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Flora and Vegetation Analysis of Jericho Area

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Dedication

To my dear parents who supported and encouraged me all over my life

To my dear and beloved wife who supports me and gives me a pleasant starts of life, and lightens my future

To my brother and sisters, and all those who stood aside me while preparing and fulfilling this thesis

To all of these, I wish them to accept my modest dedication

Declaration

I certify that this thesis submitted for the degree of Master is the result of my own research, except where otherwise acknowledged, and that this thesis (or any part of the same) has not been submitted for a higher degree to any other university or institution.

Signed:……..

(Rami Salah Mustafa Jaffal)

Date:

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Abstract

The study area is about 22 km^2 located in the southern part of Jericho district. The mean annual precipitation in the study area is approximately 200 mm/yr of which approximately 60% falls in the three months of December, January and February. The average maximum temperature during coldest month and hottest month are around 19 ºC and 38 ºC respectively, while average minimum temperatures for the same months are around 7 ºC and 22 ºC respectively.

This study aims to investigate the present status of the plant diversity and the flora of the study area based on collecting, describing, identifying, and listing the plants species growing their and the vegetation analysis for those plant. According to survey it is found that there are 40 species in the study area and those species belong to 22 families. The result showed a predominance of the family Compositeae which it self comprises (20 %), with the number of (8) species, followed by the family Chenopodiaceae which comprises (10 %), with (4) species.

Based on chorotype the species in the study area are classified into 12 categories. Analysis of chorological spectrum of the collected plant species showed a predominance of Mediterranean species which comprises (17.5 %) with (7) species. Mediterranean / Irano-Turanean chorotype also has the same percentage and number of species.

The collected plant species are classified according to their life forms into four types that are Theophytes, Phanerophytes, Hemicryphytes, and Chamaephytes. Analysis of biological spectrum of the collected plant species according to Runkiaer system of life forms of plants showed a predominance of Theophytes which comprise (42.5 %) with (17) species, followed by Phanerophytes which comprise (30 %) with (12) species. Therophytes have greater capacity for growth than other life forms, apparently because of their wider ecological amplitude, greater plasticity in size, and their small growth requirements.

It was estimated that the average of species density ranged between (0.097) and (12.258) plant/line. The highest density was for *Malva parviflora*, followed by *Calendula palaestina* with density of (5.52) p/L, where as the least dense species was *Salvia dominca*.

Based on data analysis it is estimated that the frequency ranges between (5.65 – 66.13 %). The most frequent species recorded is *Seidlitzia rosmarinus*, followed by *Atriplex halimus* with a frequent of (61.3 %), while the least frequent species is *Salvia dominca*..

According to the data obtained from this study, abundance ranges between (1.1 p/L) - (33 p/L). The most abundant species is *Malva parviflora*, followed by *Rostraria perythea* with abundance of (22.2 p/L), while the least abundant species recorded is *Prosopis juliflora*..

ملخص

النباتات والتحليل الخضري لمنطقة أريحا

تقع منطقة الدراسة (التي يبلغ مساحتها 22 كيلومتر مربع) في الجزء الجنوبي لمدينة أريحا. يبلغ المعدل الكلي لهطول الأمطار حوالي 200 ملم/سنة, حيث يتركز في أشهر الشتاء. يتراوح معدل درجات الحرارة العليا في الأشهر الباردة 19 درجة مئوية والحارة 38 درجة مئوية, بينما يتراوح معدل درجات الحرارة الدنيا من 7 إلى 22 درجة مئوية.

هدفت الدراسة بحث الوضع الحالي للتنوع النباتي وذلك بالاعتماد على جمع العينات, وصفها, ترتيبها في قائمة, و عمل تحليل (vegetation). وبناء على ذلك تم التعرف على 40 نوع تعود إلى 22 عائلة مختلفة. بينت النتائج أن عائلة Compositeae هي العائلة الشائعة, حيث تشكل 20 % من العائلات الأخرى, كذلك ينتمي لهذه العائلة 8 أنواع. يلي هذه العائلة عائلة Chenopodiaceae التي تشكل 10 % من كل العائلات, والتي ينتمي لها 4 أنواع.

بالاستناد إلى chorotype تبين أن عينات منطقة الدراسة تنقسم إلى 12 صنف. دلت الدراسة أن 8 عينات والتي تشكل 17.5 % تنتمي إلى Mediterranean, يليها Irano-Mediterranean / Turanean chorotype التي تساوى نوع Mediterranean في نسبة العينات.

صنفت العينات حسب life forms إلى 4 أصناف وهى على التوالي Theophytes, Phanerophytes, Hemicryphytes, Chamaephytes. دلت النتائج إلى أن 42.5 % من العينات تنتمي إلى Theophytes محتوية 17 عينة, يتبعها نوع Phanerophytes التي تشكل 30 % محتوية 12 عينة. Theophytes هو أعلى نوع وذلك لأنها لا تحتاج إلى متطلبات كبيرة للنمو كذلك لأنها تنمو في عدة أنظمة بيئية.

استنادا إلى تحليل vegetation تبين أن كثافة الأنواع النباتية تتراوح بين 0.097 و 12.258 نبتة/خط. كانت أعلى كثافة لنبات *Malva parviflora* يليها *Calendula palaestina* والتي تتراوح الكثافة فيها إلى 5.52 نبتة/خط, بينما أقل كثافة لنبات Salvia *dominca*. دلت النتائج أن تردد هذه النباتات المدروسة يتراوح بين 5.56 إلى 66.13 %. تبين أن أعلى تردد هو *Seidlitzia rosmarinus* , يليها *Atriplex halimus* التى تشكل 61.3 % من العينات, بينما أقل نبات هو *Salvia dominca*..

دلت النتائج إلى أن التواجد للعينات يتراوح بين 1.1 إلى 33 نبتة/خط, وأن عينة *Malva parviflora* هي أكثر تواجد, يليها عينة*Rostraria perythea* مع 22 نبتة/خط, بينما أقل عينة كانت *Prosopis juliflora*.

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%	Percentage
∑	Summation
&	and
2n	Somatic chromosome number
AE	Actual evapotranspiration
C	Central
C°	Degree centigrade
CH	Chamaephytes
cm	centimeter
comb	Combination
diam	diameter
E	East
Euro-Sib	Euro-Siberian
env	Environs
excl	Excluding
F	Fahrenheit
f	Forma
F1	Flowering
Fr	Fruiting
gr	Gram
GNP	gross national product
H	Hemicryphytes
Hab	Habitat
HUJ	Hebrew University Herbarium
incl	Including
I.c	Ioco citato
Km²	Kilometer square
m/sec	Meter per second
max	maximum
Med	Mediterranean
Med/ Sah-Ara	Mediterranean/Saharo-Arabian
Med/ Ira-Tur	Mediterranean/Irano-Turanian
Min	minimum
mm	Millimeter
Mt	Mount (ains)
N	North
No	number
nov	Novus
PE	Potential evapotranspiration
PH	Phanerophytes
pi	Relative abundance of species
P/L	Plant per line
Plur	Pluriregional
p.p.	Pro parte
R.H	Relative humidity
S	Total number of species
S	south
Sah-Ara	Saharo - Arabian

Sec	Section
Sp., spp.	Species
Stat.	Status
Subfarm	Subfamily
Subgen.	Subgenus
Subsp., ssp.	Subspecies
Sud	Sudanian
Tab	Tabula
Temp	Temperature
TH	Therophytes
Trib.	Tribe
Trop	tropical
UTM	
Var	Variety
w	wind
W.	West, western
w/m²	Watt per meter square
Y	Year

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Chapter One

1 Introduction

Palestine's geographical position is located at the meeting point between Eurasia and Africa, whereas plants and animals of three continents have interacted and spread throughout history. This contributed to a rich diversity of Palestine's flora and fauna, which has long captured the interests of ecologists and scientists alike.
The climate in Palestine is typical Mediterranean, with a rainy winter, long, hot and dry summer, and a mild dry autumn season. The temperature and the evaporation rates increase towards south and east, and the rainfall decrease in the same direction and reach its minimum (100mm) at the shore of the Dead Sea (Arad and Michaeli, 1967).
Palestine is located between 29° and 33° North Latitude, and between 35° and 39° Longitude, comprising a total area of (6,210 km^2). The area of the West Bank covers (5844.5 Km^2) while Gaza Strip covers only (365 Km^2) (Jica Country Profile on Environment, 1999).
Palestine within its small area, enjoys a dry land ecological systems and natural habitats prevailed by significant topographical and climatic variations, in terms of richness of biological diversity, this makes Palestine home to a stunning variety of plants and animals. Some 47,000 living species have been identified in Palestine, with another 4,000 assumed to exist. There are 116 species of mammals native to Palestine, 511 species of birds, 97 species of reptiles and seven species of amphibians (Al-Baba, 2000).
Some 2,780 types of plants grow country wide, from Alpine flowers on northern mountain slopes to bright red coral peonies and desert papyrus reeds in the south, some of these species live under actual threats, degradation and extinction (Al-Baba, 2000).
Based on phytogeographical attributes and topographical characteristics, Palestine is recognized as a rich area in biodiversity, composed of five climatic zones: 1- Coastal, 2- Semi-Coastal, 3- Central Highlands, 4-Eastern Slopes, 5-The Jordan Valley. Each dominated by rather common type of chorological and phytogeographical flora and fauna characteristics (Rofe and Rafftey, 1963).
The region's long history of local indigenous and invading cultures, and human movement for trade and politics made it a migratory route for exchange and dispersion of crop, seeds, flowers and animal species. Many species have thus entered the region through out the history making it a realm of significant biodiversity.
According to the Palestinian Bureau of Statistics, the population of this combined area is about 2.4 million. In recent years, the estimated natural population growth rate for Palestinians has been between 3 - 5%, comprising one of the highest growth rates in the region (PCBS, 1994).

1.1 Biodiversity

Somewhere between 3 and 100 million species inhabit the Earth (Heywood, 1995). As a shorthand description of this great variety of life, the term "biodiversity" is a contraction of "biological diversity", and was first coined by Walter Rosen for the 1986 National Forum

on Biodiversity (Wilson, 1988). However, biodiversity refers to more than just an accumulation of species. If that were all that it was, then we might hope to conserve biodiversity in zoos. Instead, biodiversity also refers to organisms' existence *in situ*, and incorporates the ecological and evolutionary interactions among them. For example, the UN Convention on Biological Diversity defines biodiversity as ". . . the variability among living organisms from all sources including, inter alias, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems" (United Nations Environment Program, 1992, p. 4). Also following the environmental summit in Rio de Janeiro in 1992, the use of the word biodiversity has proliferated in public, scientific and governmental policy media. While many people have some understanding of the concept of biodiversity, many would struggle to articulate a clear definition. A clear understanding of the meaning of biodiversity is therefore necessary before its importance can be fully comprehended. Biodiversity describes the diversity of life. More ecological definitions emphasis that the relative abundance (evenness) of individuals within different species is as important as the actual number (richness) of species (Wratten, 2002).

1.1.1. Elements of biodiversity:

The variety of life is expressed in a multiplicity of ways. Some sense of this variety can begin to be made by distinguishing between different key elements. These are the basic building blocks of biodiversity and can be divided into three groups (Table 1.1).

Table 1.1: Elements of biodiversity (Adapted from Heywood & Baste 1995)

Ecological diversity	Genetic diversity	Organismal diversity
Biomes	Population	Domains or Kingdoms
Bioregion	Individuals	Phyla
Landscape	Chromosomes	Families
Ecosystem	Genes	Genera
Habitats	Nucleotides	Species
Niches		Subspies
Population		Population
		Individuals

1.1.1.1. Genetic diversity:

Encompasses the components of the genetic coding that structures organisms (nucleotides, genes, chromosomes), and variation in the genetic make-up between individuals within a population and between populations.

1.1.1.2. Organismal diversity:

Encompasses the taxonomic hierarchy and its components, from individuals upwards to species, genera and beyond. Historically, ecologists have tended to focus on the species level of biodiversity, and have quantified it in two ways:

- Richness: the number of species in a given area.

- ❖ Evenness: how evenly balanced are the abundances of each species, where the abundance of a species is the number of individuals present.

The contribution of richness to biodiversity is evident. The role of evenness is subtler. To illustrate, consider communities of 10 species comprising 100 individuals. A community that has 10 individuals of each species is more diverse than one with 91 individuals of one species and one of each of the other species. The first community is more diverse because, all else being equal, a rare species will play a lesser overall role in ecological processes than will more common species. Of course, if the rare species is very large, or is particularly effective at modifying the environment, then this distinction may no longer apply.
However, estimating relative abundances for all of the species in a community can be time consuming and difficult, and is usually not feasible for the rapid assessments performed to set conservation priorities. Therefore, in many conservation contexts, species richness is used as a proxy for species-level biodiversity. These places have a value on genetic diversity above the species level, as well as on the large-scale evolutionary history of the biota. Typically, measures of species-level diversity are not applied to all species at a site, but rather to a particular taxonomic group (e.g., mammals, insects, or plants). This may be in part a function of specific scientific or conservation goals, but also reflects the fact that very different techniques and expertise are required to accurately survey different types of organisms.

1.1.1.3. Ecological diversity:

Encompasses the scales of ecological differences from populations, through niches and habitats, on up to biomes. Although presented separately, the groups are intimately linked, and in some cases share elements in common. Our study will focus on organismal and ecological biodiversity.
Another important level of biodiversity is that of communities or suites of interacting species. Different communities may share some species, but the relative abundances of species, and the nature and intensity of interspecific interactions among them, may vary greatly among communities. Indeed, is this diversity of interactions that distinguishes species in their natural habitat from the same species in a zoo. Often attention is focused on conserving communities that are rare or unique to a region.
Terrestrial communities are usually classified in terms of vegetation associations, which are defined in terms of the largest and most numerically dominant plant species. These are easier to map than are animal communities, although boundaries between adjacent communities are not always distinct. Vegetation associations are controlled by a biotic factors such as soil type, hill slope, aspect (the direction that the slope faces), and climate, as well as biotic interactions among the plant species and with animals. There is also a historical component to community composition. For example, many long-lived tree species are still migrating north in response to the climate change at the end of the last ice age, and have not yet attained their maximum range potential. These migrations are proceeding at different rates for different species (Davis, 1976). For a rapidly dispersing species, the current range could represent the available habitat; for a slow disperser, it may only represent the habitat that the species has been able to reach. Aquatic and marine communities are classified by a variety of variables, including physical factors—water depth; temperature; salinity; nutrient availability; wave exposure; bottom type, etc.—as well as the dominant species of plants or sessile organisms that are associated with the substrate (such as kelp beds or coral communities) (Mumby and Harborne, 1999).

Far from shore, pelagic communities of highly mobile marine species can move long distances in response to changes in water temperature and nutrient availability. Defining characteristics of these pelagic communities would include geographic range distributions and strong trophic interactions. Communities are dynamic entities that may change rapidly. Following a disturbance, such as fire, flood, hurricane or intense grazing, vegetation and sessile animal communities can sometimes move through fairly predictable successional stages as the bare substrate is recolonized and a sequence of ecological interactions allows the previous community to reestablish. Some species can only flourish on freshly disturbed sites, and some important communities are intermediate successional stages; these would be lost if disturbance were suppressed. Maintaining a patchwork of different successional stages can allow a high diversity to exist on a site (Paul R *et al*, 2003).

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1.1.2. Spatial scales of biodiversity:

As well as choosing an organizational level over which to measure biodiversity, one must also choose a relevant spatial scale; because richness increases with area. Typically, one chooses either an economically meaningful scale (the individual land parcel) or an ecologically meaningful one (habitat zones). Having chosen this "local" scale, there are three aspects of biodiversity to consider when looking at the landscape (Whittaker, 1972; Schluter and Ricklefs, 1993).

(α diversity), the "local" diversity within each site or the average of the local measures across all of the sites, (β diversity) the change in species composition from one site to another. The fewer species that the various sites have in common, the higher is the β diversity, and **(**γ diversity) the "total" diversity measured over the entire suite of sites being considered. This can be estimated directly, or calculated from α and β diversities. By definition, γ diversity is a function of α and β diversities within the region. If α and β diversities are both low, then so will be γ diversity; likewise, all may be high. An intermediate level of γ diversity could correspond either to high α diversity (each site is locally diverse) but low β diversity (the sites all have the same suite of species) or to low α diversity (each site is very species poor) but high β diversity (all sites are different from one another).
For example, Cox and Ricklefs (1977) studied bird diversity on two Caribbean islands. Both islands had the same nine habitat types, but the larger island had five times the γ diversity of the smaller island (108 species vs. 20). This was due to an increase both in α diversity (the average number of species per habitat) from 12 to 28 and β diversity (measured as the inverse of the average number of habitats per species) from 0.19 to 0.43. The three measures represent a partitioning of diversity across relative spatial scales. Here, the "local" scale used to define diversity could be anything from a small habitat patch to an entire reserve. This partitioning is commonly defined in terms of species richness, but analogues can be developed for other diversity measures (Paul R *et al*, 2003).

1.1.3. The significance of biodiversity:

Human civilization, indeed human life on earth, is ultimately dependent upon myriads of other organisms with which we all share the planet. Our dependence on biodiversity is absolute: without it humans would not be able to survive. All food is directly or indirectly obtained from plants and other photosynthetic organisms. Apart from direct benefits of biodiversity from the harvest of domesticated or wild species for food, fibers, fuel, pharmaceuticals and many other purposes, humans also derive benefit from its influence

on climate regulation, water purification, soil formation, flood prevention and nutrient cycling (i.e. ecological services); and the aesthetic and cultural impact is obvious (Daily 1997; Balmford *et al* 2002). Biodiversity is thus fundamental for current and future social and economic livelihoods.

1.1.3.1. Sustainability and biodiversity conservation:

A series of ethical questions is at the core of the sustainability debate – sustainability of what, for whom, for how long. For example, one approach might be to seek sustainability in the levels of well-being necessary to meet individual preferences. Another might be to seek sustainability in the options or opportunities to meet broader societal needs. The issue of equality also impinges directly on these questions. For many people greater equity in contemporary society (intergenerational equity) is an urgent priority. For others equality of opportunities between generations (intergenerational equity) lies at the heart of the sustainability debate (O'Neill 2001).
Biodiversity provides substantial socio-economic, scientific, technical, and socio-cultural opportunities. These opportunities give rise to benefits that are based on diversity within and among species and ecosystems. The perspective on sustainability adopted here requires that these benefits continue to be available to future generations. Thus biodiversity conservation is essential to sustainability (P Crane, 2003).

1.1.3.2. Direct and indirect benefits from species and ecosystems:

The delivery of sustainable development objectives requires the efficient and ongoing conversion of solar energy into useful goods and services. Biodiversity fulfils this role, providing a vast range of significant use and non-use benefits, as well as essential life-support services. It is estimated that 40% of the global economy is based on biological products and processes (Packer 2002). However, quantifying these benefits is not straightforward, because they are mostly not captured by conventional, market-based economic activity and analysis. A synthesis of more than one hundred studies attempting to value ecosystem goods and services estimated their aggregated annual value to lie in the range of about $20 trillion to $60 trillion, around a rough average of about $40 trillion (Costanza *et a,l* 1997). These figures are of similar size to the total gross national product of the world (GNP). Although such estimates should be interpreted with caution, they nevertheless indicate the potential magnitude of the global ecological goods and services. At a more local level, estimates of the differences in benefit flows between relatively intact and converted versions of different biomes suggest that, despite private, often short-term, gains, the total economic value of natural systems, to society as a whole, is roughly halved following conversion to farming, forestry or aquaculture (Balmford et al 2002; Turner *et al* 2002).

1.1.4. Threats to biodiversity:

Human activities have dramatically accelerated the global rate of species extinction (Pimm *et al*., 2001). For example the extinction rate for mammals for the period 1600 a.d.–2000 a.d. may have been 50–100 times higher than the background rate for mammals estimated from the fossil record (Regan et al., 2001). Anthropogenic threats to biodiversity come in several major forms (Orians and Soulé, 2001):

1.1.4.1. Habitat loss:

Losses of habitat can be attributed to:

- Conversion: When land is converted from a wild or semi-wild state to agriculture or urban development, many species are unable to persist. For example, butterfly diversity in the Amazon declines markedly if more than 30% of the forest is converted to agriculture (Brown, 1997). This transformation includes the clearing of forest land, conversion of pasture land to cultivation or urbanization, and the filling and draining of wetlands.
- Degradation: Some human activities reduce the quality of habitat without destroying it completely. For example, pollution and pesticides can lower habitat quality, and reduce a species' birth and survival rates, sometimes to the point that the species goes locally extinct. Also, livestock grazing can reduce the plant biomass available to other herbivorous animals, and cause an increase in the relative abundance of unpalatable plant species.
- Fragmentation: small areas hold fewer species than large ones, and a collection of isolated habitat fragments may contain less biodiversity than a contiguous habitat of similar size. In addition, species that are not effective at dispersing among fragments could be at greater risk of extinction. We tend to think of fragmentation as the process of increasing the patchiness of habitat in an otherwise hostile anthropogenic habitat. However, some species can have their movement restricted by as little as a road through otherwise pristine habitat (Trombulak and Frissell, 2000).
- Harvesting: Fishing or logging has a negative impact on the targeted species, as well as on any species that directly depend on the target species for food or shelter. Certain harvest techniques have broader impacts on the ecological community (Dayton et al., 1995). Fisheries often take large "incidental catches" of non-target species, and trawling can destroy the community that lives on the sea floor. Clear-cut logging has a similar impact to land conversion of forests. "Bushmeat" hunting is an important threat to wildlife when other sources of food are scarce, especially in poor countries.

1.1.4.2. Exotic species (D'Antonio *et al*., 2001):

Humans have greatly accelerated the movement and introduction of species from one region or continent to another (e.g., Cohen and Carlton, 1998). This has included both the deliberate introduction of species with perceived agricultural or aesthetic benefits and accidental introductions of "hitchhikers" on trading activities. Few of these exotic introductions persist in their new environment. Unfortunately those that do are often extremely successful. These exotic invaders can dramatically change an ecological community by being dominant competitors or effective predators, and can drive many native species to low densities or extinction (Reid and Miller, 1989).

1.1.4.3. Climate changes (Schlesinger *et al*., 2001):

If temperature and rainfall patterns change to the point that a species can no longer thrive in the sites where it is currently found, then the species will decline unless it can either adapt to the changes or migrate to new, more suitable sites. Faced with rapid climate change, any organism that cannot adapt rapidly or migrate across the anthropogenically

fragmented landscape will not fare well. For example, 5–10% of species in California may be driven extinct if climate warms 4 .F (Morse *et al*., 1995; Field *et al*., 1999).
All of these threats can be devastating to a particular species or community. In the long term, climate change is likely to be an increasingly important factor. In the short term, however, habitat loss is probably the most important threat to biodiversity in terrestrial and coastal systems (Sala *et al*., 2000; Hixon *et al*., 2001). Overfishing and its collateral damage is the largest current threat to ocean biodiversity (Hixon *et al*., 2001).

