, Therophyte), (1000, 1300, 1500, 1600 and 1700 m), N36.591298, E44.921851, on limestone, in *Quercus* forest, waste land, 10.05.2017, A. Galalaey 0319, (KASOF 3292).

399. *Dipsacus* L.

813. *D. laciniatus* L.

(IT, Hemicryptophyte), 1200 m, N36.605848, E44.898752, damp spots near road; roadside, muddy clay soil, 03.05.2017, A. Galalaey 0312, (KASOF 3294).

Figure 4.164. *Dipsacus laciniatus*

400. *Lomelosia* L.

814. *L. palaestina* (L.) Raf

(IT.M, Therophyte), (1100, 1200, 1300 and 1400 m), N36.561543, E44.823259, open forest area, 22.04.2017, A. Galalaey 0321, (KASOF 3295).

Figure 4.165. *Lomelosia palaestina*

401. *Lonicera* L.

815. *L. arborea* Boiss

(IT.M, Phanerophyte), (1400, 1600, 1700, 1900, 2000, 2100, 2200 and 2300 m), N36.575349, E44.912545, undershrub in oak forest, in rocky mountain valleys and slopes, 11.05.2017, A. Galalaey 0309, (KASOF 3296).

Figure 4.166. *Lonicera arborea*

402. *Pterocephalus* Vaill. ex Adans.

816. *P. papposus* (L.) Coult.

(IT.M, Therophyte), (1000 and 1200 m), N36.601187, E44.852861, rocky slopes and stony mountainsides, in oak forest, 10.04.2017 and 20.04.2016, A. Galalaey 0318, (KASOF 3297).

403. *Scabiosa* L.

817. *S. macrochaete* Boiss. & Hausskn.

(IT, Therophyte), (1100, 1200, 1600 and 1700 m), N36.578399, E44.835497, open oak forest, 09 05 2016, A. Galalaey 0320, (KASOF 3298).

404. *Valeriana* L.

818. *V. alliariifolia* Adams

(IT, Hemicryptophyte), (2000, 2400, 2600, 3100 and 3200 m), N36.588544, E44.989099, mountain rocky slope, on cliffs, 06.08.2016, A. Galalaey 0313, (KASOF 3299).

Figure 4.167. *Valeriana alliariifolia*

819. *V. sisymbriifolia* Vahl

(IT, Hemicryptophyte), (2300, 2500, 2600 and 3100 m), N36.568091, E44.941546, in high mountains by springs, 22.07.2017, A. Galalaey 0314, (KASOF 3300).

Figure 4.168. *Valeriana sisymbriifolia*

405. *Valerianella* Mill.

820. *V. dactylophylla* Boiss. & Hohen.

(IT.M, Therophyte), (1900 and 2000 m), N36.575821, E44.890204, rocky places in mountains, on serpentine, 15.05.2016, A. Galalaey 0315, (KASOF 3301).

821. *V. vesicaria* (L) Moench

(IT.M, Therophyte), (1100 and 1700 m), N36.593385, E44.893436, mountain slopes, open places in forest, 14.5.2017, A. Galalaey 0316, (KASOF 3302).

822. *V. coronata* (L.) DC.

(IT.M, Therophyte), 1100 m, N36.590922, E44.854584, rocky mountain slopes, dry rocks under *Quercus* scrub, 14.05.2017, A. Galalaey 0317, (KASOF 3303).

Apiales Nakai

87. Apiaceae Lindl. (= Umbelliferae Juss.)

406. *Ainsworthia* Boiss.

823. *A. trachycarpa* Boiss.

(IT.M, Therophyte), (1000, 1100, 1200 and 1300 m), N36.581437, E44.828822, lower mountain slopes, among coppiced oak, 09.05.2016, A. Galalaey 0027, (KASOF 3009).

407. *Ammi* L.

824. *A. majus* L.

(IT.M, Therophyte), (1000, 1100 and 1200 m), N36.612666, E44.872589, gravelly hillsides, in damp places, 22.04.2016, A. Galalaey 0028, (KASOF 3010).

408. *Anthriscus* Pers.

825. *A. cerefolium* (L.) Hoffm.

(IT, Therophyte), (1100, 1200, 1300 and 1500 m), N36.600476, E44.902540, shady place under trees on mountain slope, 23.04.2016, 28.04.2017 and 14.07.2018, A. Galalaey 0029, (KASOF 3011).

409. *Apium* L.

826. *A. nodiflorum* (L.) Lag.

(IT, Helophytes), (1000, 1100, 1200 and 1300 m), N36.569520, E44.822409, moist places (spring), beside streams, 15.04.2016, A. Galalaey 0031, (KASOF 3012).

410. *Artedia* L.

827. *A. squamata* L.

(IT.M, Therophyte), (1000, 1100, 1200, 1500 and 1600 m), N36.556059, E44.862555, mountain slopes and stony hillsides, 07.05.2016 and 20.04.2017, A. Galalaey 0032, (KASOF 3013).

411. *Bunium* L.

828. *B. cornigerum* (Boiss. et Hausskn.)

(IT, Cryptophyte-Geophyte (tuber), (1400, 1500, 1700, 1800, 2000, 2100 and 2300 m), N 36.555248, E 44.879177, in the mountains, on rocky slopes, 07.05.2017, A. Galalaey 0033, (KASOF 3014), **Endemic**, IUCN: LC.

829. *B. paucifolium* DC

(IT, Cryptophyte-Geophyte (tuber), (1000, 1100, 1300 and 1500 m), N36.581437, E44.828822, on mountain sides, in coppiced *Quercus*, 09.05.2016, A. Galalaey 0034, (KASOF 3015).

412. *Bupleurum* L.

830. *B. gerardii* All.

(IT, Hemicryptophyte), (1100, 1400, 1600, 1700 and 2000 m), N36.560945, E44.872566, mountains slopes, on dry open overgrazed stony ridges, 07.05.2017, A. Galalaey 0035, (KASOF 3016).

413. *Chaerophyllum* L.

831. *C. crinitum* Boiss.

(IT, Hemicryptophyte), (1100 and 2100 m), N36.578727, E44.934033, mountain sides, above the tree line, 20.05.2017, A. Galalaey 0061, (KASOF 3017).

414. *Cionura* Griseb.

832. *C. erecta* (L.) Griseb

(IT, Chamaephytes), (1100 and 1800 m), N36.555502, E44.874002, mountains and valleys on limestone, 09.05.2016, A. Galalaey 0072, (KASOF 3018).

415. *Conium* L.

833. *C. maculatum* L.

(PL, Hemicryptophyte), (1000, 1100 and 1200 m), N36.605458, E44.901800, mountains, near water, in *Quercus* forest, 12.05.2016 and 08.05.2017, A. Galalaey 0036, (KASOF 3019).

416. *Daucus* L.

834. *D. carota* L.

(IT-ES, Hemicryptophyte), (1200 and 1300 m), N36.603261, E44.857452, moist places, beside streams, 05.05 2016, A. Galalaey 0037, (KASOF 3020).

417. *Eryngium* L.

835. *E. billardieri* Delar.

(IT, Hemicryptophyte), (1200, 1300, 1400, 1500, 1600, 1700, 2200, 2600, 2700, 2900 and 3100 m), N36.568816, E44.93661, rocky mountain slopes, 08.05.2017, A. Galalaey 0038, (KASOF 3021).

836. *E. creticum* Lam

(IT.M, Hemicryptophyte), (1000, 1100, 1200, 1300 and 1600 m), N36.597646, E44.910874, dry stony hillsides, in *Quercus* forest, 10.05.2016, A. Galalaey 0039, (KASOF 3022).

837. *E. glomeratum* Lam.

(IT.M, Hemicryptophyte), (1000 and 1200 m), N36.607816, E44.895649, dry hillside, 05 05 2017, A. Galalaey 0040, (KASOF 3023).

838. *E. pyramidale* Boiss.

(IT, Hemicryptophyte), (1000 and 1500 m), N36.596270, E44.908627, rocky mountain slopes, on limestone, 18.07.2015, A. Galalaey 0041, (KASOF 3024).

839. *E. thyrsoideum* Boiss.

(IT.M, Hemicryptophyte), 1600 m, N36.556059, E44.862555, mountain slopes and valleys among *Quercus* forest, 07.05.2016 and 20.04.2017, A. Galalaey 0060, (KASOF 3025).

418. *Falcaria* Fabr.

840. *F. vulgaris* Bernh

(IT.ES.M, Hemicryptophyte), (1100, 1300, 1500 and 1600 m), N36.597646, E44.910874, mountain slopes and valleys among *Quercus* forest, 28.04.2017 and 14.07.2018, A. Galalaey 0042, (KASOF 3026).

419. *Ferula* L.

841. *F. orientalis* L.

(IT, Hemicryptophyte), 1700 m, N36.559220, E44.864182, on the mountains, among rocks in *Quercus* forest; 07.05.2017, A. Galalaey 0043, (KASOF 3027).

420. *Ferulago* W.D.J. Koch

842. *F. angulata* (Schlecht.) Boiss.

(IT, Hemicryptophyte), (1300, 1900 and 2000 m), N36.575821, E44.890204, on cliffs in *Quercus* forest, on metamorphic rock (sub-alpine), 15.05.2016, A. Galalaey 0044, (KASOF 3028).

843. *F. stellate* Boiss.

(IT.M, Hemicryptophyte), (1100 and 1200 m), N36.575821, E44.890204, on the mountains, on rocky slopes, in oak forest, on limestone, 16 04 2017, A. Galalaey 0062, (KASOF 3029).

421. *Foeniculum* mill.

844. *F. vulgare* Mill.

(IT, Hemicryptophyte), 1000 m, N36.603261, E44.857452, in waste land near villages, 05 05 2016, A. Galalaey 0030, (KASOF 3030).

422. *Grammosciadium* Boiss.

845. *G. scabridum* Boiss.

(IT.M, Hemicryptophyte), (1700, 1900 and 2000 m), N36.575821, E44.890204, grassy places, on stony red soil above the tree line, 15.05.2016, A. Galalaey 0045, (KASOF 3031).

423. *Heracleum* L.

846. *H. amanum* Boiss. & Kotschy

(IT, Hemicryptophyte), (1100, 1300 and 1500 m), N36.600476, E44.902540, lower of Shiwallok village, channels near Sakran road / oak forest, 23.04.2016, 28.04.2017 and 14.07.2018, A. Galalaey 0063, (KASOF 3032).

424. *Lagoecia* L.

847. *L. cuminoides* L.

(IT, Therophyte), (1000, 1200, 1400, 1500 and 1700 m), N36.583229, E44.843418, mountainsides, in denuded *Quercus* forest, 20.04.2016, A. Galalaey 0046, (KASOF 3033).

425. *Lisaea* Boiss.

848. *L. strigosa* (Banks & Sol.) Eig

(IT, Therophyte), (1000, 1100 and 1200 m), N36.591341, E44.824195, beside the wheat cultivar field, 29.04.2017, A. Galalaey 0064, (KASOF 3034).

426. *Malabaila* (Miller) Boissier

849. *M. secacul* Banks et Sol. subsp. *aucheri* (Boiss.) C.C. Townsend

(IT, Hemicryptophyte), (1000, 1100 and 1200 m), N36.612666, E44.872589, dry rocky open space in *Quercus* forest, 22.04.2016, A. Galalaey 0065, (KASOF 3035).

427. *Myrrhoides* L.

850. *M. nodosa* (L.) Cannon

(IT, Therophyte), 1100 m, N36.612666, E44.872589, lower mountain slopes, in *Quercus* shade on limestone, 22.04.2016, A. Galalaey 0047, (KASOF 30306).

428. *Opopanax* W.D.J.Koch

851. *O. hispidus* (Friv.) Griseb

(IT.M, Hemicryptophyte), (1000, 1100, 1400 and 1700 m), N36.583229, E44.843418, lower mountains, in valleys, among denuded oak forest, 20.04.2016, A. Galalaey 0066, (KASOF 3037).

429. *Physocaulis* L.

852. *P. nodosus* (L.) W.D. Koch

(IT, Therophyte), 1100 m, N36.612666, E44.872589, dry rocky open space in *Quercus* forest, 22.04.2016, A. Galalaey 0048, (KASOF 3038).

430. *Pimpinella* L.

853. *P. kotschyana* Boiss.

(IT, Hemicryptophyte), (1000, 1100, 1200, 1300, 1700 and 2000 m), N36.547463, E44.875503, rocky mountain slopes, on limestone, 20.04.2017, A. Galalaey 0049, (KASOF 3039).

854. *P. peregrina* L.

(IT.M, Hemicryptophyte), 1300 m, N36.557165, E44.850957, hillside, under light *Quercus* shade (in denuded Quercetum) on limestone, 03.05.2017, A. Galalaey 0050, (KASOF 3040).

431. *Prangos* L.

855. *P. asperula* Boiss. subsp. *haussknechtii* (Boiss.) Herrnst. et Heyn

(IT, Hemicryptophyte), (1900, 2000, 2300, 2400, 2500, 2800 and 2900 m), N36.564022, E044.895885, high mountain sides, rocky slopes, 15.05.2017, A. Galalaey 0067, (KASOF 3042).

856. *P. ferulacea* (L.) Lindl.

(IT.M, Hemicryptophyte), (1000, 1100, 1200, 1300, 2000 and 2200 m), N36.598971, E44.861230, mountains rocky slopes, 10 04 2017, A. Galalaey 0051, (KASOF 3041).

857. *P. uloptera* D.C

(IT, Hemicryptophyte), (2400, 2600, 2700, 2800, 3000 and 3100 m), N36.566234, E44.895117, on mountains, on igneous and metamorphic rock, on limestone scree, on dry rocky ridges among oak forest, 24.06.2018, A. Galalaey 0068, (KASOF 3043).

Figure 4.169. *Prangos uloptera*

858. *P. pabularia* Lindl.

(IT, Hemicryptophyte), (1000, 1300 and 1500 m), N36.592832, E44.881817, open coppiced *Quercus* scrub, 22.05 2016, A. Galalaey 0069, (KASOF 3044).

432. *Scandix* L.

859. *S. pecten-veneris* L.

(IT-ES, Therophyte), (1000, 1100, 1300, 1400, 1600 and 1700 m), N36.592011, E44.921365, in the mountains on grassy places, 14.05.2017, A. Galalaey 0052, (KASOF 3045).

860. *S. stellata* Banks.

(IT.M.ES, Therophyte), (1000, 1200, 1400, 1500 and 1600 m), N36.607816, E44.895649, lower mountain slopes in oak woods on limestone, 05 05 2017, A. Galalaey 0053, (KASOF 3046).

433. *Smyrniopsis* Boiss.

861. *S. aucheri* Boiss.

(IT, Hemicryptophyte), (1100, 1300, 1500, 1700 and 1800 m), N36.573903, E44.924952, in the mountains, among *Quercus* forest, on limestone, 11.05.2017, A. Galalaey 0054, (KASOF 3047).

434. *Smyrnium* L.

862. *S. cordifolium* Boiss.

(IT, Hemicryptophyte), (1000, 1100, 1400, 1500, 1600, 1700, 2100, 2200, 2400 and 2700 m), N36.567890, E44.869589, in the mountains in denuded *Quercus* forest on limestone, 08.05.2017, A. Galalaey 0055, (KASOF 3047).

Figure 4.170. *Smyrnium cordifolium*

435. *Torilis* L.

863. *T. leptophylla* (L.) Reichb

(PL, Therophyte), (1000, 1300, and 1400 m), N36.598725, E44.876665, on mountains, sometimes on stony slopes in denuded *Quercus* wood, 04.05.2017, A. Galalaey 0056, (KASOF 3049).

436. *Trachydium* Lindl.

864. *T. depressum* (Boiss.) Boiss

(IT, Hemicryptophyte), (2800, 3100 and 3200 m), N36.549280, E44.978736, high mountain slope and summit, on rocks, 06/07.08.2017, A. Galalaey 0070, (KASOF 3050).

437. *Trigonosciadium* Boiss.

865. *T. viscidulum* Boiss. & Hausskn

(IT, Hemicryptophyte), (1100 and 1500 m), N36.581661, E44.852825, rocky mountain slopes, in oak forest, on limestone (near Chaqalla Bawi \ NE of Wallash). 25.04.2016, A. Galalaey 0071, (KASOF 3051).

438. *Turgenia* L.

866. *T. latifolia* (L.) Hoffm.

(PL, Therophyte), (1000, 1100, 1300, 1400 and 1500 m), N36.549899, E44.873637, on mountains, on stony slopes in denuded forest trees, 07.05.2017, A. Galalaey 0058, (KASOF 3052).

439. *Zosima* Boiss.

867. *Z. absinthifolia* (Vent.) Link

(IT, Therophyte), (1000, 1100, 1300, 1400, 1600 and 1700 m), N36.595239, E44.850090, on mountains, on high rocky, among coppiced *Quercus* woods, on limestone, 23.04.2017, A. Galalaey 0059, (KASOF 3054).

4.2. Flora statistics

In this study, a total of 867 plant taxa belonging to 439 genera and 87 families were identified, about three major plant life groups were determined of which 789 (91.00%) of the species were herbs, 38 (4.38%) were trees and 40 (4.61%) shrubs. Pteridophytes include 3 families and 7 taxa. The total 862 plant taxa belonging to angiosperms were recorded (84 families, 436 genera, 788 species, 44 subspecies, 35 variety). Also, 16 endemic taxa were identified.

Table 4.1. The distribution of taxa into large taxonomical groups

	Families	Genera	Species	Subsp.	Var.	Endemic	Total
Pteridophytes (A)	3	6	7	0	0	0	7
Spermatophytes (B)	84	433	781	44	35	16	860
Angiosperms	84	433	781	44	35	16	860
Magnoliids	1	1	1	0	0	0	1
Monocots	15	79	138	6	4	3	148
Eudicots	68	353	642	38	31	13	711
Total (A+B)	87	439	788	44	35	16	867

The richest five plant families with the highest percentages of the total recorded were Asteraceae 111 taxa (12.80%), Fabaceae 85 taxa (9.80%), Brassicaceae 62 taxa (7.15%), Poaceae 57 taxa (6.57%) and Lamiaceae 51 taxa (5.88%) (Table 4.2.). About 39 families were represented by more than one species between 0.23% to 1.38%, finally of the 31 families were represented by a single species each accounting 0.11% of the total.

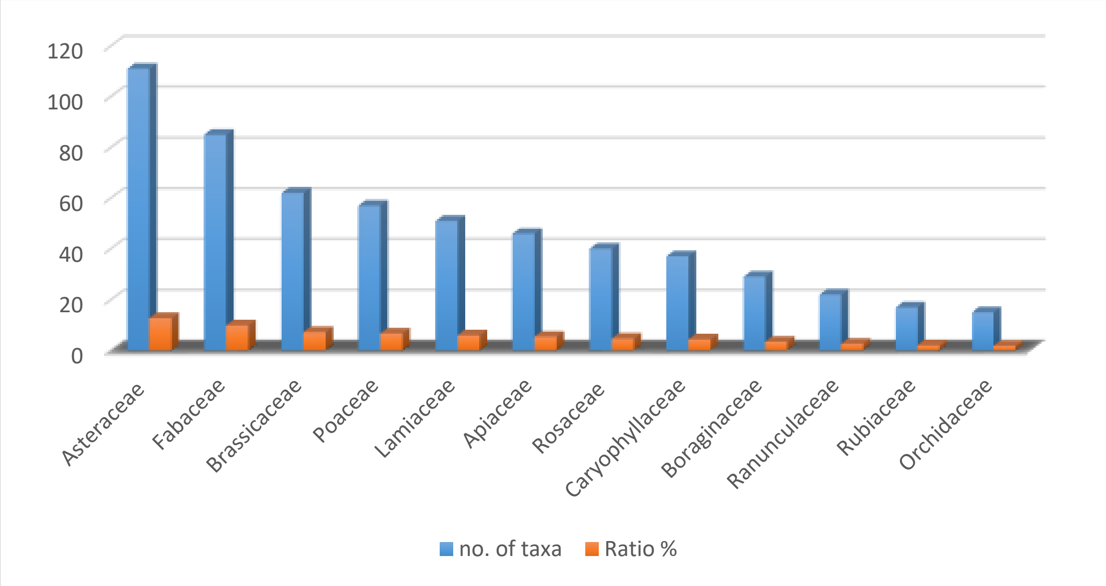


Figure 4.171. Richest families in the study area

Table 4.2. Richest families and genera with the number of taxa

Family	Species	Ratio (%)	Genera	Species	Ratio (%)
Asteraceae	111	12.80	*Astragalus*	19	2.19
Fabaceae	85	9.80	*Trifolium*	15	1.73
Brassicaceae	62	7.15	*Prunus*	15	1.73
Poaceae	57	6.54	*Silene*	13	1.50
Lamiaceae	51	5.88	*Allium*	12	1.38
Apiaceae	45	5.19	*Salvia*	11	1.27
Rosaceae	40	4.61	*Centaurea*	10	1.15
Caryophyllaceae	37	4.27	*Euphorbia*	10	1.15
Boraginaceae	29	3.34	*Vicia*	9	1.04
Ranunculaceae	22	2.54	*Medicago*	8	0.92
Rubiaceae	17	1.95	*Ranunculus*	8	0.92
Orchidaceae	15	1.73	*Galium*	8	0.92

According to the richest vascular plant genera; *Astragalus* spp. (Fabaceae) (2.19%) is the most contributing family with 19 taxa to the flora (Table 4.2). *Trifolium* spp. (Fabaceae) and *Prunus* spp. (Rosaceae) (1.73%) share the second and third rank with 15 taxa for each of them in the study area. *Silene* spp. (Caryophyllaceae) is the fourth species-rich genus with

13 taxa (1.50%) in the study area. These three genera are followed by other genera respectively, as *Allium* spp. with 12 taxa, *Salvia* spp. with 11 taxa, *Centaurea* spp. and *Euphorbia* spp. each with 10 taxa, *Vicia* spp. with 9 taxa, *Medicago* spp., *Ranunculus* spp. and *Galium* spp. each with 8 taxa, *Aethionema* spp., *Veronica* spp. and *Bromus* spp. each with 7 taxa, *Campanula* spp. and *Scrophularia* spp. each with 6 taxa, *Achillea* spp., *Lactuca* spp., *Alyssum* spp., *Lamium* spp., *Orobanche* spp., *Iris* spp., *Papaver* spp. and *Aegilops* spp. each with 5 taxa.

As a result of the phytogeographical distribution of plants; 442 taxa (50.98%) belong to the Irano-Turanian phytogeographical region, 143 taxa (16.49%) are pluregional or Unknown region, 98 taxa (11.30%) to the Irano-Turanian and Mediterranean regions, 66 taxa (7.61%) belong only to the Mediterranean region. In addition, 33 taxa (3.81%) belong only to the Cosmopolitanopolitan region, 24 taxa (2.77%) belong to Irano-Turanian and Euro-Siberian, 22 taxa (2.54%) belong to the Ir.-Tur., Medit. and Euro-Sib. Element, 16 taxa (1,85%) belong to the Euro-Sib. Element, 11 taxa (1.27%) belong to the Sub-cosmopolitan elements, 5 taxa (0.58%) belong to the Ir.-Tur._Saharo-Sindian, 2 taxa (0.23%) belongs to the each of Hyrcano-Euxine element, Saharo-Sindian elements and Medit._Euro-Sib. element and 1 taxa (0.12%) belong to the Euxine element (Table 4.3).

Table 4.3. Number of taxa and percentages of chorotypes

Chorotypes	**Taxa no.**	**Ratio %**
Ir.-Tur. element	442	50.98
Pluregional or Unknown	143	16.49
Ir.-Tur._Medit. element	98	11.30
Medit. element	66	7.61
Cosmopolitan	33	3.81
Ir.-Tur. and Euro-Sib. element	24	2.77
Ir.-Tur., Medit. and Euro-Sib. element	22	2.54
Euro-Sib. element	16	1.85
Sub-cosmopolitan	11	1.27
Ir.-Tur._Saharo-Sindian element	5	0.58
Hyrcano-Euxine element	2	0.23
Saharo-Sindian element	2	0.23
Medit._Euro-Sib. element	2	0.23
Euxine element	1	0.12
Total	**867**	**100%**

According to (Raunkiaer, 1934) life-forms, it was revealed that Hemicryptophytes were the richest among the plant life-forms with 333 taxa (38.41%), and followed by Therophytes with 271 taxa (31.26%), Cryptophyte-Geophyte with 116 taxa (13.38%), Phanerophytes with 79 taxa (9.11%), Chamaephytes with 43 taxa (4.96%), Hydrophytes with 11 taxa (1.27%) respectively (Table 4.4). Also, 9 parasite taxa (1.04%), three Therophyte & Hemicryptophyte taxa (0.35%) and only one Epiphyte taxon (0.11%) were determined.

Table 4.4. Number of taxa and percentage of plant life forms

Life forms	**No. of taxa**	**Ratio%**
Hemicryptophyte	333	38.41
Therophyte	271	31.26
Cryptophyte-Geophyte	116	13.38
Phanaerophyte	79	9.11
Chamaephytes	43	4.96
Hydrophyte	11	1.27
Therophyte (Parasite)	9	1.04
Therophyte & Hemicryptophyte	3	0.35
Helophyte	1	0.11
Epipyphyte	1	0.11
Totally	867	100.0

The higher percentage of Hemicryptophytes and Therophytes among other life forms could be attributed to the adaptation of plants to the Mediterranean climate conditions (Zohary, 1973) and also intensive grazing in Zagros may have affected these rates in an upward direction. Thorny and spiny forms like *Astragalus* spp. and poisonous species like *Euphorbia* spp. can better survive from grazing and hence they are among the most abundant and diverse taxa in this region.