1.1.5. Role of science in the conservation and sustainable use of biodiversity:

According to (Crane, 2003).In broad terms enough is already known of the distribution and drivers of biodiversity loss to indicate the scale of the problem and to guide urgent conservation action. However, there are major gaps in knowledge. For example, it is not known how much an ecosystem can be simplified but still provides the ecological services on which humans depend. Similarly, surprisingly little is known about the changing state of populations, species and ecosystems. Much of our existing knowledge has been developed opportunistically, leaving us with information that is too patchy and selective for optimal long-term planning. Improved knowledge, improved analysis and improved synthesis at regional and global levels will enhance the effectiveness of attempts to measure biodiversity for sustainability and conservation goals. Working together with conservation practitioners, economists, lawyers and other social scientists, science has a key role to play in developing ever more effective conservation and sustainability practices.

- Scientific principles must guide the systematic and objective documentation, analysis and assessment of biodiversity as well as trends in the state of wild species, populations, habitats, and the ecological services that these organisms and systems provide.
- Both large and small-scale scientific studies are essential in establishing the causes of biodiversity losses, in identifying priority responses, and in evaluating their effectiveness.
- Scientific analyses (integrated with economic and sociological studies) are vital to developing a thorough understanding of the significance and value of biological diversity, and to the development of management protocols that enable the benefits of biodiversity to be delivered sustainably.
- New and innovative techniques, methods and discoveries from across the natural and social sciences will need to be integrated to address the complex and inter-disciplinary challenges inherent in biodiversity conservation.

Chapter Two

Study area

2.1 Location

Jericho lies in the Jordan valley zone**.** This zone has unique topographic and climatic conditions. The approximately 400,000 dunums that comprise this region lie between 90-414 meters below the sea level, surrounded by one high series of mountains in the west and the Jordan River in the east, and characterized by hot summers and warm winters. Most of the soil contains high ratio of sodium (Dudeen, 2000). Due to the hot and dry climate, the rainfall is not truly effective to agriculture. So, all kinds of agriculture are entirely irrigated. Uncultivated areas are used as natural grazing lands. The availability of both springs and ground water wells makes this area most suitable for off-season vegetables cropping and for semi-tropical tree plantations. All strains and varieties of dates palm trees and still in existence, Citrus orchards with special taste and early season are remarkable in the Jordan Valley (PIALES, 1996). The study area is about 22 km^2 located in the southern part of Jericho district between the following positions (Fig. 2.1).

2.2 Population

The population of the Jericho district is estimated at around 21.500 inhabitants, representing approximately 1% of the total population of Palestine.Within the Jericho district Jericho city represents around 64.2%; refugee camps represent 22.5%, and 13.3% in villages (PBC, 1994).

2.3 Soils

Palestine is relatively a small geographic area however; the soils are remarkably diverse in their properties. This diversity is due to the variation in climatic, origin (parent material) and topographic features (Roffet and Raffti, 1963). The Jordan valley is the only ecosystem in Jericho district. Nine soils association can be distinguished in this ecosystem (Dan *et. al*, 1975). Out of those types there are four soil types dominated over the study area and those are as follow.

1- Alluvial arid brown soil which generated from calcareous silty and clay materials. It is characterized by brown colour and loamy texture.This types dominate in the study area.
2- Regosols soil, characterize by pale brown colour and loamy texture. The parent materials of this soil are sandy, clayed, and loess.
3- Loessial Serozems soil which is characterized by yellowish-brown colour and loamy texture. It originated from conglomerated chalk.
4- Calcareous Serozems soil, characterize by greyish-brown colour with medium to fine texture. It originated from limestone, Chalk, and marl rocks.

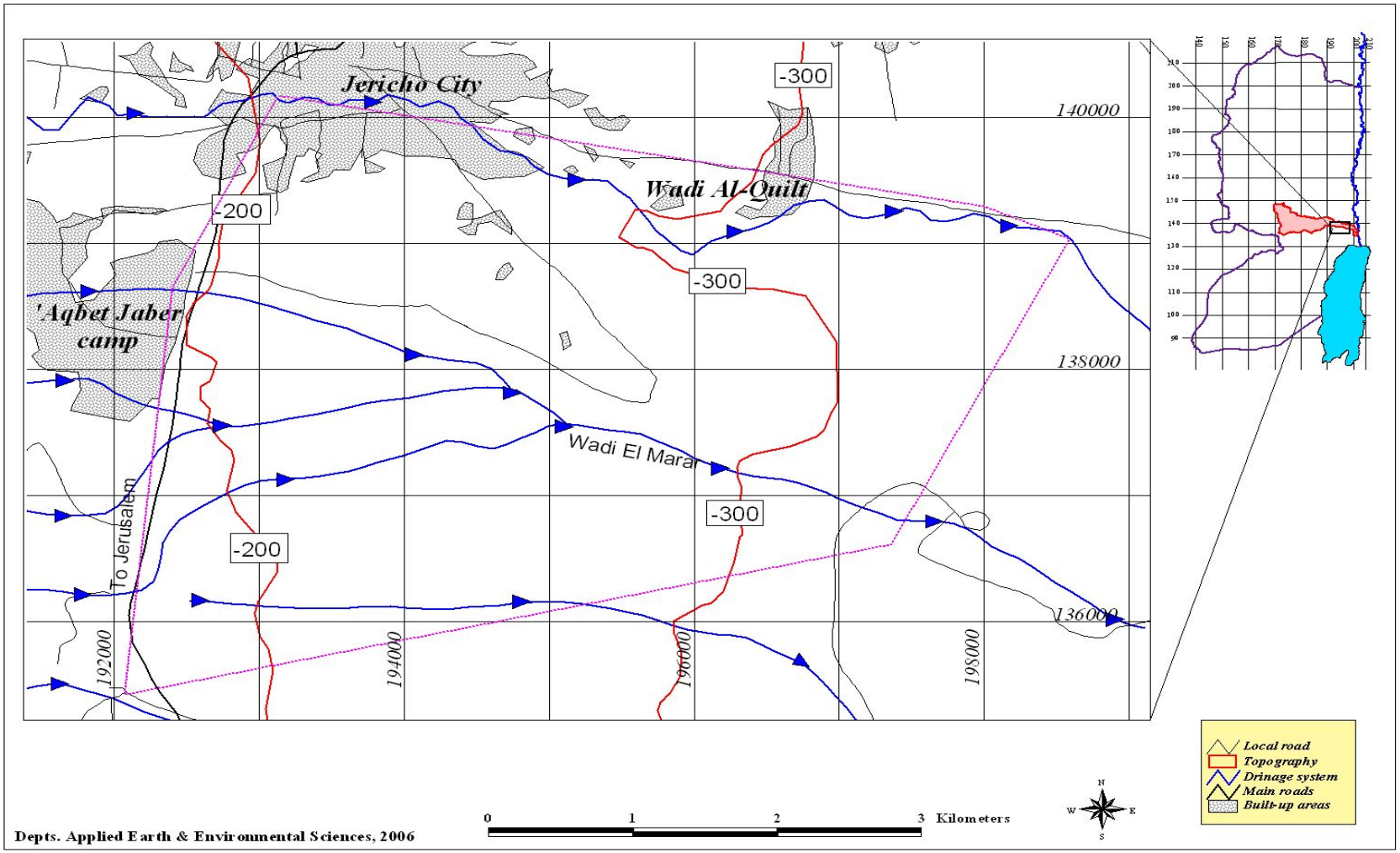

Fig. 2.1: Location of the study area.

2.4 Temperature

The temperature in Jericho area increases toward north and west direction, and decrease toward the south and east, The average maximum temperature during coldest month and hottest month are around 19 ºC and 38 ºC respectively. The average minimum temperatures for the same months are around 7 ºC and 22 ºC respectively (Rofe and Raffety, 1963). According to Arij (1995) the maximum temperature recorded between 1970 and 1981 reached to 49 ºC in June, and the minimum was -1 ºC in December/January.

2.5 Rainfall

Rainfall is limited to the winter and spring months, mostly between November and March. Generally, rainfall decreases from north to south and the altitudinal gradient as rainfall decreases along with the decrease in elevation. The maximum average annual rainfall of 594 mm/yr occurs in the north-western part of the study area (East Jerusalem) and the minimum average annual rainfall of 80 mm/yr occurs along a small hyper-arid longitudinal zone running along the Dead Sea coast. The mean annual precipitation in the study area is approximately 200 mm/yr (Fig 2.2), of which approximately 60% falls in the three months of December, January and February (Fig. 2.3).

2.6 Evaporation

Scientists distinguish between two different aspects of evapotranspiration: potential evapotranspiration and Actual evapotranspiration (AE). Potential evapotranspiration (PE) is a measure of the ability of the atmosphere to remove water from the surface through the processes of evaporation and transpiration assuming no control on water supply. Actual evapotranspiration or AE is the quantity of water that is actually removed from a surface due to the processes of evaporation and transpiration, and it is difficult to calculate it, so we talk about the potential evaporation. The evaporation rate is affected by the changes in sun radiation. The minimum and maximum evaporation rate recorded in Jericho district are 59 mm in winter and 298.5 mm in summer, the evaporation rate reaches 200-250 mm/month during spring. Generally, the evaporation rate is twice precipitation during the year, this indicate that it's necessary to irrigate the agricultural land (Arij, 1995) (Fig. 2.4).

2.7 Wind

The average daily wind speed in the district is around 3.27 m/sec. the wind direction in the Jericho area changes from northwestern at night to southern in the early morning. The maximum wind speed is measured at 15 m/sec during spring (Arij, 1995).

2.8 Radiation

According to Jericho weather station the solar radiation reaches its maximum value during July. The total annual solar radiation measured for the period between June 1994 and May 1995 was 62.520wa/m² (Fig 2.5).

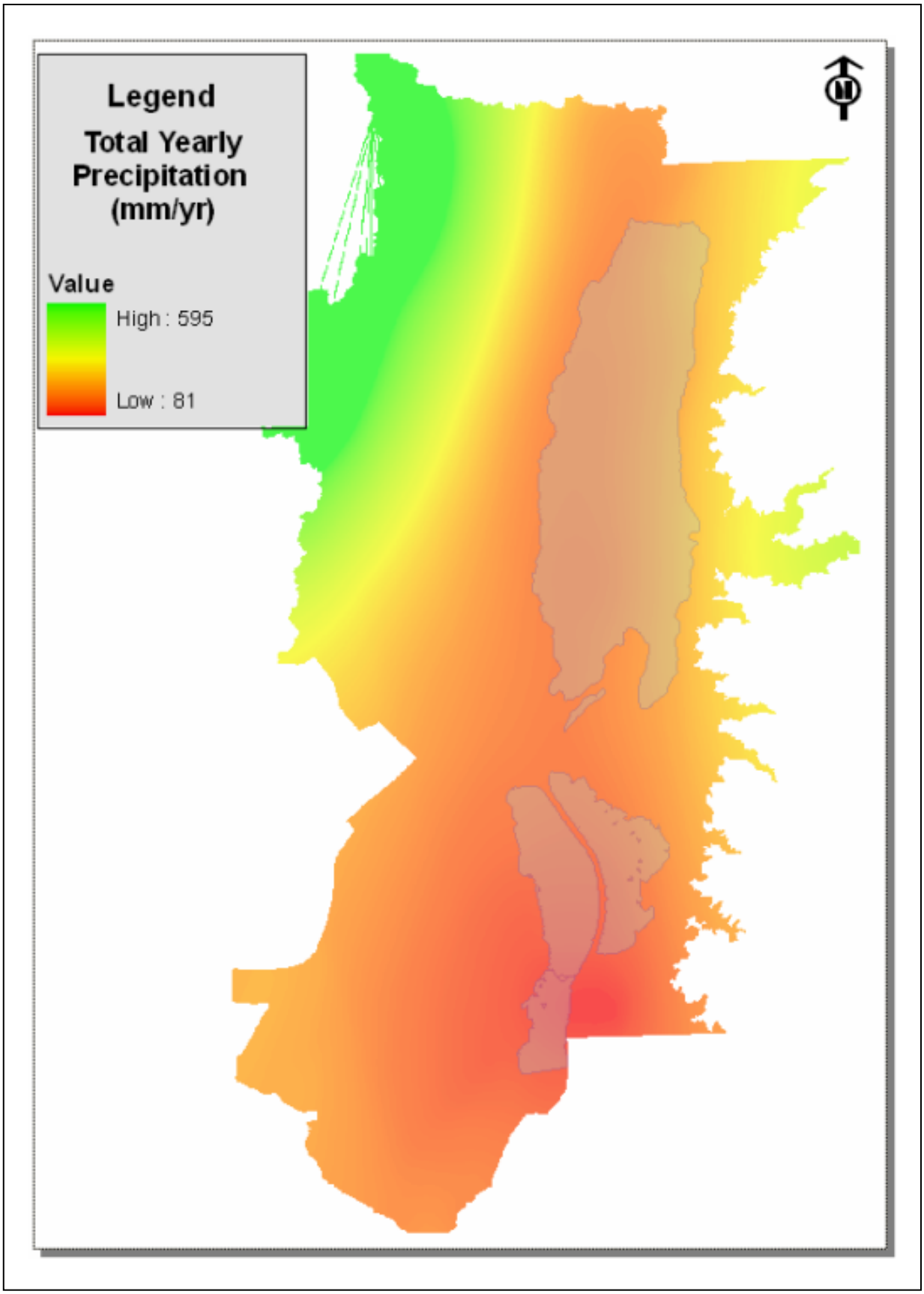

Fig. 2.2: Average annual precipitation of the Jericho area (Arij, 1995).

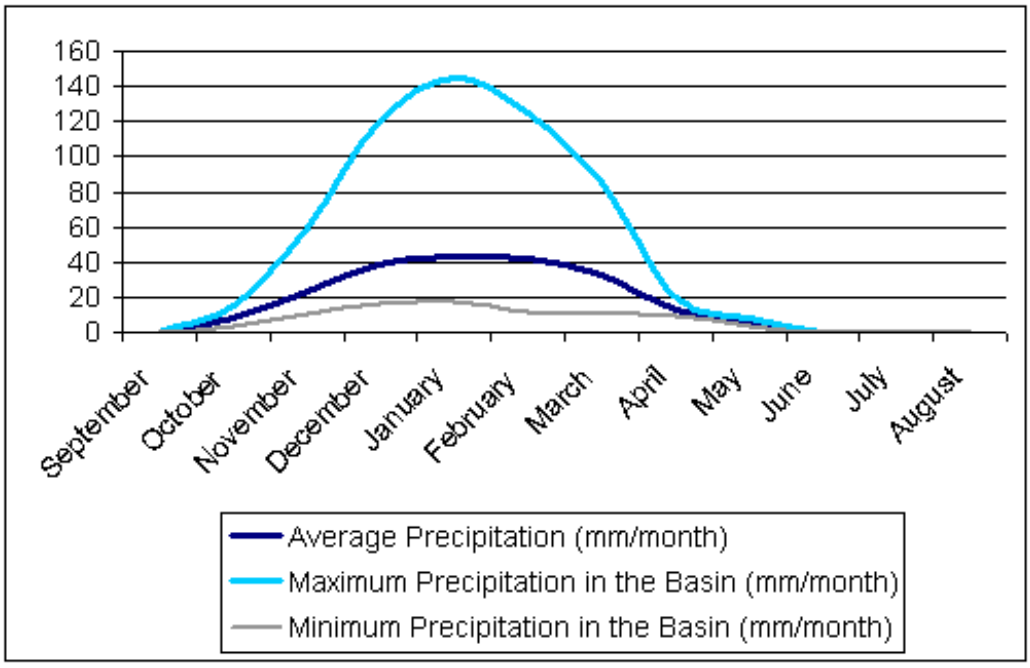

Fig 2.3: Distribution of the monthly precipitation over Jericho area (Arij, 1995).

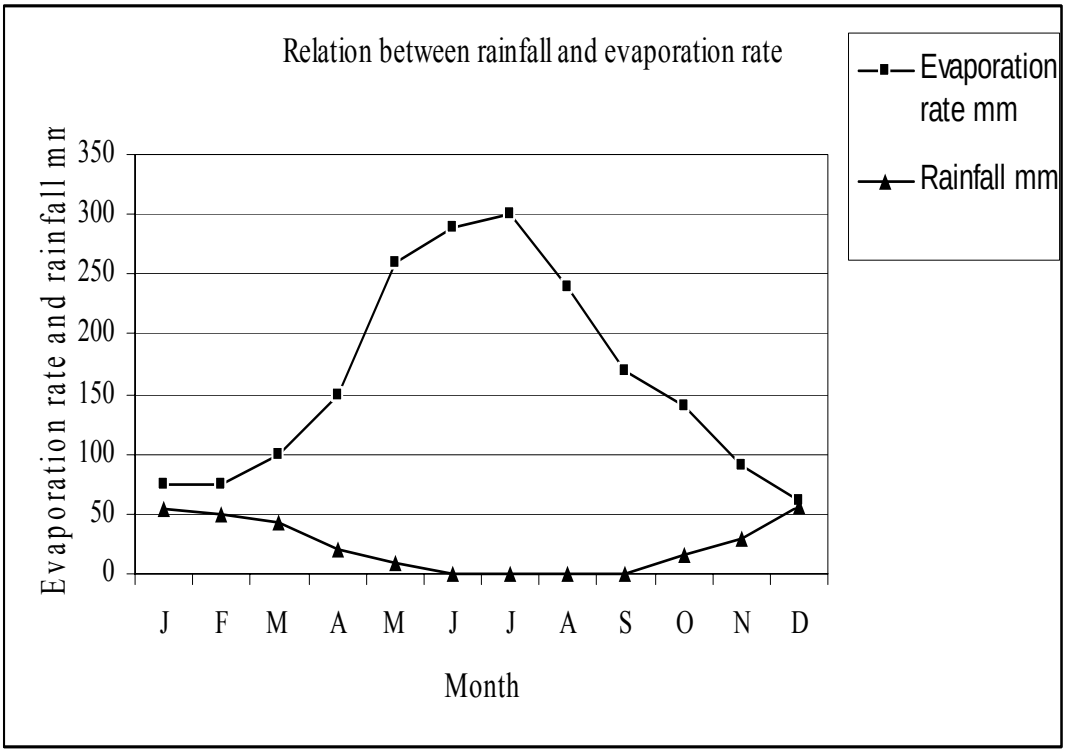

Fig 2.4: Monthly evaporation rate and rainfall in Jericho district for1992 (Arij, 1995).

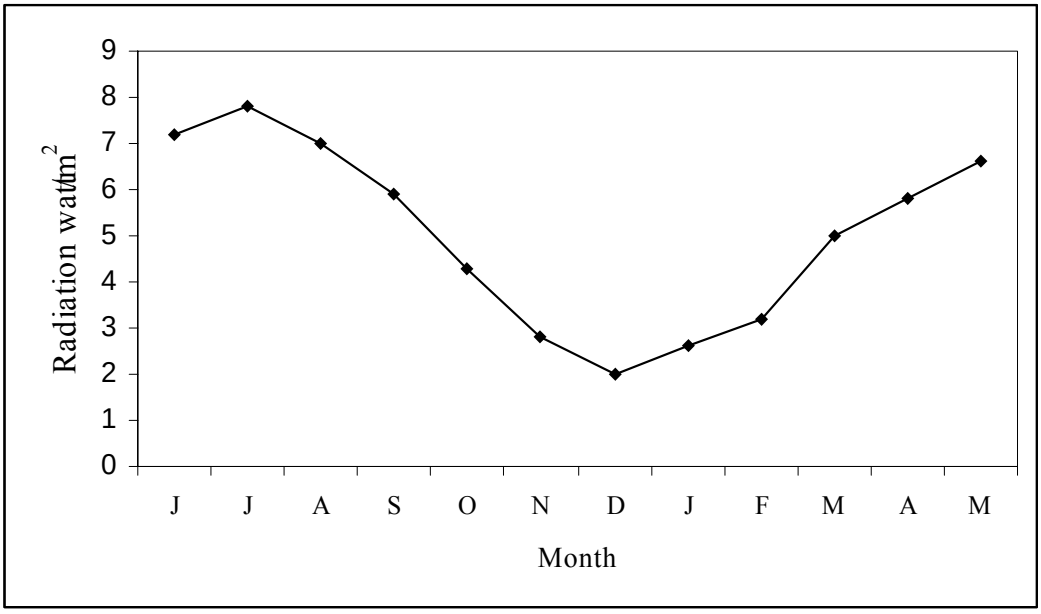

Fig. 2.5: Monthly variations in radiation from period 1994-1995 (Arij, 1995).

2.9 Humidity

The mean annual relative humidity in Jericho district is about 50%. It reaches its highest rate in winter and the lowest rate in summer. During the winter the humidity ranges from 70%-85%, while in summer ranges from 40%-60%. In spring semester the average relative humidity is 30% (Rofe &Raffety, 1963). The average climatic parameters in the Jericho district from 1969-1992 is presented in (Table 2.1) (Arij, 1995).

Table 2.1: Average climatic parameters in Jericho district from (1969-1992) Arij, 1995).

	Rainfall	Max Temp	Min Temp	Pressure (Mb)	Evapo (mm/month)	W.speed (m/s)	R.H %
J	35.73	19.15	7.43	1048.03	76.88	2.48	69.8
F	30.7	20.88	8.32	1045.80	76.72	2.88	65.4
M	25.4	24.34	10.54	1043.86	128.65	3.64	57.2
A	9.83	29.31	14.15	1041.06	189.3	4.5	44.6
M	2.04	33.7	17.58	1039.56	261.64	4.4	38.1
J	0.28	36.69	20.36	1036.94	289.2	4.26	38.2
J	0.00	37.8	22.12	1034.19	298.53	4.45	40.5
A	0.00	37.59	22.41	1034.82	267.0	4.08	44.0
S	0.38	36.07	21.14	1038.50	226.61	3.48	47.2
O	7.19	32.32	17.94	1042.15	153.59	2.6	51.2
N	21.84	26.38	12.93	1045.73	93.6	2.16	59.5
D	32.96	20.54	8.95	1047.72	59.21	2.04	70.2

2.10 Problem statement

Due to the lack of available information about the status of biodiversity in Palestine, this study is conducted to investigate and describe the present status of the plant diversity and flora of Jericho area.

2.11 Objectives

The aim of this study is to survey and to investigate the present status of the plant diversity and the flora of the study area based on collecting, describing, identifying, and listing the plant species growing their. In addition to conduct a vegetation analysis for those plant.