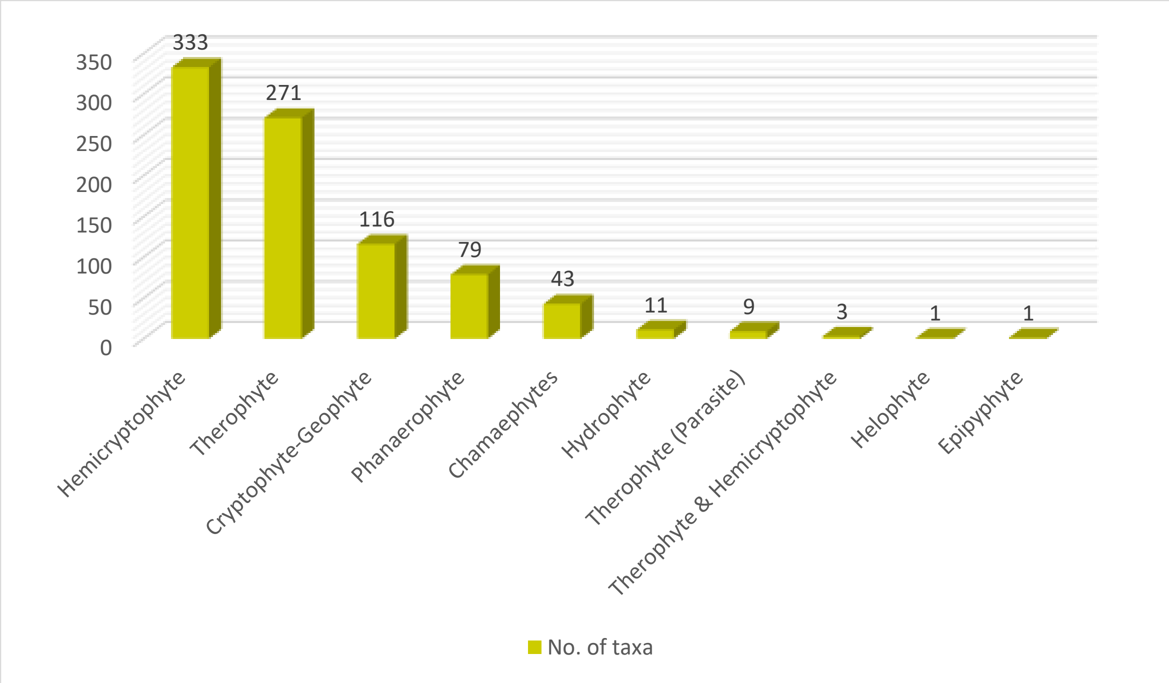


Figure 4.172. Phytogeographical distribution of plant taxa in chorotypes and life forms

4.3. Plant endemism

Mountains and mountain ranges with high levels of endemism are extremely important terrestrial areas, as they have microclimatic valley habitats and suitable places that act as shelters for threatened endemic species which at risk of extinction. However, due to difficulties in accessing the study areas in Iraqi mountains, and harsh terrain conditions, it has not been fully studied even in today (Ghazanfar and McDaniel, 2016). According to a review about endemic plant species (Youssef, 2020), Iraq contains a total of 174 endemic taxa (153 species, 11 subspecies, 10 varieties) in 27 families and 75 genera. Endemism rate is 5.3% of the total estimated flora of Iraq. This ratio constitutes very low compared to those of neighboring Irano-Anatolian countries. Endemic species rich plant families were Asteraceae, Papilionaceae, Boraginaceae and Apiaceae. We compared our plant list with the above study and also with the evaluation of Royal Botanical Garden of Edinburgh for Iraqi endemics by Miller and Neale (2015). According to comparison, we determined 16 endemic plant taxa, 6 of which in Endangered (EN) threat category, 3 Vulnerable (VU), 4 Least Concern (LC) and 3 Not Evaluated (NE). Endemism ratio 1.84% in the study area.

Table 4.5. Endemic plants and IUCN threat categories

	Family	Scientific names	IUCN Category	Number of elevation steps	Elevations (m)
1	Asteraceae	*Cousinia kurdica* C.Winkl. & Bornm.	EN	3	1100, 1400 and 2200
2	Asteraceae	*Cousinia algurdina* Rech.f.	EN	3	2700, 3000 and 3200
3	Asteraceae	*Cousinia rawandunensis* Mehregan	EN	2	1900 and 2300
4	Brassicaseae	*Hesperis kurdica* F.Dvorák & Hadac	EN	2	1700 and 2000
5	Orobanchaceae	*Rhynchocorys elephas* subsp. *carduchorum* Burbidge & Richardson	EN	3	1900, 2600 and 2800
6	Rosaceae	*Alchemilla kurdica* Rothm.	EN	4	1800, 2400, 2500 and 2800
7	Fabaceae	*Vavilovia formosa* (Steven) Al.Fed.)	VU	1	3200
8	Fabaceae	*Vicia canescens* subsp, *gregaria* (Boiss. et Heldr.) P. H. Davis	VU	3	2500, 3100 and 3200
9	Liliaceae	*Fritillaria crassifolia* subsp. *kurdica* (Boiss. & Noe) Rix	VU	2	1300 and 1400
10	Apiaceae	*Bunium cornigerum* (Boiss. & Hausskn.) Drude	LC	7	1400, 1500, 1700, 1800, 2000, 2100 and 2300
11	Asparagaceae	*Scilla kurdistanica* Speta	LC	2	1600 and 1900
12	Asparagaceae	*Ornithogalum kurdicum* Bornm.	LC	4	1000, 1100, 1300 and 1400
13	Brassicaceae	*Erysimum filifolium* Boiss. et Hausskn	LC	1	1000
14	Boraginaceae	*Onosma haussknechtii* Bornm.	NE	2	1900 and 2100
15	Brassicaceae	*Erysimum gladiiferum* Boiss. Et Haussk.	NE	3	1700, 2100 and 2200
16	Caryophylaceae	*Silene retinervis* Ghaz.	NE	2	3000 and 3100 m

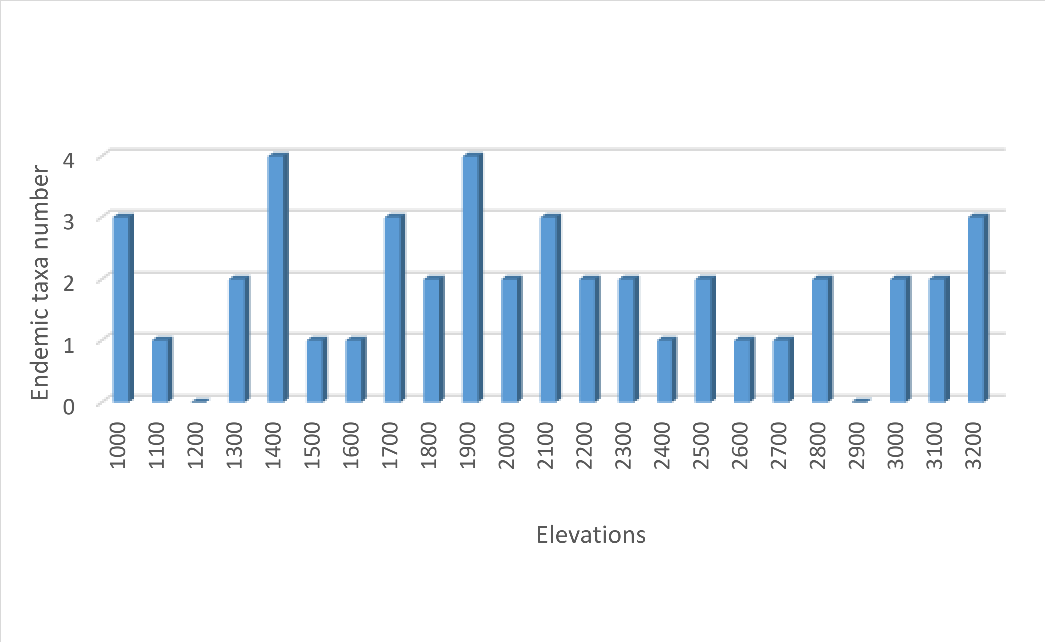


Figure 4.173. Distribution of endemic taxa numbers according to the elevation gradient

4.4. Plant biodiversity calculations

In the calculations made for the study area, the richness and diversity of the plant species were evaluated separately. In this context, in order to calculate plant species diversity, existing taxa in each sample plot were recorded and subjected to presence / absence analysis, and then the diversity was calculated with the BioDiversity Pro package program. In addition, the frequencies of the species in both the elevation steps and the whole list were determined.

4.5. Plant species richness

As a result of examining the sample plots, it was determined that the number of plant species varied between 54 and 319 from the higher to lower elevation levels. In addition, as the altitude increases, as a general trend, there is always a gradual decrease in the number of plant species but they get diverse. Only, due to the large number of mined lands at 1800 m, a sufficient number of samples could not be taken and therefore the number of taxa determined was less than it should have been. In general interpretation, 1000-1100 m has over 300 plant taxa, while between 1200-1400 m has 200-300 taxa number range. Besides, elevations between 1500-2000 m host 100-200 plant taxa. Finally; Less than 100 plant taxa always show distribution between 2100-3200 m. The number of taxa was determined less than it should be, since sufficient sample plots could not be taken due to the high amount of land mined areas at only 1800 m.

Table 4.6. Taxa numbers (Average, St.d., Min., Max.)

Elevation	Total taxa number	Taxa numbers in sample plots			
		Aver.	St.d.	Min.	Max.
1000 m	316	26.5	9.9	14	49
1100 m	319	33.6	11.8	13	57
1200 m	276	26.6	7.3	18	43
1300 m	258	27.4	11.8	13	64
1400 m	243	20.1	7.4	12	35
1500 m	196	19.7	8.1	12	40
1600 m	158	21.9	11.2	10	40
1700 m	199	19.3	8.1	10	46
1800 m	*89	13.8	4.4	9	25
1900 m	121	17.0	4.2	13	25
2000 m	112	18.3	6.3	11	30
2100 m	82	12.9	3.3	8	19
2200 m	78	17.1	6.0	7	24
2300 m	77	14.9	6.3	9	27
2400 m	64	11.1	4.8	5	21
2500 m	54	8.7	2.4	4	12
2600 m	56	11.6	2.9	9	15
2700 m	58	12.3	5.4	7	20
2800 m	38	11.2	3.4	8	16
2900 m	28	12.0	1.0	11	13
3000 m	46	12.6	2.7	10	16
3100 m	50	16.5	7.0	12	27
3200 m	39	14.3	5.2	6	22

* Because of the mined land areas were abundant in this elevation step, the number of taxa were lower than expected.

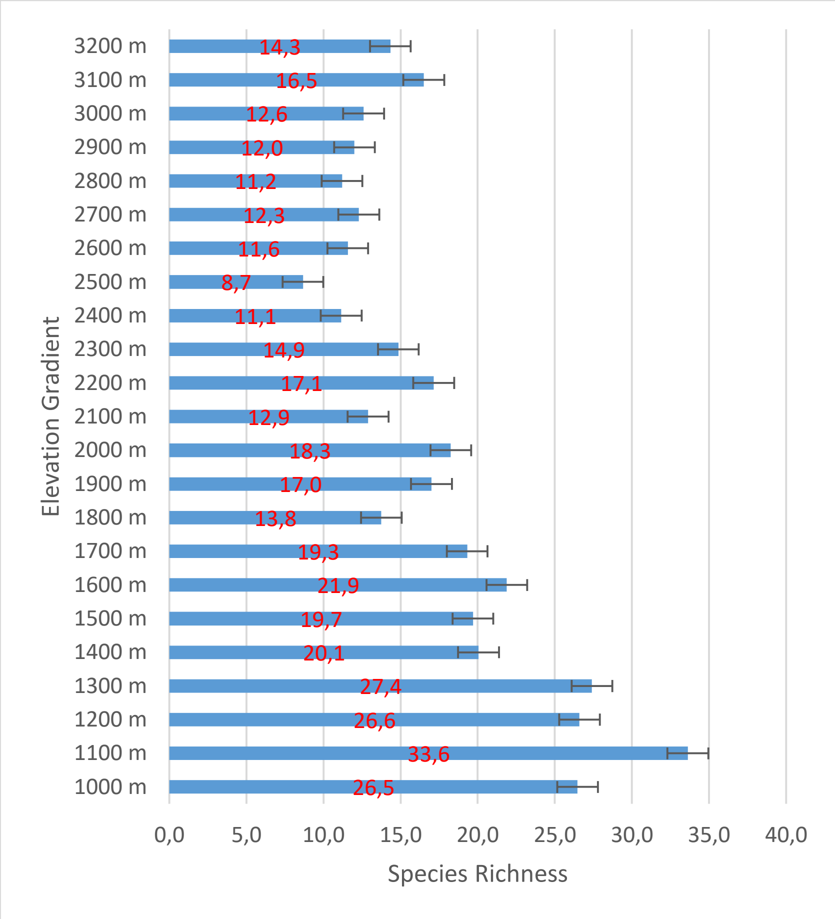


Figure 4.174. Average species richness values according to the altitudinal gradient

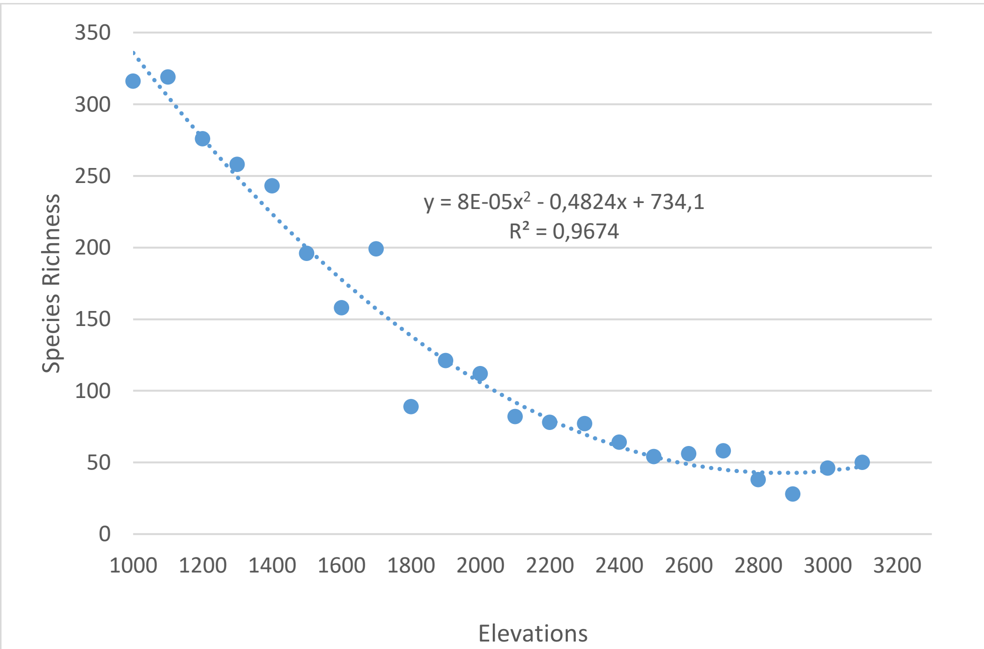


Figure 4.175. Plant species richness according to total data set

4.6. Plant species diversity

As a general evaluation, the diversity values calculated in the sample plots show a decreasing tendency up to 2500 m. However, there is a small increase after 2500 m. It is possible to attribute this to the vegetation in the area being alpine and subalpine. Because, with the addition of alpine plants to the flora, there has been a small increase. In addition, vegetation becomes more or less homogeneous with the limiting effect of climatic conditions in such high regions and the values of diversity measured in sample plots converge more closely than at low elevations.

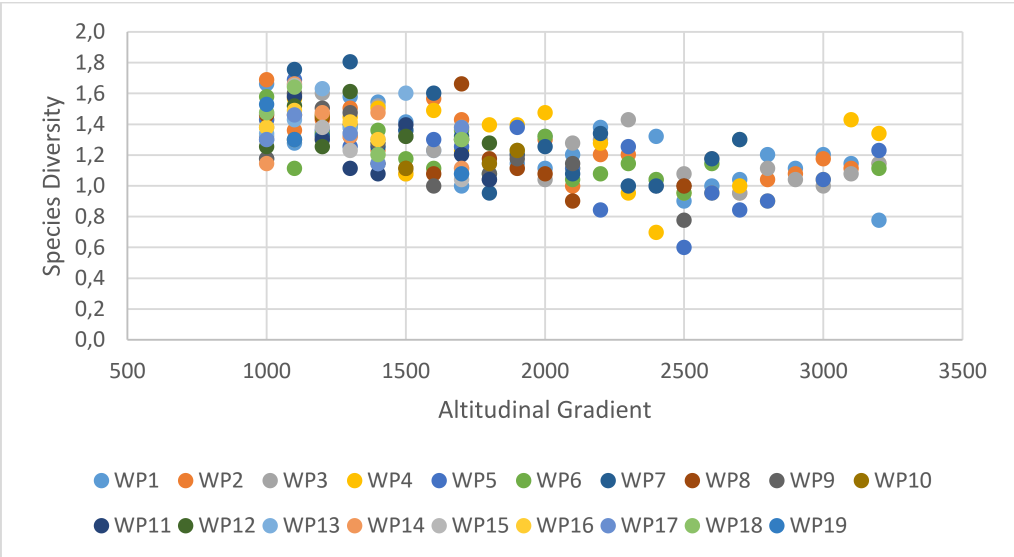


Figure 4.176. Distribution of the plant species diversity values by altitude levels

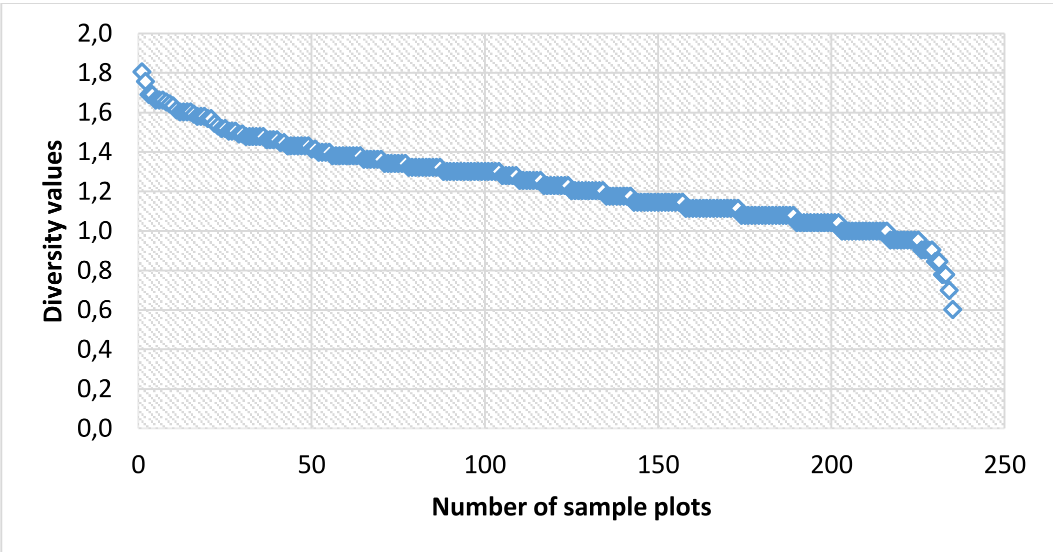


Figure 4.177. Range of plant species diversity values according to the number of the sample plots

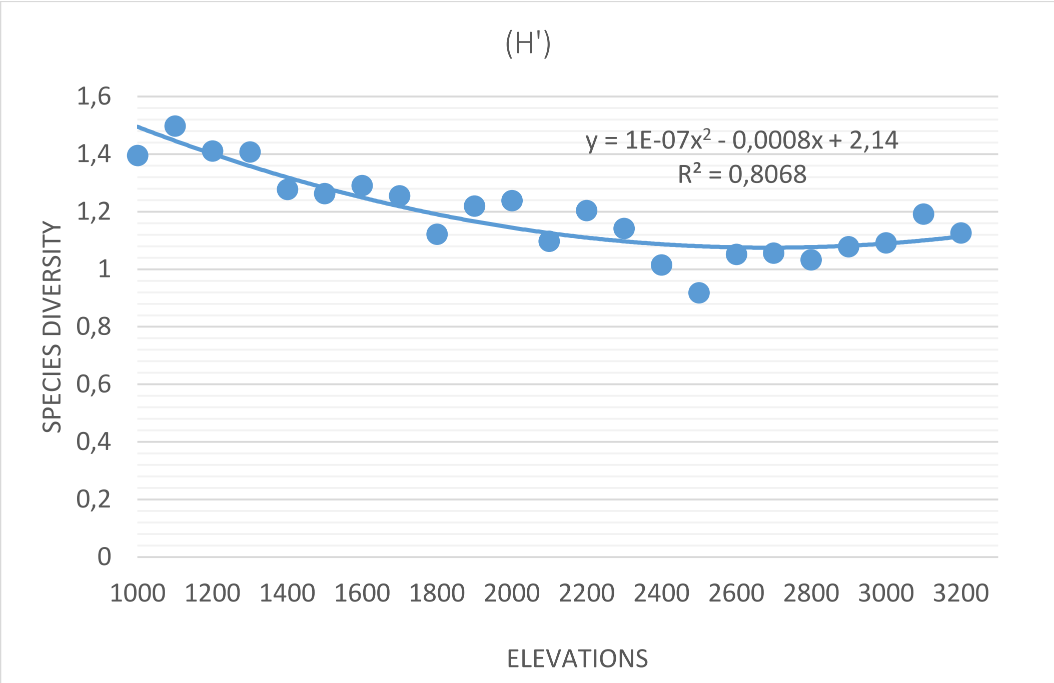


Figure 4.178. Plant species diversity values according to the mean values of the sample plots

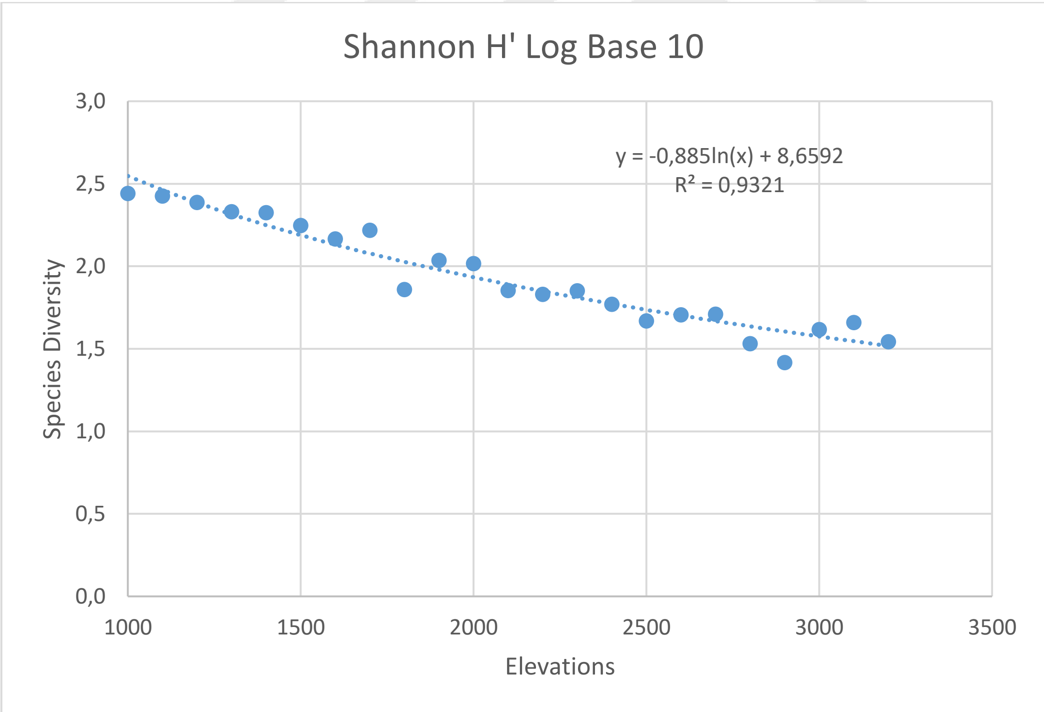


Figure 4.179. Plant species diversity values according to the total data set including frequencies

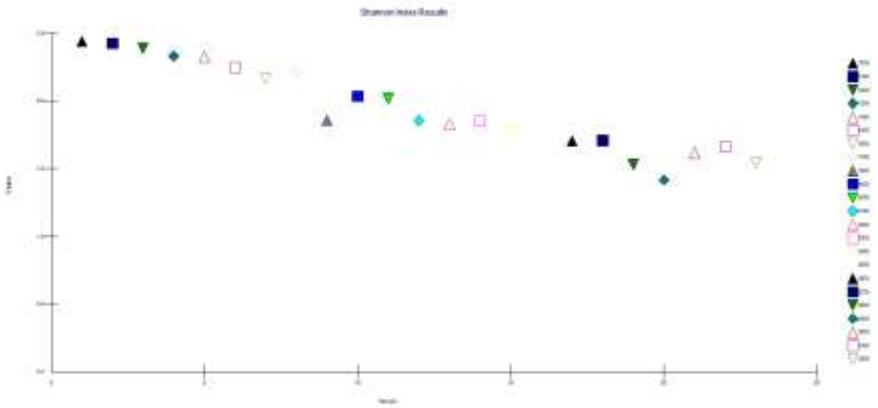


Figure 4.180. Shannon diversity graph of the total data set by elevation levels

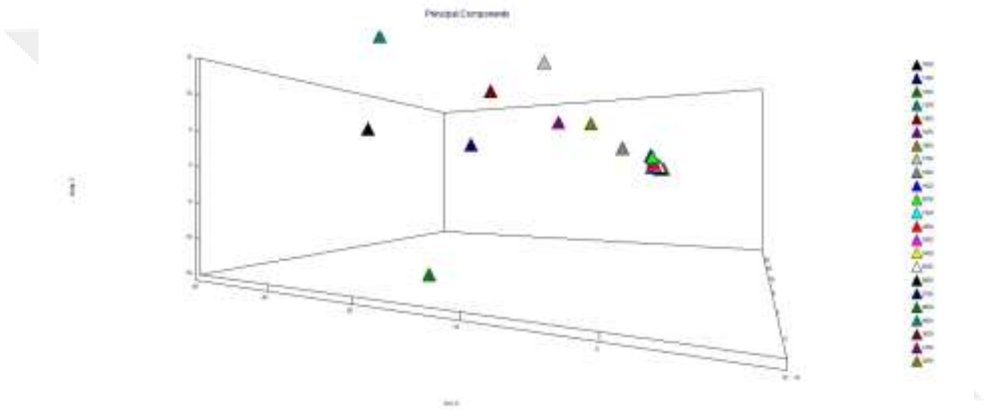


Figure 4.181. Principle component analysis of the total data set by elevation levels