2.11.1. General objectives:

- To investigate about plant diversity.
- This study will be conducted to cover part of information that deals with plant diversity in Jericho start to make preliminary biodiversity data base for the area.
- To provide recommendations for biodiversity conservation

2.11.2. Special objectives:

- To specify endangered plants in Jericho area.
- To specify endemic plants in the research area.
- Preparation of a brief description for each species and key to the families and genera.
- Preparation a checklist of plant diversity of the study area.
- Floristic analysis of the plant diversity of the study area.
- Vegetation analysis of the study area.

2.12 Literature Review

There was no available information which concern biodiversity in West Bank in general and plant diversity in particular. Consequently, the studies which were conducted in the nearest countries were taken as a literature review in this study. For more convenience literature review is divided into three categories according to the type of study.

2.12.1. Floristic:

The flora of Palestine was indirectly studied in earlier works related to the area as Flora Orientals (Boissier, 1867-1883), Flora of Syria, Palestine, Sinai (Post, 1932-1933), and Flora Palaestina (Zohary-1966-1973).

In Jordan, Al-Eisawi (1982) recorded 2079 species of vascular plants. He updated a checklist based on reviewing and compiling of information about the plant species in Jordan reported in the recent publications and flora surveys to many localities and sites around the country. This checklist included 122 families, 761 genera, and a total number of plant species as up to 2240 species. He recorded that the largest families and most dominant in Jordan in terms of genera and species number are: Fabaceae, Asteaceae, Poaceae, Brassicaeae, Lamiaceae, Caryophyllaceae, Liliaceae, Umbelliferae,

Boraginaceae, Chenopodiaceae and Scrophulariaceae. While the largest genera are *Astragalus, Trifoluim, Silene, Euphorbia, Allium, Galium, Centaurea, Medicago, Anthemis, Salvia, Trigonella, Rananculus, Plantago* and *Erodium* .

Al-Eisawi (1983, A), studied the flora of Jordan. He recorded a new nine species which belong to different genera. Five of these genera were recorded in Jordan for the first time. Those genera are: *Opoponax*, *Ambrosia*, *Zoegea*, *Euclidium*, and *Cytinus*.

Al-Eisawi (1983, B), studied the flora of Wadi Araba area where he recognized 290 species of vascular plants.

Al-Eisawi (1985, A), conducted additional floral survey on Jordan in which he discussed 17 species of monocotyledons. Out of which some were considered as new records to the flora of Jordan, Others are rare and were recorded in new localities, and such species are related to Araceae, Graminae, and Iridaceae families.

Al-Eisawi (1985, B), studied the vascular plants in the eastern Jordan. He recorded about 2200 species, and 100-200 species in the West of Dead Sea.

Al-Eisawi *et al* (1994), conducted a study in which he recorded two genera of Umbelliferae as new to the flora of Jordan, which are *Hohenacheria* and *Oliveria.* Those genera are represented by *Hohenacheria exscapa* (Steve.) Kos-Pol., *Oliveria decumbens* Vent, and *Ducrosia antethifolia* (DC.) Boiss species. The first two species which were collected from Eastern desert of Jordan were recorded before, while the third species is recorded as a new species to the flora of Jordan.

Additional surveys were carried out by Oran (1994). She recorded that medicinal plants comprise about 25% of the total flora in Jordan. About 485 species of wild medicinal plants belong to 330 genera and 99 families.

According to Oran *et al* (1994), an intensive survey for various places in Jordan revealed the discovery of two new genera of Compositae which are *Dipterocome* and *Siebers*. The first genus was represented by the species *Dipterocome puwilla*, while the second by *Siebers pungens*.

Oran (1995), studied several plant specimens based on lots of plant collections made during continuous visits to the Shoubak area between “1992-1993”. As well as revising the available material of the related area in the herbarium: University of Jordan (AMM). This work aimed to provide a well identified list to the unknown flora of the south especially the mountains, and added to the previous knowledge of the flora of Jordan. In addition she provided a list of flowering plants of Shoubak district. A total number of 381 species belonging to 59 families and 223 genera were recorded. The list of flowering plants of Shoubak province was published with ecological notes about the area and a map of the studied area were indicated. Out of the reported species some are endemic to the area such as *Iris petrana* and *Iris endomensis*, and rare juniper forest *Juniperus phoenicea*, which is particular and confined to Southern Jordan. Also the presence of few wild *Cupressus sempervirnes* trees that is very important as an original of natural occurrence was confirmed. In addition, many of the recorded species are medicinal plants or edible which are of great importance as a socioeconomic natural resources for such a rural province. A significant loss of biodiversity was observed due to human activities. Therefore, she

recommended that effective measures should be taken to conserve such valuable plant genetic resources.

Oran and Al-Eisawi (1996), collected the species *Nicotiana glauca* Graham (Sloanaceaea), and recorded it for the first time in Jordan. The specimens of this species have been collected from Jordan Valley, South amphitheatre and Roman historic meat. Specimens were deposited at the herbarium, University of Jordan.

Oran (1997), reported a list of flowering plants in the Petra area. This study emphasized on the fact that tourism is a destructive factor on the plant diversity especially in the old archaeological city.

2.12.2. Vegetation:

Several studies related to the vegetation of Jordan in particular or as part of the Middle East region have been carried out (Kasapligil, 1956; Long, 1957; Zohary, 1973 and Al-Eisawi, 1985 and 1996).

Al-Eisawi (1985), presented a vegetation map for Jordan based on previous surveys and observations on delimitation of plant associations. This vegetation map of Jordan illustrated thirteen specific and recognizable vegetation regions. Natural vegetation was considered in this vegetation map. The thirteen vegetation types which were recognized are: Pine forests, Evergreen oak forest, deciduous oak forest, Juniper forest, Mediterranean non forest region, Steppe vegetation, Halophytic vegetation, Hammada vegetation, Tropical vegetation, Acacia and rocky vegetation, Hydrophytic vegetation and Mud flats.

Al-Eisawi (1985, 1995), recognized the vegetation on saline marshes, which is called (Hydrophytic) vegetation. This vegetation is confined to the water streams such as *Salix spp.* and *Vitex Angus-castus*.

Davis *et al* (1986), in their book *Plants in Danger*; studied the vegetation of Jordan. They found out about 88% in the desert and less than 1% forested. The Jordan River valley which is a branch of the African Rift Valley system, divides Jordan into two regions: The hilly West Bank area is mainly Hammada desert supporting sparse thorn scrub, particularly in the upper Jordan Valley. The East Bank, and land to the east of the Dead Sea, is the edge of a high plateau which supports dwarf shrub steppes with *Artemisia*, and deciduous steppe forests with *Amygdalus*, *Crataegus* and *Pistacia*; *Pinus halpensis* and ever green oak forests, with *Quercus calliprinos*, to the north-east of the Dead Sea, between Irbid and Amman, above 700 m; deciduous oak forests, with *Quercus aegilops* at the lower altitudes; juniper forests on the southern mountains above 1000 m. There are extensive areas of saline marshes to the north and south of the Dead Sea, with *Tamarix*, *Salsola*, and *Atriplex*.

Based on Oran *et al* (1994), the vegetation and the flora of Karak province (Jordan) have been studies to assess the biodiversity as well as the vegetation status. A total number of 545 species belonging to 327 genera and 63 families were recorded. Fifteen of these species were new records to the list of Jordan Vascular Plants. Description of the present status of the vegetation regions as well as remarks on soil, land use, human activities, and socioeconomics were recorded. Also a map of Jordan showing the study area and the biographical regions is provided.

According to Al-Eisawi (1995), recent vegetation survey of the Azraq Wetland Reserve revealed the presence of a total of 133 species of vascular plants within the wetland reserve. He demonstrated the plant distribution variation according to prevailing habitats.

The silt dunes are dominated by *Nitraria retusa* and *Tamarix passerinoides*. While the rocky limestone areas are dominated by two main species, *Limonium meryeri* and *Inula crithmoides*. Approaching the Azraq oasis from the marshes, the leading species consist of *Tamarix passerinoides* and *Halocnemum stroilaceum* until the latter species begins to dominate.

Al-Eisawi (1996), introduced the first specialized book about the vegetation of Jordan. In his book he presented the geology and geographical regions of Jordan, and the vegetation types in relation to their location and association. In addition, an analysis of the flora and biodiversity was performed. Moreover, he presented the human impact on the ecosystems and vegetation cover in various parts of Jordan.

According to Al-Eisawi, *et al*. (1996), Al-Eisawi and Oran (1996) and GCEP (1998) remarkable achievements and studies related to the biodiversity of Jordan have been published. Their publications were related to the terrestrial ecosystems in general and plant diversity in particular. Surveys of plants species and descriptions of various biodiversity components were provided.

2.12.3. Economics:

Al-Eisawi and Takrori (1989) have listed 142 wild edible plants which are used by local people in Jordan. The edible parts of those recorded plants are either the fruits and seeds of trees, like *Ceratonia siliqua*, *Pinus halepensis*, *Ziziphus spina-christi*, *Z. lotus*. Other plants are edible herbs like: *Pisum sativum*, *P. syriacum*, *Lathyrus cicera*, *Vivcia narbonensis* and *V. hybrida*. Also leaves and fleshy parts pf herbs are the edible parts such as: *Malva spp*., *Rumex cyprius*, *R. vesicarius*, *Scorzonera papposa*, *Chrysanthomum coronarium*, *Gudelia tuornefortii*, *Origanum syriacum*, *Foeniculum vulgare* and *Cichorium pumilum*.

According to the survey of the flora of Shoubak province by Oran in 1994, a total number of 380 species of flowering plants were recorded. Some of these species are endemic to the area of study, such as *Iris petrana* and *Iris endomesis*. In addition to that, medicinal plants were recognized out of the recorded plants. The recorded medicinal plants are used in folk medicine and comprise more than 10% of the Shoubak flora.Such as *Artemisia herba-alba*, *Teucrium poluim*, and *Paronychia argentea*. Many edible and economic plants were also recorded that are good source of vitamins and minerals such Sinapis alba, Sisymbrium irio, Lathyrus cicera, Lactuca Orientalis, Malva nicaeensis and others. Human impacts on the biodiversity of Shoubak province were observed during the survey of the studied area. Therefore, recommendations about conservation of the studied area were suggested.

Oran and Al-Eisawi, (1998) prepared a list of the medicinal plants in Jordan for the first time. It consists of 363 species of vascular plants belonging to 263 genera and 86 families. The recorded taxa are wild plants that occur in Jordan, with the exception of few cultivated plants, which are well known to the people in the country. The total number of the species listed comprises around 20% of the total Flora. Arabic names as well as the major medical uses are also provided.

UNEP (1992) reported that some species in Jordan are necessary to protect against soil erosion. Some others are essential for the substantial survival for other plant species in the same habitat or ecosystem. Some of these are also considered as medicinal plants. The loss of biodiversity will erode some of the socioeconomics and environmental benefits in the long run, and man has to find other alternatives. "The loss of biodiversity could cripple the genetic base required for the continued improvement and maintenance of currently utilized species and deprive us of developments in biotechnology."

Al-Eisawi *et al* (2000), showed that Jordan is rich in plants of potential ornamental value, that are well adapted to the dry conditions prevailing in the country, and many are with towers of unique colors, forms and sizes and beautifully expressed in the flowering season. Examples of the wild species which can be used for ornamental purposes are: trees and shrubs used as garden and road sides plantations as *Ceratonia siliqua*, *Populus sop*, *Nerium oleander*, *Cercis siliquastrum*, *Salix spp*., *Retama raetam*, *Styrax officinalis*, and *Arbutus andrachne*. Other recorded plants are bushes and perennial herbs as *Cistus creticus, C. salviifolius, Salvia spp., Lavandula spp., Astragalus spp., Ononis natrix*. Ultimate of Mediterranean basin e.g. *Iris* spp., *Orchis* spp., *Tulipa* spp., *Colchicum* spp., *Allium* spp. and *Ophyrus* spp.

Chapter Three

Material and methods

3.1 Study period

The study was conducted from October 2005 to April 2006 to investigate the status of plant biodiversity in the studied area from both sides flora and vegetation analysis.

3.2 floras analysis

3.2.1. Sampling site:

Random sampling sites were chosen within the study area making sure that those sites approximately cover most of the studied area (Fig 3.1) Appendix (3.1).

3.2.2. Sampling method:

3.2.2.1. Collection:

Plant specimens were collected carefully and representative as much as possible. A small pick was used digging and uprooting. Some time plant specimens were collected more than one time during their life cycle, one is during their vegetative growth and another collection is during flowering and/or fruiting growth.
For small herbaceous plants the entire plant was collected including the underground parts roots, bulbs, corms or rhizomes as they may serve for diagnostic importance. For large herbaceous and woody plants parts of the stem were collected including leaves, flowers, inflorescence, and fruits. A photograph of all the plant species were taken by digital camera.
The collected plant specimens were placed into plastic bags. Each specimen was placed into a separated plastic bag. Brief notes with the locality and habitat, color of flower and may be essential information were recorded on the spot in the field note book.
Each plant specimen was then given collection number and labeled with its collection number.The collected specimens then brought into the herbarium for further treatments.

3.2.2.2. Pressing and Drying:

The most important thing to do with freshly collected plant specimens is to dry them out as fast as possible, to prevent fungal infections and preserving the natural color. The collected plant specimens then must be pressed and dried as soon as possible. Specimens which have to be left overnight were placed in a cool place.
Then plant specimens then were laid in folded newspaper between layers of blotter sheets to draw the moisture away from the specimen. The collection number of each specimen

has been written on a special label and placed within the newspaper. Several specimens then were arranged in 12 X 18 inches plywood press folder, compressed and strapped as tight as possible. After that the newspaper and blotters were changed after every 24 hours to enhance the drying quality of the specimens.
The time that plant specimens have to stay in the press for complete drying was (3-7 days) according to the weather conditions (Porter, 1967).

3.2.2.3. Poisoning:

In order to protect the plant specimens from insect attacks, it is advisable to dip them in a poisonous solution before they are finally taken for mounting. The solution which is most commonly used for this purpose consist of 150gr. Mercury Chloride and 350 g. Ammonium chloride, dissolved in as little water as possible, and to this added 10 liters of 96% (commercial) alcohol. For private use 15gr. Mercury Chlorides, 35gr. Ammonium Chloride, and 1 liter of alcohol are sufficient quantities to start with (Tackholm, 1974). So plant specimens were poisoned using the above solution. After poisoning plant specimens they may remain in the press for a day or two in order to dry and not get wrinkled.

3.2.2.4. Mounting:

Once plant materials were pressed, dried and poisoned they were mounted on herbarium sheets, which are made from stiff cardboard. Specimens were laid on the sheet in an attractive, space filling way, and fixed by means of stiff gummed paper handled to the sheet by small clips. This provides physical support that allows the specimens to be handled and stored for long duration with minimum damage. A space in the lower right corner should be left for herbarium label.

3.2.2.5. Identification:

Accurate identification of unknown plant specimens requires a considerable amount of time and effort. So it is important to find out what research being or has been done on the flora of the region. Plant specimens were examined with the aid of a binocular dissecting microscope for preliminary identification. Final identification was confirmed by using dichotomous keys, plant description illustrations, and photographs, provided by manuals and floras of the region, such as flora Palestrina (Zohary. 1966. & 1972; Feinbrun -Dutan 1976-1986), flora of Egypt (Tackholm, 1974), flora of Syria, Palestine and Sinai (Post, 1932-1933), orchids of Britain and Europe with North Africa and the Middle East (J. Williams. A. Williams & N. Arlott, 1978), the Orchids of Jordan (Al-Eisawi 1985), Field to Wild Flowers of Jordan and Neighboring Countries (Al-Eisawi, D.M.1998). Key to the Families of Flora of Libya (F.B.Erteb. 1994), The Grasses of Libya (A.S. Sheriff. 1995), List of Jordan Vascular plants (Al-Eisawi, 1982), Flora of Iraq Vol 2&3 (Townsend & Evan Guest, 1966-1974), Flora of Iraq (Monocotyledons) Vol 8 (Townsend *et al*, 1985), Flora Orientalis (Boissier, 1867-1883) and Flora of Turkey Vol 3 & 4 & 5 (Davis et al, 1970-1972-1975). The identified species then were compared with the properly identified herbarium specimens. Finally their identifiction were confirmed consulting prof. Dawud Al-Eisawi /plant taxonomist / University of Jordan. Species identification was achieved through using the following key of the families and the genera (Mahklouf, 2005) Appendix (3.2).

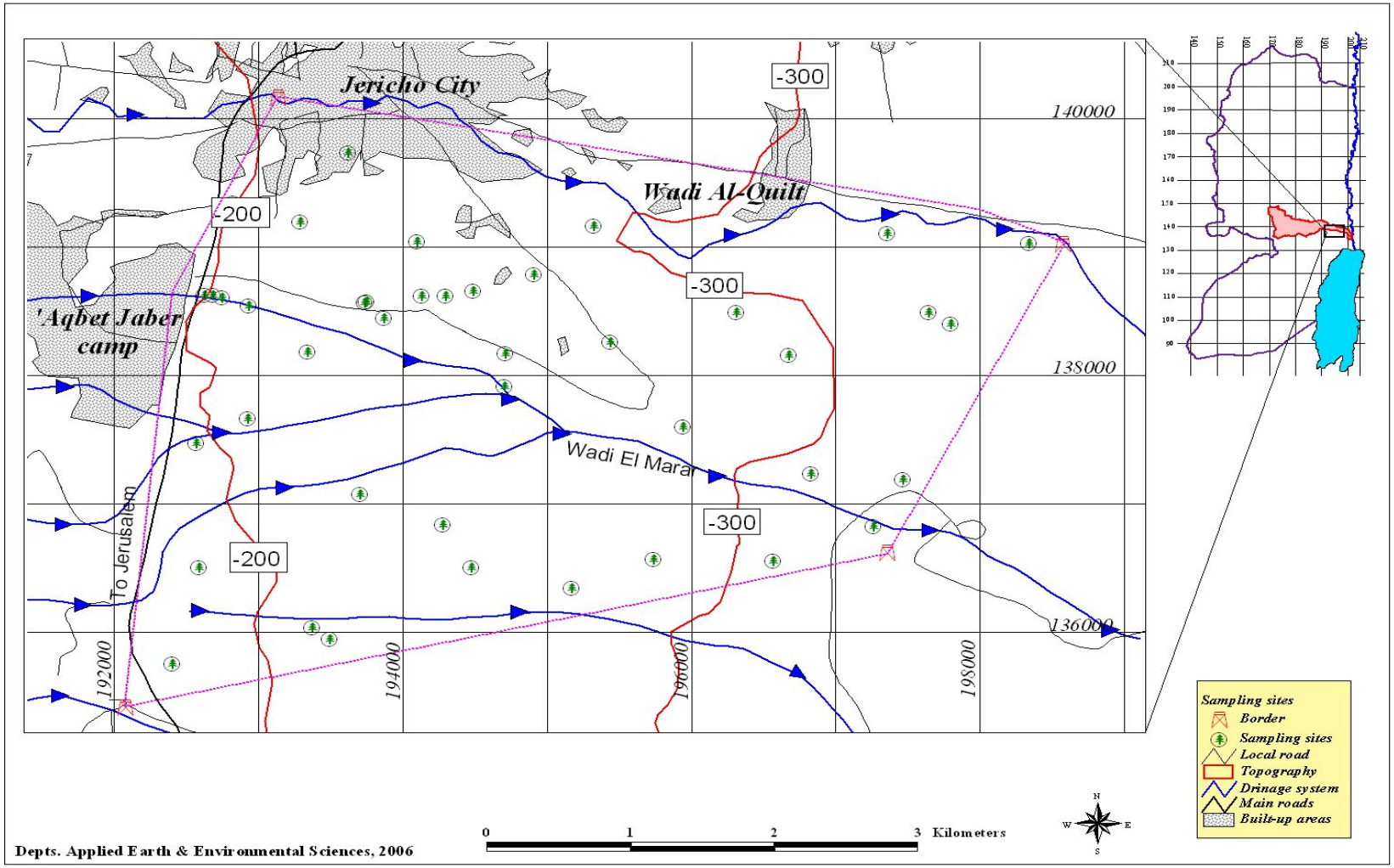

Fig. 3.1: Sampling sites locations.

3.3 Vegetation analysis

3.3.1. Line transects method:

The line is an expression of tapeline; a method considered the most important for this study. There was random distribution of 124 lines, over the whole area of study (Fig. 3.2).

Each of this line-transect was subdivided into fifty-meter unit intervals. Every line is stretched and fixed at terminus, all plant that intersect with the line were recorded.The number of individual of each species recorded, in addition to the whole species canopy. The data were entered into a table designated for this method in the field, Appendix (3.3). Then calculation methods were applied on the obtained data for each plant species, this method of study is based on (Al-Eisawi and Hatough, 1987).

3.3.1.1. Density:

Density, in synecology means the number of individual of a species per unit area or volume (Daubenmire, 1968).Counting the plants of each species along each line and taking the average of this counting in all studied lines achieve this. Mean density was measured; which represents the total number of plant species on the lines divided by the total number of lines (Smith, 1980).