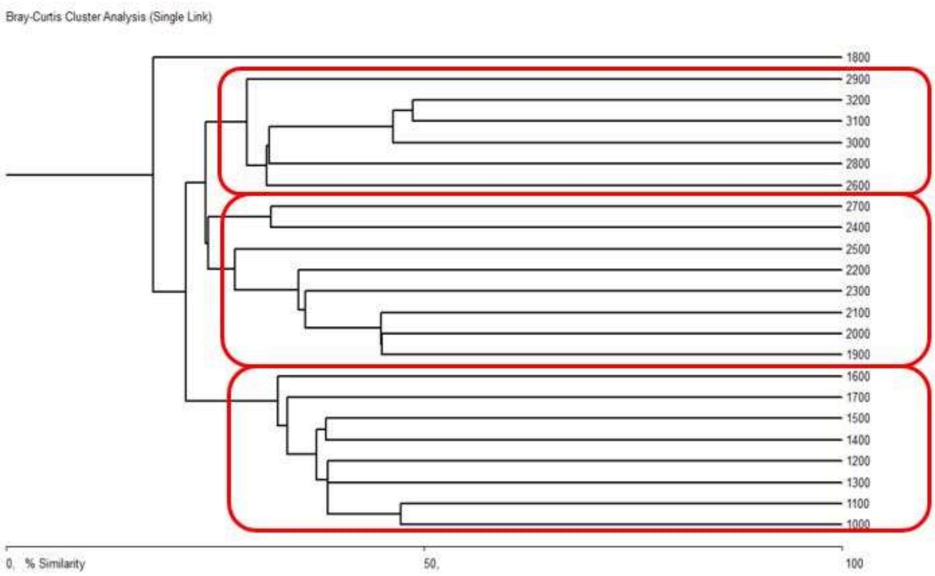


Figure 4.182. Bray-Curtis cluster analysis of the total data set by elevation levels

Table 4.7. Sorensen smilarity index

Elevation Steps

	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	2500	2600	2700	2800	2900	3000	3100	3200
1000	*	47.2	38.4	38.5	32.6	26.6	19.4	24.8	12.2	7.7	6.5	3.9	4.2	3.0	1.7	0.7	0.7	0.7	0.4	0.4	0.4	0.7	0.0
1100	*	*	36.4	38.0	29.5	22.9	19.2	19.9	8.5	6.7	5.6	3.5	3.4	3.0	1.4	1.1	0.6	1.4	0.0	0.9	0.6	1.1	0.8
1200	*	*	*	26.6	26.9	20.9	13.8	13.9	7.8	7.4	7.4	4.3	5.8	4.8	0.8	1.7	2.5	1.2	0.0	0.9	0.4	0.9	0.0
1300	*	*	*	*	37.1	30.2	27.7	25.6	9.4	9.0	7.5	6.5	7.8	3.8	2.2	2.2	1.5	1.8	0.0	0.4	0.8	1.5	1.1
1400	*	*	*	*	*	38.2	32.6	33.7	14.7	15.7	18.9	14.6	14.0	14.2	6.4	6.3	6.3	5.8	1.9	1.5	1.9	2.8	1.3
1500	*	*	*	*	*	*	31.4	27.3	15.6	19.2	20.4	12.9	12.7	8.4	7.8	9.0	3.6	7.6	1.9	2.1	1.3	2.5	0.6
1600	*	*	*	*	*	*	*	28.0	16.5	16.2	21.5	17.3	13.2	10.6	9.5	10.1	5.1	7.8	0.8	2.6	3.9	5.3	2.1
1700	*	*	*	*	*	*	*	*	17.6	18.9	17.5	13.2	12.2	11.4	5.8	5.8	5.4	7.0	3.7	1.5	2.8	5.5	3.1
1800	*	*	*	*	*	*	*	*	*	15.9	15.9	13.4	11.1	10.3	4.9	6.5	3.2	2.4	2.6	1.0	1.8	1.7	1.6
1900	*	*	*	*	*	*	*	*	*	*	45.0	30.4	33.9	29.6	19.9	20.6	15.8	16.2	9.4	7.7	12.8	13.4	8.5
2000	*	*	*	*	*	*	*	*	*	*	*	44.9	34.9	35.9	24.0	27.4	15.0	18.0	7.7	6.6	9.6	9.4	6.0
2100	*	*	*	*	*	*	*	*	*	*	*	*	33.6	30.9	21.6	21.5	17.3	13.9	6.8	6.6	5.6	5.5	2.0
2200	*	*	*	*	*	*	*	*	*	*	*	*	*	31.9	20.0	21.9	16.8	17.3	4.4	8.9	9.8	8.5	4.8
2300	*	*	*	*	*	*	*	*	*	*	*	*	*	*	18.7	23.0	23.9	20.0	13.3	7.1	12.1	11.8	7.4
2400	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	24.2	13.9	31.7	23.0	14.0	12.9	5.6	4.9
2500	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	23.9	21.8	20.0	15.7	18.6	22.1	12.1
2600	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	20.5	31.2	19.0	27.0	27.4	19.3
2700	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	21.8	21.3	21.8	19.7	14.0
2800	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	28.9	26.2	31.5	28.6
2900	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	28.9	25.5	18.0
3000	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	42.5	46.3
3100	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	48.7
3200	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*

5. DISCUSSION

The study area is characterized by a high altitude from 967 to 3200 m and unique orographic structures from forests especially composed of oak species, riparian zones mainly bordered by hygrophyllous trees and plant species, and alpine and sub-alpine regions with a wide range of soil categories and water resources. So, the complex of various topographic, geologic, hydrologic, and climatic conditions provides a wide range of biotopes inhabited by many plants with completely different habitats. The study area can be grouped as using elevation gradient. The elevation zones between 1000-2000 m comprise oak forests, riparian trees and scrubs. Between 2101-2700 m altitudes are mostly covered with mountain meadows and steppes, and finally, between 2701-3200 m altitudes, it includes alpine and lower alpine stony and rocky areas and alpine meadows (Table 5.1).

Table 5.1. The number of species with elevations of forest and riparian area in study area

Elevational zones	**Taxa number**	**Ratio (%)**
1000-2000 m	653	75.31
2001-2700 m	164	18.92
2701-3200 m	50	5.77
Total flora	867	100.0

The results of table 5.2 show that phytogeographical regions, different elevations and other phytochoria is central to phytogeography and evolution and invaluable for conservation plans. Multivariate analysis of phytogeographic and species occurrence data may have interesting applications for classification purposes and elucidation of the floristic structure of regions. Interestingly, Kreft & Jetz (2010) have observed that quantitative regions obtained through different elevations have both similarities and differences in respect to the classic divisions of the world biota. They have shown that Sahara, North Africa, the Arabian Peninsula, and parts of the Middle East may be included in the AfroTropics. This approach may be also applied for refining/ redefining the borders of lower phytochoria. The flora of Sakran area showed that the species richness in this area is higher than in the neighbouring local floras and merits more attention. The flora of this area may be considered for higher levels of conservation, in order to protect its diversity. Overgrazing in the Sakran area has always had a direct impact on plant species diversity. Changes in species distributions, which could be regarded as a sign of the gradual climatic change, might be studied consistently, while changes in the borders/transition zones of lower phytochoria might be monitored in the future studies (Ghahremaninejad and Agheli, 2009; Ghahremaninejad, et al., 2011; Jalilian, et al., 2014).

Table 5.2. The elevations, with number of families, number of taxa, and number of plant taxa in study area

Elevation (m)	No. of families	No. of taxa	No. of species
1000	58	486	312
1100	63	644	335
1200	72	352	247
1300	53	456	298
1400	54	349	231
1500	52	245	185
1600	43	191	151
1700	49	363	199
1800	32	161	87
1900	40	165	116
2000	44	144	112
2100	34	115	81
2200	31	121	79
2300	35	105	79
2400	29	87	57
2500	27	78	54
2600	27	81	54
2700	24	89	61
2800	21	58	35
2900	14	34	25
3000	21	61	42
3100	21	67	54
3200	23	87	40

The highest number of species is at 1100 m with 335 taxa and the lowest number of species is at 2900 m with 25 taxa. The highest species richness has been detected in the lower altitude steps. Decrease in species with high altitude can be attributed to ecophysiological constraints such as extremely low temperature, short growing season, and geographic barriers. Moreover, lower altitudes were in common anthropogenic repression regime such as road construction, settlement and agricultural practices, which resulted in the replacement of natural vegetation with man-made ecosystems consisting of plantations and agriculture This may be attributed to the mention by McCain and Grytnes (2010) that are reported the proposed drivers of elevational gradients of biodiversity could be grouped into four main categories: (1) climatic variables like temperature and rainfall that determine energy availability and ecosystem productivity, (2) spatial aspects like area size and geometric constraints. (3) evolutionary history like clade age, speciation and extinction rates, and (4) biotic processes like competition, mutualism, and ecotone effects. (Figure 5.1).

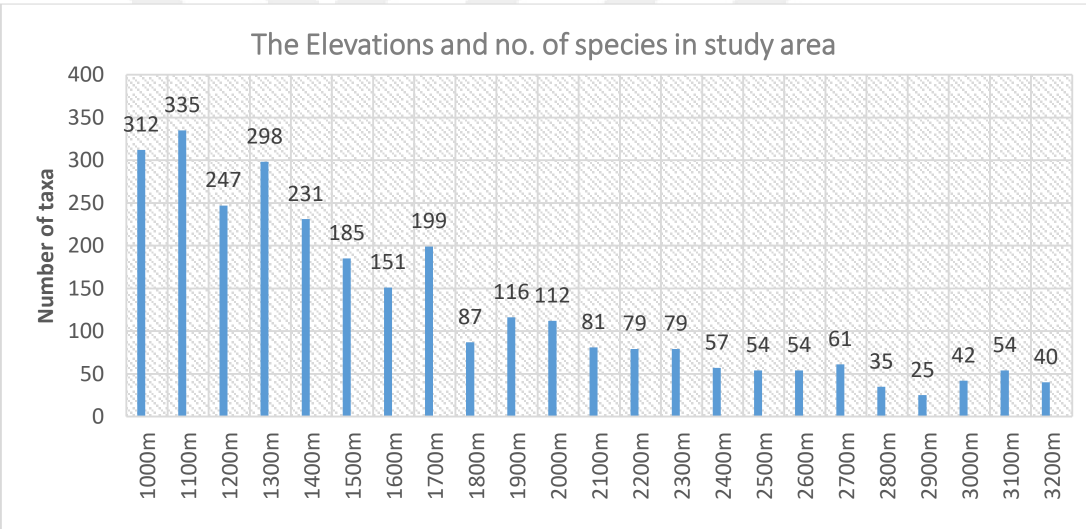


Figure 5.1. The elevations and number of taxa in study area

The highest number of taxa show an altitudinal of ca. 1100 m with 20 WP (644 taxa), and the lowest number of taxa the show an altitudinal of ca. 2900 m with 3 WP (34 taxa). The hight number of families show an altitudinal of ca. 1200 m with (72 families), and the lowest number of taxa the show an altitudinal of ca. 2900 m with (14 taxa) (Figure 5.3).

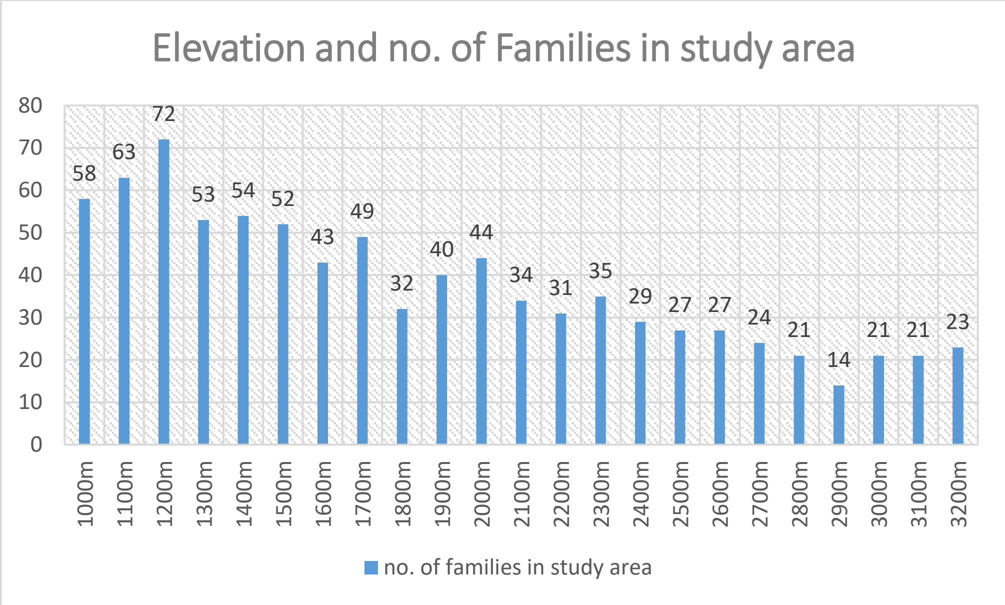


Figure 5.2. The elevations and number of families in study area

Table 5.3. Twenty biggest plant families in Iraq and comparison with the present study

		No. of genus		**No. of taxa**	
No	Family	Flora of Iraq	Present study	Flora of Iraq	Present study
1	Asteraceae	118	57	409	111
2	Fabaceae	58	25	393	85
3	Poaceae	101	37	264	57
4	Brassicaceae	79	37	195	62
5	Apiaceae	67	35	155	45
6	Boraginaceae	30	19	140	29
7	Scrophulariaceae	20	2	138	10
8	Caryophyllaceae	29	13	125	37
9	Liliaceae	22	3	124	11
10	Amaranthaceae	25	5	68	7
11	Rosaceae	20	15	64	40
12	Cyperaceae	15	5	63	11
13	Rubiaceae	12	7	63	17
14	Euphorbiaceae	7	3	51	12

15	Solanaceae	11	4	47	4
16	Ranunculaceae	7	11	45	22
17	Convolvulaceae	6	3	39	6
18	Polygonaceae	8	6	41	14
19	Orchidaceae	9	9	31	15
20	Malvaceae	8	3	29	5

Based on studies mentioned by Soleymani and Khara (2017) collected 447 plant taxa were identified from 81 families and 301 genera were recorded in the Mirabab protect area in Azerbaijan within a range of 1177-2068 m. The largest families in terms of species richness and genera were Asteraceae with 57 taxa (12.75%), Poaceae with 48 taxa (10.73%), Fabaceae with 37 taxa (8.27%), and Lamiaceae with 24 taxa (5.36%). The Asteraceae has 35 genera (7.82%), Poaceae 32 genera (7.15%), Apiaceae 21 genera (4.69%), Brassicaceae 19 genera (4.25%), Lamiaceae 17 genera (3.8%), Fabaceae 16 genera (3.57%), Rosaceae 12 genera (2.68%), Caryophyllaceae 10 genera (2.23%), Liliaceae 9 genera (2.01%), Boraginaceae and Ranunculaceae 6 genera each (1.34%) respectively. In other side Hameed (2017) collected 288 plant taxa and determined 200 genera and 57 families in Hujran Basin Northern Iraq. The largest families in terms of species richness and genus were Asteraceae had 37 taxa (12.84%), Poaceae had 17 taxa (5.9%), Fabaceae had 38 species (13.19%), Brassicaceae had 27 taxa (9.37%), Lamiaceae and Rosaceae had 11 taxa (3.81%), Caryophyllaceae and Boraginaceae 10 taxa each (3.47%), Ranunculaceae had 7 taxa (2.43%) and Liliaceae 2 taxa (0.69%). The families; Asteraceae had 30 genera (10.41%), Poaceae had 15 genera (5.2%), Apiaceae 11 genera (3.81%), Brassicaceae 20 genera (6.94%), Lamiaceae and Boraginaceae had 9 genera each (3.12%), Fabaceae 17 genera (5.9), Rosaceae 7 genera (2.43%), Caryophyllaceae 5 genera (1.73%), Ranunculaceae 3 genera (1.04%) and Liliaceae 2 genera (0.69%).

In this study area the largest families were Asteraceae (57 genera with 111 species), Poaceae (37 genera with 57 species), Lamiaceae (22 genera with 51 species), Fabaceae (25 genera with 86 species), Apiaceae (35 genera with 45 species), and Brassicaceae (37 genera with 62 species) which show the highest genera and species richness. While the (Solymani and Khara, 2017) mentioned the largest family is Asteraceae (35 genera with 57 species), Poaceae (32 genera with 48 species), Lamiaceae (17 genera with 24 species), Fabaceae (16 genera with 37 species), Apiaceae (21 genera with 23 species), and Brassicaceae (19 genera with 21 species) showed the highest Genera and species richness. Therefore, (Hameed, 2016) reported in his study the largest family is Asteraceae (30 genera with 37 species), Poaceae (15 genera with 17 species), Lamiaceae (9 genera with 11 species), Fabaceae (17 genera with 38 species), Apiaceae (11 genera with 12 species), and Brassicaceae (20 genera with 27 species) showed the highest genera and species richness. While (Memariani, et al, 2016) reported in their study in Iran the largest family is Asteraceae (50 genera with 88 species), Poaceae (42 genera with 78 species), Lamiaceae (21 genera with 45 species), Fabaceae (14 genera with 38 species), Apiaceae (18 genera with 26 species), and Brassicaceae (31 genera with 43 species) showed the highest genera and species richness, then (Sinan, 2014) mentioned in his study Altikardes mountain and its surroundings (Genc, Bingol) the largest family is Asteraceae (41 genera with 61 species), Poaceae (35 genera with 58 species), Lamiaceae (17 genera with 21 species), Fabaceae (11 genera with 14 species), Apiaceae (11 genera with 31 species), and Brassicaceae (17 genera with 31 species) showed the highest genera and species richness, Finally, (Adanaş, 2014) showed the highest genera and species richness in his study the flora of Çat Mountaın (Gurpınar-Van) and its surroundıngs, he reported the largest family is Asteraceae (25 genera with 73 species), Poaceae (23 genera with 47 species), Lamiaceae (16 genera with 40 species), Fabaceae (12 genera with 60 species), Apiaceae (8 genera with 13 species), and Brassicaceae (33 genera with 68 species) (Table. 5.6).

Results provide important insights into the comparison of diversity in study area with each of two different areas is manifest in the floristic composition, also in life reflects the adaptive responses of plants to environment and climate and provides differences of various vegetation types.

It is concluded that the plant diversitry spectrum more accurately describes the vegetation physiognomy since individuals are counted by their life form. The disadvantage of the floristic diversity spectrum is the necessity of identification all the species present in an area and underestimation of dominant life forms (Heydari, et al., 2013). The differential pattern of rainfall and snowing appears as the most operative factors as compared to biotic factors for evaluation of biological spectrum. The present study also concludes that vegetation biological spectrum is considerable at all scales and provides a clear picture of prevailing climate. Also, floristic studies have important consequences for management and conservation. Apart from ecological reasons, maintaining biodiversity in forest ecosystems has economic, spiritual, ethical, scientific, and educational importance. Therefore, the preservation of these species is crucial not only for the conservation of their rich biodiversity but also for meeting the basic needs of the local population. Some of the plant species with a narrow and high distribution which are potentially endangered and vulnerable species are severely threatened. Therefore, the protection and management of rangelands in this zone need to be considered. It is essential to control human and domestic animals use from the reserve. Substantial research on internalizing the values of biodiversity and the adoption of new indices of global and national wealth based on functioning ecosystems are required, including clear and consistent rules and processes that cross economic and political jurisdictions, such as are emerging in semi-arid areas. (Batalha and Martins, 2004; Farouji and Khodayari, 2016; Jafari, et al., 2016; Lazarina et al., 2019).

Table 5.4. Comparison of the intercorrelations among the three different locations of plant biodiversity

	Present study		**Soleymani and Khara (2017) Iran**		**Hameed (2016) Iraq**		**Memariani, et al, (2016) Iran**		**Adanas (2014) Turkey**		**Karabacak and Behcet (2007) Turkey**	
Family	Genus, (%)	Taxa no. (%)	Genus, (%)	Taxa no. (%)	Genus, (%)	Taxa no. (%)	Genus, (%)	Taxa no. (%)	Genus, (%)	Taxa no. (%)	Genus, (%)	Taxa no. (%)
Asteraceae	57, (6.66)	111, (12.80)	35, (7.82)	57, (12.75)	30, (10.41)	37, (12.84)	50, (7.54)	88, (13.27)	25, (4.39)	73, (12.82)	142, (15.90)	42, (4.71)
Poaceae	37, (4.27)	57, (6.57)	32, (7.15)	48, (10.73)	15, (5.2)	17, (5.9)	42, (6.33)	78, (11.77)	23, (4.04)	47, (8.26)	68, (7.6)	33, (3.70)
Fabaceae	25, (2.88)	85, (9.80)	16, (3.57)	37, (8.27)	17, (5.9)	38, (13.19)	14, (2.11)	38, (5.76)	12, (2.11)	60, (10.54)	68, (7.6)	12, (1.35)
Lamiaceae	22, (2.54)	51, (5.88)	17, (3.80)	24, (5.36)	9, (3.12)	11, (3.81)	21, (3.7)	45, (6.79)	16, (2.82)	40, (7.07)	57, (6.3)	16, (1.79)
Apiaceae	35, (4.04)	45, (5.19)	21, (4.69)	23, (5.14)	11, (3.81)	12, (4.16)	18, (2.7)	26, (3.92.)	8, (1.23)	13, (2.28)	13, (1.5)	8 (0.90)
Brassicaceae	38, (4.38)	62, (7.15)	19, (4.25)	21, (4.69)	20, (6.94)	27, (9.37)	31, (4.67)	43, (6.48)	33, (5.8)	68, (11.74)	69, (7.7)	30, (3.37)
Rosaceae	14, (1.61)	40, (4.61)	12, (2.68)	21, (4.69)	7, (2.43)	11, (3.81)	13, (1.96)	23, (3.47)	8, (1.23)	13, (2.28)	32. (3.5)	14, (1.57)
Caryophyllaceae	13, (1.50)	37, (4.27)	10, (2.23)	16, (3.57)	5, (1.73)	10, (3.47)	14, (2.11)	32, (4.83)	7, (1.04)	29, (5.09)	51, (5.7)	13, (1.46)
Liliaceae	3, (0.35)	8, (0.92)	9, (2.01)	16, (3.57)	2, (0.69)	2, (0.69)	3, (0.45)	13, (1.96)	10, (1.76)	27, (4.11)	41, (4.6)	11, (1.12)
Boraginaceae	17, (1.96)	29, (3.34)	6, (1.34)	8, (1.78)	9, (3.12)	10, (3.47)	14, (2.11)	20, (3.02)	12, (2.11)	22, (3.30)	36. (4.0)	17, (1.91)
Ranunculaceae	11, (1.27)	22, (2.54)	6, (1.34)	8, (1.78)	3, (1.04)	7, (2.43)	9, (1.36)	17, (2.56)	5, (0.8)	16, (2.80)	27, (3.2)	13, (1.46)
Total taxa	**867**		**447**		**288**		**663**		**569**		**891**	

The results have also shown that the largest genera in the flora of Sakran area are *Astragalus* with 19 taxa (2.19%), *Trifolium* with 15 taxa (1.73%), *Prunus* with 15 taxa (1.73%), *Silene* with 13 taxa (1.50%), *Allium* with 12 taxa (1.38%), *Centaurea* with 10 taxa (1.15%), *Medicago* with 8 taxa (0.92%). These differences can be explained in part by the proximity of Soleymani and Khara, 2017 and Hameed, 2016), *Astragalus* with 7 taxa (1.56%), *Trifolium* with 7 taxa (1.56%), *Silene* with 4 taxa (0.49%), *Allium* with 5 taxa (1.11%), *Prunus* with 3 taxa (0.67%), *Centaurea* with 4 taxa (0.89%), *Medicago* with 3 taxa (0.67%) return to (Soleymani and Khara, 2017) and the largest of species in Hujran Basin was recorded from (Hameed, 2016) are *Astragalus* with 3 taxa (1.04%), *Trifolium* with 11 taxa (3.81%), *Silene* with 5 taxa (1.73%), *Allium* with one taxon (0.34%), *Prunus* with 4 taxa (1.38%), *Centaurea* with 4 taxa (1.38%), *Medicago* with 5 taxa (1.73%), Memariani, et al, (2016) Iran *Astragalus* with 15 taxa(2.26%), *Trifolium* with 4 taxa (0.60%) , Silene with 17 taxa (2.56%) , *Allium* with 6 taxa (0.90%), *Prunus* with 12 taxa (1.81%), *Centaurea* with 4 taxa (0.60%), *Medicago* with 5 taxa (0.75%), Adanas, 2014 (Turkey) mentioned in his study *Astragalus* with 26 taxa (4.93%), *Silene* with 13 taxa(2.3%), *Euphorbia* with 13 taxa(2.3%), *Allium* with 3 taxa(0.53%), *Bromus* with 7 taxa(1.24%), *Cuosinia* with 1 taxa(0.18%), *Centaurea* with 8 taxa (1.41%), *Onobrychis* with 6 taxa(1.1%). Finally, Karabacak and Behcet, (2007) reported in their study *Astragalus* with 1 taxa (2.24%), *Trifolium* with 10 taxa (1.87%), *Allium* with 6 taxa (1.12%), *Bromus* with 5 taxa (0.93%), *Carex* with 4 taxa (0.75%), *Centaurea* and Medicago with 3 taxa (0.56%), *Euphorbia*, *Silene*, *Quercus and Prunus* with 2 taxa (0.37%). (Table 5.5).