Density = (Total number of plants on lines) / (Number of lines studied)

3.3.1.2. Frequency of a species:

Frequency is defined as the percentage of occurrence of a species in a series of samples of uniform size contained in a single stand; the number and size of plant in each sample have been ignored.

$$\text{Frequency} = \frac{\text{Number of lines in which a species occurs}}{\text{Total number of lines}} \times 100\%$$

3.3.1.3. Abundance of species:

The estimated number of individuals of a species per unit area is referred to as abundance. To determine abundance, the sampling done by quadrate or other methods at random at many places and the number of individuals of a species is added for all the quadrates studied (Shukla and Chandel, 1972). The abundance is determined by the following formula:

$$\text{Abundance} = \frac{\text{Total number of individuals of the species in all lines}}{\text{Number of lines in which the species occurred}}$$

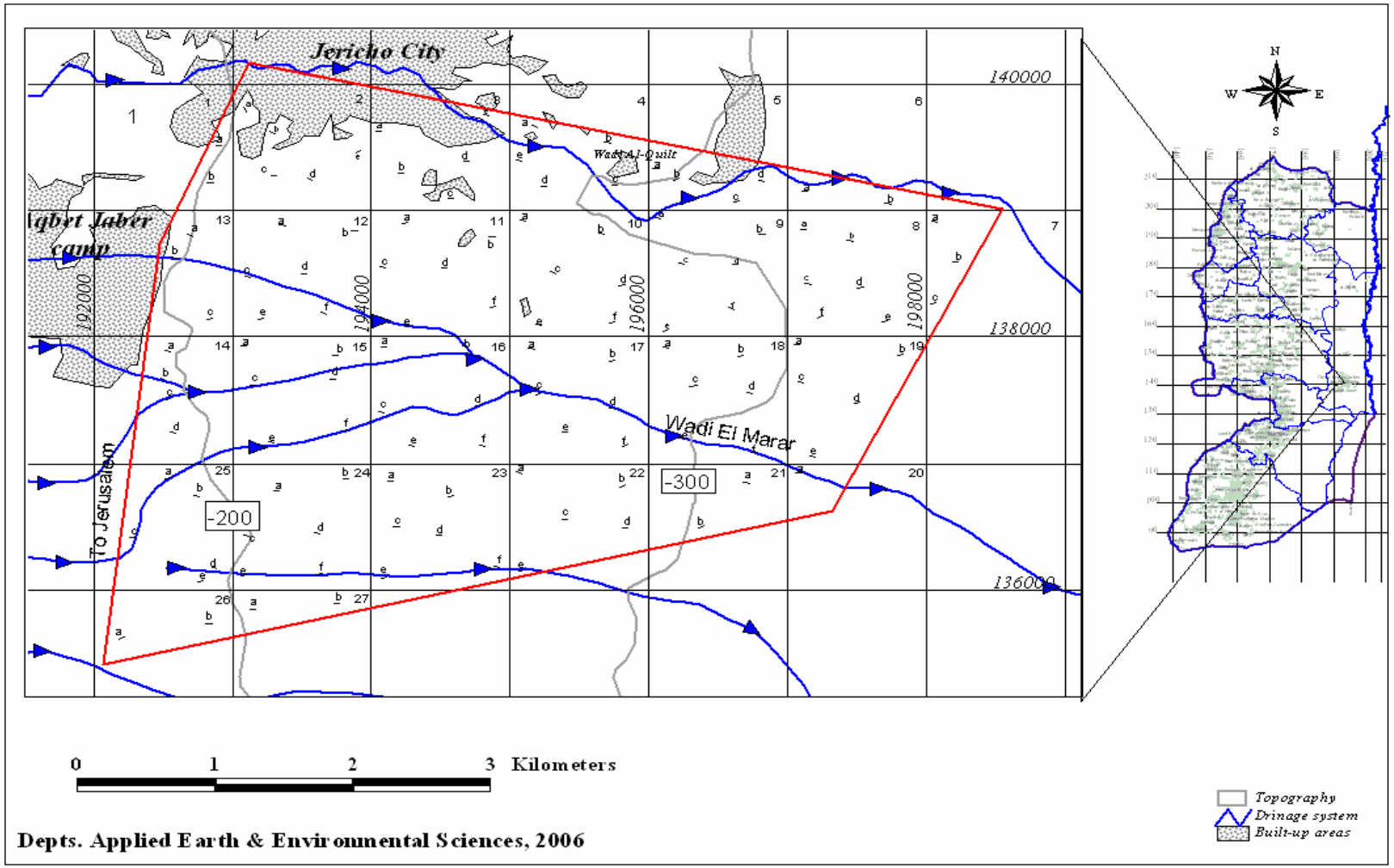

Fig 3.2: The distribution of the lines within the study area.

Chapter Four

Results and Discussion

4.1 Flora analysis

According to the collected plant samples which founded in the sampling points it was found that there are 40 species in the study area. Those recorded species belong to 22 families as shown in the following (Table 4.1).

Table 4.1: Recorded species and the families to which they belong.

No	**Txon**	**Family**
1	*Calendula tripterocarpa*	Compositeae
2	*Calendula palaestina*	Compositeae
3	*Notabasis syriaca*	Compositeae
4	*Sonchus oleraceus*	Compositeae
5	*Anthemis bornmullri*	Compositeae
6	*Hydipnois rhagadioloides*	Compositeae
7	*Lactuca orientalis*	Compositeae
8	*Launaea nudicaulis*	Compositeae
9	*Rostaria pyrethea*	Gramineae
10	*Balanites aegyptiaca*	Balanitaceae
11	*Tamarix titragyna*	Tamaricaceae
12	*Tamarix jordanis*	Tamaricaceae
13	*Salvia dominca*	Labiatae
14	*Solanum incanum*	Solanaceae
15	*Solanum luteum*	Solanaceae
16	*Lycium shawii*	Solanaceae
17	*Ochradenus baccatus*	Resedaceae
18	*Cardaria draba*	Curciferar
19	*Mathiola aspera*	Curciferar
20	*Notoceras bicorne*	Curciferar
21	*Salsola virmiculata*	Chenpodiaceae
22	*Malva parviflora*	Malvaceae
23	*Chaetoscididium trichosprmum*	Umbellifereae
24	*Peganum harmala*	Zygophyllaceae
25	*Verbascum jordanicum*	Scrophulariaceae
26	*Verbascum sinaiticum*	Scrophulariaceae
27	*Calotropis procera*	Asclipiadaceae
28	*Withania somnifera*	Malvaceaceae
29	*Ranunculus asiaticus*	Ranunculaceae

30	*Atriplex halimus*	Chenopodiaceae
31	*Chenopodium murale*	Chenopodiaceae
32	*Seidlitzia rosmarinus*	Chenopodiaceae
33	*Androcymbium palawstinum*	Lilaceae
34	*Prosopis juliflora*	Leguminaceae
35	*Ziziphus spina-chiristi*	Rhamnaceae
36	*Glinus lotoids*	Mocluginaceae
37	*Cleome droserifloia*	Amaranthaceae
38	*Euphorbia peplus*	Euphorbiaceae
39	*Pteranthus dichotomus*	Caryophyllaceae
40	*Avena sterilis*	Gramineae(Poaceae)

4.1.1 Plant species description

In this part each species will be described according to Flora Palastina and the species are arranged alphabetically as follow:

1. *Androcymbium palsetinum.* Baker, Jour. Linn. Soc. London (Bot.) 17:445 (1879); Post, Fl. 2:616.*Erythrostictus palaestinus* Boiss.Ex Baker, *loc*. *cit*. (1879) *pro syn*.; Boiss, Fl. 5:170 (1882) **(Photo 4.1)**.
Plant 5-10 cm. Corm 1.5-2 * 1-1.5 cm, ovoid; tunics dark brown, extending along subterranean stem.Leaves 6-10, overtopping inflorescence, linear-lanceolate, the upper broadened at base, 6-18 mm broad, long-acuminate. Perianth-segments 16-18 * 4 mm, white to pale lilac, with purple veins and sometimes spots; limb longer than claw, oblong-lanceolate, obtuse or sub acute.Stamens ½ length of perianth; anthers twice as long as broad. Fl. December-February.
Hab.: Steppes and arid places; calcareous soil. S. Philistean Plain (Gaza); E. Samaria, Judean Mts., Judean Desert; Upper Jordan Valley, Beit Shean Valley, Lower Jordan Valley, Dead Sea Area, Arava Valley; Gilead, Moav, Edom.
Area: E. Saharo-Arabian (Palestine, Egypt).Reproduction by seeds and cormlets.

Photo 4.1: *Androcymbium palsetinum*.

2. *Anthemis bornmuelleri*.Stoj& Acht.Notizbl.Bot.Gart.Berlin 13:522 (1937).*A. galilaea* Eig, Palest. Jour. Bot. Jerusalem ser., 1:201 (1938) emend.Yavin, Israeli Jour. Bot. 19:141, 151 (1970) **(Photo 4.2)**.

Annual, 15-50 cm, sparsely pilose, branched from above base. Stems generally erect. Leaves ovate-oblong in outline, 2-3 pinnatisect; segments subremote; lobes linear to narrowly lanceolate, acute, short-mucronate; lower leaves petiolate. Peduncles not thickened in fruit. Heads 15-20 mm in diameter. Involuclar bracts membranuous with a green midvein; outer bracts more or less acute; inner bracts obtuse. Receptacle conical, covered with bracts nearly all over; receptacular bracts linear-subulate, ending in a bristle-like point. Corolla-tube of disc-flowers inflated at base.Achenes deciduous at maturity, 1-15 mm, turbinate-cylindrical, whitish, thickly ribbed, smooth or obscurely tuberculate, auriculate to epappose. 2n = 18. Fl. March-June.

var. **bornmuelleri** A. *galilaea* Eig var. *hierosolymitana* (Eig) Yavin, Israeli Jour. Bot. 19:142 (1970). A. *cotula L*. subsp. *paleacea* Eig var. *hierosolymitana* Eig & var. *dentata* Eig, *op. cit*. 195. [Plate 568]. Achenes epappose, sometimes with a very short tooth at apex.

Hab.: Batha, fields and roadsides. Sharon Plain, Philistean Plain; Upper and Lower Galilee, Esdraelon Plain, Mt. Giloboa, Samaria, Shefela, Judean Mts.; Hula Plain, Upper Jordan Valley, Beit Shean Valley.

var. **brachyota** (Eig) Feinbr.& Fertig, Israel Jour. Bot. 25:82 (1976). *A. galilaea* Eig var.*brachyota* Eig, *op. cit*. 201.Auricle ½ as long as achene or shorter.

Hab.:As above.Upper Galilee, Esdraelon Plain, Mt. Gilboa; Upper Jordan Valley.

var. **galilaea** (Eig) Feinbr. & Fertig, Israel Jour. Bot. 25:82 (1976). *A. galilaea* Eig, *op. cit*. 201.]. Auricle nearly as long as achene, irregularly dentate, spreading.

Hab.: As above.Upper Galilee, Mt. Carmel; Hula Plain, Upper Jordan Valley; Golan.

Area of species: E. Mediterranean (Palestine, Lebanon, Syria, Cyprus, Samos).

The variation within *A. bornmuelleri* is discussed by Yavin (*op. cit*. 143) under *A. galilaea*.

Photo 4.2: *Anthemis bornmuelleri***.**

3. *Atriplex halimus* L., Sp. Pl. 1052 (1753); Boiss., Fl. 4: 916 (1879) **(Photo 4.3).**
Shrub with vesicular hairs, about 1-2 cm. Stem erect, much branched, woody, terete, or angular, whitish. Leaves 1-6 * 0.5-4 cm., alternate, sometimes opposite below, ovate to ovate-rhombic to triangular, sometimes cuneate or hastate at base, entire or obsoletely repand-lobed or dentate, silvery-white, without prominent nerves, the upper narrower, lanceolate; petiole 0.3-1.2 cm. Flower clusters densely spicate; spikes in terminal, almost leafless panicles. Staminate flowers inconspicuous, with 5 membranous tepals, generally at top of cluster. Pistillate flowers at base of cluster, with valve 4-5 mm, long and short cuneate at base, entire or dentate, smooth or reticulate but not tuberculate.Stigmas filiform, free.Seeds 1-2 mm. in diam., vertical, lenticular, dark brown, Fl. April-October.
var. **halimus.** Leaves up to 3 cm. long, short petioled.Fruiting valves entire or obsoletely toothed.
Hab.: Salines, wadi beds and sandy soils. Sharon Plain, Philistean Plain, Judean Mts., Judean Desert, Negev, Upper and Lower Jordan Valley, Dead Sea area, Arava Valley, Moav, Edom.var. **schweinfurthii** Boiss., Fl. 4:916 (1879). Leaves larger, about 4 * 3.5 cm., long-petioled, almost hastate at base, sinuate to dentate. Fruiting valves toothed.
Hab.: Wadi beds and sandy soils. Sharon Plain, Philistean Plain, Judean Desert, S. Negev,Upper and Lower Jordan Valley, Dead Sea area, Arava Valley.
Transitional forms between the two varieties, as well as other as yet undescribed forms, occur in both the coastal plain and the desert.
Area of species: Mediterranean and Saharo-Arabian. *A. halinus* is especially common in inundated saline depressions and around oases of the Jordan Valley.Rather a platable browse shrub; the leaves are sometimes eaten by hungry shepherds; the salt content of the leaves increases with the aridity of the habitat, which makes the plant less platable. The ash of *A.halimus* is used for manufacturers of soap.
Believed to be the ……of the Bible (Job.xxx: 4). Sect. **STYLOSA** Aellen, Bot. Jahrb, 70: 16 (1939).Half-shrubs and dwarf-shrubs.Leaves oblog, deltoid to orbicular, mealy-scurfy. Inflorescences axillary and terminal, forming interrupted spikes.Valves deltoid, rarely campanulate mostly tuberculate or appendiculate on back.

Photo 4.3*: Atriplex halimus*.

4. *Avena sterilis* L., Sp. Pl. ed. 2, 118 (1762); Bor, Fl. Iraq 9:340; Baum, Monogor. 334, Map 302; Boiss, Fl. 5:542; Post, Fl. 2:737 **(Photo4.4)**.
Annual, 40-100 cm. Panicle 12-30 cm, nearly one-sided. Spikelets large, 3-4-flowered; the lower 2-3 florets dorsally aristate and densely villose from base up to middle; the upper 1-2 florets awnless and glabrous; rachilla disarticulatig below lowermost floret only. Glumes subequal, (27-)30-35(-40) mm, exceeding florets (excel. Awns); lemma 20-26 mm, long villose in lower ½, 2-dentate, teeth hyaline, not aristulate; dorsal awn much longer than glumes; callus short; callus-scar ovate. Dispersal unit: spikelet without glumes. 2n=42. March-May. Subsp.**sterilis.** Ligule 5-6 mm. Florets 3-5. Glumes (27-)30- 35(-40) mm; lemma of lower floret up to 26 mm.
Hab.: Batha, openings in maquis, fallow and cultivated ground, on various soils. Very common. Coastal Galilee, Coast of Carmel, Esdraelon Plain, Mt. Gilboa, Samaria, Shefela, Judean Mts., Judean Desert, N. and C. Negev; Dan Valley, Hula Plain, Upper Jordan Valley, Beit Shean Valley, Dead Sea area, Arava Valley; Golan, Gilead, Ammon.
Subsp.**Ludoviciana** (Durieu) Nyman,Consp.810 (1882). *A. Ludoviciana* Durieu, Bull. Soc. Linn.Bord. 20-41 (1855); Bor; Fl.Iraq 9:336, tt.125, 126.Ligule 2-4 mm.Florets 2, rarely 3.Glumes 18-52 mm; lemma of lower floret20-22 mm.
Hab.: Rare and sporadic.Philistean Plain; Mt. Carmel, Esdraelon Plain, Judean Mts., Gilead, Ammon, Moav. Area of species: Mediterranean and Irano-Turanian.

Photo4.4: *Avena sterilis*.

5. *Balanites aegyptiaca* (L.) Del., Fl. Aeg. Ill. 61 no. 472(1813) et Fl. Eg.77, t. 28, f. 1 (1813); Boiss, Fl. 1:944 (1867). *Ximenia aegyptiaca* L., Sp. Pl. 1194 (1753) **(photo 4.5).**
A thorny shrub or tree up to 6 m. Stems divaricately and very intricately branched. Branched long, spiny, sparingly leafy to almost naked.Twigs terete, mostly hairy; spines 1-3 cm.or more.Leaflets 1-3 * 0.6-1 cm., deciduous petiolate, leathery, ovate to elliptical or almost orbicular, obtuse, tomentellous.Flowers 0.8-1.2 cm, subsessile, in cymes of 3-5. Sepals about 4 mm., oblong, pubescent.Petals much longer than sepals, greenish, linear-oblong, glabrous. Drupe 2-3 * 1-1.5 cm., fleshy, ellipsoidal, covered with a bluish bloom.Fl.Mainly February-July.
Hab.: Hot deserts; oases and wadis. E. Judean Desert, Beit Shean Valley, Lower Jordan Valley, Dead Sea area, N. Arava Valley. Not area.
Area: Sudanian.
The oil which constitute up to 40% of the fruit is comestible and also widely used in folk medicine and in soap manufacture.
Believed by some to be the Biblical……. (e.g. Gen. XLIII: 11 and elsewhere).

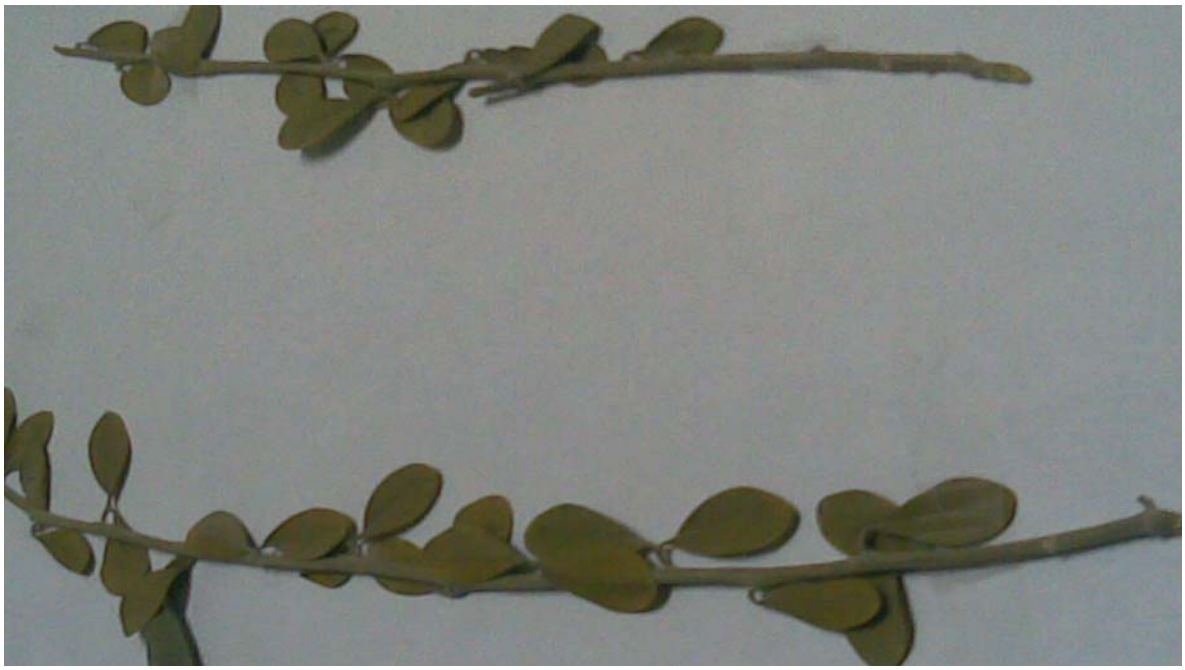

Photo 4.5: *Balanites aegyptiaca*.

6. *Calotropis procera* (Ait.) Ait. Fil. In Ait., Hort. Kew. Ed. 2, 2:78 (1811); Boiss., Fl. 4:57; Post, Fl. 2:192. *Ascelpias procera* Ait., Hort. Kew. 1:305 (1789) **(Photo 4.6)**.
Strout glaucous shrub, 2-5 m. Young branches white-tomentose, glabrescent; stems with white corky bark. Latex abundant, milky. Leaves 10-20 cm, broadly ovate, elliptic or obovate, auriculate at base, somewhat fleshy, cottony or mealy-velvety when young, especially on lower face, later glabrescent. Corolla about 20 mm in diameter; lobes ovate, acute, spreading, dark purple at tip; centre of ellipsoid or ovoid, soft to the touch. Fl. May-November.
Hab.: Desert plains. S. Negev; Lower Jordan Valley, Dead Sea area, Arava Valley; E. Ammon, Moav, Edom; apparently introduced and naturalized near Tiberias, in Beit Shean Valley and in Haifa.
Area: Sudanian, extending into the E. Saharo-Arabian.

Photo 4.6: *Calotropis procera.*

7. *Calendula palaestina* Boiss., Diagn, ser. 1, 10:38 (1849); Heyn et al., *op. cit*. 191; Boiss., Fl. 3:417 p. p. excl. var. *repanda* (Boiss. & Noe) Boiss.; Post, Fl. 2:72 **(Photo 4.7)**.
Annual, 20-40(-60) cm, usually erect, somewhat branched, glandular-pubescent and sparsely pilose.Leaves elliptic to oblong-ovate, repand-dentate; lower leaves tapering at base; cauline leaves sessile, auriculate. Flowering heads 1.5-2.5 cm in diameter.Florets yellow, very rarely disc-florets maroon; ligules about twice as long as involcure. At least some outer achenes 2.5-4 cm, long-beaked, winged or wingless; beak straight, 1.5-2 cm, longer that the body of the achene, with scattered hairs; beakless winged achenes sometimes present; cymbiform and annulate achenes usually numerous.2n=± 85. Fl. February-April.
Hab.: Mainly batha and garigue; fallow and cultivated ground on diverse soils. Upper and Lower Galilee, Mt. Carmel, Esdraelon Plain, Mt. Gilboa, Samaria, Shefela, Judean Mts., Judean Desert, Upper and Lower Jordan Valley, Dead Sea area; Golan, Gilead, Ammon, Moav.
Area: E. Mediterranean (Palestine, Lebanon).

Photo 4.7: *Calendula palaestina.*

8. *Calendula tripterocarpa* Rupr, Bull.Phys.-Math.Acad.Petersb.14:231 (1850); Heyn et al., *op. cit*. 178. *C. platycrapa* Coss, Bull. Soc.Bot. Fr.3:703(1856) *nom.nud. C.aegyptiaca* Desf.Subsp.*tripterocarpa* (Rupr.) Lanza Monogr.110 (1919). *C. aegyptiaca* auct. p.p **(Photo 4.8)**.

Annual, 5-15(-30) cm, branched, glandular-pubescent.Leaves oblong, acute, repand-dentate to subentire; lower leaves tapering to a petiole; cauline leaves sessile. Flowering heads usually 0.5-1.5 cm in diameter; disc-florets concolorous with ray-florets, yellow to orange; ligules not reaching 1 cm. Achenes beakless; at least a few marginal achenes broadly 3-winged; wings entire or denticulate; dorsal ridge shortly denticulate, not aculeate; cymbiform and annulate achenes present. 2n=30. Fl. March-April.

Hab.: sand, sandstone and gravel in deserts. Rather rare. C. Negev; Arava Valley; Moav, Edom.

Area: Mainly Saharo-Arabian.

Photo 4.8: *Calendula tripterocarpa*.

9. *Cardaria draba* (L.) Desv, Journ.Bot.Appl.3:163 (1814).*Lepidium darba* L., Sp. Pl. 645 (1753); Bioss, Fl. 1:356 (1867) **(Photo4.9)**.
Perennial, pubescent herb, 10-50 cm. stems leafy, erect, arising from branchy woody stock. Leaves up to 10(-12) * 3 (-4.5) cm.; the radical ones more or less petiolate, spatulate or obovate-oblong, entire or dentate-repand, sometimes lyrately lobed; stem leaves sessile, spreading to erect, oblong-lanceolate to broadly elliptical or ovate, sagittate-amplexicual, acute or obtuse, entire or dentate.Inflorescence a dense, corymbose panicle.Flowers 3-4 mm. Sepals spreading, glabrous, white-margined. Petals twice as long as sepals, white. Fruiting racemes elongated.Fruiting pedicels more or less horizontal, terete-filiform, about 3 times as long as fruit. Fruit (-2)3-4 * 3-5mm., indehiscent, transversely ovoid-cordate, with a rather long style and capitate stigma, sometimes 1 of the 2 cells rudimentary; valves reticulate, glabrescent, somewhat turgid.Seeds 1-2, ellipsoidal, brown. Fl. March-April (-May).
Hab.: Wastes and roadsides, especially in mountainous regions. Philistean Plain, Upper Galilee, Esdraelon Plain, Judean Mts., Judean Deserts, W. N. and C. Negev, Hula Plain, Upper Jordan Valley, Gilead, Ammon, Moav, Edom.
Area: Mainly Mediterranean and Irano-Turanian; adventive in the other regions.

Photo 4.9: *Cardaria draba.*

10. *Chaetosciadium trichospermum* (L.) Boiss, Fl. 2: 1078 (1872). *Scandix trichosperma* L., Mant 57 (1767) **(Photo 4.10)**.

Annual, sparingly setulose, 10-60- cm. stems dichotomously branched from base. Leaves oblong to ovate in outline, 3-pinnatisect, ultimate segments parted into oblong or ovate, acute, entire, dentate, or lobulate lobes, Umbels long-peduncled; rays 3-6.Bracts 0. Bracteoles many, 3-8 mm., longer than the pedicles, subulate.Fruiting umbelltes 0.8-1.5 cm. across, more or less globular. Mericarps covered with long, weak, purple or white scabrous bristles 3-5 times as long as the diameter of the seed-bearing part. Fl. March-April.

Hab.: Batha and among rocks. Acco Plain, Sharon Plain, Upper and Lower Galilee, Mt. Carmel, Esdraleon Plain, Mt. Gilboa, Samaria, Shefela, Judean Mts., Judean Desert, W., N. and C. Negev, Hula Plain, Upper and Lower Jordan Valley, Dead Sea area, Arava Valley, Golan, Gilead, Ammon, Moav, Edom.Common.

Area: E. Mediterranean (Palestine to Syria).

Photo 4.10: *Chaetosciadium trichospermum.*

11. *Chenopodium murale* L., Sp. Pl. 219 (1753); Boiss, Fl. 4:9092 (1879) **(Photo 4.11)**.
Annual, green, sparingly mealy, 25-70 cm. Stems ascending to erect, generally branching, more or less angular and thickened at base.Leaves 1-7 * 0.5-4 cm, petiolate, rhombic-ovate to rhombic-oblong, cuneate at base, acute to acuminate at apex, irregularly, unequally, and acutely serrate-dentate, glabrous or somewhat mealy, mainly on lower surface. Inflorescence axillary and terminal, paniculate, divaricately branched, with dense or loose clusters.Flowers hermaphrodite.Tepals 5, green, bluntly keeled, more or less enclosing fruit.Pericarp membranous, hardly separable from seed. Seeds 1-1.5 mm. in diam., lenticular, acutely keeled at margin, minutely pitted, black. Fl. February-September.
Hab.: Roadsides, waste places, refuse heaps and irrigated fields. Acco Plain, Sharon Plain, Philistean Plain, Upper Galilee, Esderaleon Plain, Judean Mts., Judean Desert, W., N. and S. Negev, Hula Plain, Upper and Lower Jordan Valley, Dead Sea area, Gilead, Ammon, Moav.Very common.
Area: Pluriregional.
The 2 varieties of this species: var. *microphyllum* Boiss, l.c. and var. *humile* Peterm. (cited from Aschers.U.Graebn., Syn. 5, 1:35, 1913), should, in our opinion, be included within the variability range of the typical form.
Used as salad herb.
Sect. CHENOPODIUM. Terminal flower of each cluster with 3-5 perianth segments free almost to base, and with horizontal seeds; the lateral flowers with 3 perianth segments connate to middle or to apex, and with vertical seeds.

Photo 4.11: *Chenopodium murale.*

12. *Cleome droserifolia* (Forssk.) Del...Fl.Eg. 106 (1813); Boiss, Fl.1:415 (1867). *Roridula droserifolia* Foressk.Fl. Aeg.-Arab. LXII et 35 (1775) **(Photo 4.12)**.
Compact, cushion-like, green-yellowish, glandular-viscid half shrub, profusely and intricately branching, densely leafy, 25-50- cm. Leaves 0.5-1.5 cm. in diam., lomg-petiolated, simple, orbicular to reinform or subcordate, 3-nerved, densely covered with short simple hairs and long-stipitate glands. Flowers about 1-1.2 cm., solitary in axils of upper leaves, long-pedicelled, somewhat zygomorphic.Sepals glandular, oblong.Petals reddish yellow, with a thickened scale-like appendage at base, ciliate-glandular at apex. Stamens 4, shorter than style.Ovary subsessile, oblong or ellipsoidal, shortly and densely glandular.Fruit 1-1.5 cm, on erect or spreading pedical, setose-glandular.Seeds rather compressed, reinform-globular, glabrous, minutely granular. Fl. March-May.
Hab.: Hot deserts, rocks and wadis. Judean Desert, Lower Jordan Valley, Dead Sea area, Arava Valley.
Area: E. Sudanian.

Photo 4.12: *Cleome droserifolia*.

13. *Euphorbia peplus* L., Sp. Pl. 456 (1753); Boiss, Fl. 4: 1112 (1879) **(Photo 4.13)**.
Annual, glabrous, 10-30(-50) cm. Stems erect, rarely prostrate, simple or mostly branched. Leaves (0.3-)0.6-2(-3) * (0.3-)0.4-1 cm.; lower leaves petiolate, obovate, tapering at base, obtuse or retuse, entire; umbellar leaves larger, subsessile; floral leaves broadly ovate. Rays of umbel 3, forked repeatedly.Cyathia 1-1.5 mm, pedicellate; involucre turbinate, lobes ovate, fimbriate; glands lunate, with slender horns much longer than the width of the glands.Capsule about 2 mm., short-ovoid, 3-sulcate, smooth or slightly rough at back; carpels with 2 wing-like keels at back. Seeds about 1.5 mm., ovoid-hexagonous, white-gray, with 2 longitudinal furrows and 4 rows of round or elongated pits; caruncle depressed-conical. 2n = 16. Fl. December-May.
Hab.: Waste Places, roadsides, nurseries and fields. Coastal Galilee, Acco Plain, Sharon Plain, Philistean Plain, Upper and Lower Galilee, Mt. Carmel, Esdraelon Plain, Samaria, Shefela, Judean Mts., Judean Desert, C. Negev, Dan Valley, Hula Plain, Upper and Lower Jordan Valley, Dead Sea Area, Golan, Gilead, Ammon, Moav, Edom. Very common.
Area: Euro-Siberian, Mediterranean and Irazno-Turanian; elsewhere introduced.
This species has been subdivided by some authors into two varieties: the typical variety and var. *minima* DC. in Lam. Et DC., Fl. Fr. Ed. 3, 3:331 (1805) [= *E. peplus* L. var. *β* Willd., Sp. Pl. 2:903 (1800; "*β Peplis minor*") = *E. peplus* L. var. *peploides* (Gouan emend. DC.) Vis., Fl. Dalm. 3:299 (1850-1852) = *E. . peploides* Gouan, Fl. Monsp. 174 (1764); Boiss., 1.c.]. The latter is distinguished from the typical form by its dichotomously branched umbel, smaller seeds with fewer pits and suborbicular leaves. As there are intergrading forms between the two taxa, it is practically impossible to delimitate them.

Photo 4.13: Euphor*bia peplus*.

14. *Glinus lotoides* L., Sp. Pl. 463 (1753); Boiss, Fl. 1:755 (1867) **(Photo 4.14)**.
Annual, pubescent-tomentose, stellately hairy, up to 30 cm.Stems prostrate or ascending, dichasially branched.Leaves spuriously whorled, petiolate, unequal in size and shape, oblong-spatulate to obovate or orbicular, obtuse, densely pubescent to glabrescent. Flowers 3-8 mm., axillary, few or many at each node, on short, unequal pedicles.Sepals oblong-ovate, more or less obtuse, membranous at margin, hairy on outer faces.Petals 0 or indefinite, white, linear, entire or 2-3 fid.Stamens 8-15 (-20).Capsule almost as long as calyx, ovoid-pentagonous, many-seeded.Seeds finely tuberculate, brown. Fl. May-October.
Var. **lotoides.** Leaves 0.6-3.5 * 0.6-2.5 cm. flowers and fruit 5-8mm. Stamens 12-15 (-18).Stigmas5.Petals usually present.
Hab.: Soils inundated in winter and dried up in early summer. Acco Plain, Sharon Plain, Philistean Plain, Mt. Carmel, Esdraelon Plain, Hula Plain, Upper Jordan Valley, Beit Shean Valley.
Var. **dictamnoides** (Burm. f.) Maire, Fl. Afr. N. 8:276 (1962). *G.dictamnoides* Burm. f., Fl. Ind. 113 (1768); L., Mant. Alt. 243 (1771); Boiss., Fl. 1:756 (1867). Leaves much smaller than in preceding variety, 0.3-1.5(-2) * 0.2-1 cm. flowers and fruits are mostly up to 5m. Stamens 8-10. Stigmas 3. Petals usually 0.
Hab.: As above. Sharon Plain, Philistean Plain, Upper Galilee, Judean Mts., Hula Plain, Upper Jordan Valley, Gilead.
Area of species: Mainly Mediterranean and Irano-Turanian; also found in tropical parts of Asia and Africa.
Transitions between the two varieties have been observed.

Photo 4.14: *Glinus lotoides.*

15. *Hedypnois rhagadoiloides* (L.) F.W. Schmidt, Samml.Phys-Ok.Aufs.1:279 (1795) emend. Spreng, Syst. Veg. 3:670 (1826); Post, Fl. 2:125.*Hyoseris rhagadoiloides* L., Sp. Pl. 809 (1753).*Hyoseris cretica* L., Sp. Pl. 810 (1753).*Hedypnois cretica* (L.) Dum.-Cours., Bot.Cult.2:339 (1802); Boiss., Fl. 3:719, incl. var. *garcilior* Boiss., *loc. cit*.; Post, *op. cit*. 126, incl. var. *monspeliensis* (Willd.) Halacsy **(photo 4.15)**.

Annual, 10-40 cm, more or less hispid to scabrous.Stems erect or diffuse, sparingly branched, sometimes reduced to a 1-2 headed scape.Radical leaves obovate-oblong, sinuate-dentate or pinnatifid, tapering to a petiole; cauline leaves few, sessile.Peduncles elongated, hollow, in fruit or less clavate-thickened and sometimes constricted under the head. Fruiting heads nearly globose.Involucral bracts varying from glabrous to hispid-setose or scabrous at back or at tip at maturity.Achenes scabridulous.Pappus of inner achenes about as long as achenes and protruding from the involucre. Fl. March-April.

A polymorphic species subdivided into several subspecies according to the shape of fruiting peduncles. Two subspecies are presented in our flora. The indumentum of the involucre of *H. rhagadoiloides* commonly varies within each of the two subspecies.

Subsp. **rhagadoiloides.** *Hyoseris rhagadoiloides* subsp *cretica* (L.) Hayek, Prodr.Fl.Penins.Balc.2:807 (1931). Fruiting peduncles more or less clavate, about 2-3(-4) mm in diameter, constricted under the head.Involucre varying from glabrous to hispid or scabrous.Hab.: Batha and fallow fields.Common. Coastal Galilee, Acco, Plain, Coast of Carmel, Sharon Plain, Philistean Plain; Upper Galilee, Mt. Carmel, Esdraelon Plain, Samaria, Shefela, Judean Mts., Judean Desert, W., N. and C. Negev; Upper Jordan Valley, Beit Shean Valley, Lower Jordan Valley, Dead Sea area; Golan, Gilead, Common, Ammon, Moav, Edom.Subsp.**tubaeformis.**(Ten.) Hayek, Prodr. Fl. Penins.Balc.2:807 (1931).*H. tubaeformis*. Ten., Prodr. Fl. Nap. XLVI (1811-1815); Ten., Fl. Nap.2:173, t.73 (1820).*H. rhagadoiloides* var. *tubaeformis* (Ten.) Dinsmore in Post, Fl.2:125 (1932); Dinsmore Pl. Post.Dinsm.1, Publ.Amer.Univ.Beirut Nat. Sci. ser., 2:10 (1932). Fruiting peduncles clavate strongly thickened, 3-6 mm in diameter, not constricted under the head. Involucre as in subsp. *rhagadoiloides.* Hab.: Batha and fallow fields. Coast of Carmel, Sharon Plain; Upper and Lower Galilee, Mt. Carmel, Esdraelon Plain, Shefela, Judean Mts., Judean Desert, W., N. and C. Negev; Dan Valley, Hula Valley, Upper Jordan Valley, Beit Shean Valley, Lower Jordan Valley, Dead Sea area; Golan, Gilead, Ammon.

Area of species: Mediterranean, extending into the W. Irano-Turanian.

Photo 4.15: *Hedypnois rhagadoiloides*.

16. *Lactuca orientalis* (Boiss.) Boiss., Fl. 3:819 (1875); Post, Fl. 2:147. *Phaenopus orientalis* Boiss., Voy. Bot. Midi Esp. 2:390 (1840). *Scariola orientalis* (Boiss.) Sojak, Novit. Bot. Hort. Bot. Univ. Car.Prag. 46 (1962) **(Photo 4.16)**.
Chamaephyte, 20-50 cm, wolly-floccose, later glabrescent.Stems and branches white, intricate, branches rigid, short, spreading, later spinescent at tip. Leaves pinnatifidinto few triangular to oblong lobes, withering soon; radical leaves tapering to a petiole; cauline leaves long-decurrent, with adnate linear appendages.Heads mostly solitary, sessile, 5-flowerewd.Involucre 8-14 mm in fruit. Florets yellow. Achenes 6-8 mm, tawny or dirty purple, linear to narrowly elliptic, subcompressed, 7-9 striate on each side, tapering above, nearly beakless.Pappus white, easily deciduous, about as long as achene. Fl. August-September.
HAb.: Rocky Mediterranean and Irano-Turanian dwarf-shrub associations.Judean Mts., Judean Desert, N. and C. Negev; Gilead, Ammon, Moav, Edom.
Area: Irano-Turanian.

Photo 4.16: *Lactuca orientalis*.

17. *Launea nudicaulis* (L.) Hook.fil. Fl. Brit. Ind. 3:416 (1881); Post, Fl. 2:149. *Chondrilla nudicaulis* L., Mant. Alt. 278 (1771). *Zollikoferia nudicaulis* (L.) Boiss, Fl. 3:824 (1875) **(Photo 4.17)**.

Perennial herb, 20-50- cm, glabrous, loosely corymbose above.Stems slender, virgate, repeatedly forked, erect or decumbent, often numerous, radical leaves rosulate, oblong in outline, runcinately, pinnatilobed, white-aculeate along margin; lobes triangular or ovate; cauline leaves few, small.Heads on rather short bracteate peduncles, often nodding in fruit, remote along virgate branches of lax dichasia.Involcure narrowly cylindrical, about 1.5 cm in fruit; involcure bracts broadly hyaline-margined.Florets much longer than involucre.Achenes subtetragonal-compressed, 3-4 mm, striate, finely muricate, the inner mouth, some of them sterile.Pappus persistent, white, longer than achenes.Fl. April-May.

Hab.: Sandy deserts.Fairly common. Judean Desert, W., C. and S. Negev; Lower Jordan Valley, Dead Sea area, Arava Valley; Ammon, Moav, Edom.

Area: Saharo-Arabian, extending into the Sudanian and Irano-Turanian regions.

Photo 4.17: *Launea nudicaulis*.

18. *Lycium shawii* Roem.& Schult, Syst. Veg. 4:693 (1891). Cf. Shaw, Travels f.349 (1738). *L. persicum* Miers, Ann. Nat. Hist. ser. 2, 14:12 (1854); Ill. S. Amer. Pl. 2:100, t.65B (1857). *L. orientale* Miers, *op. cit*.99, t.65A ff.6-9 (1857) qouad pl. Arabiae Petreae. *L. arabicum* Schweinf. Ex Boiss, Fl. 4:289 (1879); Post, Fl. 2:260.*L. ableiaeflorum* Reichenb. fil., Icon. Fl. Germ. 20:10, t.1636 (15) II ff. 3-6 (1816). *L. mediterraneum* Dunal var. *cinnamomeum* Dunal & var. leucocladum Dunal in DC, Prodr.13, 1:525 (1852) **(photo 4.18)**.

Shrub, 1-2 m, intricately branched; young branches, leaves, peduncles and calyces grey-tomentose, rarely glabrous. Dolichoblasts erect; brachyblasts ending in a strong thorn, bearing leaf-clusters and usually single flowers. Leaves oblong-spathulate, ,more or less obtuse, tapering at base, somewhat fleshy.Flowers pedicellate.Calyx tubular, 3-5 mm, with 5 nearly equal short triangular ciliolate teeth; in fruit sub-2-labiate. Corolla pale violet, 15 mm; tube long and narrow, glabrous or sometimes hairy inside; limb short; lobes ovate-oblong, obtuse.Stamens usually very unequal, included or some anthers slightly exserted; filaments glabrous. Berries red, globose, fairly commonly found. Fl. November-June.

Hab.: Hammada or beds of wadis in desert, often with various *Acacia* species. Judean Desert, N., C. and S. Negev; Lower Jordan Valley, Dead Sea area, Arava Valley; Moav, Edom.

Area: E. Saharo-Arabian and E. Sudanian.

Photo 4.18: *Lycium shawii*.

19. *Matthiola aspera* Boiss., Diagn. Ser. 1, 8:16 (1849) et Fl. 1:155 (1867) **(photo 4.19)**.
Annual, glaucous-green, rough, with scattered branching hairs or almost glabrous, 15-30 cm. Stems erect or ascending. Leaves (3-)5-7 cm., oblong-lanceolate to linear, tapering, obtuse, almost entire or obsoletely repand, slightly tomentose or with spreading, stellate hairs, greenish. Racemes many-flowered. Flowers large, sessile, Sepals 0.8-1 cm., scarious-margined, tomentose at base. Petals 1.2-1.5(-2) cm., pink or purple, obovate-spatulate with entire margin. Fruit 4-6 * 0.2 cm., firm, spreading, glabrous or sparingly stellate-hairy; stigma conical, more or less elongated; horns twice as long as diameter of fruit, awl-shaped, erect or spreading. Fl. February-April.
var. **aspera.** Stems with branching hairs. Fruit with stellate hairs.
Hab.: Deserts. Judean Mts., Judean Desert, W. Negev, Lower Jordan Valley, Dead Sea area, deserts of Ammon and Moav.
var. **leiocarpa** Bornm., verh. Zool.-Bot. Ges. Wien 48:550 (1898). Stems almost glabrous. Fruit glabrous.
Hab.: Deserts, Judean Desert, Lower Jordan Valley, Dead Sea area, deserts of Ammon.
Area of species: Saharo-Arabian (endemic in Palestine).

Photo 4.19: *Matthiola aspera*.

20. *Malva parviflora* L., Demonstr.Pl.Hort.Upsal, 18 (1753), Amoen. Acad. 3:416 (1756) et Sp. Pl. ed. 2, 969 (1763); Boiss, Fl. 1:820 (1867). *M. parviflora* L. var. *cristata* Boiss, 1.c. 821 et var. *cristata* Boiss. F.*hirusta* Nab., Publ. Fac. Sci. Univ. Masaryk 35:54 (1923). *M. parviflora* L.var. *Arguta* Post, Fl. Syr. Pal. Sin. 179 (1883-1896) et ed. 2, 1:237 (1932) **(photo 4.20)**.

Annual, hairy or glabrescent, 5-50(-80) cm. Stems erect to ascending or prostrate. Leaves 1-4(-10) cm.; stipules 3-7 mm., submembranous, oblong-lanceolate to ovate, acuminate, long-ciliate; petiole 5-25 cm.; blade orbicular in outline, cordate to reinform at base, crenate, undivided or 5-7 fid into obtuse lobes. Pedicles 0.3-2.5 cm., spreading to deflexed in fruit.Flowers 2-4 or more in axillary clusters.Epicalyx of 3 linear bracteoles, about one half or two thirds as long as the calyx. Calyx 3-6 mm, growing up to 0,8-1 cm. in fruit; lobes ovate to orbicular, apiculate, spreading in fruit.Petals 5-7(-9) mm, barely exceeding the calyx, pink to purple, sometimes white, obovate, notched. Fruit 4-7(-9) mm. in diam., glabrous, rarely hairy; mericarps reticulately and prominently wrinkled, with sharp, entire or dentate, sometimes elevated and crested margins. Fl. February-May.

Hab.: Roadsides and waste places. Coastal Galilee, Acco Plain, Sharon Plain, Philistean Plain, Mt. Carmel, Esdraelon Plain, Shefela, Judean Mts., Judean Desert, W., N. and C. Negev, Upper Jordan Valley, Beit Shean Valley, Lower Jordan Valley, Dead Sea area, Arava Valley, Golan, Gilead, Ammon, Moav, Edom.Very common.

Area: Mediterranean and Irano-Turanian.

We were unable to divide *M. parviflora* into var. *microcarpa* (Desf.) Paol. In Fioro et Paol., Fl. Anal. Ital. 2:268 (1901) and var. *typical* Paol, l.c., on the base of the size of the fruit, as there is continuous variation in this character. For the same reason it was impossible to separate var. *cristata* Boiss, i.c., from the ordinary form. Because of continuous variation we were unable to establish other varieties based on the size and shape of leaves, pedicles, calyx, lobes, etc.Leaves and fruits edible.

Photo 4.20: *Malva parviflora.*

21. ***Notobasis syriaca*** (L.) Cass, Dict. Sci. Nat. 35:177 (1825); Boiss, Fl. 3:355; Post, Fl. 2:92.*Carduus syriaca* L., Sp.Pl. 823 (1735) **(photo 4.21)**.
Annual, 30-100 cm or more, sparsely white-hairy to glabrescent.Stem erect, striate, branched above.Leaves usually large, nearly glabrous on upper face, somewhat cobwebbed on the lower, green with white or purplish veins, oblong to elliptic in outline, sinuate-lobed and spiny-dentate; radical leaves petiolate; cauline leaves auriculate-clasping; upper and floral leaves purplish with silvery veins, surrounding and overtopping the heads and reduced to pinnatisect branched spines, stout and narrow margined. Heads medium-sized, short pedunculate, in short racemes.Involucral bracts cobwebbed, narrow-lanceolate, spreading above.Florets deep purple.Achenes 5 mm. Fl. March-May.
Hab.: Roadsides and manured fields.Very common and abundant.Coast of Carmel, Sharon Plain; Upper Galilee. Mt. Carmel, EsdraelonPlain, Mt. Gilboa, Samaria, Shefela, Judean Mts., Judean Deserts, N. Negev; Hula Plain, Upper Jordan Valley, Dead Sea area; Golan, Gilead, Ammon, Moav.
Area: Mediterranean, extending into the W. Irano-Turanian.
Young shoots used as raw salad, though less appreciated than those of *Silybum marianum*.