Table 5.5. The largest genera of species in the flora of study area comparison with neighouring cuontries study

	Present study (2021) Iraq		**Soleymani and Khara (2017) Iran**		**Hameed (2016) Iraq**		**Memariani et al. (2016) Iran**		**Adanaş (2014) Turkey**		**Karabacak and Behcet (2007) Turkey**	
Genera	Taxa No.	Ratio (%)	Taxa No.	Ratio (%)	Taxa No.	Ratio (%)	Taxa No.	Ratio (%)	Taxa No.	Ratio (%)	Taxa No.	Ratio (%)
Astragalus	19	2.19	7	1.56	3	1.04	15	2.26	26	4.93	1	2.24
Trifollium	15	1.73	7	1.56	11	3.81	4	0.60	0	0	10	1.87
Allium	12	1.38	5	1.11	1	0.34	17	2.56	3	0.53	6	1.12
Bromus	7	0.81	5	1.11	2	0.69	6	0.90	7	1.24	5	0.93
Cousinia	4	0.46	5	1.11	0	0	12	1.81	1	0.18	0	0
Euphorbia	7	0.81	5	1.11	4	1.38	4	0.60	8	1.41	2	0.37
Carex	3	0.35	4	0.89	0	0	5	0.75	0	0	4	0.75
Centaurea	10	1.15	4	0.89	4	1.38	5	0.75	8	1.41	3	0.56
Quercus	3	0.35	4	0.89	2	0.69	1	0.15	0	0	2	0.37
Silene	13	1.50	4	0.89	5	1.73	9	1.36	13	2.3	2	0.37
Echinops	3	0.35	3	0.67	1	0.34	4	0.60	0	0	1	0.19
Prunus	15	1.73	3	0.67	4	1.38	2	0.30	2	0.35	2	0.37
Medicago	8	0.92	3	0.67	5	1.73	3	0.45	4	0.71	3	0.56
Onobrychis	3	0.35	3	0.67	2	0.69	3	0.45	6	1.1	0	0
Orobanche	5	0.58	3	0.67	4	1.38	2	0.30	3	0.53	1	0.18

Although the woodline and the alpine and semi-alpine regions in the Sakran region are naturally more protected than forests, they provide a great deal of food capacity for the animals, so they are under pressure mainly from past decades grazing sheep and continue until now without grazing laws. Human and agricultural activities, livestock grazing, severe harvesting of endangered species for economic as wild edible plants and ornamental purposes as well as the collection of medical plants are the main threats in the Oak forest. On the other hand, overgrazing of the vegetation in the delicate sub-alpine and alpine areas caused destruction in vegetation, habitat and biodiversity loss and intensive reduction in space for endemic and narrow distributed species (Noroozi et al. 2008; Naqinezhad et al. 2010, Akhani, et al., 2013). For both conservation and theoretical reasons, the region of Sakran should be given considerable ecological attention. In order to protect its rich and distinctive flora and vegetation, it is important to conserve and preserve species and habitat.

This area comprises several high elevation areas in northern Iraq, topographically and thereupon floristically well connected to Sakran area. This spatial proximity to kurdo-Zagrosian regions probably explains the relatively high proportion of genera restricted to this region. At high elevations, the number of local plants increases considerably, especially in Hasari--Rust and Hasar-i-Sakran Mountains.

In this study, a source of weakness that affected collection localities was the mined land areas, in spite of its limitations, the study certainly adds to our understanding of the survey and cleaning all parts of mined lands. In recent decades, the natural ecosystems and biodiversity of the Sakran region have undergone extensive degradation following an increase in the human population, urbanization and industrialization. Over-exploitation and overgrazing are the principal destructive factors, as is the case in many other areas of Iraq. Since the last century, cutting firewood and wood, except in inaccessible or mined land, have destroyed the unique forests of Northern Iraq. Pistacia trees have been over-exploited for nut and resin production or by overgrazing.

6. CONCLUSION

Investigation of floristic habitat composition is important for continuous environmental study, management and protection of plants. Detailed data can shed light on less costly conservation, as resources available for conservation of species and habitats are minimal. Plant biodiversity, which is evaluated according to altitude steps in the study, is also an important tool for conservation and management actions for species and ecosystems.

The ecosystems and gene pool of a region reflect the biodiversity of the area. The life forms of plants in this region are hemicryptophytes, therophytes, cryptophytes, chamaephytes and phanerophytes respectively. This biological spectrum is mostly compatible with moderately cold climates. There is a close relationship between climate and plant life forms. Therefore, the high species richness and the tangible superiority of Hemicryptophytes probably stemmed from the mountain and cold climate surrounding the area. According to the results, almost half of the plants in the region (50.08%, 442 taxa) are of Iran-Turan origin, so it can be concluded that Irano-Turanian elements are dominant in this mountainous area.

Some lower parts of the study area are covered by human settlement and livestock in the area have caused the destruction of the vegetation. Since, grazing damages vegetation, it causes a loss of biodiversity and the dominance of annual, prickly plants, dominated by both the Fabaceae and Asteraceae families. Since some annual and perennial species have the largest numbers, destruction of vegetation can be alarming for the loss of main species. In other hand, the Orchidaceae family is one of the last individual remnants of the under trees. These highly threatened plant-rich spots possess rare species that have been drastically exterminated from other areas of the study area by the villagers. These pocket reserves, especially in the understory vegetation of oak forests are in need of more intensive protection. It is also essential to control human activities in order to prevent uprooting and collecting these types of plants. Orchidaceae family is the most exploited and destroyed plant group in the region. Therefore, all species of this family are considered priority protection according to IUCN reports.

Most of the threatened species belong to the endangered and vulnerable categories. So, it is important to create awareness for the local community about plant biodiversity conservation efforts. For protection practices, we highly recommend the integrated management of these protected areas and their adjacent regions such as all area of Hallgord Sakran National Park protected area. Also, lack of specific legislation for species, especially endemic and threatened, or weak implementations of available legislation are threat for their protection. In addition, these studies should be supported with the latest updated data of the species. Some of the approaches proposed for better protection are the creation of protected areas, effective propagation methods such as micropropagation, the collection of endangered species in botanical gardens and research centers, and improving eco-tourism and the role essential of civil society organizations (NGOs). At the same time, international conservation rules and regulations must be strictly followed to preserve this invaluable natural heritage in its current state.

7. REFERENCES

Abd-Al-Aziz, S.A. (2012). A Comparative Systematic Study of the Genus *Allium* L. (Alliaceae) in Iraq. MSc. University of Baghdad. Iraq.

Abdulhassan, N.A., Abdulrahman, S., Ahmed, H., Ararat, K. (2011). Key biodiversity survey of Kurdistan, Northern Iraq, Nature Iraq, Sulaimani. Iraq. 102 p.

Abdula, R.A., Khailany, R.N., Rasheed, M.J., Abdi, B.S. (2020). Glacial activity signs during the Pleistocene Epoch in Rawanduz River Valley, Kurdistan Region, Northeast Iraq. *Iraqi Bulletin of Geology and Mining*, 16(2): 75-93.

Abdulrahman, Sh.S. (2020). Systematic study and phylogeny of *Prunus* subgenus *Amygdalus* (Rosaceae) in Kurdistan Region / Iraq. Ph.D. Thesis, Faculty of Science University of Zakho, Duhok, Kurdistan Region. Iraq.

Aedo, C., Garcia, M.Á., Alarcón, M.L., Aldasoro, J.J., Navarro, C. (2007). Taxonomic revision of *Geranium* subsect. Mediterranean (Geraniaceae). *Systematic Botany* 32(1): 93-128.

Agard, P., Omrani, J., Jolivet, L., Mouthereau, F. (2005). Convergence history across Zagros (Iran): constraints from collisional and earlier deformation. *International Journal of Earth Sciences* 94(3): 401-419.

Agnew, A.D.Q. (1967). Contributions to the Flora of Iraq: IV: Notes on the Geraniaceae of Iraq, with a New Species of Pelargonium. Kew Bulletin, 21(2): 225-227.

Ahmad, S.A. (2013). Vascular plants of Hawraman region in Kurdistan Iraq, (Doctoral dissertation, Ph.D., Faculty of Agricultural Sciences, Sulaimani University, Iraq).

Ahmadi, F., Mansory, F., Maroofi, H., Karimi, K. (2013). Study of flora, life form and chorotypes of the forest area of west Kurdistan (Iran). *Bull. Env. Pharmacol. Life Sci.* 2(9): 11-18.

Al-Dabbagh, S.T., Saeed, J.F. (2019a). The Phenetic study of distributed species of Valerianaceae Batsch family in Kurdistan Region-Iraq. *Zanco Journal of Pure and Applied Sciences* 31(3): 23-31.

AL-Dabbagh, S.T.S., Saeed, J.F. (2019b). Some diagnostic anatomical features in two species of the Genus *Valeriana* L. (Valerianaceae) from northern Iraq. *The Journal of Research on the Lepidoptera* 50 (4): 63-75.

Al-Bayati, M.Kh.A., Maaleh, A.H.K. (2011). New taxonomic ranks from Iraq for the genus *Scutellaria* L. (Labiatae) with a key to its species. *Ibn Al-Haitham Journal for Pure and Applied Science* 24(3): 15 p.

Al-Edhari, A.H., Al Regawi, S.M., Sardar, A.S. (2019). Molecular systematic study for the two genera *Lophochloa* Rchb. & Schismus P. Beauv. (Poaceae) in Iraq. *Zanco Journal of Pure and Applied Sciences* 31(4): 138-142.

Al Doskey, Z.A.S. (2002). A taxonomic study of the genus *Crataegus* L. (Rosaceae) in the Northern of Iraq. MSc thesis. Forestry Dep. University of Dohuk. Iraq. (in Arabic).

Al Doskey, Z.A.S. (2014). A Comparative systematic study of the genera *Rosa* L. and *Rubus* L. (Rosaceae) in Kurdistan Region of Iraq. PhD thesis, Forestry Dep. University of Dohuk. Iraq.

Al-Hadeethy, M., Khamphio, M., AL-Mshhdani, A., Pornpongrungrueng, P., AL-Khesraji, T., Sahapat, B., AL-Jewari, H. (2014). Anatomical study of some characters in certain species of genus *Verbascum* L. in North and Middle of Iraq. *Direct Research Journal of Biology and Biotechnology* 1(1): 3-13.

Al-Zubaidy, A.M.A., Tobakari, S.R.A. (2018). A Comparative systematic study of the genus *Symphytum* L. (Boraginaceae) with new first record of the species *Symphytum tuberosum* l. from Iraq. *Plant Archives* 18(2): 2068-2076.

Alavi, M. (1994). Tectonics of the Zagros orogenic belt of Iran: new data and interpretations. *Tectonophysics* 229(3-4): 211-238.

Ahvazi, M., Akbarzadeh, M. (2017). Traditional uses of some medicinal plants in gastrointestinal tract treatment in East-Mazandaran (Iran). *Journal of Medicinal Plants* 3(63): 43-56.

Akbarinia, M., Zare, H., Hoseini, S.M., Ejtehadi, H. (2004). Study on vegetation structure, floristic composition and chorology of silver birch communities at Sangdeh, forest of Hyrcanian region. *Pajouhesh va Sazandegi* 64: 84-96.

Akhalkatsi, M. (2009). Conservation and sustainable use of crop wild relatives in Samtskhe-Javakheti. Final Report, GSNE "Orchis", Tbilisi, Georgia.

Akhani, H., Ziegler, H. (2002). Photosynthetic pathways and habitats of grasses in Golestan National Park (NE Iran), with an emphasis on the C4-grass dominated rock communities. *Phytocoenologia* 32(3): 455-501.

Akhani, H. (2006). Biodiversity of halophytic and sabkha ecosystems in Iran. In Sabkha ecosystems, Volume II: West and Central Asia: 71-88. Springer, Dordrecht.

Akhani, H. (2007). Diversity, biogeography, and photosynthetic pathways of *Argusia* and *Heliotropium* (Boraginaceae) in South-West Asia with an analysis of phytogeographical units. *Botanical Journal of the Linnean Society* 155(3): 401-425.

Akhani, H., Mahdavi, P., Noroozi, J., Zarrinpour, V. (2013). Vegetation patterns of the Irano-Turanian steppe along a 3,000 m altitudinal gradient in the Alborz Mountains of Northern Iran. *Folia Geobotanica* 48(2): 229-255.

Al-Dabbagh, S.T. (2010). Taxonomic Study of the Morphology of the Genus (*Eryngium* L.) (*Umbelliferae*). Master Thesis, College of Agriculture, Salahaddin University - Erbil.

Ali, S.A. (2012). Geochemistry and geochronology of Tethyan-arc related igneous rocks, NE Iraq. A thesis submitted in fulfilment of the requirements for the award of the degree. Doctor of Philosophy. University of Wollongong. Australia.

Ali, Sh.S. (2014). Building the Flora of Kurdistan Region. MSc Plant Diversity. The University of Reading. UK.

Al-Musawi, A.H.I., Al-Jbuuri, Kh.Gh.W. (2009). New species from Iraq to the genus *Alcea* L. with key for its spp. 3rd scientific conference-College of Science / University of Baghdad: 1071-1079

AL Maa'thidy, A.S., Shahbaz, S., Zeravan, A.S. (2007). Numerical taxonomy for genus Crataegus L. (Rosaceae) in North of Iraq. *Rafidain Journal of Science* 18(2): 1-15.

AL-Jibouri, K.D.W., Wahid, K.D.A., Saeed, J.F. (2013). Chemotaxonomic study (phenolic compound) of the genus *Alcea* L. spp. (Malvaceae) wild grown in Iraq. *Diyala Journal for Pure Science* 9(2): 21-32.

Al-Jibouri, K.D.W., Al-Rawi, A.A.F. (2009). Palynological study of the Genus Arabis l. (Brassicaceae) in Iraq. *Journal of Global Pharma Technology* 11(3) (Supl.): 247-250.

Al-Rawi, A. (1964). Wild plant of Iraq with their distribution. Tech. Bull. 14, Dir. Gen. of Agr. Res. Res. Proj. Ministry of Agriculture, Government Press.

Al-Sherif, E.A., Ayesh, A.M., Rawi, S.M. (2013). Floristic composition, life form and chorology of plant life at Khulais region, Western Saudi Arabia. *Pak. J. Bot* 45(1):29-38.

Al-Sindy, S.S.A. (2011). A comparative systematic study of the genus Salix L. (Salicaceae) in Kurdistan region of Iraq. MSc. Thesis, University of Zakho. Zakho, Kurdistan Region, Iraq.

AL-Zubaedy, Z.A.A., AL-Musawi, A.H.E., Al-Mousawi, A.H.A. (2016). A comparative anatomic study of leaves of the genus *Stachys* L. in Iraq. *Baghdad Science Journal* 13(4): 649-662.

AL-Zubaedy, Z.A.A., AL-Musawi, A.H.E., Al-Mousawi, A.H.A. (2014). A comparative taxonomic study of leaves of the genus *Stachys* L. in Iraq. *Baghdad Science Journal* 11(3): 1310-1318.

Ameen, M.S. (1992). Effect of basement tectonics on hydrocarbon generation, migration, and accumulation in northern Iraq. *AAPG bulletin*, 76(3): 356-370.

Amer, M.M.A. (2003). A comparative systematic study of *Prunus* L. (Rosaceae) in Iraq. PH.D. dissertation. University of Mosul.Iraq.

Amiri S, Zakaei M, Ejtahadi H, Mozaffarian V. (2008). Study of flora, life form and geographical distribution of plants Tiregan watershed Khorasan province. *Quarterly J Sci* 8: 89-106.

Amiri, M.S., Joharchi, M.R. (2016). Ethnobotanical knowledge of Apiaceae family in Iran: A review. *Avicenna journal of phytomedicine*, 6(6): 621.

Al-Mayah, A A., Al-Asadi, W.M. (2018). An Account of Orobanche L. (Orobanchaceae) in Iraq. *Biological and Applied Environmental Research*, 2(1): 22-33.

Anonymous, (2010). Iraqi Fourth National Report to the Convention on Biological Diversity. Report Research. 153 p.

Aun, Z.A., Haloob, A. (2020). A New species of genus Stachys L. (Lamiaceae) in Iraq. *Plant Archives*, 20(2): 1131-1134.

Ararat, K., Ahmad, S. A., Hassan, N. (2010). Key biodiversity survey of Kurdistan, Northern Iraq. Nature Iraq, Sulaimani. Iraq.

Asem, A., Eimanifar, A., Djamali, M., De los Rios, P., Wink, M. (2014). Biodiversity of the hypersaline Urmia Lake national park (NW Iran). *Diversity* 6(1): 102-132.

Asri, Y., Adel, J. Mostafa, A., Dianatnzhad H. (2000). A Contribution to the flora of Touran biosphere reserve. *Pajouhesh-Va-Sazandegi* 13(2, 47): 4-19.

Atashgahi, Z., Ejtehadi, H., Zare, H. (2009). Study of floristics, life form and chorology of plants in the east of Dodangeh forests, Mazandaran province, Iran. *Iranian Journal of Biology* 22 (2): 193-203.

Aziz, F.H., Karim, T.H., Ismail A. O., Ahmed, D.G., Ghaib F.A., Karim, K., Ghafoor, A.O., Abdul-Rahman, N.M. (2001). Study of agro-ecological zoning for Diana-Mergasor-Barzan and Sheruan Mazn / Rubar Barazgird valley areas. FAO Representation in Iraq, Coordination office for Northern Iraq.

Azizi, H., Keshavarzi, M. (2014). The Study of flora life form and chorotypes of the Homel Mountain, Sardasht, West Azarbaijan province, NW Iran. Bull. *Env. Pharmacol. Life Sci.*, 4:109-116.

Azizi, H., Keshavarzi, M. (2015). The study of flora life form and chorotypes of the Bazjar Qalarashe, Sardasht, West Azarbaijan province, NW Iran. *Journal of Applied Science Reports*, 10(1):31-37.

Azizi, H., Keshavarzi, M. (2016). Floristic study of the Dupaza Mountain, Sardasht County, West Azarbaijan Province, NW Iran. Phytologia Balcanica: *International Journal of Balkan Flora and Vegetation* 22(1): 79-84.

Azizi, N., Ghorbani Nohooji, M., Arman, M. and Sargazi, F. (2015). Studying of the plant biodiversity in the Arsanjan’s Bonab Park (Fars province). *Journal of Plant Ecosystem Conservation*, 2(5): 1-16.

Babashekh, S.A.A. (2006). Systematic Study of *Dianthus* L. (Caryophyllaceae. Msc. thesis, University of Sulaimani, Iraq.

Bachmann, A. (2009). Report on Sakran & Barzan Key Biodiversity Areas, Erbil Governorate, 20 p.

Bachmann, A., Chappell, B., Elliott, N., Matti, N. (2011). Key Biodiversity Survey of Iraq 2010 Site Review.Nature Iraq & Iraq Ministry of Environment Sulaimani, Kurdistan Region, Iraq.

Batalha, M.A., Martins, F.R., 2004. Floristic, frequency, and vegetation life-form spectra of a cerrado site. *Brazilian Journal of Biology*, 64(2): 201-209

Bakr, B.K., Saeed, J.F. (2014). A Chemo Taxonomical Study of Two Genera Scandix L. and Smyrnium L. of (Apiaceae) in Kurdistan Region of Iraq. *ZANCO Journal of Pure and Applied Sciences*, 26(1): 11-20.

Berger, W.H., Parker, F.L. (1970). Diversity of planktonic foraminifera in deep-sea sediments. *Science* 168(3937): 1345-1347.

Beydoun, Z.R. (1991). Arabian plate hydrocarbon geology and potential. United States America.Bisht AS, Bhatt AB. 2016. Dominance and diversity studies of tree species in lesser Himalayan forest of Uttarakhand, India. *Biodiversitas*, 17: 70-77.

Bor, N.L., Guest, E. (1968). Flora of Iraq, Vol. 9. Ministry of Agriculture, Baghdad.

Braidwood, R.F., Howe, B. (eds.) (1960). Prehistoric investigations in Iraq Kurdistan. University of Chicago Press, Chicago, Ill., 184p.

Bredenkamp, G.J., Brown, L.R. (2001). Vegetation–A reliable ecological basis for environmental planning. Urban Greenfile, 38-39.

Bridson, D.M., Forman, L. (1998). Herbarium handbook. Royal Botanic Gardens, Kew.

Buringh, P. (1960). Soils and soil conditions in Iraq. Republic of Iraq, Ministry of Agriculture, Directorate General of Agricultural Research and Projects.

Byfield, A., Wilson, P. (2005). Important Arable Plant Areas: identifying priority sites for arable plant conservation in the United Kingdom. Plantlife International.

Carvalho, D., Costa, R., Soares, D., Araujo, F., Wilson Lima-Verdel L. (2007). Flora and life- form spectrum in an area of deciduous thorn woodland (cattinga) in northeastern, Brazil. *J Arid Environ* 68: 2.

Chakravarty, H.L. (eds.) (1976). Plant Wealth of Iraq (A dictionary of economic plants): Vol. 1. Baghdad (IQ): Ministry of Agriculture & Agrarian Reform.

Chase, M.W., Christenhusz, M.J.M., Fay, M.F., Byng, J.W., Judd, W.S., Soltis, D.E., Mabberley, D.J., Sennikov, A.N., Soltis, P.S., Stevens, P.F. (2016). An update of the Angiosperm Phylogeny Group classification for the orders and families of flowering plants: APG IV. *Botanical Journal of the Linnean Society*, 181(1):1-20.

Daget, P. (1977a). Le bioclimate mediterraneen: analyse des formes climatiques par le systeme d'Emberger. *Vegetatio*, 34(2):87-103.

Daget, P. (1977b). Le bioclimate mediterraneen: caracteres generaux, modes de caracterisation. *Plant Ecology*, 34(1):1-20.

Darwesh, T.D.D. (2017). Plant Biodiversity in the Vicinity of Choman in Terms of Non-Wood Forest Products, Erbil-Iraq. MSc. Plant Biodiversity. Kahramanmaraş Sutcu İmam University. Turkey.

Davis, P.H. (1965-1985). Flora of Turkey and the East Aegean Islands, Vol I-IX, Edinburgh University Press, Edinburgh.

Davis, P.H., Mill, R.R., Tan, K. (1988). Flora of Turkey and the East Aegean Islands, Vol. X, Supplement, Edinburgh University Press, Edinburgh.

Davis, S., Heywood, V., Hamilton, A. (eds.) (1994). Centres of Plant Diversity. Vol 1: Europe, Africa, Southwest

Dehshiri, M.M., Jozipoor, M. (2014). Angiosperms, Kuhdasht gypsum areas, Lorestan, Iran. *Check List*, 10(3):516-523.

Dogan, H.M., Dogan, M. (2006). A new approach to diversity indices – modeling and mapping plant biodiversity of Nallihan (A3-Ankara/Turkey) forest ecosystem in frame of geographic information systems. *Biodiversity and Conservation*, 15: 855–878.

Dusky, Z.A. (2001). A Taxonomic Study of the (Rosaceae) L. *Crataegus* in the northern region of Iraq, MSc. Thesis, College of Agriculture, University of Duhok, Iraq.

Ejtehadi, H., Amini, T., Kianmehr, H., Assadi, M. (2003). Floristical and chorological studies of vegetation in Myankaleh wildlife refuge, Mazandaran province, Iran. *Iranian International Journal of Science*, 4(2):107-120.

Eren, Ö., Gökçeoğlu, M., Parolly, G. (2004). The flora and vegetation of Bakirli Daği (Western Taurus Mts, Turkey), including annotations on critical taxa of the Taurus range. *Willdenowia*: 463-503.

Fahrig L. (1997). Relative effects of habitat loss and fragmentation on population extinction. *Journal of Wildlife Management*, 61: 603–610.

FAO (2014). TheInternational Treaty on Plant Genetic Resources for Food and Agriculture. Available on http://www.planttreaty.org/content/texts-treaty-officialversions access on March 25, 2014.

Faris, Y. S. (1983). The Vascular Plants of Pira Magrun Mountain. M.Sc. Thesis. University of Salahaddin. Erbil, Iraq.

Farjon, A. (1998; 2nd ed. 2001). World Checklist and Bibliography of Conifers. Royal Botanic Gardens, Kew.

Farouji, A.E., Khodayari, H. (2016). Evaluation of vegetation types in the West Zagros. Biodiversitas *Journal of Biological Diversity*, 17(1): 1-10

Feizi, M., Jaberalansar, Z., Alijani, V. (2014). Investigation of flora, life form and chorotype of plants in yasooj region. *Natural Ecosystems of Iran*, 3(4):17-36.

Fırat, A.F. (1997). Globalization of fragmentation: A framework for understanding contemporary global markets. *Journal of International Marketing* 5:77-86.

Fritsch, R.M., Abbasi, M. (2013). A taxonomic review of *Allium* subg. Melanocrommyum in Iran. *Gatersleben*. ISBN 978-3-9813096-3-8.