Photo 4.21: *Notobasis syriaca.*

22. *Notoceras bicorne* (Sol.) Caruel, Flor.Toscan.536 (1860).*Erysimum bicrone* Sol.In Ait, Hort. Kew.ed.1, 2:394 (1789).*N. canariense* R. Br. In Ait, Hort. Kew.Ed 2, 4:117 (1812); Boiss, Fl.1:314 (1867) **(photo 4.22)**.
Low annual with appressed, simple and forked hairs, 5-10(-30) cm.Stems procumbent to ascending, branching from base.Branches often spreading or horizontal.Leaves 2.5-3.5(-6) cm., oblong-linear or laneolate, tapering at base.Racemes dense, overtopped by leaves, compact in fruit. Pedicles thickened, appressed to rhachis. Sepals about 1 mm., hirsute, with membranous margin.Petals about 1.5-2 mm, oblong-linear, obtuse. Fruit 0.6-1 * 0.2 cm., tetragonous; valves rigid, distinctly 1-nerved, horned at apex; septum membranous. Seeds 2-3 in each cell, compressed. Fl. January-March.
Hab.: Deserts. Judean Desert, N., C. and S. Negev, Upper and Lower Jordan Valley, Dead Sea area, Arava Valley, Moav, Edom.
Most characteristic of the *Anabasis articulata – Notoceras* community in the Plain of Jericho and elsewhere.Also occurring in other ephermeral communities in hot deserts.A hygrochastic plant: fruit diverge from stem when moistened.

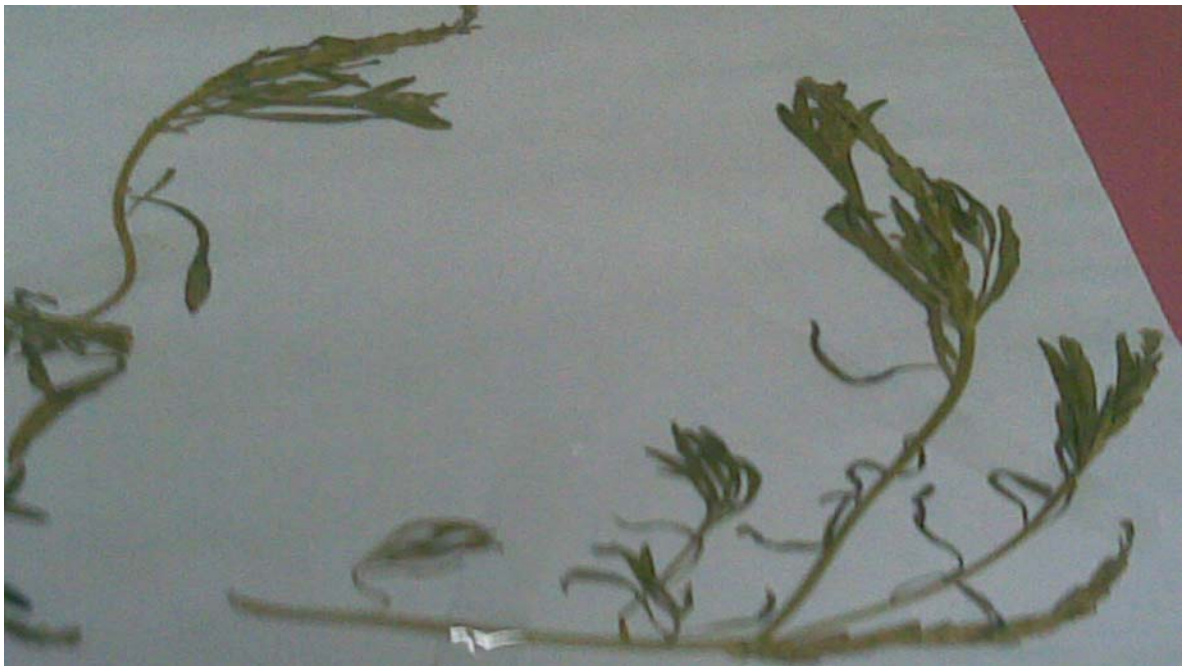

Photo 4.22**:** *Notoceras bicorne*.

23. *Ochradenus baccatus* Del., Fl. Eg.15 (1813); Mull, Res. 94 (1857); Boiss, Fl. 1:422 (1867) **(photo 4.23)**.

Glabrous, dioecious or polygamous shrub, 50-100 cm.Stems erect, woody, with divaricate, twiggy or simple branches.Leaves soon deciduous, frequently fasciculate, narrowly linear, sometimes subulate or oblanceolate or spatulate, acuminate at apex, glabrous.Flowering racemes more or less spike-like, rigid.Bracts minute, lancoelate, frequently somewhat concave.Flowers mostly unisexual, short-pedicelled.Sepals 4-6 mm, more or less equaling pedicle in length, persistent, linear-lanceolate.Petals 0.Stamens 10-13; filaments longer than sepals, soon deciduous. Fruit a berry, 4-6 mm, ovoid or obovoid-globular, with rounded apex, 3-denticulate, glabrous, whitish. Seeds 1-1.5 mm, reinform tuberculate, yellow to brown.Fl.Mainly December-May.

Hab.: Hot desert wadis and depressions. Judean Desert, W., N. and C. Negev, Lower Jordan Valley, Dead Sea area, Arava Valley, deserts of Moav and Edom.

Area: Sudanian, extending into adiacent Saharo-Arabian territories.Fruit sweet, edible; plant browsed by camels.

Photo 4.23: *Ochradenus baccatus*.

24. *Peganum harmala* L., Sp. Pl. 444 (1753); Boiss, Fl. 1:917 (1867) **(photo 4.24)**.
Perennial, woody at base, green, glabrous, leafy, 30-50 cm. Stems much branched, angular above.Branches erect and ascending. Leaces 5-10 cm., sessile; stipules 1.5-2.5 mm., subulate to setaceous; blade irregularly pinnatisect; lobes 2-4 cm., spreading, linear-lanceolate, acute, entire. Inflorescences terminal, cymose.Flowers large, on long pedicles thickening above.Sepals 1.5-2 cm, linear, sometimes 3-fid, with minute scales of epicalyx between the sepals.Petals about 1.5 * 0.5-0.7 cm, white or yellowish, oblong-elliptical. Capsule -.8-1 cm, 3-celled, many-seede, depressed-globular, 3-lobed, glabrous, with persistent style.Seeds about 2 mm, triangular, blackish-brown, tuberculate. 2n = 24. Fl. March-April.
Hab.: Roadsides and other ruderal sites deserts and steppes. Philistean Plain, Lower Galilee, Judean Mts., Judean Desert, Negev, Upper and Lower Jordan Valley, Dead Sea area, Arava Valley, Golan, Gilead, Moav, Edom.Locally fairly common.
Area: Irano-Turanian and Saharo-Arabian, with extensions into Mediterranean and S. Euro-Siberian territories.
Medicinal plant: Seeds (semen harmalae) are used as an emmenagogue, diuretic and emetic; they contain the alkaloids harmin and harmalin.Subfam.TETRADICILDOIDEAE. Fruit a 3-4 carpelled loculicidal capsule.Seeds partly free, partly enclosed in the membranous-spongy part of pericarp.Leaves exstipulate, pinnately dissected or entire.

Photo 4.24: *Peganum harmala*.

25. *Prosopis juliflora* (Sw.) DC.
P. chilensis Stuntz
Straggly shrub to large, wide-crowned tree, more or less prickly, with glabrous foliage. Leaves 2-pinnate with 1-3 pinnae pairs; leaflets oblong, 3-10(12) mm long, in 15-23 pairs. Flowers greenish-yellow, c. 4-5 mm long, in dense cylindrical pendulous spikes mostly 6-9 cm long, 1 cm broad. Stamens well exerted; ovary and ventral surface of the petals densely pubescent. Pod compressed, straight or somewhat curved, 8-22 cm long, c. 10mm wide, with margins linear or obscurely constricted between the seeds, a slight beak at apex, green, ripening to straw-yellow.**(photo 4.25)**
All plants seen in our area belong to var. *juliflora*, with closely-spaced oblong leaflets and short fruit beak.
Habitat: cultivated, but frequently escaped around urban and village areas; always on somewhat distributed ground. Locally frequent.
Central Coastal Lowlands: 1082 (BM), Dhahran.
Vernacular Names and Uses: No local name has been noted for this introduced American native, the mesquite. It is widely planted in the oil company community at Dhahran, where with frequent irrigation it reaches great stature, 12-15 m or more, with a thick trunk often branching about 2-3 m above ground level. It has also been planted along city streets and roadsides in Al-Khubar, ad-Dhahran, and other towns.
It has the virtues of being extremely tough and hardly, quick in growth, and requiring virtually no care. Its vices are the production of messy litter form fallen leaves, an apparent inhibiting effect on the growth of lawns and other plants beneath it, and a reputation for causing hay fever by its abundant wind-borne pollen.
The tree has blooming periods in both spring and autumn and tends to drop its leaves in late winter, bringing out new foliage in the spring before blooming. Some trees at Dhahran, however, may be seen blooming and fruiting at nearly any time of year. It sometimes escapes from cultivation, apparently by two means: the spread pf pods by flooding after rainstorm, and by being carried to dump areas after land cleaning operations. It can self-propagate on distributed ground but is never found in truly natural desert habitats.

Photo 4.25: *Prosopis juliflor*

26. *Pteranthus dichotomus* Forssk, Fl. Aeg.-Arab. LXII *et* 36 (1775).*P. echinatus* Desf, Fl. Atl. 1:144 (1798); Boiss, Fl. 1:752 (1867) **(photo 4.26)**.
Annual, almost glabrous below, rather puberulent above, 5-25 cm. Stems procumbent to ascending, repeatedly forked. Leaves 0.5-3 (-4) * 0.1 cm, more or less fleshy, linear; stipules lancoelate.Inflorescences dichaisially branched, usually forming a corymbose panicle.Flowers sessile in papillose-puberulent 3-flowered cymes. Bracts concave, minute.Calyx 3-4 mm, with 4 oblong-linear lobes, the outer 2 lobes of the middle flower and the outer lobe of each lateral flower deeply keeled, narrowly white-margined, with wing-like appendages.Utricle and seed about 2 mm. oblong ellipsoidal. Fl. January-April.
HAb.: Deserts, mostly on dry, saline ground and also in ruderal sites. Samaria, Judean Desert, W. and C. Negev, Upper and Lower Jordan Valley, Dead Sea area, Arava Valley, Ammon, Moav, Edom.
Area: Saharo-Arabian, slightly extending into some Irano-Turanian, Mediterranean and Sudanian territories.Farily common in typical desert communities, e.g. that of *Zygophyllum dumosum*, the *Suaeda palaestina* community, and others.

Photo 4.26: *Pteranthus dichotomus*.

27. *Ranunculus asiaticus* L., Sp. Pl. 522 (1753); Boiss, Fl. 1:31 (1867) **(photo 4.27)**.
Perennial, hirsute, 10-30 cm. Roots dimorphic: short, cylindrical, tuberous and long, thin, fibrous. Subterranean short stem often with thin, horizontal runners.Lower leaves long-petioled, broadly ovate to orbicular, crenate or 3-lobed, rarely dissected; the others cuneate or more or less dissected into oblong, toothed or incised lobes, or 30partite into cuneate ones; the uppermost cut into oblong to linear lobes.Scape solitary, simple or slightly branching, 1-4 flowered. Flowers (2-)3-6(-8) cm. in diam., crimson (rarely orange or yellow).Sepals 5, spreading or deflexed. Petals 5, obovate-cuneate, without nectary scale. Stamens numerous.Receptacle (rhachis) glabrous, elongating in fruit.Heads 2-4 cm., cylindrical, spike-like; achenes 2-3 mm., compressed, papery, ovate-orbicular with a hooked beakabout half as long as disk. Fl. February-May.
Hab.: Devastated maquis, batha, stony hillsides, abandoned fields and steppes. Coastal Galilee, Acco Plain, Sharon Plain, Philistean Plain, Upper and Lower Galilee, Mt. Carmel, Mt. Gilboa, Samaria, Judeam Mts., Judean Desert, N. and N. E. Negev, Dan Valley, Upper Jordan Valley, Gilead, Ammon, Moav, Edom.
var.**asiaticus.** Lower leaves undivided or only 3-fid into broad lobes.
Hab.: Throughout the Mediterranean territory.
var.**tenuilobus** Boiss, 1.c. All the leaves much dissected into narrow lobes.
Hab.: Predominantly in steppes and deserts.
Area of species: Mediterranean, with extensions into W. Irano-Turanian territories.
R. asiaticus is one of the most common showy flowers of the late winter and spring flora. It occurs in a variety of habitats and penetrates deeply into steppes in the south and east of the country. Sometimes the two varieties mentioned meet and intermediates between them occur. In Palestine the yellow-flowered form is very rare.Also grown as ornamental plant.

Photo 4.27: *Ranunculus asiaticus*

28. *Rostaria pyrethea*.Syn. Lophochloa berythea (Boiss. & Bl.) Bor, **(photo 28).**
Annual, 10-30(-40) cm. Culms glabrous. Leaf-blades and sheaths with soft white hairs. Panicle 3-4(-8) * 0.6-1.2(-2) cm, dense, bristly, often lobed. Spikelets (3-) 4-6.5 mm (excl. awns), 3-5 flowered. Glumes unequal, hyaline-matgined, glabrous, sometimes puberulent; lower glume linear-lanceolate, acuminate; upper glume ovate, acute; lemma acute, keeled, broadly membranous-margined, glabrous or pilose; lobes of 2-lobed apex acute; mid-vein produced into a straight awn; awn varying in length (0,5-3 mm); palea ending in 2 long bristle-like awns, 1/5-1/2 length pf palea proper. Fl. February-June.
Hab.: Fallow fields, roadsides, batha; various soils. Common. Acco Plain, Coast of Carmel, Sharon Plain, Philistean Plain; Upper and Lower Galilee, Mt. Carmel, Esdraelon Plain, Samaria, Judean Mts., Judean Desert, W., N. and C. Negev; Hula Plain, Upper and Lower Valley, Dead Sea area; Golan, Gilead, Ammon, Moav, Edom.
Area: E. Mediterranean and W. Irano-Turanian (Palestine, Lebanon, Syria, Cyprus, Iraq, Iran).
Post (loc. cit.) records three varieties under *K. phleoides* (Vill.) Pers. Subsp. *berythea* (Boiss. & Bl.) Domin:
(1) var. *berythea. K. phleoides* var. *grandiflora* Boiss. (1884). Awns 1/3-1/2 length of lemma;
(2) var. *postiana* Domin. Awns as long or nearly as lemma;
(3) var. *bistea* (Steud.) Domin.

Photo 4.28: *Rostaria pyrethea*

29. *Salsola vermiculata* L., Sp. Pl. 223 (1753); Boiss, Fl. 4:962 (1879) **(photo 4.29)**.
Shrubby perennial, 20-60(-70) cm, grey-pubescent or yellowish-villosewith long denticulate hairs.Stems ascending to erect, paniculate, with many flowering branches.Lower leaves 0.3-1.3 cm, alternate, terete, or semiterete, filiform, falf-claspig at the somewhat dilated base, obtuse or acute, villose; upper leaves or those of the shorterbranches ovate, densely imbricated, scale-like, very short with broader base, obtuse. Bracts ovate, sometimes short-cuspidate, concave, scarious-margined; bracteoles almost as long as bracts, suborbicular, concave above, keeled beneath or slightly so, scarious-margined.Flower about as long as or longer than bracts, solitary, forming more or less dense spikes.Perianth segments almost free, more or less connivent, ovate-triangular, more or less hairy, broadly scarious-margined.Ovary ovoid.Fruiting perianth 0.7-1.2 cm. in diam. (incl. wings); wings obovate to semiorbicular, imbricated.Seeds horizontal.
var. **villosa** (Del. ex Roem. et Schult.) Moq, Chenop.Monogr.Enum. 141 (1840) et in Dc, Prodr.13, 2; 181 (1849).*S. villosa* Del. ex Roem. et Schult., Veg. ed. 15, 6:232 (1820) quoad descr. et nom. excl. specim.Sieberianae; Del., Fl. Aeg. Ill. 57, n. 309 (1813) *nom. nud. S. vermiculata* L. ssp. *villosa* (Del.) Eig, Palest.Journ.Bot.Jerusalem ser. 3:132 (1945).*S. rigida* Pall.Var.*tenuifolia* Boiss, Fl.4:962 (1879).*S. delileana* Botsch, in Novit.Syst.Pl.Vasc. 371 (1964).Villosa palnts, usually with long, yellowish to greyish, often denticulate hairs.Lower leaves rather long, about 1 cm. Fl. Almost throughout the year, but mainly in spring.
Hab.: Calcareous stony steppes and somewhat saline soils.Judean Desert, N. Negev, Upper and Lower Jordan Valley, Dead Sea area, Arava Valley, deserts of Ammon, Moav and Edom.
Area: Saharo-Arabian and Irano-Turanian/
A series of ecological races occur among the local populations.A notable desert pasture plant.A dominant of the local, widespread Salsoletum villosa.

Photo 4.29: *Salsola vermiculata*

30. *Salvia dominica* L., Sp. Pl. 25 (1753). *S. graveolens* Vahl, Enum. Pl. 1:273 (1804); Boiss, Fl. 4:615; Post, Fl. 2:356 **(photo 4.30)**.
Strong-smelling chamaephyte, 40-80 cm, namy-stemmed, grey, with dense spreading white hairs. Stems erect or ascending, simple or often forming narrow panicles. Leaves appressed-canescent, strongly rugose, 3-7 cm, triangular-ovate to-oblongs, generally obtuse, truncate or cordate at base, crenate and often undulate-lobed; lower leaves short-petiolate; upper leaves sessile; floral leaves cordate-ovate, acuminate, glabrous on upper face, shorter than calyx. Veriticillasters 4-6 flowered, in long and rather dense racemes. Calyx campanulate, 7-10 mm, covered with dense long white hairs and sessile glands; lips about as long as tube, widely spreading; teeth of upper lip very short; teeth of lower lip lanceolate.Corolla about twice as long as calyx or longer, cream-coloured, with a yellow lower lip; upper lip falcate, long; tube aprubtly dilated above, with a fringed scale at base of throat. Fl. February-May.
Hab.: Batha on Senonian and Eocenian chalky hills. Abundant. Upper and Lower Galilee, Mt. Carmel, Esdraelon Plain, Mt. Gilboa, Samaria, Shefela, Judean Mts., Judean Desert, N. and C. Negev; Upper Jordan Valley, Beit Shaean Valley, Lower Jordan, Dead Sea area, Golan, Gilead, Ammon, Moav, Edom.
Area: E. Mediterranean.
A leading species in the *Salvia dominica* – Ballota undulata association.

Photo 4.30: *Salvia dominica*.

31. *Seidlitzia rosmarinus* Bge. ex Boiss, Fl. 4:951 (1879).*Suaeda rosmarinus* Ehrenb. ex Boiss., l.c. *pro syn. Salsola rosmarinus* (Bge. ex Boiss.) Solma-Laub., Bot.Zeit.59:171 (1901); Eig, Palest.Journ.Bot.Jerusalem ser. 3:132 (1945) **(photo 4.31)**.
Glabrous low shrub, up to 60 cm. Stems branched, lower internodes longer than upper.Branches whitish, glossy.Leaves 0.5-3 cm, fleshy, thickening towrd apex.Clusters 2-3(-5) flowered, opposite, in fleecy leaf axils.Perianth lobes obtuse.Fruit 0.8-1.2 cm. broad (incl. wings).Fl.March-May.
Hab.: Saline soils in hot deserts. Negev, Lower Jordan Valley, Dead Sea area, Arava Valley, deserts of edom.
Area: E. Saharo-Arabian, extending into the adjacent territories of the Irano-Turanian and E. Sudanian regions.

Photo 4.31: *Seidlitzia rosmarinus*.

32. *Solanum incanum* L., Sp. Pl. 188 (1753); Post, Fl. 2:258; Muschler, Man. Fl. Eg.843 (1912). *S. sanctum* L., Sp. Pl. ed. 2, 269 (1762); Schonb.-Tem., in Fl. Iran.100:22 (1972). *S. coagulans* Forssk, Fl.Aeg.-Arab.CVII, 47 (1775); Del., Fl. Eg. 207, t.23 f.l (1813-1814); Boiss, Fl. 4:286**(photo 4.32)**.

Shrub, 60-150 cm, spiny, branched from base, yellowish, covered with a dense stellate tomentum.Branches bearing short mostly recurved prick; es thichened at base. Leaves petiolate, mostly large, ovate, undulate-repand or obtusely sinuate-lobed, oblique at base, often prickly along midvein; lower face with elevated veins.Cymes short-pedunculate, extra-axillary, with several pedicellate flowers; only the lower flower of the cyme fertile.Calyx campanulate; lobes narrowly triangular.Corolla rotate, lilac, tomentose outside, 2-2.5 cm in diameter; lobes ovate, acute.Anthers yellow, 5-6 mm, opening by apical pores. Berry nearly globose, yellow, about 2.5 cm in diameter. Fl. January-August.

Hab.: Hot valleys in deserts.Lower Jordan Valley, Dead Sea area; Moav.

Area: Sudanian (Egypt, Trop. Africa, Arabia, Pakistan, N.W. India), extending into south Africa.Presumably the……..*hedek* of the Bible (Mic. Vii: 4; Prov. xv 1:9).

Photo 4.32: *Solanum incanum.*

33. *Solanum luteum* Mill, Gard.Dict.ed.8, no.3 (1768). Boiss, Fl. 4:285 & Post, Fl. 2:257 as *S. villosum* (L.) Lam.? *S. nigrum* L. var. *induratum* Boiss, Fl. 4:274 (1879) **(photo 4.33)**. Annual or perennating herb, 30-50 cm, unarmed, pubescent to densely villose-tomentose. Stems and branched nearly terete.Leaves petiolate, ovate, entire or irregularly sinuate-dentate, obtuse or acute to acuminate. Cymes nodding, yellowish when dried, 3-6 flowered, peduculate, extra-axillary; fruiting pedicles thickened towards apex, deflexed. Calyx-lobes about as long as broad.Corolla rotate, white, about 7-10 mm in diameter, twice as long as calyx or longer.Anthers yellow, dehiscing by apical pores.Berries yellow or vermilion, rarely black, nearly glabrous, globose, pea-sized.Fl.Mainly in spring and summer.Hab.:Waste places. Acco Plain, Coast of Carmel, Sharon Plain, Philistean Plain; Upper and Lower Galilee, Mt. Carmel, Esdraelon Plain, Samaria, Shefala, Judean Mts., Judean Desert, N. and C. Negev; Hula plain, Upper Jordan Valley, Beit Shean Valley, Lower Jordan Valley, Dead Sea area; Gilead, Ammon, Moav, Edom.
Area: Mediterranean, W. Irano-Turanian and Euro-Siberian.

Photo 4.33: *Solanum luteum***.**

34. *Sonchus oleraceus* L., Sp. Pl. 794 (1753) excl. var. γ and δ, emend. Gouan, Hort. Reg. Monsp. 407 (1762); Boiss, Fl. 3:795; Post, Fl. 2:144.Incl. var. *lacerus* Wallr. & var. *triangularis* Wallr.Cited by Opphr. & Evenari, florula Cisiord, Bull.Soc.Bot. Geneve ser. 2, 31:422 (1941) **(photo 4.34)**.

Annual, 30-100 cm, glabrous, sometimes glandular-hairy above. Stem erect, sparingly branched, hollow. Leaves oblong, runcinate-pinnatilobed, rarely undivided; lobes irregular in shape, dentate, acute, terminal lobe triangular or ovate; radical and lower cauline leaves petiolate; upper cauline leaves sessile, acutely auriculate. Florets usually pale yellow. Achenes 3-3.5 mm, tawny, compressed, oblanceolate, broadest above their middle, 3-ribbed on each face and transversely tuberculate-rugose between ribs.Fl.Almost all year around, mainly in March-October.

Hab.: Cultivated ground, roadsides.Very common weed. Coastal Galilee, Acco Palin, Coast of Carmel, Sharon Plain, Philistean Plain; Upper and Lower Galilee, Mt. Carmel, Esdraelon Plain, Mt. Gilboa, Shefela, Judean Mts., Judean Desert, W. Negev, Dan Valley, Hula Plain, Upper and Lower Jordan Valley, Golan, Gilead, Ammon.

Area: Mainly Euro-Siberian, Mediterranean and Irano-Turanian; naturalized in the New World.

Photo 4.34: *Sonchus oleraceus*.

35. *Tamarix jordanis* Boiss, Fl. 1:771 (1867). *T. jordanis* Boiss, ssp. *xeropetala* Gutm, Palest.Journ.Bot.Jerusalem ser., 4:49 (1947). *T. jordanis* Boiss. Var. *brachystachys* Zoh., Trop.Woods 104:41 (1956) **(photo 4.35)**.

Tree or shrub with reddish-brown to brown dark, glabrous, 2.5-4(-6) m. leaves 2-2.5 mm., sessile with narrow base, oblong-lanceolate, acute with more or less divergent apex, membranous at margin.Racemes of vernal inflorescences 4.5-6 * 0.3-0.5 cm, ovoid or oblong, in racemose or paniculate branches; aestival inflorescences occurring immediately after the vernal (sometimes both types occurring together).Lower sterile bracts longer than the pedicles, oblong, acute to acuminate, the fertile ones triangular-ovate, somewhat denticulate.Pedicles shorter than the calyx.Sepals 5, 1-1.5 mm, rhombic-ovate to ovate, somewhat denticulate or eroded at apex. Corolla of aestival flowers semipersistent, i.e. remaining entirely or partly until the fruit is mature; petals 5, 2-2.5 mm., erect, white, obovate to elliptical, keeled in their lower half.Stamens 5; filaments arising from the sinuses of the disk; anthers apiculate.Styles 3.capsule about 3 mm, narrowly pyramidal. Fl. March-August.

Hab.: Mainly by streams and other fresh water bodies.Dan Valley, Hula Plain, Upper (and rarely Lowert) Jordan Valley, Golan, Moav.Locally common.

Area: E. Mediterranean (Palestine, Syria, Lebanon).

The specimens identified by the present author as *T. jordanis* have been preferred by Baum (Monogr. Tamarix, MS. 47) to *T. smyrnesis* Bge., Tent. 53 (1852). To judge from the specimens of *T. smyrnesis* collected by us in the locus classicus and from the description of Bunge, there is a whole series of differences between our specimens and what has been considered as *T. smyrnesis* by Bunge. Here are some of them:

T. jordanis. Three types of inflorescences: vernal-with long, linear or filfiform, interrupted racemes up to 6 * 0.3-0.5 cm., aestival-with 2-4 * 0.5-0.7 cm. racemes; and intermediate ones. The vernal racemes are loose or borne on bracteate, conspicuous peduncles; bracts 2mm. or more, triangular-ovate; pedicles 1 mm. or more; sepals 1 mm. or ,ore, rhombic, with a green middle nerve; corolla semipersistent, falling of at maturity of the capsule, petals about 2 mm., obovate; disk with 5 crenate lobes.

In *T. smyrnesis* all racemes are alike, 1-2.5 cm., compact, almost sessile; bracts about 1 mm., as long as the sepals and appressed to them, triangular-subulate; flowers subsessile; sepals about 1 mm., ovate- triangular, white; corolla persisting long after maturity of the capsule, petals ovate-orbicular with a gibbous dorsal protuberance below; disk with 5 entire lobes. Such plants do not occur at all in Palestine.

T. jordanis has long been misinterpreted.The type specimen of Boissier collected by Kotschy (No. 432, sub. *T. pallasii*), which I have examined and which has been referred by Baum, l.c. 40, to *T. palaestina* Bertol., Misc. Bot. 14:16, t l.f. 4 (1853), includes two forms of inflorescence, and is identical with the plants growing abundantely in the Upper Jordan Valley (referred by Baum, l.c. 47, to *T. smyrnesis* Bge., l.c.), but also occurring near the northern Dead Sea foreshore, where *T. jordanis* Boiss, ssp. *xeropetala* Gutm. (also referred by Baum to *T. smyrnesis*) was found and where the above type sepimen of *T. jordanis* was collected. Besides, the latter cannot be referred to *T. palaestina* Betrol., l.c. (as done by Baum, l.c. 40), also since *T. palaestina* has slender, long ("bi-tri-pollicares") racemes almost exclusively vernal and flowers with caducous (and not semipersistent)corollas.

Photo 4.35: *Tamarix jordanis*.

36. *Tamarix tetragyna* Ehrenb.Linnaea 2:257 (1827); Boiss.Fl.1:768 (1867) **(photo 4. 36)**. Small tree or shrub with purple tp blackish-brown bark, papillose to blabrous, 1.5-4 m. Leaves 1.5-6 mm., sessile, oblong-subulate, not amplexicaul inflorescences solitary lateral racemes, 4-10 * (0.4-)0.8-1.2 cm.; aestival inflorescences 0, rarely present and then shorter and narrower; all with papillose rhachis.Bracts oblong to linear-oblong, the lowest truncate with a short obtuse point, the upper acuminate; all longer than the pedicles and calyces and sometimes equaling the flowers in length.Pedicles somewhat longer to shorter than the calyx. Calyx urceolate; sepals 4-5, ovate to elliptical, mostly with a few teeth at apex, the outer 2 acute, about 2 mm.; the inner ones somewhat shorter, obtuse. Corolla caducous, rarely subpersistent; petals 4-5, 3.5-5 mm., spreading tp deflexed, white, narrowly obovate to elliptical, tapering or short-clawed at base.Stamens 4-5, episepalous, rarely with 1-3 additional epipetalous stamens; filaments arising at the top o fthe entire or retuse disk lobes.Styles 4.Capsule 3-5 * 1.5-2 mm, pyramidal.Fl.Mainly December-April.

1. Sepals, petals and stamens predominantly 5 (rarely stamens 6-8). var. **tetragyna**-
Sepals, petals and stamens predominantly 4 2

2. Vernal racemes up to 10 * 0.4-0.8 cm, more or less loose.Styles spatulate, shorter than 1 mm.

var. **deserti** .Vernal racemes shorter, 4-6 * 0.9-1.2 cm. styles club-shaped, about 1 mm.

var. **meyeri**

var.**tetragyna.** Racemes slender, up to 10 * 0.8 cm.Calyx and corolla predominantly 5-merous. Stamens (4-)5(-6-8); anthers exapiculate.

Hab.: saline abd brackish swamps, C. Negev, Lower Jordan Valley, Dead Sea area.Rare.

var.**deserti** (Boiss) Zoh. (Comb. Nov.). *T. deserti* Boiss, Diagn.Ser. 1, 10:9 (1849); Zoh, Trop.Woods 104:33 (1956).Racemes slender, up to 10 * 0.8 cm. Calyx and corolla predominantly 4-merous.Stamens predominantly 4, as long as corolla.

Hab.: As above.Negev, Dead Sea area. Rare.

var. **meyeri** (Boiss.). Boiss, Fl.1:768 (1867). *T. meyeri* Boiss, Diagn.ser 1, 10:9(1849).Racemes thick, compact, usually shorter and boarder than above.Calyx, corolla and stamens as in var. *deserti* in its apiculate anthers and club-shaped styles.

Hab.: As above.Acco Plain, Sharon Plain, N. Negev, and Upper Jordan Valley.Common.

Area of species: E. Mediterranean and Saharo-Arabian.

Photo 4.36: *Tamarix tetragyna*.

37. *Verbascum jordanicum* Murb, Monogr. Verb.Lunds Univ.Arsskr.nov.ser., 29:503 (1933). *V. macranthum* Post in Post & Autran, Bull.Herb.Boiss.1:404 (1893) non Hoffmans & Link (1809); Post, Fl.ed.2, 2:277 & 826 **(photo 4.37)**.
Perennial herb, woody at base, 80-130 cm, many-stemmed, densely woolly-canescent. Indumentum of long and soft branched hairs. Stems leafy, winged below, with elongated virgate flowering branching. Lower leaves and those of sterile branches petiolate, 4-7 * 1.5-3 cm, oblong in outline, pinnatilobed or partite; cauline leaves sessile, coarsely crenate-dentate, the lower ones somewhat decurrent, the upper ones cordate-ovate, acute, coarsely crenate-dentate, auriculate and amplexicaul. Flowers solitary, bracteolate, sessile, in a lax spike; bracts triangular-lanceolate, bracteoles lanceolate, 4-5 mm broad, about as long as calyx. Calyx 10-12 mm, in fruit 15 mm; lobes ovate-lanceolate, acute or acuminate. Corolla large, 40-50 mm in diameter, sparsely pellucid-punctate. Stamens 5; hairs on filaments purple. Capsule globose, 5-10 mm, mucronate, densely stellate-woolly, later glabrescent. Fl. April-July.
Hab.: Dry chalky slopes. Rare. N. Negev, Upper Jordan Valley; Golan, Gilead.
Area: Endemic. W. Irano-Turanian.

Photo 4.37: *Verbascum jordanicum*

38. ***Verbascum sinaiticum*** Benth. in Dc., Prodr.10:236 (1864); Murb, Monogr.Verb.234 (1933); Murb, Nachtr. 35 (1936); Boiss, Fl. 4:318; Post, Fl. 2:272.Incl. var. *judaicum* Murb, Monogr.Verb, Lunds Univ. Arsskr.nov.ser., 29:237 (1933) **(photo 4.38)**.
Stout biennial, 60-150 cm, densely and roughly pannose with a rust-coloured tomentum of branched eglandular hairs. Stems leafy, branched above; sometimes stems simple; branches elongated, arcuate-ascending, forming a more pr less lax panicle.Leaves entire or obscurely crenulate, rarely dentate; basal leaves 30-65 * 5-20 cm, nearly entire, almost elliptic, broadcast at or above middle; cauline leaves short-petiolate or sessile, the upper ones auriculate and somewhat decurrent at base.Flowers in distant clusters of 2-7; bracts broadly triangular, cuspidate generally as ling as clusters or shorter; bracteoles 2, lanceolate to ovate, about as long as cakyx; fruiting pedicles thickened, rigid, not longer than calyx or slightly longer.Calyx 4-5 mm, tomentose; lobes oblong-lanceolate, acute; fruiting calyx 6-7 mm. corolla 20-28 mm in diameter, sparingly pellucid-punctate. Stamens 5; filaments orange-coloured; hairs on filaments dense, white (rarely with a few purple hairs intermixed); connectives of 2 anterior stamens long-hairy on inner face.Capsule ellipsoid-ovoid, 5-7.5 mm, longer than calyx, subobtuse, sometimes with a very short mucro, tomentellous to glabrescent. Fl. April-July.
Hab.: Waste places and steppes.Judean Mts., C. Negev; Dead Sea area; Golan, Gilead, Ammon, Moav, Edom.
Area: W. Irano-Turanian, E. Saharo-Arabian and Sudanian, extending into E. Trop. Africa.
According to Murbeck, var. *judaicum* differs from the typical *V. sinaiticum* in its entire to obscurely vrenulate leaves (not dentate or crenate). Though in our material leaves are mostly entire or nearly so, dentate-crenate leaves sometimes also appear. It is as yet uncertain whether this variability is taxonomically significant.

Photo 4.38: *Verbascum sinaiticum*

39. *Withania somnifera* (L.) Dunal in Dc, Prodr. 13, 1:453 (1852); Boiss, Fl. 4:287; Post, Fl. 2:260. *Physalis somnifera* L. & *P. flexuosa* L., Sp. Pl. 182 (1753) **(photo 4.39)**.
Erect shrub, 1-1.5 m, tomentose with stellate hairs, sometimes glabrescent.Branches terete.Leaves petiolate, ovate, acute, entire, 3-10 cm, the upper ones sometimes opposite.Flowers short-pedicellate, in dense axillary cymes, sometimes solitary. Calyx white-tomentose; lobes linear, triangular at base, muticous; fruiting calyx vesicular, membranous, 1.5-2 cm. Corolla greenish-yellow, tomentose, 5-8 mm, tubular-campanulate, somewhat lomger than calyx. Berry about 5 mm in diameter, red.Fl.Mainly in summer.
Hab.: Waste palces. Coast of Carmel, Sharon Plain, Philistean Plain, Upper and Lower Galilee, Mt. Carmel, Samaria, Shefela, Judean Mts., Judean Desert, N. Negev; Upper and Lower Jordan Valley, Dead Sea area; Gilead, Ammon, Moav.
Area: Mainly Mediterranean and W. Irano-Turanian; also tropical regions of the Old World and S. Africa.

Photo 4.39: *Withania somnifera*.

40. *Ziziphus spina-christi* (L.) Desf, Fl. Atl. 1:201; Willd, Sp. Pl. 1:1105 (1798); "*Ziziphus*"); Boiss, Fl. 2:13 (1872).*Rhamnus spina-christi* L, m Sp. Pl. 195 (1753) **(photo 4.40)**.

Evergreen tree, 3-8 m., with main stem and almost globular or ovoid crown.Branches ascending and spreading, rather long, grayish-white, glabrous.Stipular spinesstout, one straight, about 1 cm. or more, the other recurved, shorter, sometimes spines 0. Leaves 2-8 * 1.5-3 cm., elliptical or ovate to oblong, obtuse or acute, often mucronulate, obsoletly crenate, 3-nerved, glabrous or puberulent at nerves on lower face only; petiole 0.5-1.5 cm. cymes axillary. Pedicles 3-5 mm. flowers 4-6 mm. in diam., yellowish-green.Sepals wooly outside.Petals shorter than sepals, yellow, hooded.Disk 5-angled. Fruit 1-1.5 cm, globular or nearly so; mature fruit yellowish.Seeds 5-6 mm, dark brown.Fl.September-April and also in other seasons.

Hab.: Oases in hot deserts, wadi beds, coastal foothills, fields on alluvial soils; usually from 30 m. below to 500 m. above sea level. Acco Plain, Sharon Plain, Philistean Plain, Upper and Lower Galilee, Esraelon Plain, Samaria, Shefela, Judean Mts., Negev, Dan Valley, Hula Plain, Upper Jordan Valley, Beit Shean Valley, Lower Jordan Valley, Dead Sea area, Arava Valley, Golan, valleys in Moav and Edom.

Area: Sudanian, with extensions into the warmer parts of the Mediterranean, Saharo-Arabian and W. Irano-Turanian territories.

var. *inermis* Boiss, l.c. can scarcely be maintained as a variety. Records of it probably refer to younger branches of cultivated specimen.

One of the most common trees in the lowlands of Palestine; occurs sometimes as a weed in irrigated crops of the Jordan Valley; attains a great age and large dimensions. Frequently revered by Arabs as a scared tree; sometimes planted for its shade and edible fruits.

Photo 4.40: *Ziziphus spina-christi*.

Based on the flora analysis calculation of each family in respect to the recorded plant species number, results showed a predominance of the family Compositeae which it self comprise (20 %), with the number of (8) species, followed by the family Chenopodiaceae which comprise (10 %), with (4) species (Table 4.2) and (Fig. 4.1).

Table 4.2: The number and percentages of species belong to each family in the study area.

Families	Number of species	Percentages
Amaranthacea	1	2.5
Asclipiadaceae	1	2.5
Balanitaceae	1	2.5
Caryophyllaceae	1	2.5
Chenopodiaceae	4	10
Compositeae	8	20
Curciferar	3	7.5
Euphorbiaceae	1	2.5
Gramineae	2	5
Labiatae	1	2.5
Leguminaceae	1	2.5
Lilaceae	1	2.5
Malvaceae	2	5
Mocluginaceae	1	2.5
Ranunculaceae	1	2.5
Resedaceae	1	2.5
Rhamnaceae	1	2.5
Scrophulariaceae	2	5
Solanaceae	3	7.5
Tamaricaceae	2	5
Umbellifereae	1	2.5
Zygophyllaceae	1	2.5

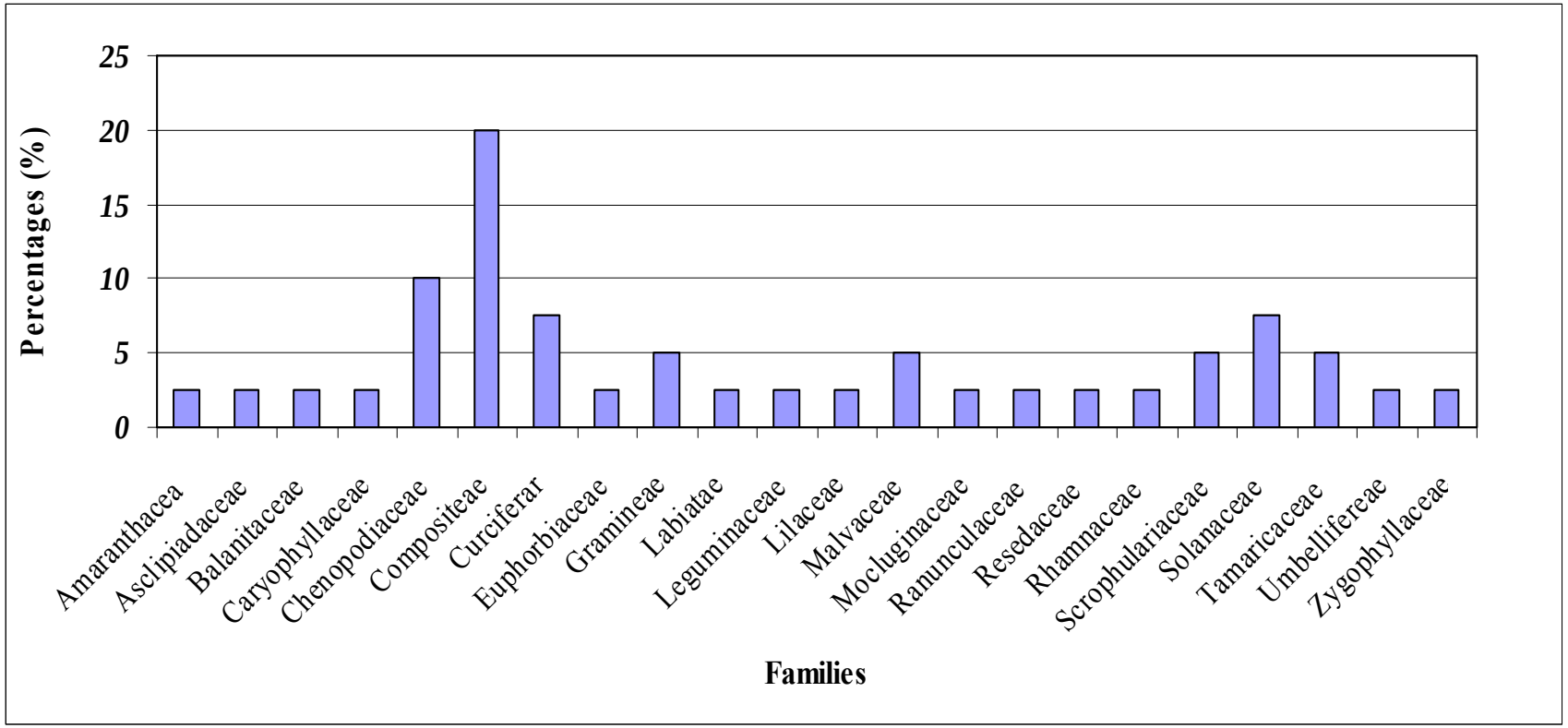

Fig. 4.1: Percenages of species in respect to their families in the study area.

Other main goals of the flora analysis are making a checklist for plants that present in the study area and classifying them according to chorotype and life forms.
Based on chorotype, the recorded species in the study area are classified into 12 categories as shown in (Table 4.3).