Galalaey, Ali M.K., Mustafa A. Shaban, Khadijah M.A. Rasul, Darwesh Tahir Darwesh, Alper Uzun, Sami M.A. Youssef. (2021). Ethnobotanical study of wild edible plants in Hujran Basin, Kurdistan Region of Iraq. ZANCO Journal of Pure and Applied Sciences, 33(s1):19-30.

Gaznayee, H., Al-Quraishi, A. (2020). Identifying Drought Status in Duhok Governorate (Iraqi Kurdistan Region) from 1998 through 2012 using Landsat Time Series Dataset. *Journal of Applied Science and Technology Trends* 1(1):17-23.

Gaznayee, H.A.A., Al-Quraishi, A.M.F. (2019). Analysis of Agricultural Drought, Rainfall, and Crop Yield Relationships in Erbil Province, the Kurdistan Region of Iraq based on Landsat Time-Series MSAVI2. *J. Adv. Res. Dyn. Control Syst*, 11(12):536-545.

Ghahremaninejad F, Agheli S. (2009). Floristic study of Kiasar national park, *Iran J Taxonomy Biosystematics*, 1 (1): 47-62.

Ghahremaninejad, F., Naqinezhad, A.R., Bahari, S.H. and Esmaeili, R. (2011). A contribution to flora, life form and distribution of plants in two protected lowland forests, Semeskandeh and Dasht-e Naz, Mazandaran, N. Iran. *Taxonomy and Biosystematics*, 3(7): 53-70.

Ghazanfar, S.A. and Haloob, A. (2017). *Scrophularia amadiyana* (Scrophulariaceae), a new species from Iraq and a key to Scrophularia in Iraq. *Kew Bulletin*, 72(1), p.17.

Ghazanfar, A.A and Edmondson, J.R. (2013). Flora of Iraq vol. 5 part 2. Lythraceae to Campanulaceae. Ministry of Agriculture Republic of Iraq by Royal Botanic Gardens, KEW.

Ghazanfar, S. A. and McDaniel, T. (2016). Floras of the Middle East: a quantitative analysis and biogeography of the flora of Iraq. *Edinburgh Journal of Botany*, 73(1), 1-24.

Ghazanfar, Sh. A, Taifour, H., Al-Oqlah, A., Borosova, R. and Osborne, J. (2013). A quantitative analysis of the flora of Jordan and its conservation status. Royal Botanic Garden, Jordan.

Ghazanfar, Sh. A., Edmondson, J.R., Hind, N.J. (2019). Flora of Iraq Volume: 6, *Royal Botanic Gardens*, Kew. UK.

Ghelichnia, H. (2014). Flora and vegetation of Mt Damavand in Iran. *Journal of Phytologia Balcanica*, 20(2-3): 257-265.

Grubb, P.J. (1977). The maintenance of species-richness in plant communities: the importance of the regeneration niche. *Biological reviews*, 52(1):107-145.

Guest E., Al-Rawi, A. (1966). Flora of Iraq. Pub. by Ministry of Agriculture of Republic of Iraq. Iraq. Baghdad. Vol. 1

Güner, A., Özhatay, N., Ekim, T. and Başer K.H.C. (eds.). (2000). Flora of Turkey and the East Aegean Islands. Vol. 11, University press, Edinburgh.

Gurgin, K.M., Karami, P. and Marofii, H. (2014). Introduction to the flora, life forms and chorology of saral of Kurdistan (case study sub catchment farhad abad). *Journal of Plant Research (Iranian Journal of Biology)* 26(4):510-525.

Haedar, F.U. (2003). Vascular plants of Haibat Sulltan Mountain. M.Sc. thesis, University of Sulaimani.

Haidari, M., Zabiholahi, S. and Shabanian, N. (2014). Effect of two traditional forest management practices (TFM) on the diversity, regeneration and spatial pattern of tree in Northern Zagros Forest, Kurdistan Province, West of Iran. *Advances in Bioresearch*, 5(1): 142-149.

Haloob, A., (2016). A new record for the Flora of Iraq: *Limonium Meyeri* (Plumbaginaceae). *Indian Journal of Plant Sciences*, 5(1):8-10.

Haloob, A. (2016). A New record of *Ziziphora* species (Lamiaceae) for Iraq. *Bulletin of the Iraq Natural History Museum* 14(2): 179-184.

Hamad, R., Balzter, H. and Kolo, K., (2019). Assessment of heavy metal release into the soil after mine clearing in Halgurd-Sakran National Park, Kurdistan, Iraq. *Environmental Science and Pollution Research*, 26(2):1517-1536.

Hamakhan, A.M., Galalaey, A.M.K., Shkwr, C.Y., Uzun, A., Shaban, M.A., Mahdi, H.S. & Youssef, S.M.A. (2020), New contribution on the distribution of Orchids (Orchidaceae) in Erbil Province in Kurdistan Region (N-Iraq). Journal Europäischer Orchideen. 52(1): 501-526.

Hameed, M.A., Uzun, A. and Saeed, J.F. (2016). Vascular plant species of Hujran Basin-Erbil/ Iraq. *Kahramanmaraş Sutcu İmam Universitesi Doğa Bilimleri Dergisi,* 19(3), 279-295.

Hameed, M.A.H. (2016). Vascular Plant Taxa of Hujran Basin - Erbil / Iraq. MSc Plant Taxonomy. Kahramanmaraş Sutcu İmam University. Turkey.

Harris, D. R. (1998). The origins of agriculture in southwest Asia. The Review of Archaeology, 19(2), 5-11.

Hassani, S.M., Yazdanshenas, H., Nazarpoor Fard, K., Bassiri, R. and Pur Rezaee, J., (2014). Study of Physiognomy and Origin of Plant Species in Sarshiv Area of Marivan, Iran. *Journal of Rangeland Science*, 4(4):270-278.

Hasan, H.H. and Sardar, A.S., (2019). Phylogenetic and Palynological Study of the Genus *Potentilla* L. (Rosaceae) in Kurdistan Region-Iraq. *Al-Kufa University Journal for Biology*, 11(1):1-17.

Hill, M.O., (1979). Twinspan: a Fortran program for arranging multivariate data in an ordered two-way table by classification of the individuals and attributes. Cornell University, Section of Ecology and Systematics, Ithaca, New York, USA. Huntly, N. 1991. *Herbivores and the dynamics of communities and ecosystems*. *Annual Review of Ecology and Systematics*, 22:477-503.

Heydari, M., Poorbabaei, H., Hatami, K., Salehi, A. and Begim Faghir, M., (2013). Floristic study of Dalab woodlands, north-east of Ilam province, west Iran. *Iranian Journal of Science and Technology (Sciences),* 37(3):301-308.

Hussein, M. H. (1998), Water erosion assessment and control in northern Iraq. Soil and Tillage Research.45, 161–173.

Hussien, K, S. (2016), Conservation planning for Bastora catchment based on detection of erosion risk prone areas. A thesis submitted to the Council of the College of Agriculture at Salahaddin University-Erbil in partial fulfilment of the requirements for the degree of Master of Science in Soil Conservation.

IPGRI, E. and GR, A., (2001). Descriptors for Allium (*Allium* sp.). *International Plant Genetic Resources Institute*, Rome, Italy.

IPNI (2012 onwards) The International Plant Names Index. Available from: http://www.ipni.org (accessed 14 June 2019)

IUCN (2013). International Union for Conservation of Nature. www.iucn.

IUCN (2006). Biodiversity in European Development Cooperation. Conference - Paris, 19-21 September.

Jafari, Z., Kianian, M.K., Aslani, F. and Akbarlo, M. (2016). Floristic Composition, Life Forms and Geographical Distribution (Case Study: Lashgardar Rangelands of Malayer, Iran). *Journal of Environmental Science and Technology*, 9 (1): 140-148.

Jalali, M., Sharifi-Tehrani, M. and Shirmardi, H.A. (2016). Flora of Jahanbin Mountain Area: A Contribution to Flora of the Central Zagros Region of Iran. *Journal of Genetic Resources*, 2(1):26-40.

Jalilian, N., Sheikhi, A. and Dehshiri, M.M. (2014). A floristic study in Bahar-ab Kuh area in Zagros Mountains (in the border of Kermanshah and Ilam provinces, Iran). *Taxonomy and Biosystematics Journal*, 6(18):.65-76.

Jassim, S.Z. and Goff. J.C. (2006). Geology of Iraq. Published by Dolin, Pragus and Moravian Museum, Brno.

Jassim, S.Z. and Buday, T. (2006). Units of the unstable shelf and the zagros suture. Geology of Iraq. Czech Republic: Published by Dolin, Prague and Moravian Museum, *Brno*. :73-90.

Kashipazha, A.M., Asri, Y., Moradi, H.M. (2004). Introduction to the flora, life forms and Chorology of Bagheshad Region, Iran. *Pajouhesh & Sazandegi* No 63:95-103

Keshavarzi, M., Ijbari, H., Mosaferi, S. and Ebrahimi, F. (2017). A Floristic study of Hamun Lake Basin, South East of Iran. *Ecologia Balkanica* 9(1): 1-9.

Keya, D.R., (2020). Building Models to Estimate Rainfall Erosivity Factor from Rainfall Depth in Iraqi Kurdistan Region. A Dissertation Submitted to The Council of The College of Agricultural Engineering Sciences at Salahaddin University-Erbil In Partial Fulfillment of the Requirements of the Degree of PhD in Soil and Water Conservation. Salahaddin University-Erbil, Iraq.

Khalaf, M.K. (1980). The vascular plants of Jabal Sinjar. M.Sc. Thesis, University of Baghdad.

Khoshbakht, K. (2006). Agrobiodiversity of Plant Genetic Resources in Savadkouh, Iran, with Emphasis on Plant Uses and Socioeconomic Aspects. Kassel University press GmbH. Germany.

Kiani, M., Memariani, F. and Zarghami, H. (2012). Molecular analysis of species of Tulipa L. from Iran based on ISSR markers. *Plant Systematics and Evolution* 298(8): 1515-1522.

Kottek, M., Grieser, J., Beck, C., Rudolf, B., and Rubel, F. (2006). World map of the Koppen-Geiger climate classification updated. *Meteorologische Zeitschrift*, 15(3):259-263.

Koyuncu, M. (2002). Some ornamental geophytes from the east Anatolia. In Biodiversity, pp: 247-251. Springer US.

Kreft, H. &, Jetz, W. (2010). A framework for delineating biogeographical regions based on species distributions. *J. Biogeogr*. 37: 2029-2053.

Kurdistan Regional Government-Iraq (2014). Kurdistan's geography and climate.

Lande, R. (1988). Genetics and demography in biological conservation. *Science* 241: 1455-1460.

Lazarina, M., Charalampopoulos, A., Psaralexi, M., Krigas, N., Michailidou, D.E., Kallimanis, A.S. and Sgardelis, S.P., (2019). Diversity patterns of different life forms of plants along an elevational gradient in Crete, Greece. *Diversity*, 11(10): 1-14.

Leakey, R.R.B., Temu, A.B., Melnyk, M., Vantomme, P. (1996). Domestication and commercialization of nontimber forest products (1-7 p.). FAO. Rome, Italy.

Lo Cascio, P. and Pasta, S. (2010). Floristic and ecological remarks on the islet Formica di Burano (Tuscan Archipelago, Tyrrhenian Sea). *Atti Della Società Toscana di Scienze Naturali, Memorie, Serie B* 116: 45-48.

Lorr, M. (1983). Cluster Analysis for Social Sciences. San Francisco: Jossey-Bass.

McAleece, N., Gage, J.D.G., Lambshead, P.J.D., Paterson, G.L.J., (1997). BioDiversity professional statistics analysis software. Jointly developed by the Scottish Association for Marine Science and the Natural History Museum London.

Maden, K. (2004). Plant collection and herbarium techniques. *Our Nature* 2(1): 53-57.

Magurran, A.E. (2004). Measuring Biological Diversity, a Blackwell Publishing company. (P. 264), ISBN: 0632056339,9780632056330

Mahmoodi, M., Ramezani, E., Eshaghi, R.J. And Heidari, R.M. (2015). Floristic study of a gallery forest in northern Zagros (Khan Valley, Urmia, NW Iran). *Journal of Plant Research (Iranian Journal of Biology* 28(4): 861-876.

Malek Mohammadi, L. and Azar, S.M. (2012). Gathering, identification, medicinal utilization and domestication of some wild edible plants in Ghasemloo valley, West Azerbaijan, Iran. *Journal of Rangeland Science* 2(2): 521-534.

Malekmohammadi, L., Mahmoudzadeh, A. and Hassanzadeh, A. (2007). Floristic study of Ghasemloo (Shohada) valley forest reserve and adjacent area. *Pak J Biol Sci* 10(10): 1618-24.

Marvi Mohadjer MR. (2005). Silviculture. Tehran: Tehran University Press, p 387.

McCain, C.M. and Grytnes, J.A. (2010). Elevational gradients in species richness. ELS.

McNeill, J. ed., (2012). International Code of Nomenclature for algae, fungi and plants (Melbourne Code) (Vol. 154, p. 240). Königstein: Koeltz Scientific Books.

Mehregan, I. and Kadereit, J.W. (2008). Taxonomic revision of *Cousinia* sect. Cynaroideae (Asteraceae, Cardueae). *Willdenowia* 38(2):293-362.

Memariani, F., Joharchi, M.R. and Akhani, H. (2016). Plant diversity of Ghorkhod protected area, NE Iran. *Phytotaxa,* 249(1):118-158.

Miller, T., Neale, S. (2015). Provisional IUCN Red List of Iraq's endemic plants (version 1). Centre for Middle Eastern Plants, Royal Botanic Garden Edinburgh, pp. 38.

Mittermeier, R.A., Gil, P.R., Hoffman, M., Pilgrim, J., Brooks, T., Mittermeier, C.G., Lamoreux, J., Da Fonseca, G.A.B. and Saligmann, P.A., (2004). Hotspots revisited: earth's biologically richest and most endangered terrestrial ecoregions cemex. Mexico City.

Moazzeni, H., Assadi, M., Zare, G., Mirtadzadini, M. and Al-Shehbaz, I.A., (2016). Taxonomic novelties in *Erysimum* for the Flora of Iran: *E. polatschekii*, a new alpine endemic, and *E. scabrum*, a new record. *Phytotaxa* 269 (1): 047–053.

Moazzeni, H., Al-Shehbaz, I.A., German, D.A., Assadi, M., Mueller, J., Joharchi, M.R. and Memariani, F. (2018). A taxonomic revision of the genus *Aethionema* Sl (Brassicaceae) in Iran. *Phytotaxa* 356(4): 241-266.

Moradi, H. and Attar, F. (2019). Comparative study of floristic diversity along altitude in the northern slope of the central Alborz Mountains, Iran. *Biodiversitas Journal of Biological Diversity* 20(1): 305-312.

Moradkhani, S. and Milan, B.S. (2015). Floristic study of the rangeland Gugerd region in Khoy city (West Azarbaijan Province, NW Iran). *Journal of Biodiversity and Environmental Sciences* 6(6): 48-59.

Muhammed, J.J. (2010). A systematic study of the genera *Pistacia* L., *Rhus* L., and *Cotinus* Mill. (Anacardiaceae) in Kurdistan Region of Iraq. MSc. in Forestry (Dendrology). Forestry Department, University of Duhok, Iraqi Kurdistan Region, Iraq.

Muhamed, H., Youssef, S., Mustafa, A., Suliman, H., Abdulqader, A., Mohammed, H. and Michalet, R. (2019). Natural regeneration of *Pinus brutia* Ten. in a recreational public forest in Zawita-Kurdistan region, Iraq. *Journal of Forestry Research*, 30(5):1849-1857

Myers, N., Mittermeier, R.A., Mittermeier, C.G., da Fonseca, G.A.B., Kent, J. (2000). Biodiversity hotspots for conservation priorities. *Nature* 403(24):853-858 www.nature.com Macmillan Magazines Ltd.

Naghinezhad, A., Saeidi, M.S., Norouzi, M., Faridi, M. (2006). Contribution to the vascular and bryophyte flora as well as habitat diversity of the Boujagh National Park, N. Iran. *Rostaniha* 7(2): 85-105.

Naqinezhad, A., Hosseini, S, Rajamand, M.A., Saeidi Mehrvarz, S. (2010). A floristic study on Mazibon and Sibon protected forests, Ramsar, across the altitudinal gradient (300-2300 m). *Taxonomy Biosystematics* 2(5): 93-114.

National report on biodiversity in Iraq (2010). Ministry of Environment, Iraq. http://www.cbd.int/doc/world/ iq/iq-nr-04-en.pdf.

Nejati, E.M., Ghahremaninejad, F., Attar, F. (2016). Foliar anatomy of the genus Silene L. (Caryophyllaceae) at sectional level in Iran. *Iran. J. Bot.* 22 (2): 138-158.

Noroozi, E.J. (2013). Comparative analysis of high-alpine and subnival vegetation of mountain ecosystems in Iran (Alborz and NW-Iran) and assessing the impacts of climate change and land-use (Doctoral dissertation, uniwien).

Noroozi, J., Akhani, H., Breckle, S.W. (2008). Biodiversity and phytogeography of the alpine flora of Iran. *Biodiversity and Conservation* 17(3): 493-521.

Pahlevani, A., Geltman, D.V. and Riina, R. (2011). Taxonomic revision of Euphorbia subsect. Myrsiniteae in Iran. *Annales Botanici Fennici* 48(6): 483-493.

Palani, Kh. F.D.M. (2013). A comparative biological study of some species of the genus Salvia L. (Lamiaceae) in Mid and North cities of Iraq. Ph.D., College of Education, University of Tikrit. Iraq.

Pourreza, M., Shaw, J.D. and Zangeneh, H. (2008). Sustainability of wild pistachio (*Pistacia atlantica* Desf.) in Zagros forests, Iran. *Forest Ecology and Management* 255(11): 3667-3671.

PPG I, (2016). A community-derived classification for extant lycophytes and ferns. *Journal of Systematics and Evolution* 54(6): 563-603.

Prance, G., Nesbitt, M. (eds.) (2005). The cultural history of plants. Routledge, Great Britain.

Rahimi, A. and Atri, M. (2013). Study of flora of Miandasht Wildlife Refuge in Northern Khorassan Province, Iran (a). *Journal of Ecology and the Natural Environment* 5(9): 241-253.

Rahimi, A., Aghaalinejad, M., Arslan, N. (2012). Geophytes of sulduz region, west azerbayjan province, Iran and their characteristics. *Pure and Applied Biology* 1(1): 18-21.

Rajaei, P., Mohamadi, N. (2012). Hezar Mountain allocated in south east of Iran. *Iranian Journal of Pharmaceutical Research* 11(4): 1153.

Rajaei, P., Maassoumi, A.A., Mozaffarian, V., Nejad Sattari, T., Pourmirzaei, A. (2011). Alpine flora of Hezar Mountain (SE Iran). *Rostaniha* 12(2): 111-127.

Ramezani, E., Marvie Mohadjer, M.R., Kna, H.D., Ahmadi, H., Joosten, H. (2008). The late-Holocene vegetation history of the Central Caspian (Hyrcanian) forests of northern Iran. *The Holocene* 18(2): 307-321.

Raunkiaer, C. (1934): The life forms of plants and statistical geography. – Claredon, Oxford.

Rashed, Y.A. (1990). An Ecological and Taxonomical Study of the Distribution of the Vegetation in Hujran Valley-Erbil. Master Thesis, University of Salahaddin- Erbil.

Ranjbar, M., Karamian, R., Johartchi, M.R. (2006). Notes on the taxonomy of *Hedysarum* (Fabaceae) in Iran. *Annales Botanici Fennici* pp. 152-155.

Rechinger, K. H. (1965-1977). Flora Iranica, Akadedemische Druck- u Verlagsanstalt. Report Research.

Rechinger, K. H. (ed.). (1963−2012). Flora of Iranica, Vols. 1−179. Akademische Druck-u. Verlagsanstalt. Graz.

Reveal, J.L. and Chase, M.W., (2011). APG III: Bibliographical information and synonymy of Magnoliidae. *Phytotaxa* 19(1), pp.71-134.

Saeed, J.F. (2017). Ecology and geographical distribution of the species *Ferula* L. from the umbrella family Umbeliferae in Iraq. *Diyala Journal of Pure Sciences* 13 (3-part 3): 30-39.

Saeed, J.F. (2013). Morphological study of the *Centaurium pulchelum* and *C. erythraea* (Gentianaceae) in Kurdistan region of Iraq. *Journal of University of Anbar for Pure Science*, 7(1).

Saeed, J. F, (2007). New record of *Campanula stellaris* Boiss in Iraq. *Journal of Zankoy Sulaimani* 10(1a): 1-8.

Saeidi Mehrvarz, S. and Ashouri Nodehi, M. (2015). A floristic study of the Sorkhankol Wildlife Refuge, Guilan province, Iran. *Caspian Journal of Environmental Sciences* 13(3): 183-196.

Saeidi Mehrvarz, S.H. (2006). Notes of the genus *Pedicularis* (Scrophulariaceae) in Iran. *Iran J. Bot* 11: 241-245.

Saeidi-Mehrvarz, S. (2005). Distribution pattern of the genus Veronica L. in Iran. *Bangladesh Journal of Botany* 34(2): 71-75.

Salmaki, Y., Zarre, S., Govaerts, R., Bräuchler, C. (2012). A taxonomic revision of the genus Stachys (Lamiaceae: Lamioideae) in Iran. *Botanical Journal of the Linnean Society* 170(4): 573-617.

Sardar, A.S. (2014). A new record of *Cephalaria paphlagonica* Bobrov (Dipsacaceae) for the Iraqi Flora\Jordan. *Journal of Biological Sciences* 7(4): 293-297.

Sardar, A.S. (2017a). A new record of *Rhynchocorys odontophylla* Burbidge & Richardson (Scrophulariaceae) For Flora of Iraq. *Diyala Journal for Pure Science*, 13(2-part 2): 270-281.

Sardar, A.S. (2017b). A new record of *Saxifraga afghanica* Aitch. & Hemsl. (Saxifragaceae) in Iraq. *Iraqi Journal of Science* 58(1B): 222-229.

Sardar, A.S. (2018a). *Erysimum amasianum* Hausskn. & Bornm. (Brassicaceae) as a new record for Flora of Iraq. *Zanco Journal of Pure and Applied Sciences* 30(6): 58-65.

Sardar, A.S. (2018b). A new record of *Paracaryum shepardii* Post & Beauv. (Boraginaceae) in Iraq. *Diyala Journal for Pure Science* 14(02): 174-186.

Sardar, A.S. (2019a). Taxonomic study for the new record *Orobanche armena* Tzvelev (Orobanchaceae) in Iraq. *Zanco Journal of Pure and Applied Sciences* 31(1): 23-31.

Sardar, A.S. (2019b). Taxonomic Study for the new record *Cephalaria hirsuta* Stapf (Dipsacaceae) In Iraq. *Plant Archives* 19(1): 1951-1958.

Sardar, A.S., Al-Edhari, A.H. (2017). Taxonomic study for the new record *Epilobium obscurum* Schreber (Onagraceae) in Iraq. *Asian Journal of Research* 6(6): 127-139.

Sardar, A.S., Hussein, S.A.A., Al-Dabbagh, S.T. (2015). Palynological study of the genus *Valerianella* Miller (Valerianaceae) in Kurdistan Region-Iraq. *Journal of Zankoi Sulaimani, Part-A- (Pure and Applied Sciences)* 17-3 (Part-A): 171-178.

Schönbeck-Temesy, E., Ehrendorfer, F. (1977). New taxa of Rubiaceae-Rubieae from Iraq. *Plant Systematics and Evolution,* 127(4): 299-305.

Seaby, R.M. and Henderson, P.A., (2006). Species diversity and richness version 4. Pisces Conservation Ltd., Lymington, England, 123.

Shabanian, N., Soheili, S. and Haidari, M. (2013). Tree spatial patterns in the Zagros forests (Case study: Kurdistan forests; western part of Iran). *Euro. J. Exp. Bio*. 3: 121-125.

Shahbaz, S.E. (2009). Field guide to the trees and shrubs of Kurdistan Region of Iraq. No 2232. University of Duhok.

Shahbaz, S.E., Sharif, N.M. (2017). Anatomical and palynological characters of *Celtis* L. in Kurdistan-Iraq. *Science Journal of University of Zakho* 5(1): 57-63.

Shahbaz, S.E. and Sadeq, Z.A. (2003). *Crataegus azarolus* var. *sharania* (Rosaceae), a new variety for the flora of Iraq. *Nordic Journal of Botany* 23(6): 713-717.

Shahbaz, S.E. and Abdulrahman, S.S. (2015). Use of wood macerated elements for classification of *Salix* L. Species in Kurdistan Region-Iraq. *Science Journal of University of Zakho,* 3(1): 67-78.

Shannon, C.E. (1948). A mathematical theory of communication. *The Bell System Technical Journal* 27(3): 379-423.

Sharland, P.R., R. Archer, D.M. Casey, R.B. Davies, S.H. Hall, A.P. Heward, A.D. Horbury, Simmons, M.D. (2001). Arabian Plate sequence stratigraphy: Gulf PetroLink, Manama, Bahrain, 2371 p.

Simpson, E.H. (1949). Measurement of diversity. *Nature* 163(4148): 688-688.

Sinan, A., Behçet, L. (2014). The flora of Altıkardeş Mountain and its surroundings (Genç, Bingöl Turkey). *Bio. Dicon*. 7: 98-116.

Snogerup, S. and Snogerup, B. (2004). Changes in the flora of some Aegean islets 1968–2000. *Plant Systematics and Evolution* 245(3-4): 169-213.

Sodagar, N., Bahrami, A.R., Memariani, F., Ejtehadi, H., Vaezi, J., Khosravi, A.R. (2012). Biosystematic study of the genus *Berberis* L. (Berberidaceae) in Khorassan, NE Iran. *Plant systematics and Evolution* 298(1): 193–203.

Sohrabi, M., Alstrup, V. (2007). Additions to the lichen mycota of Iran from East Azerbaijan Province. *Mycotaxon*, 100: 145-148.

Solé-Senan, X. O., Juárez-Escario, A., Conesa, J. A., Torra, J., Royo- Esnal, A., Recasens, J. (2014). Plant diversity in Mediterranean cereal fields: unraveling the effect of landscape complexity on rare arable plants. *Agriculture, Ecosystems & Environment*, 185:221-230.

Solecki, R.S. (1971). Shanidar, the first flower people. Knopf.

Soltanipour, M. (2006). Introduction to the flora, life form and chorology of Hormoz Island plants, S. Iran. *Rostaniha* 7(1): 19-34.Sorensen, T.A. (1948). A method of establishing groups of equal amplitude in plant sociology based on similarity of species content, and its application to analyses of the vegetation on Danish commons. *Biologiske Skrifter* 5(4): 1–34.

Storkey, J., Meyer, S., Still, K.S. and Leuschner, C. (2012). The impact of agricultural intensification and land-use change on the European arable flora. Proceedings of the Royal Society B: *Biological Sciences*, 279(1732):1421-1429.

Tabad, M.A., Jalilian, N., Maroofi, H. (2016). Study of flora, life form and chorology of plant species in Zarivar region of Marivan, Kurdestan. *J Taxonomy Biosyst* 8:69-102.

Takhtajan, A. (1986). Floristic regions of the world. Berkeley, etc.: (Transl. by TJ Crovello.) Univ. Calif. Press 581, 1.

Tavakoli, Z. and Asadi, M. (2006). *Cephalorrhynchus tuberosus* (Asteraceae), a new record for the flora of Iran. *Iranian Journal of Botany* 12(2): 144-146.

Thiers, B. (2020). Index herbarium: A global directory of public herbaria and associated staff. Available from: http:// sweetgum.nybg.org/ih/ (accessed 06.09.2020).

Townsend, C.C. (1980). Malvaceae: 230‒274 in Townsend C.C. and Guest E. (eds.), Flora of Iraq, vol. 4(2). Ministry of Agriculture and Agrarian Reform, Baghdad.

Townsend, C.C. and Guest E. (1974). Flora of Iraq. Vol. 3. Iraq Ministry of Agriculture, University Press, Glasgow.

Townsend, C.C., Guest, E. and Rawi, A. (1966). Flora of Iraq. Vol. 2. Iraq Ministry of Agriculture, University Press, Glasgow.

Townsend, C.C., Guest, E., Rawi, A. (1968). Flora of Iraq. Vol. 9. Iraq Ministry of Agriculture, University Press, Glasgow.

Townsend, C.C., Guest, E., Omar, S. A., Al-khayat, A.H. (1985). Flora of Iraq. Vol. 8. Iraq Ministry of Agriculture, University Press, Glasgow.

Townsend, C.C., Guest, E., Omar, S.A., Al-khayat, A.H. (1985). Flora of Iraq. Vol. 8. Iraq Ministry of Agriculture, University Press, Glasgow.

Townsend, C.C., Guest, E., Al-Rawi, A. (1966). Flora of Iraq, vols 1, 2, 3, 4, 8, 9. Ministry of Agriculture & Agrarian Reform, Baghdad.

Turki, Z.A., F.M. El Shayeb, (2005). Floristic and ecological studies of the western Mediterranean Coastal land in Egypt (Wadi um Rakham). *Flora Mediterraea* 15: 331-341.

Van Rooyen, M.W., G.K. Theron and N. Grobbelaar (1990). Life form and dispersal spectra of the flora of Namaqualand, South Africa. *J. Arid Environ*. 19: 133-145.

Van Zeist, W. and Bottema, S. (2016). Palynological investigations in western Iran. *Palaeohistoria* 19: 19-85.

Varnosfaderani, M.K., Kharazmi, R., Samani, A.N., Rahdari, M.R., Matinkhah, S.H. and Aslinezhad, N., (2017). Distribution changes of woody plants in Western Iran as monitored by remote sensing and geographical information system: a case study of Zagros forest. *Journal of forestry research*, 28(1): 145-153.

Veiskarami, G. and Sharifi-Tehrani, M. (2017). Plant species diversity in the Central Zagros Region of Iran. *Phytologia Balcanica* 23(1): 101-118.

Vela, E., Youssef, S., Mahmood, A. (2013). First Survey on Orchids (Orchidaceae) of Duhok province in Kurdistan region (N-Iraq), *J. Eur. Orch.* 45 (2-4): 235-254.

Vural, C., Aytaç, Z. (2005). The Flora of Erciyes Dağı (Kayseri, Turkey). *Turkish Journal of Botany* 29(3): 185-236.

Walker, K.J., Critchley, C.N.R., Sherwood, A.J., Large, R., Nuttall, P., Hulmes, S., Rose, R. and Mountford, J.O. (2007). The conservation of arable plants on cereal field margins: an assessment of new agri-environment scheme options in England, UK. *Biological Conservation* 136(2): 260-270.

Web-site http://huh.harvard.edu/ (date access: 20.12.2020)

Web-site http://rainforests.mongabay.com/deforestation/archive/Iraq.htm#8-protected (date access: 1994-2005)

Web-site http://www.fao.org/docrep/x5402e/x5402e03.htm (date access: 1998)

Web-site http://www.ipni.org/ (in 19.08.2020)

Web-site http://www.iucnredlist.org/static/categories_criteria (date access: 3-2020)

Web-site http://www.kew.org/ (date accessed in 26.01.2021)

Web-site http://www.krg.org/p/page.aspx?l=12&s=050000&r=303&p=213 (date access in 12.04.2018)

Web-site http://www.physicalgeography.net/fundamentals/9k.html (date accessed in 20.04.2010)

Web-site http://www.theplantlist.org/ (date access: 2016)

Web-site https://www.nationalgeographic.com/environment/habitats/sustainable-agriculture/ (date access: 2015)

Web-site https://www.nationalgeographic.org/encyclopedia/agriculture/ (date access: 2015)

Web-site https://www.usda.gov/ (date access: 2019)

Wolfslehner, B., Prokofieva, I. and Mavsar, R. (editors). (2019). Non-wood forest products in Europe: Seeing the forest around the trees. What Science Can Tell Us 10. European Forest Institute.

Youssef, S. (2020). Endemic plant species of Iraq: from floristic diversity to critical analysis review. *Journal of University of Duhok* (*Agri. and Vet. Sciences*) 23(2):90-105.

Youssef, S., Galalaey, A., Mahmood, A., Mahdi, H., Véla, E. (2019). Wild orchids of the Kurdistan Region areas: a scientific window on the unexpected nature of the North-Western Zagros.

Youssef, S., Mahmood, A., Mahdi, A., Vela, E. (2015). New contribution on orchids (Orchidaceae) of Duhok Province in Kurdistan Region (N-Iraq). *Journal Europaischer Orchideen* 47(2-4): 405-420.

Youssef, S., Mahmood, A., & Vela, E. (2017a). On the genus *Sternbergia* (Amaryllidaceae) in Iraq. *Anales Del Jardin Botanico de Madrid* 74(1): 1-6.

Youssef, S. M., Mahdi, H. S., Mergye, Z. A., Salim, J. I., Mahmood, A. M., & Vela, E. (2017b). Two new records of orchid Species for the Flora of Iraq: *Anacamptis papilionacea* (L.) RM Bateman, Pridgeon & MW Chase and *Dactylorhiza romana* (Sebast.) Soo. *ARO-The Scientific Journal of Koya University* 5(2): 55-60.

Yousofi M, Safari R, Nowroozi M. (2011). An investigation of the flora of the Chadegan Region in Isfahan province. *J Plant Bio* 3(9): 75-96.

Yu, M. and Sun, O.J. (2013). Effects of forest patch type and site on herb-layer vegetation in a temperate forest ecosystem. *Forest Ecology and Management* 300: 14-20.

Zare, M., Khosravi, A.R. and Joharchi, M.R. (2013). Distribution patterns of the genus *Cousinia* (Asteraceae) in Iran. *Iranian Journal of Botany*, 19(1): 127-141.

Zarezadeh, A., Mirvakili, S.M. and Mirhossaini, A. (2007). Introduction to the flora, life form and plant geographical distribution of Darrah Damgahan in Mehriz (Yazd province). Pajouhesh and Sazandegi. 74: 129-137.

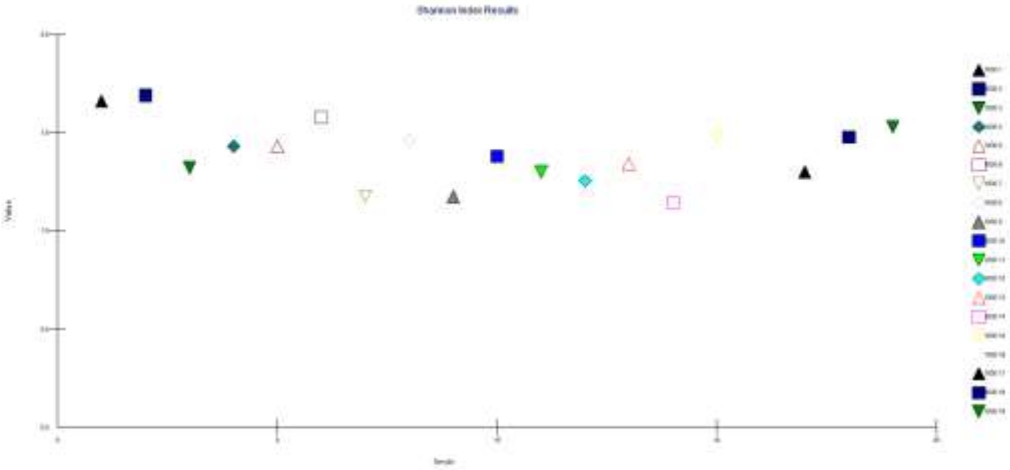
Zohary, M. (1946). The flora of Iraq and its phytogeographical subdivisions. Iraq. Dept. Agr. Bull., N. 13. Baghdad.

Zohary, M. (1963). On the geobotanical structure of Iran. Bulletin of the Research Council of Israel, Botany, 11D, Supplement: 1-113.

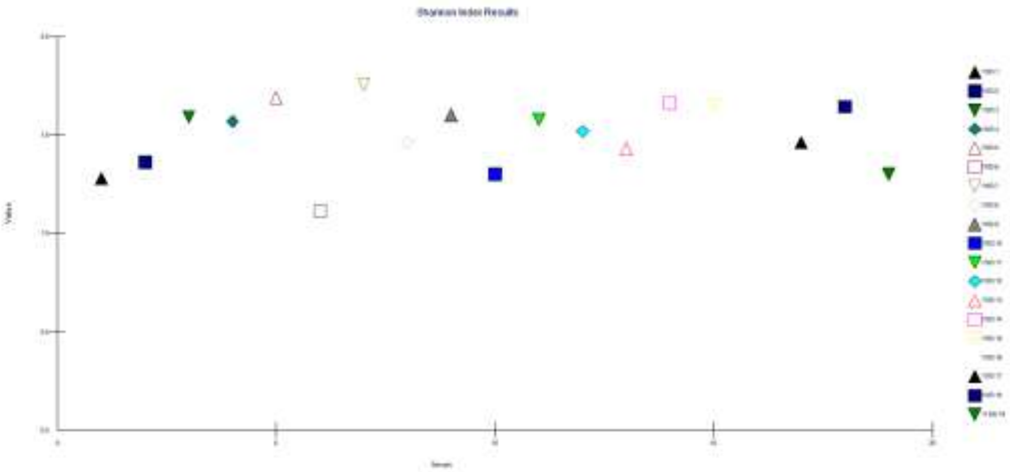
Zohary, M. (1973). Geobotanical Foundations of the Middle East, Vols 1 & 2. Gustav Fischer Verlag, Stuttgart, Germany.

Appendix 1. Species diversity values according to altitudinal gradient

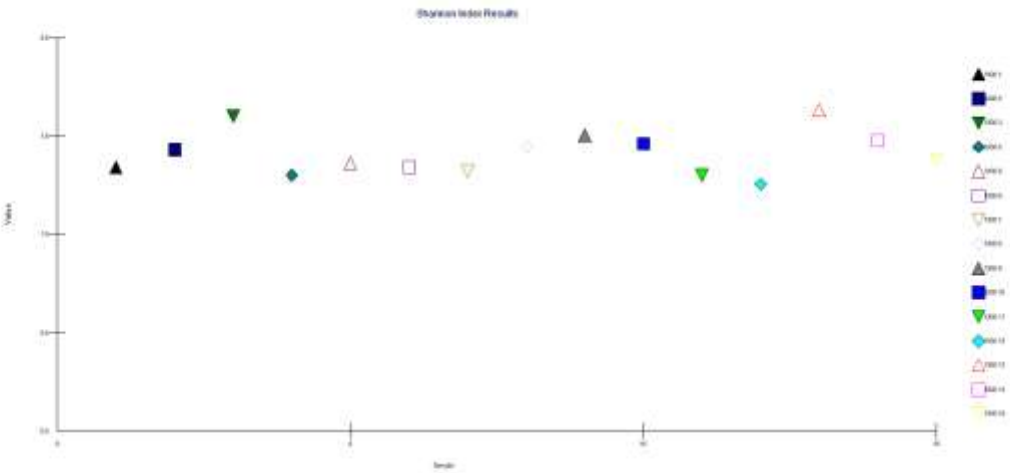
1000 m



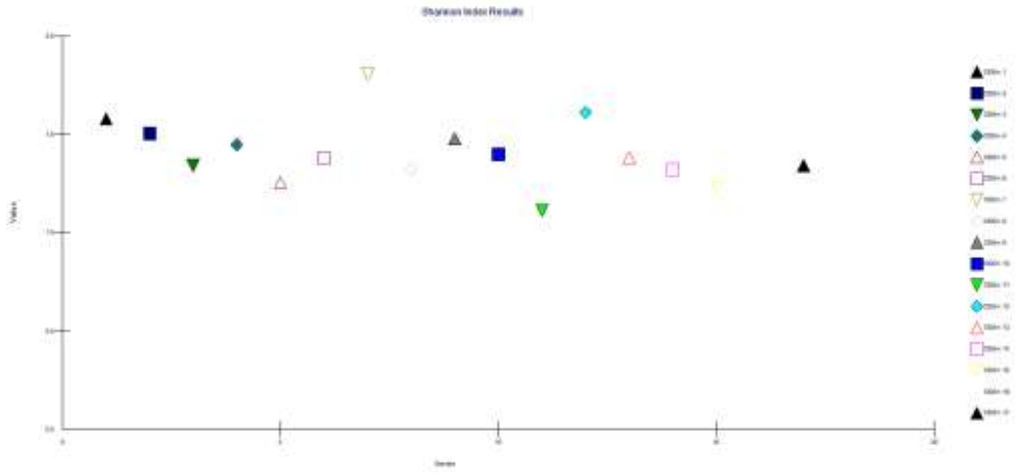
1100 m



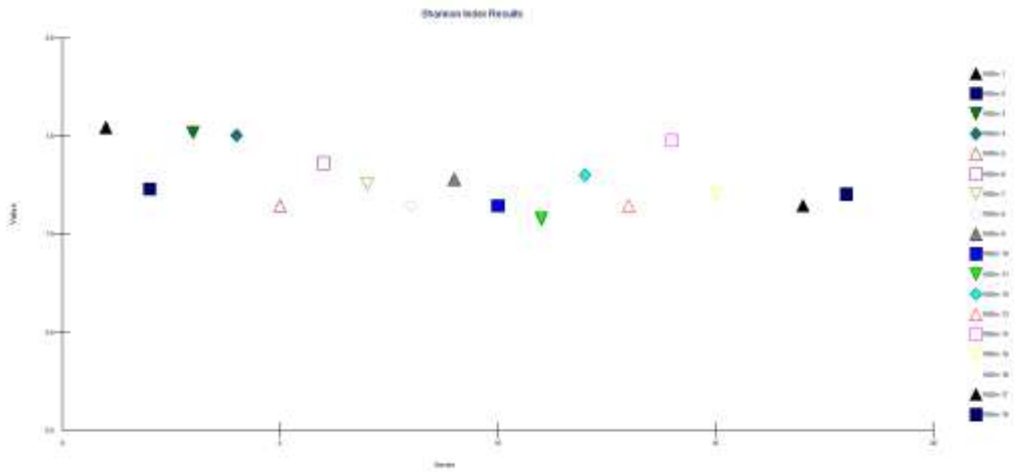
1200 m



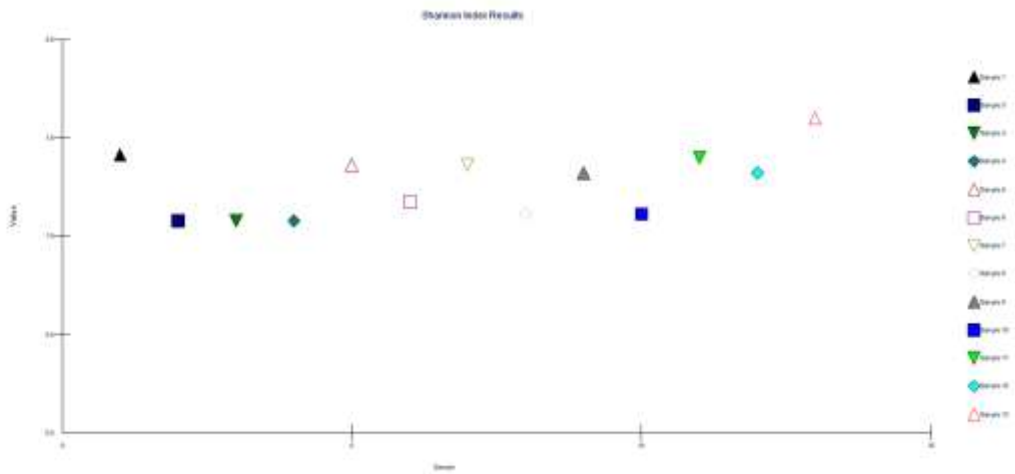
1300 m



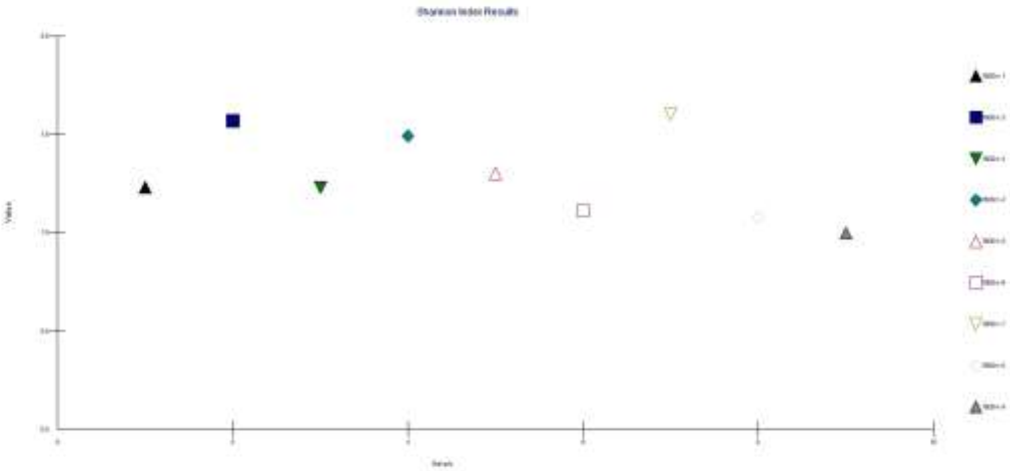
1400 m



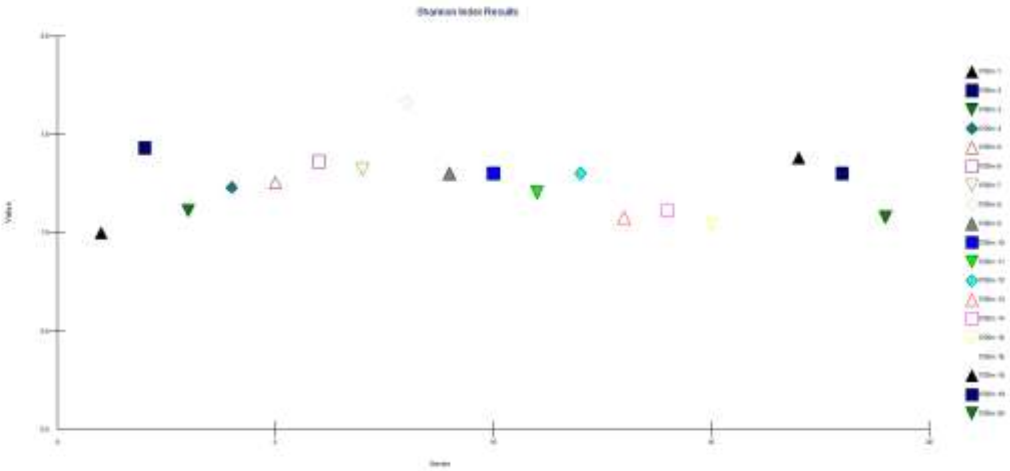
1500 m



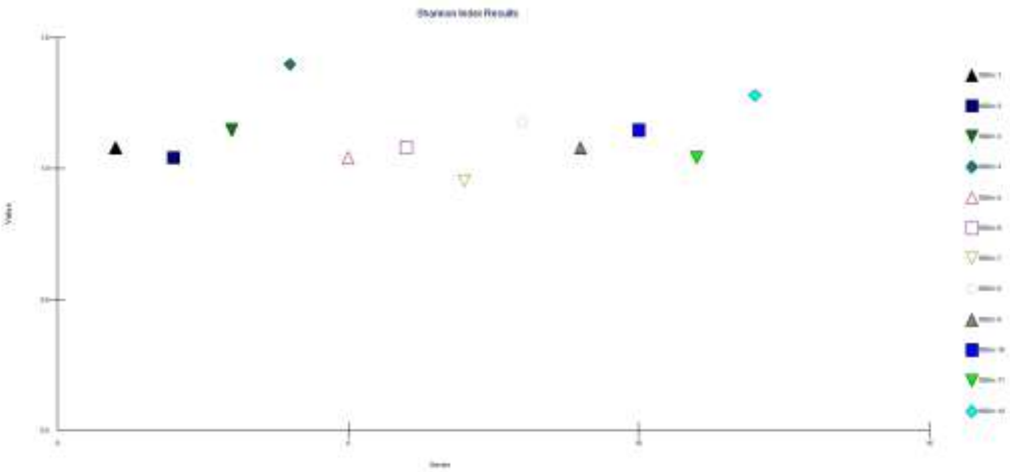
1600 m



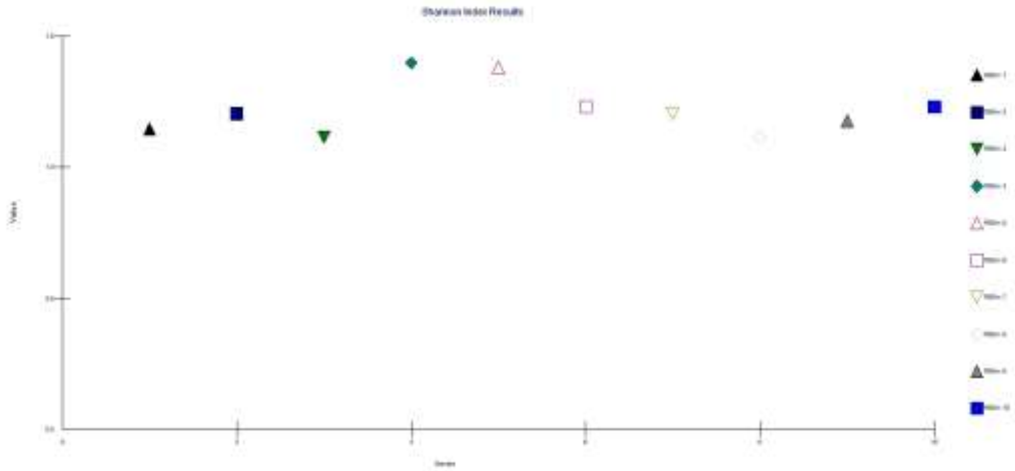
1700 m



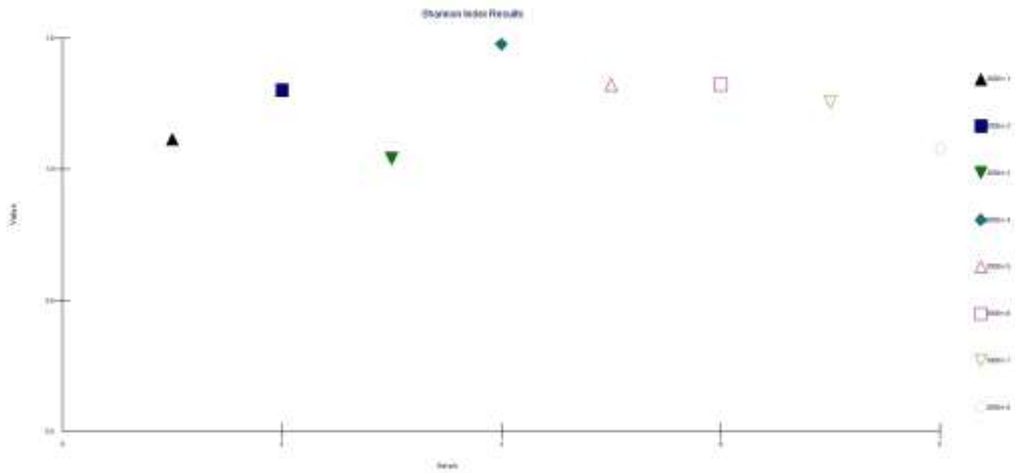
1800 m



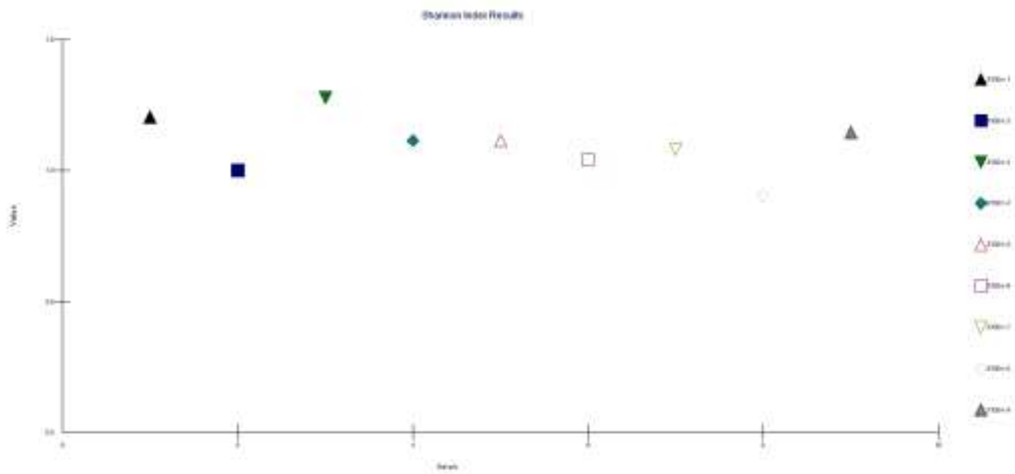
1900 m



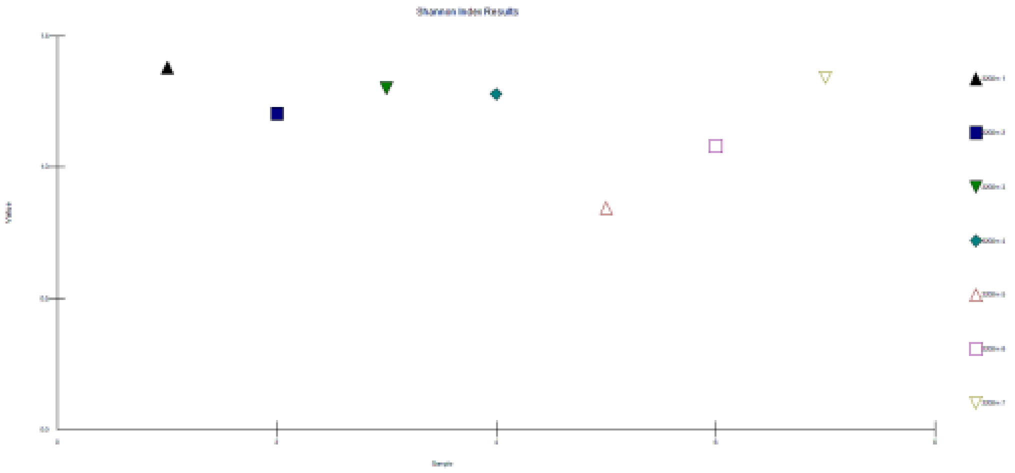
2000 m



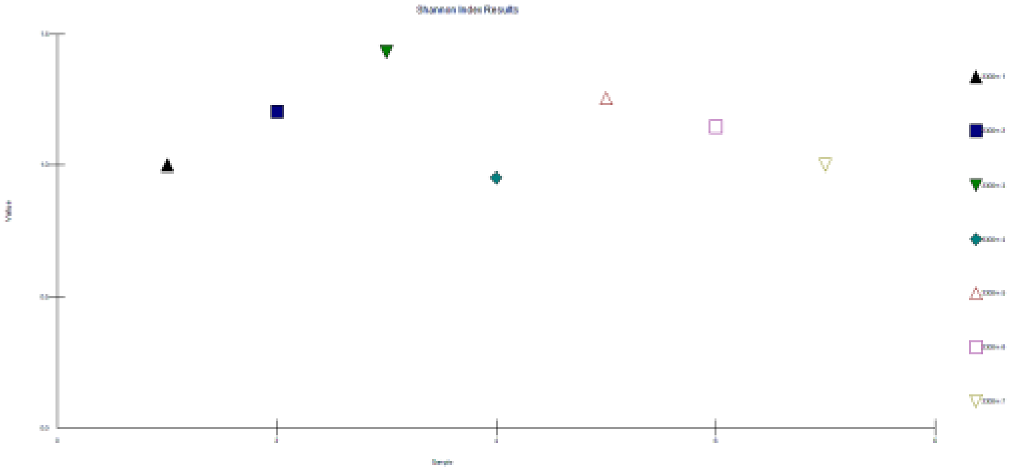
2100 m



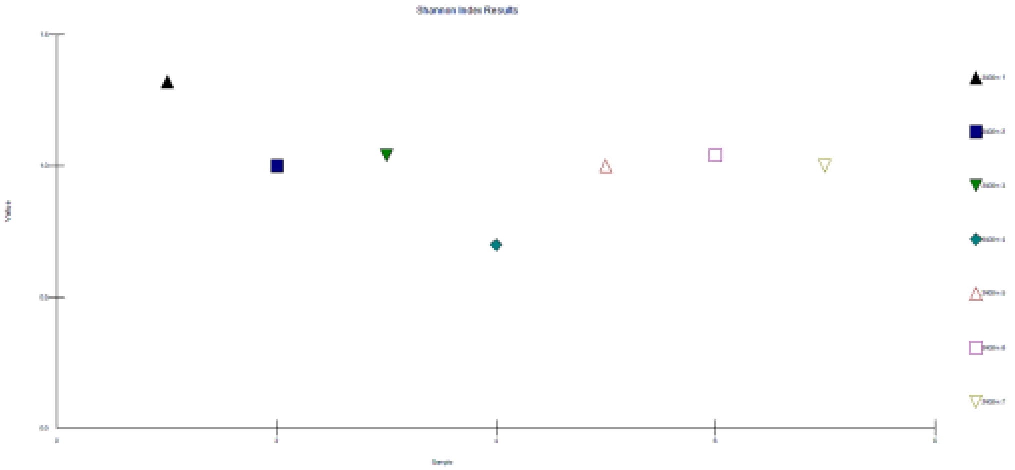
2200 m



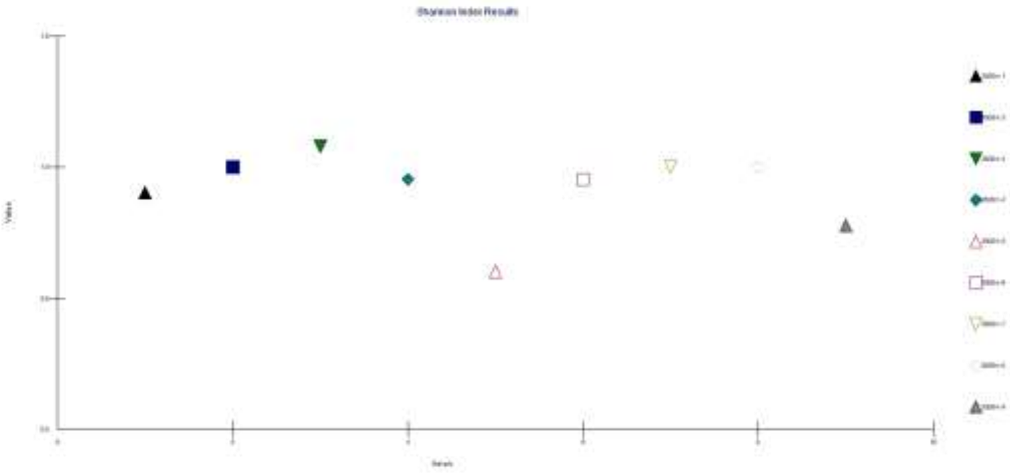
2300 m



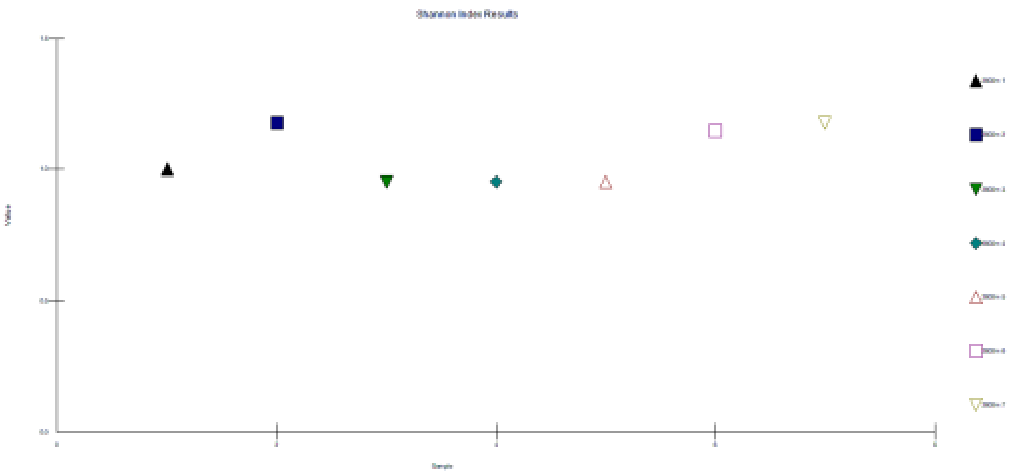
2400 m



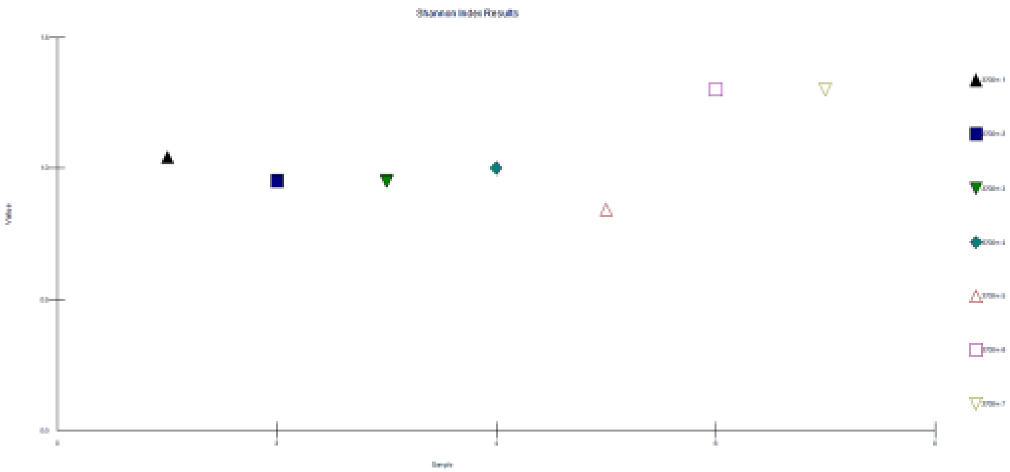
2500 m



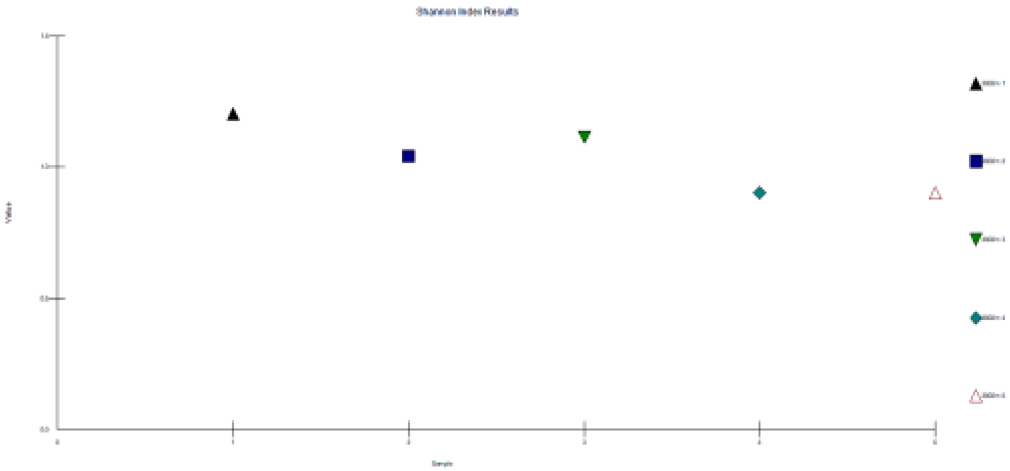
2600 m



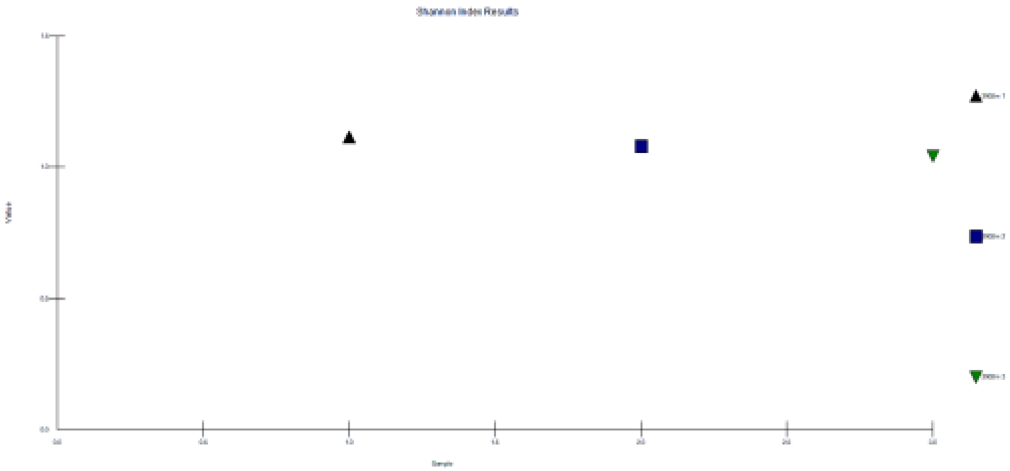
2700 m



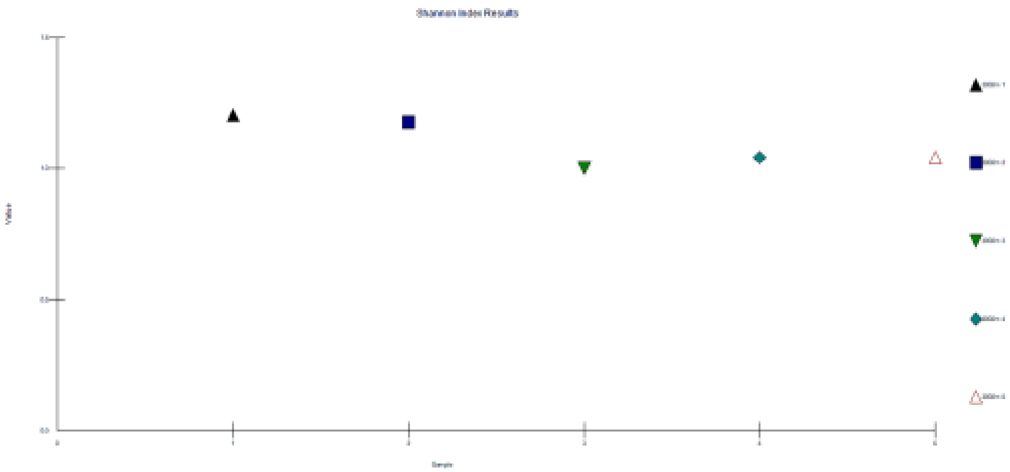
2800 m



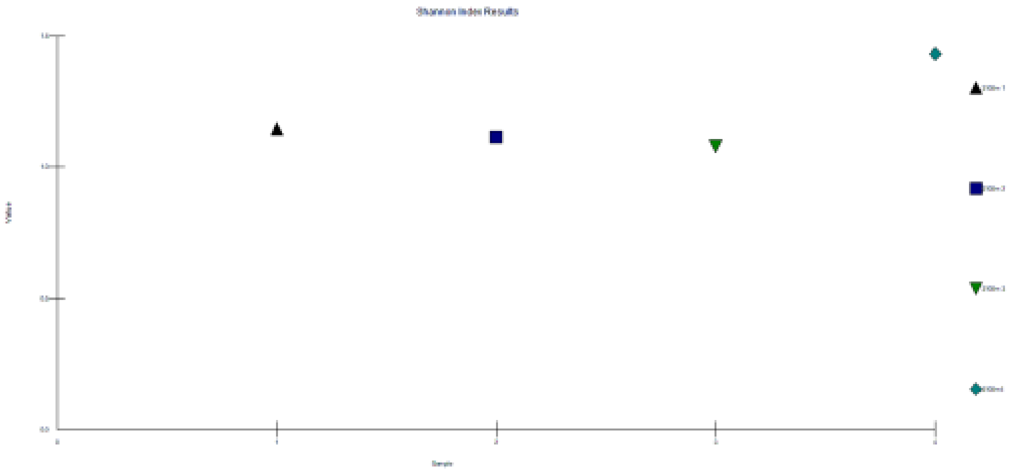
2900 m



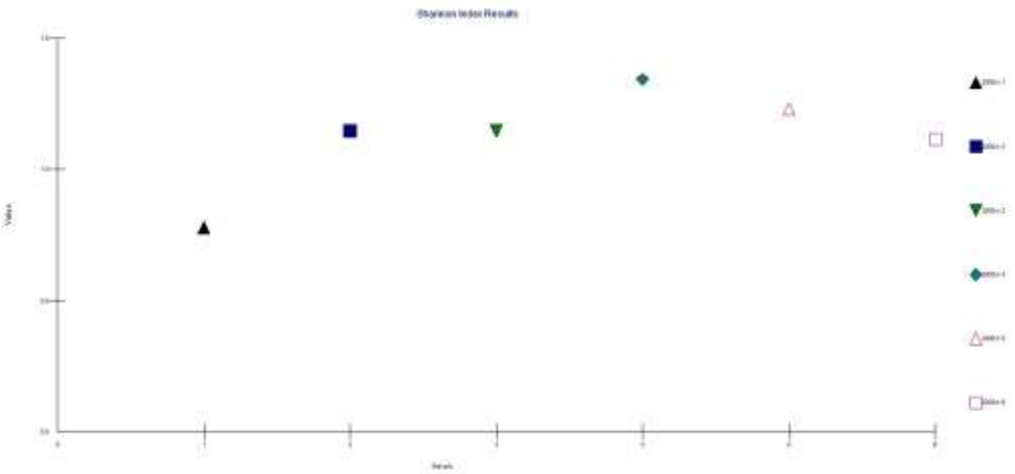
3000 m



3100 m

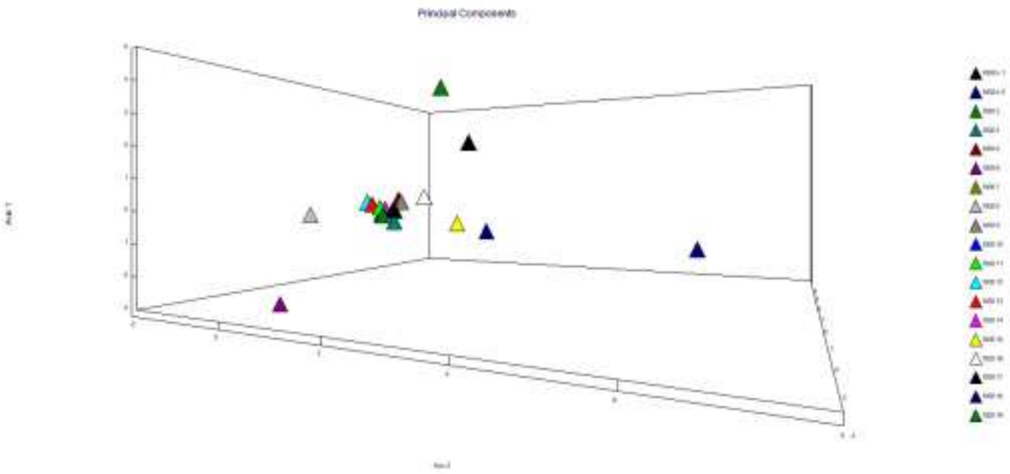


3200 m

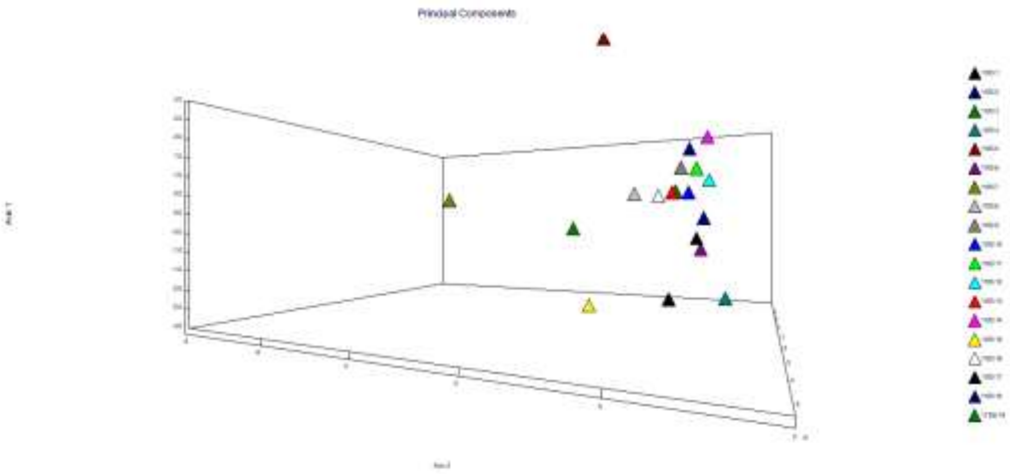


Appendix 2. Principle component analysis of altitudinal zones

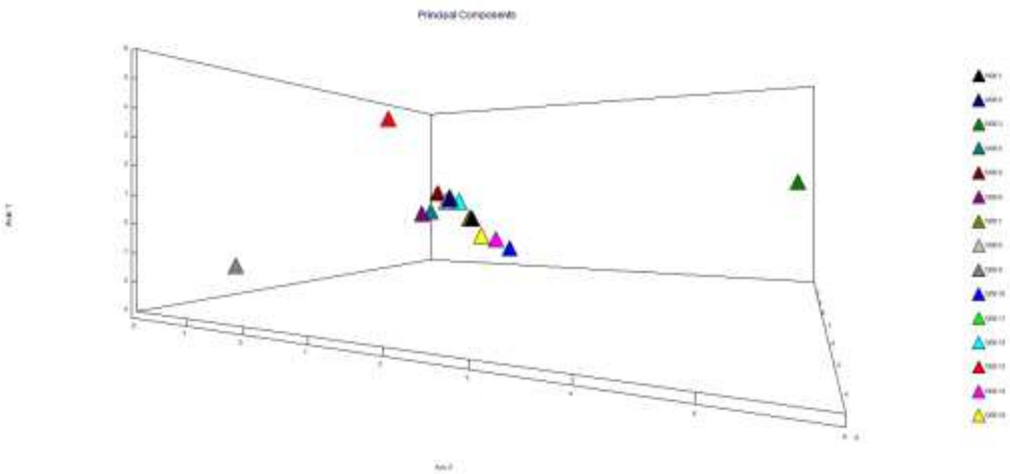
1000 m



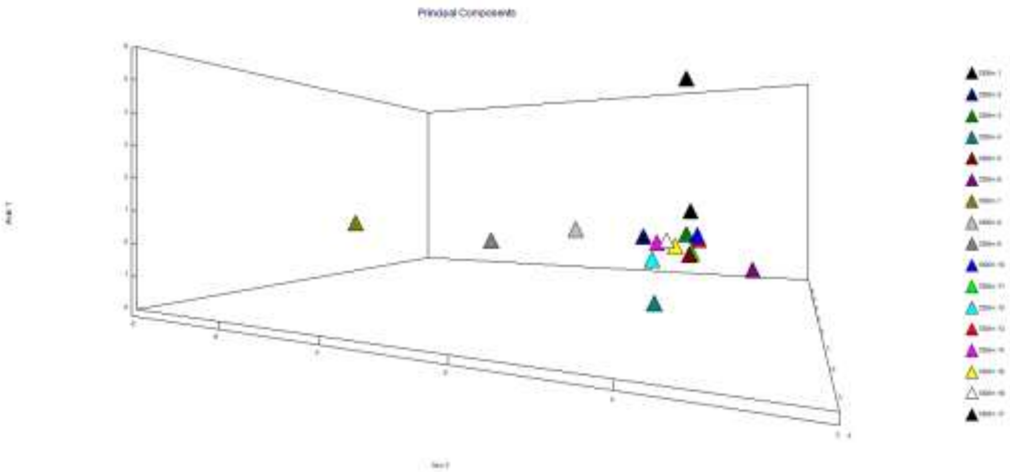
1100 m



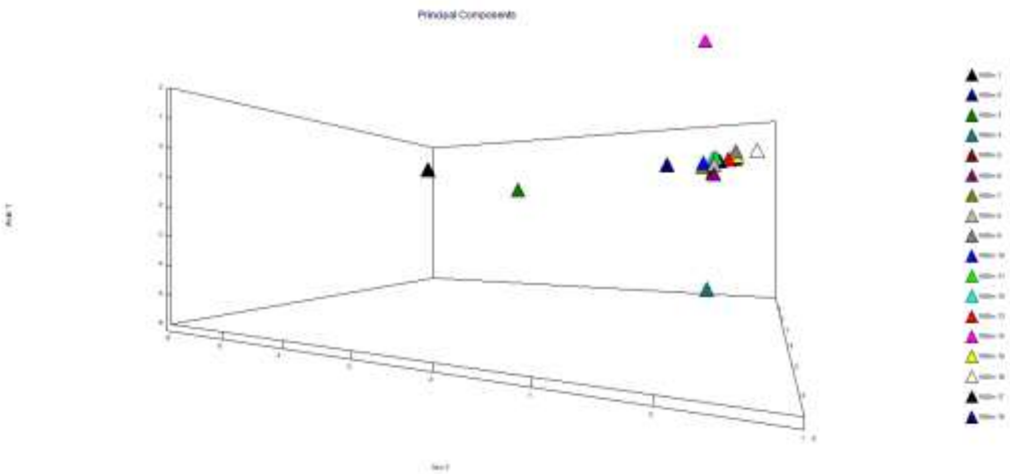
1200 m



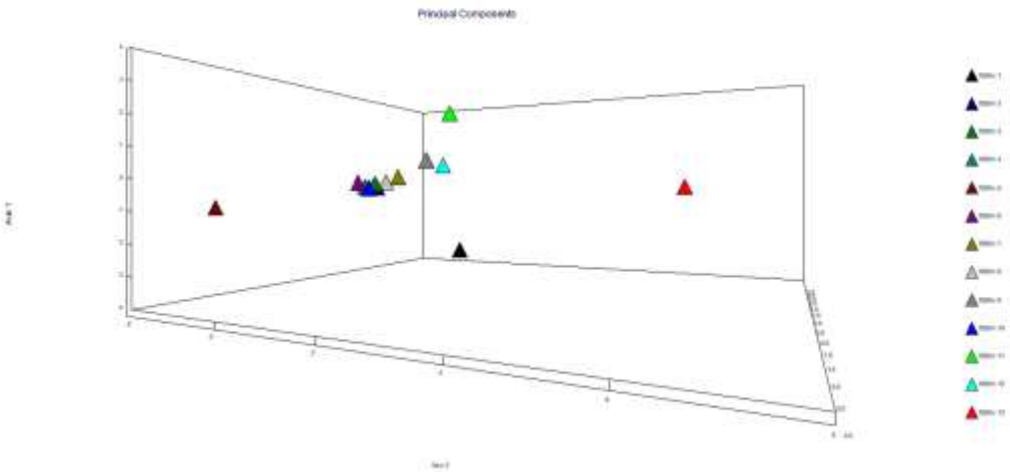
1300 m



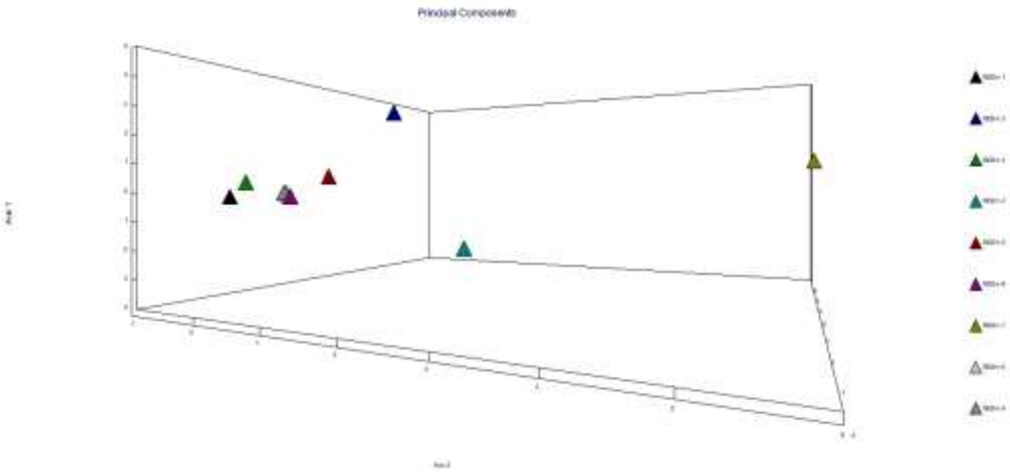
1400 m



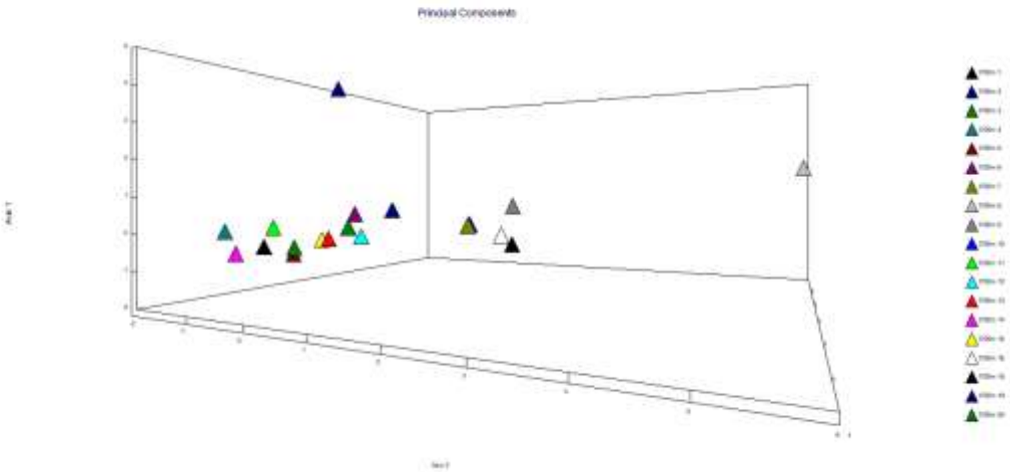
1500 m



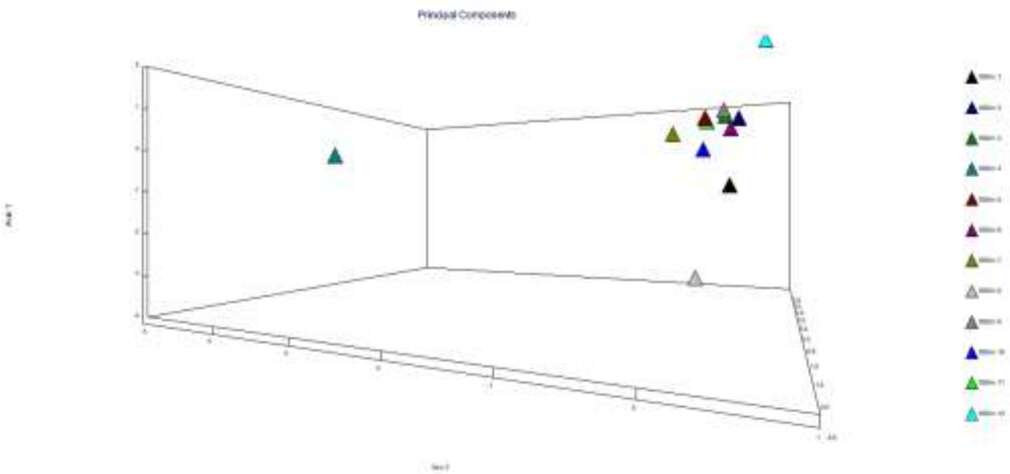
1600 m



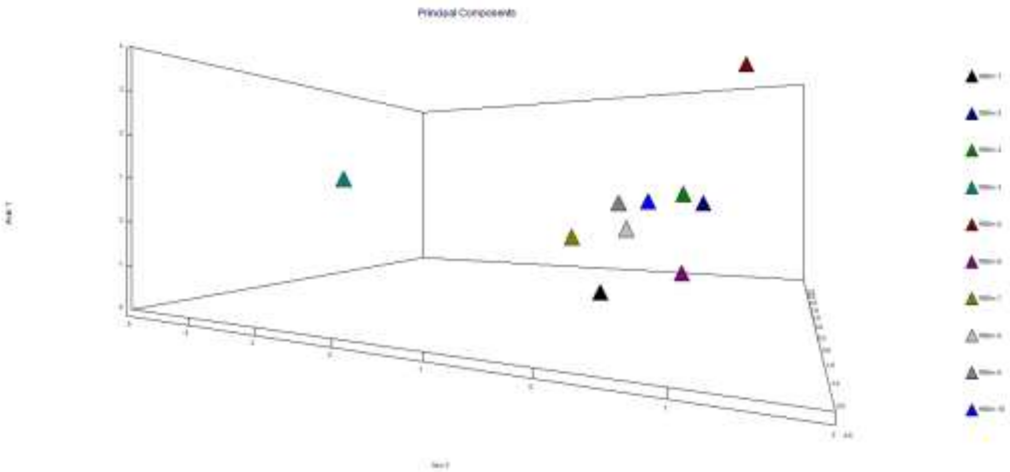
1700 m



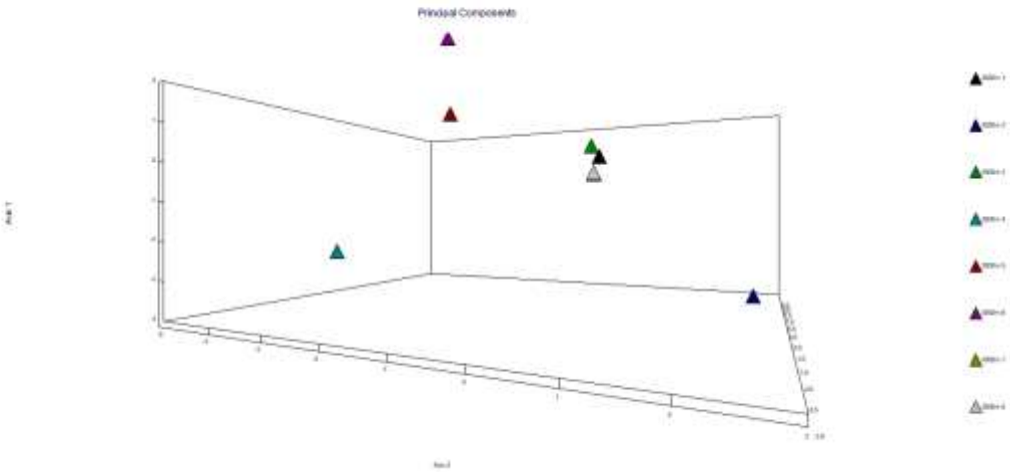
1800 m



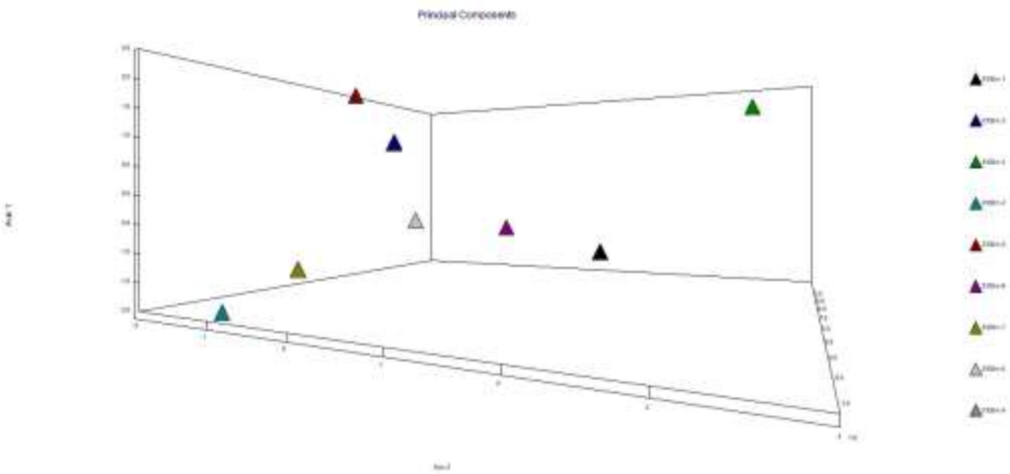
1900 m



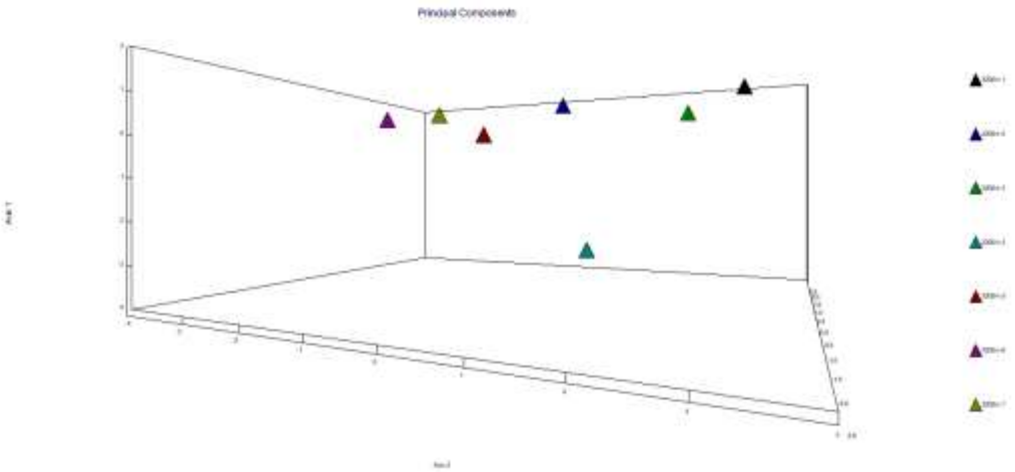
2000 m



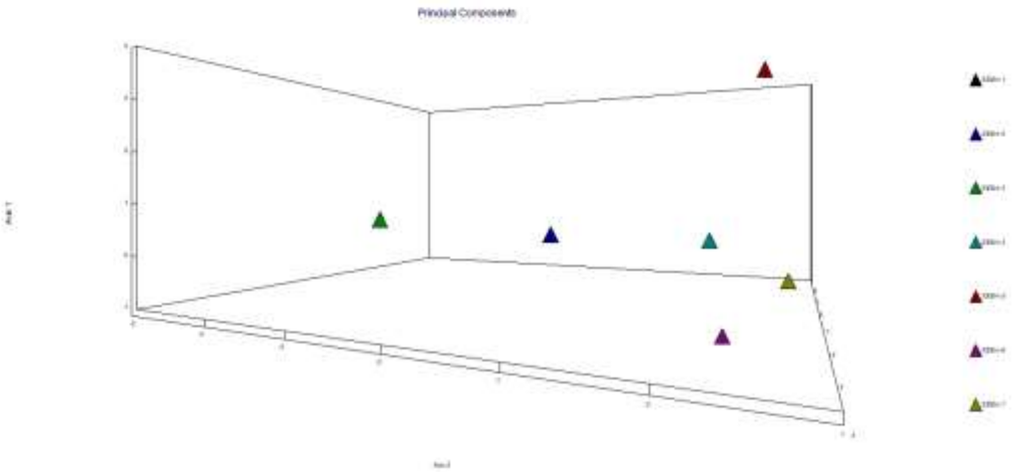
2100 m



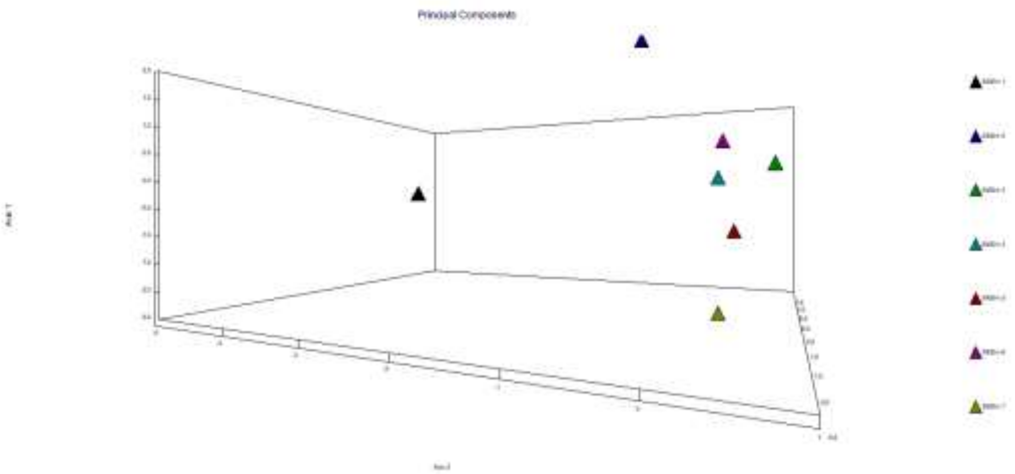
2200 m



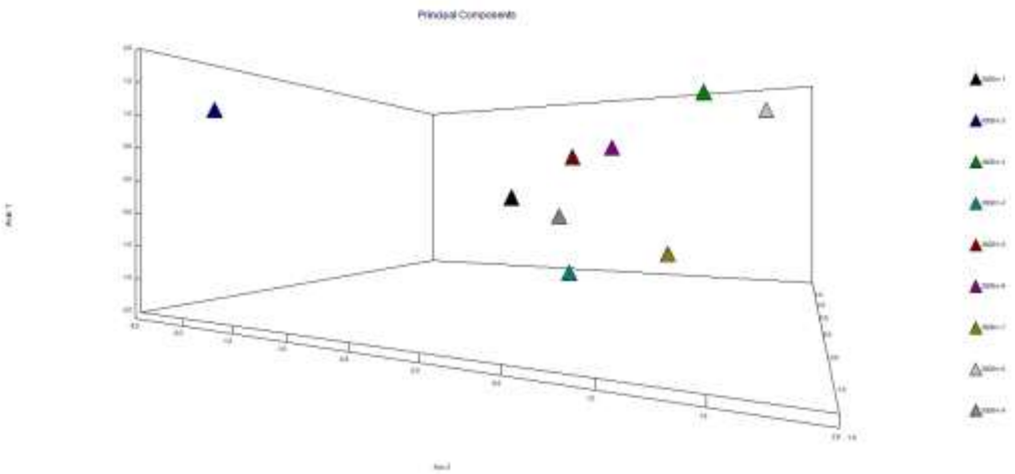
2300 m



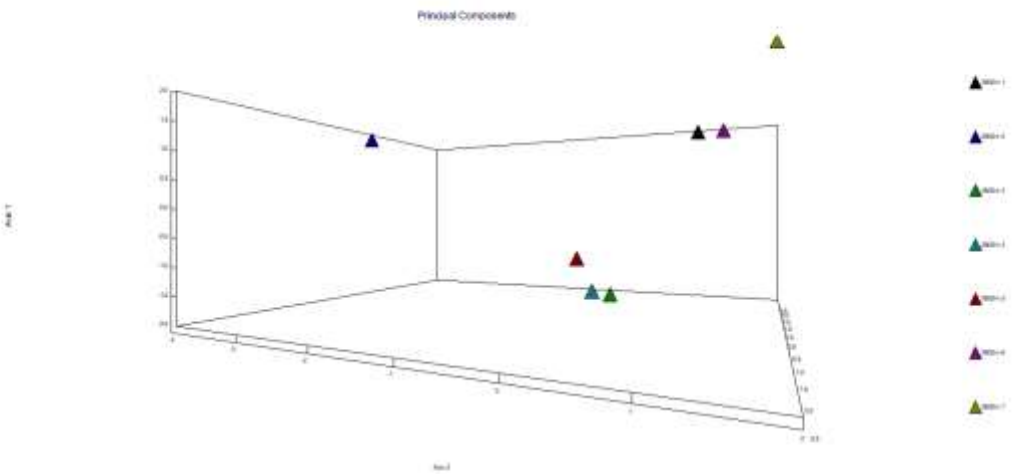
2400 m



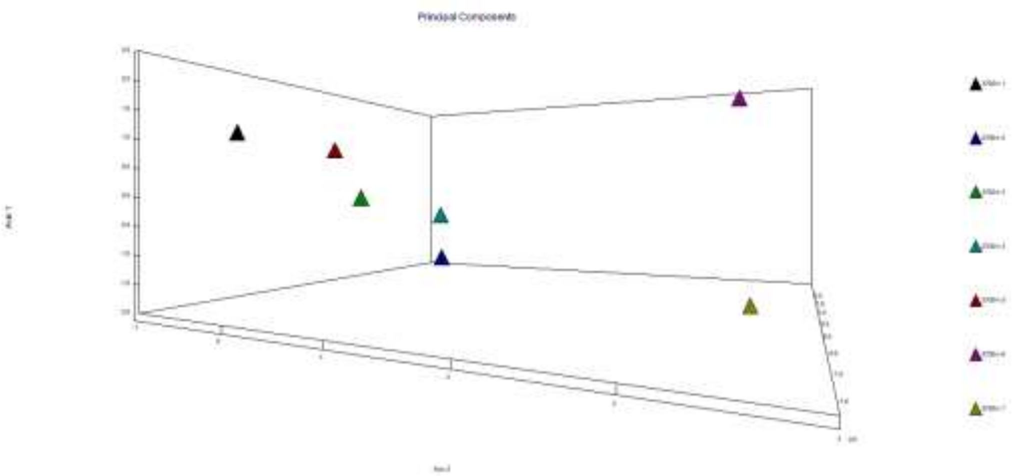
2500 m



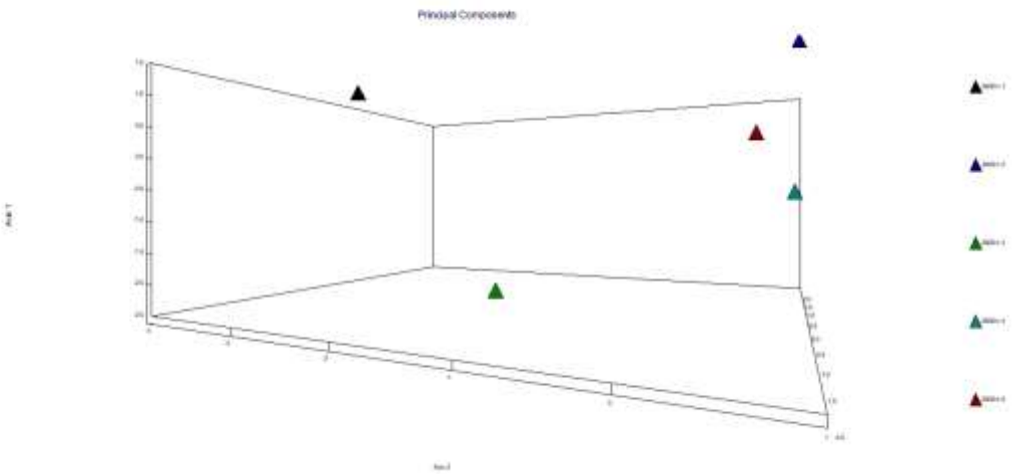
2600 m



2700 m



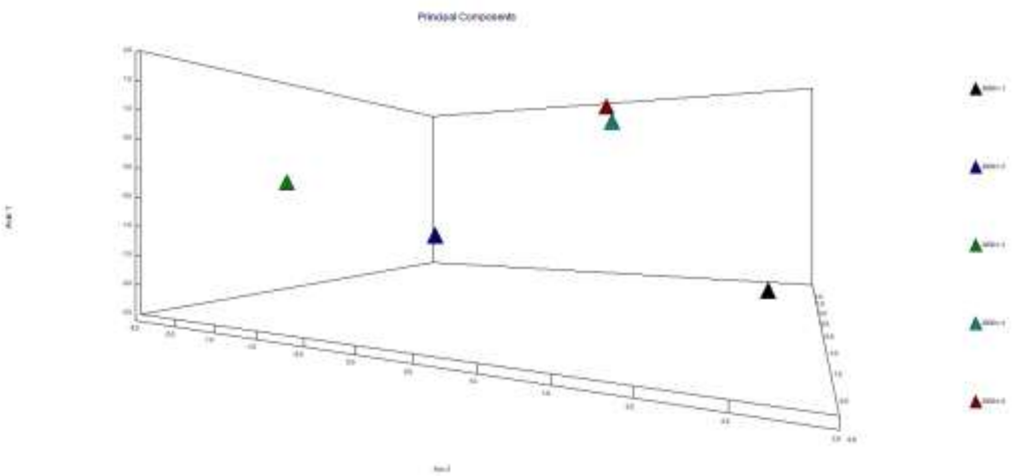
2800 m



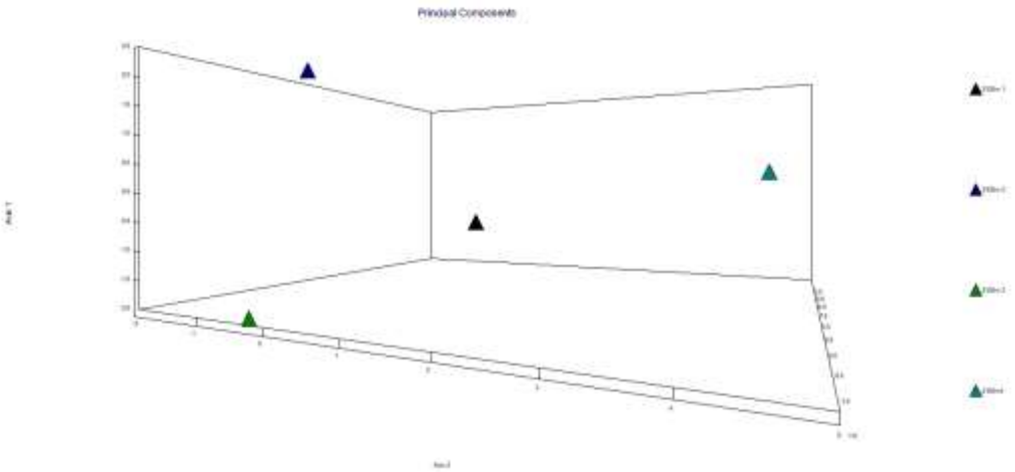
2900 m

Std. deviation zero "0" so it couldn’t calculated.

3000 m



3100 m



3200 m