Table 4.3: Classification of recorded species according to their chorotype

No	Species	Chorotype
1	*Androcymbium palsetinum*	Saharo-Arabian
2	*Anthemis bornmuelleri*	Mediterranean
3	*Atriplex halimus*	Mediterranean and Saharo-Arabian.
4	*Avena sterilis*	Mediterranean and Irano-Turanian
5	*Balanites aegyptiaca*	Sudanian
6	*Calotropis procera*	Sudanian,
7	*Calendula palaestina*	Mediterranean
8	*Calendula tripterocarpa*	Saharo-Arabian
9	*Cardaria draba*	Mediterranean and Irano-Turanian
10	*Chaetosciadium trichospermum*	Mediterranean
11	*Chenopodium murale*	Pluriregional.
12	*Cleome droserifolia*	Sudanian.
13	*Euphorbia peplus*	Euro-Siberian, Mediterranean and Irano-Turanian
14	*Glinus lotoides*	Mediterranean and Irano-Turanian
15	*Hedypnois rhagadoiloides*	Mediterranean
16	*Lactuca orientalis*	Irano-Turanian
17	*Launea nudicaulis*	Saharo-Arabian
18	*Lycium shawii*	Saharo-Arabian and Sudanian
19	*Matthiola aspera*	Saharo-Arabian (endemic in Palestine)
20	*Malva parviflora*	Mediterranean and Irano-Turanian
21	*Notobasis syriaca*	Mediterranean
22	*Notoceras bicorne*	Saharo-Arabian
23	*Ochradenus baccatus*	Sudanian
24	*Peganum harmala*	Irano-Turanian and Saharo-Arabian
25	*Prosopis juliflora*	Irano-Turanian
26	*Pteranthus dichotomus*	Saharo-Arabian
27	*Ranunculus asiaticus*	Mediterranean
28	*Salsola vermiculata*	Saharo-Arabian and Irano-Turanian
29	*Salvia dominica*	Mediterranean
30	*Seidlitzia rosmarinus*	Saharo-Arabian
31	*Solanum incanum*	Sudanian
32	*Solanum luteum*	Mediterranean
33	*Sonchus oleraceus*	Mediterranean and Irano-Turanian
34	*Tamarix jordanis*	Mediterranean
35	*Tamarix tetragyna*	Mediterranean and Saharo-Arabian
36	*Verbascum jordanicum*	Irano-Turanian
37	*Verbascum sinaiticum*	Irano-Turanian, Saharo-Arabian

38	*Withania somnifera*	Mediterranean and Irano-Turanian; also tropical regions
39	*Ziziphus spina-christi*	Sudanian
40	*Rostaria pyrethea*	Mediterranean and Irano-Turanian

From (Table 4.3), the percentage of each chorotype was found to be as shown in (Table 4.4).

Table 4.4: The number and percentages of species belong to each chorological spectrum along the study area.

Chorotype	Number of species	Percentage (%)
Sah-Ara	6	15
Med	7	17.5
Med/ Sah-Ara	2	5
Med/ Ira-Tur	7	17.5
Sud	6	15
Plur	1	2.5
Euro-Sib/ Med/ Ira-Tur	3	7.5
Ira-Tur	3	7.5
Ira-Tur/ Sah-Ara	3	7.5
Sah-Ara/Sud	1	2.5
Med / Ira-Tur / trop	1	2.5

Analysis of the previous chorological spectrum of collected plant species showed a predominance of Mediterranean which comprise (17.5 %) with (7) species, Mediterranean / Irano-Turanean chorotype also has the same percentage and number of species (Fig. 4.2).

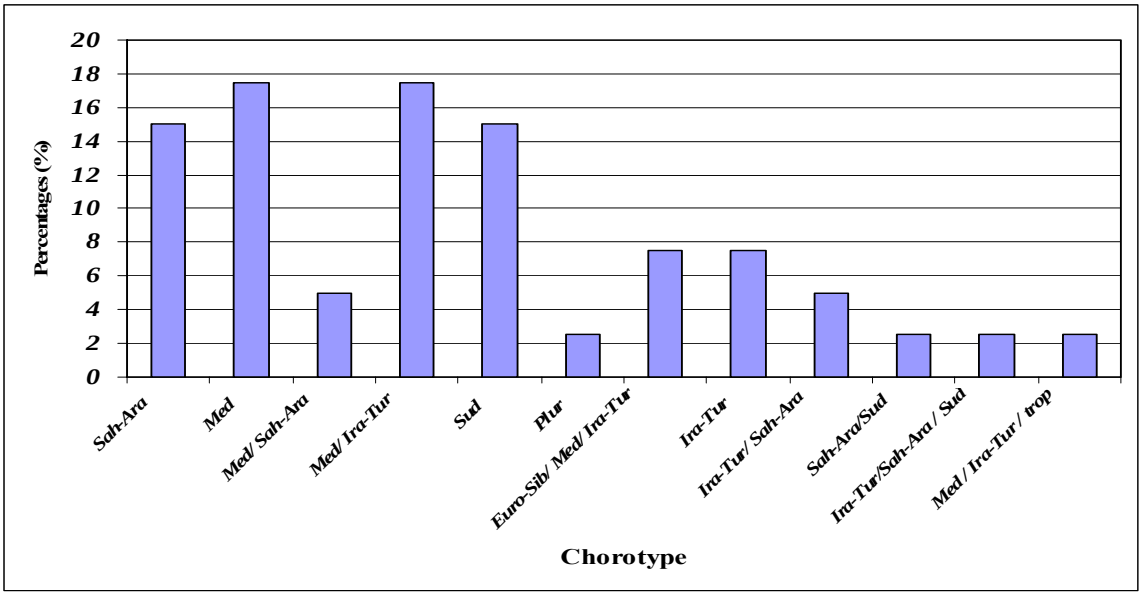

Fig. 4.2: Chorological spectrum of plant along the study area.

Inspite of that Jerico area which is the area under study is actually Saharo-Arabian and Irano-Turanean, the result showed the predominance of Mediterranean and Mediterranean / Irano-Turanean chorotypes.That contradiction is explaned by the surrounding of the study area by the Mediterranean region and that agree with the fact that Palestine as whole country is considered as Mediterranean and Mediterranean / Irano-Turanean region . Instead other chrological types such as: Pluriregional, Mediterranean / Irano-Turanian /tropical regions and Saharo-Arabian / Sudanian were poorly represented. This is due to have been introduced or transported, or because the study area is crossed by different wadies and is characterized by different altitudes. This may cause the area to be characterized by different bioclimatic conditions which leads to the appearance of different chorological types.

In addition the collected species were classified according to their life forms into four types as shown in (Table 4.5).

Table 4.5: Species classification regard to their life forms

No	Species	Life forms
1	*Androcymbium palsetinum*	Chamaephytes
2	*Anthemis bornmuelleri*	Therophytes
3	*Atriplex halimus*	Chamaephytes
4	*Avena sterilis*	Therophytes
5	*Balanites aegyptiaca*	Phanerophytes
6	*Calotropis procera*	Phanerophytes
7	*Calendula palaestina*	Therophytes
8	*Calendula tripterocarpa*	Therophytes
9	*Cardaria draba*	Hemicryphytes
10	*Chaetosciadium trichospermum*	Therophytes
11	*Chenopodium murale*	Therophytes
12	*Cleome droserifolia*	Chamaephytes
13	*Euphorbia peplus*	Therophytes
14	*Glinus lotoides*	Therophytes
15	*Hedypnois rhagadoiloides*	Therophytes
16	*Lactuca orientalis*	Chamaephytes
17	*Launea nudicaulis*	Chamaephytes
18	*Lycium shawii*	Phanerophytes
19	*Matthiola aspera*	Therophytes
20	*Malva parviflora*	Therophytes
21	*Notobasis syriaca*	Therophytes
22	*Notoceras bicorne*	Therophytes
23	*Ochradenus baccatus*	Phanerophytes
24	*Peganum harmala*	Hemicryphytes
25	*Prosopis juliflora*	Phanerophytes
26	*Pteranthus dichotomus*	Therophytes
27	*Ranunculus asiaticus*	Chamaephytes
28	*Salsola vermiculata*	Chamaephytes
29	*Salvia dominica*	Chamaephytes

30	*Seidlitzia rosmarinus*	Phanerophytes
31	*Solanum incanum*	Phanerophytes
32	*Solanum luteum*	Therophytes
33	*Sonchus oleraceus*	Therophytes
34	*Tamarix jordanis*	Phanerophytes
35	*Tamarix tetragyna*	Phanerophytes
36	*Verbascum jordanicum*	Phanerophytes
37	*Verbascum sinaiticum*	Chamaephytes
38	*Withania somnifera*	Phanerophytes
39	*Ziziphus spina-christi*	Phanerophytes
40	*Rostaria pyrethea*	Therophytes

Moreover analysis of biological spectrum of the collected plant species, Runkiaer system of life forms of plants (Archibold, 1995) was conducted which showed a predominance of Theophytes (TH) which comprises (42.5 %) with (17) species, followed by Phanerophytes (PH) which comprise (30 %) with (12) species (Table 4.6) and (Fig. 4.3).

Table 4.6: The number and percentages to each biological spectrum

Life form	Number of species	Percentages (%)
Chamaephytes (CH)	9	22.5
Phanerophytes (PH)	12	30
Theophytes (TH)	17	42.5
Hemicryphytes (H)	2	5

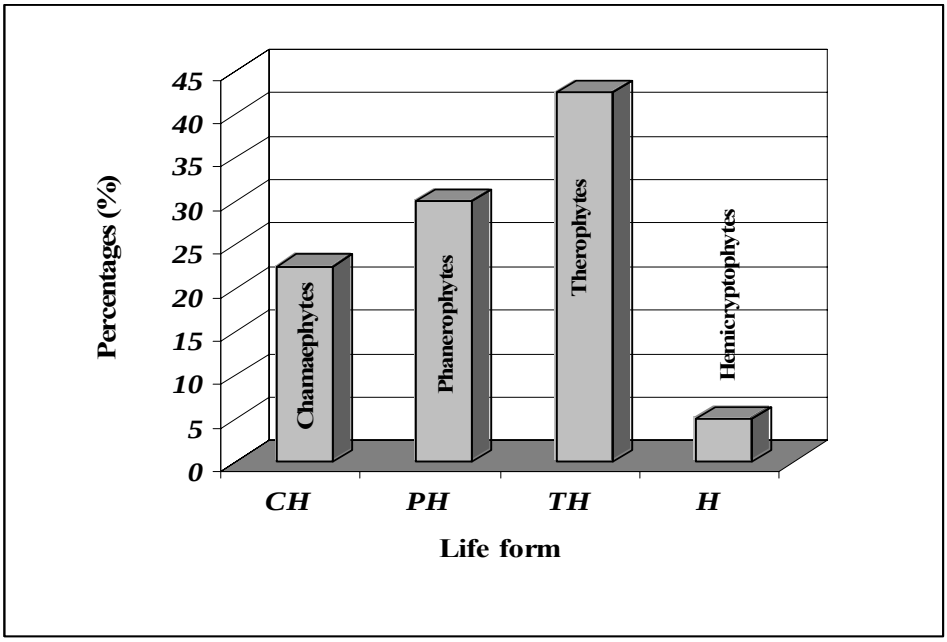

Fig 4.3: Biological spectrum of plants along the study area.

Obtained results as we expected as therophytes have greater capacity for growth than other life forms. Apparently that is because of their wider ecological amplitude, greater plasticity in size, and their small growth requirements. In addition, according to the results in (Table 4.4), there is a clear positive correlation between therophytes and Mediterranean chorophyte. This explains why therpphytes are dominating the study area which falls within the Mediterranean region.

4.2 Vegetation analysis

The raw data which was obtained by the line transect method Appendix (3.3), was used to estimate the following biological indicators: (a) frequency, (b) abundance, and (c) density (Table 4.7).

Table 4.7: The results of the vegetation analysis of the study area are related to the following table.

No	**Recorded Species**	**Total No of specimens**	**No of lines of occerrence**	**Total No of studied quadrates**	**Frequency**	**Abundance**	**Density**
1	*Androcymbium palastinum*	229	20	124	16.12903	11.5	1.846774
2	*Anthemis bornmullri*	231	26	124	20.96774	8.9	1.862903
3	*Atriplex halimus*	152	76	124	61.29032	2.0	1.225806
4	*Avena sterilis*	148	42	124	33.87097	3.5	1.193548
5	*Balanites aegyptiaca*	16	13	124	10.48387	1.2	0.129032
6	*Calotropis procera*	104	64	124	51.6129	1.6	0.83871
7	*Calendula palaestina*	685	31	124	25	22.1	5.524194
8	*Calendula tripterocarpa*	470	29	124	23.3871	16.2	3.790323
9	*Cardaria draba*	151	32	124	25.80645	4.7	1.217742
10	*Chaetoscididium trichosprmum*	181	37	124	29.83871	4.9	1.459677
11	*Chenopodium murale*	83	25	124	20.16129	3.3	0.669355
12	*Cleome drosrrifiora*	61	32	124	25.80645	1.9	0.491935
13	*Euphorbia peplus*	122	27	124	21.77419	4.5	0.983871
14	*Glinus lotoids*	110	45	124	36.29032	2.4	0.887097
15	*Hydipnois rhagadioloides.*	121	53	124	42.74194	2.3	0.975806
16	*Lactuca orientalis*	136	49	124	39.51613	2.8	1.096774
17	*Launaea nudicaulis*	474	40	124	32.25806	11.9	3.822581
18	*Lycium shawii*	71	51	124	41.12903	1.4	0.572581
19	*Mathiola aspera*	98	27	124	21.77419	3.6	0.790323
20	*Malva parviflora*	1520	46	124	37.09677	33.0	12.25806
21	*Notabasis syriaca*	154	27	124	21.77419	5.7	1.241935

22	*Notoceras bicorne*	71	44	124	35.48387	1.6	0.572581
23	*Ochradenus baccatus*	34	27	124	21.77419	12.8	2.790323
24	*Peganum harmala*	127	72	124	58.06452	1.8	1.024194
25	*Prosopis juliflora*	23	21	124	16.93548	1.1	0.185484
26	*Pteranthus dichotomus*	111	24	124	19.35484	4.6	0.895161
27	*Ranunculus asiaticus*	448	37	124	29.83871	12.1	3.612903
28	*Rostaria pyrethea*	422	19	124	15.32258	22.2	3.403226
29	*Salsola virmiculata*	150	75	124	60.48387	2.0	1.209677
30	*Salvia dominca*	12	7	124	5.645161	1.7	0.096774
31	*Seidlitzia rosmarinus*	184	82	124	66.12903	2.2	1.483871
32	*Solanum incanum*	149	72	124	58.06452	2.1	1.201613
33	*Solanum luteum*	52	22	124	17.74194	2.4	0.419355
34	*Sonchus oleraceus*	164	34	124	27.41935	4.8	1.322581
35	*Tamarix jordanis*	100	55	124	44.35484	1.8	0.806452
36	*Tamarix titragyna*	119	57	124	45.96774	2.1	0.959677
37	*Verbascum jordanicum*	61	20	124	16.12903	3.1	0.491935
38	*Verbascum sinaiticum*	27	15	124	12.09677	1.8	0.217742
39	*Withania somnifera*	90	48	124	38.70968	1.9	0.725806
40	*Ziziphus spina-chiristi*	40	32	124	25.80645	1.3	0.322581

4.2.1. Species density:

It was found that the average of plant species density ranged between (0.097) and (12.258) plant/line. The highest density is for *Malva parviflora*, followed by *Calendula palaestina* with density of (5.52) p/L, where as the least dense species was *Salvia dominca* (Table 4.8).

Table 4.8: Plant species of the study area in relation to their density

No	**Txon**	**Family**	**Density**
1	*Malva parviflora*	Malvaceae	12.25806
2	*Calendula palaestina*	Compositeae	5.524194
3	*Launaea nudicaulis*	Compositeae	3.822581
4	*Calendula tripterocarpa*	Compositeae	3.790323
5	*Ranunculus asiaticus*	Ranunculaceae	3.612903
6	*Rostraria perythea*	Gramineae	3.403226
7	*Ochradenus baccatus*	Resedaceae	2.790323

8	*Anthemis bornmuellri*	Compositeae	1.862903
9	*Androcymium palaestinum*	Lilaceae	1.846774
10	*Seidlitzia rosmarinus*	Chenopodiaceae	1.483871
11	*Chaetosciadium trichosprmum*	Umbellifereae	1.459677
12	*Sonchus oleraceus*	Compositeae	1.322581
13	*Notobasis syriaca*	Compositeae	1.241935
14	*Atriplex halimus*	Chenopodiaceae	1.225806
15	*Cardaria draba*	Curciferar	1.217742
16	*Salsola vermiculata*	Chenopodiaceae	1.209677
17	*Solanum incanum*	Solanaceae	1.201613
18	*Avena sterilis*	Gramineae(Poaceae)	1.193548
19	*Lactuca orientalis*	Compositeae	1.096774
20	*Peganum harmala*	Zygophyllaceae	1.024194
21	*Euphorbia peplus*	Euphorbiaceae	0.983871
22	*Hedypnois rhagadioloides*	Compositeae	0.975806
23	*Tamarix tetragyna*	Tamaricaceae	0.959677
24	*Pteranthus dichotomus*	Caryophyllaceae	0.895161
25	*Glimus lotoides*	Mocluginaceae	0.887097
26	*Calotropis procera*	Asclipiadaceae	0.83871
27	*Tamarix jordanis*	Tamaricaceae	0.806452
28	*Matthiola aspera*	Curciferar	0.790323
29	*Withania somnifera*	Malvaceae	0.725806
30	*Cenopodium murale*	Chenopodiaceae	0.669355
31	*Notoceras bicorne*	Curciferar	0.572581
32	*Lycium shawii*	Solanaceae	0.572581
33	*Cleome droserifolia*	Amaranthacea	0.491935
34	*Verbascum jordanicum*	Scrophulariaceae	0.491935
35	*Solanum luteum*	Solanaceae	0.419355
36	*Ziziphus spina-christi*	Rhamnaceae	0.322581
37	*Verbascum sinaiticum*	Scrophulariaceae	0.217742
38	*Prosopis juliflora*	Leguminaceae	0.185484
39	*Balanites aegyptiaca*	Balanitaceae	0.129032
40	*Salvia dominca*	Labiatae	0.096774

4.2.2. Species frequency:

From vegetation analysis data, the frequency was found in the range (5.65 – 66.13 %). The most frequent species recorded is *Seidlitzia rosmarinus*, followed by *Atriplex halimus* with a frequency of (61.3 %), while the least frequent species is *Salvia dominca* (Table 4.9).

Table 4.9: Plant species of the study area in relation to their frequency

No	*Txon*	Family	Frequency
1	*Seidlitzia rosmarinus*	Chenopodiaceae	66.12903
2	*Atriplex halimus*	Chenopodiaceae	61.29032
3	*Salsola vermiculata*	Chenopodiaceae	60.48387
4	*Solanum incanum*	Solanaceae	58.06452
5	*Peganum harmala*	Zygophyllaceae	58.06452
6	*Calotropis procera*	Asclipiadaceae	51.6129
7	*Tamarix tetragyna*	Tamaricaceae	45.96774
8	*Tamarix jordanis*	Tamaricaceae	44.35484
9	*Hedypnois rhagadioloides*	Compositeae	42.74194
10	*Lycium shawii*	Solanaceae	41.12903
11	*Lactuca orientalis*	Compositeae	39.51613
12	*Withania somnifera*	Malvaceae	38.70968
13	*Malva parviflora*	Malvaceae	37.09677
14	*Glimus lotoides*	Mocluginaceae	36.29032
15	*Notoceras bicorne*	Curciferar	35.48387
16	*Avena sterilis*	Gramineae(Poaceae)	33.87097
17	*Launaea nudicaulis*	Compositeae	32.25806
18	*Ranunculus asiaticus*	Ranunculaceae	29.83871
19	*Chaetosciadium trichosprmum*	Umbellifereae	29.83871
20	*Sonchus oleraceus*	Compositeae	27.41935
21	*Cleome droserifolia*	Amaranthacea	25.80645
22	*Cardaria draba*	Curciferar	25.80645
23	*Ziziphus spina-christi*	Rhamnaceae	25.80645
24	*Calendula palaestina*	Compositeae	25
25	*Calendula tripterocarpa*	Compositeae	23.3871
26	*Notobasis syriaca*	Compositeae	21.77419
27	*Matthiola aspera*	Curciferar	21.77419
28	*Euphorbia peplus*	Euphorbiaceae	21.77419
29	*Ochradenus baccatus*	Resedaceae	21.77419
30	*Anthemis bornmuellri*	Compositeae	20.96774
31	*Cenopodium murale*	Chenopodiaceae	20.16129
32	*Pteranthus dichotomus*	Caryophyllaceae	19.35484
33	*Solanum luteum*	Solanaceae	17.74194
34	*Prosopis juliflora*	Leguminaceae	16.93548
35	*Androcymium palaestinum*	Lilaceae	16.12903
36	*Verbascum jordanicum*	Scrophulariaceae	16.12903

37	*Rostraria perythea*	Gramineae	15.32258
38	*Verbascum sinaiticum*	Scrophulariaceae	12.09677
39	*Balanites aegyptiaca*	Balanitaceae	10.48387
40	*Salvia dominca*	Labiatae	5.645161

From the previous obtained results in (Table 4.9), it was found that the most frequent speices is *Seidlitzia rosmarinus*, because this species is characterized by random distribution, while the lowest frequent is *Salvia dominca* and this is refered to it is patchy distribution.

4.2.3. Species abundance:

According to the data obtained in this study, abundane ranges between (1.1 p/L) - (33 p/L). The most abundance species is *Malva parviflora*, followed by *Rostraria perythea* with abundancy of (22.2 p/L), while the least abundant speices recorded is *Prosopis juliflora* (Table 4.10).

Table 4.10: Plant species of the study area in relation to their abundance

No	***Txon***	**Family**	**Abundance**
1	*Malva parviflora*	Malvaceae	33
2	*Rostraria perythea*	Gramineae	22.2
3	*Calendula palaestina*	Compositeae	22.1
4	*Calendula tripterocarpa*	Compositeae	16.2
5	*Ochradenus baccatus*	Resedaceae	12.8
6	*Ranunculus asiaticus*	Ranunculaceae	12.1
7	*Launaea nudicaulis*	Compositeae	11.9
8	*Androcymium palaestinum*	Lilaceae	11.5
9	*Anthemis bornmuellri*	Compositeae	8.9
10	*Notobasis syriaca*	Compositeae	5.7
11	*Chaetosciadium trichosprmum*	Umbellifereae	4.9
12	*Sonchus oleraceus*	Compositeae	4.8
13	*Cardaria draba*	Curciferar	4.7
14	*Pteranthus dichotomus*	Caryophyllaceae	4.6
15	*Euphorbia peplus*	Euphorbiaceae	4.5
16	*Matthiola aspera*	Curciferar	3.6
17	*Avena sterilis*	Gramineae(Poaceae)	3.5
18	*Cenopodium murale*	Chenopodiaceae	3.3
19	*Verbascum jordanicum*	Scrophulariaceae	3.1
20	*Lactuca orientalis*	Compositeae	2.8
21	*Glimus lotoides*	Mocluginaceae	2.4
22	*Solanum luteum*	Solanaceae	2.4
23	*Hedypnois rhagadioloides*	Compositeae	2.3
24	*Seidlitzia rosmarinus*	Chenopodiaceae	2.2
25	*Solanum incanum*	Solanaceae	2.1
26	*Tamarix tetragyna*	Tamaricaceae	2.1

27	*Salsola vermiculata*	Chenopodiaceae	2
28	*Atriplex halimus*	Chenopodiaceae	2
29	*Cleome droserifolia*	Amaranthacea	1.9
30	*Withania somnifera*	Malvaceae	1.9
31	*Verbascum sinaiticum*	Scrophulariaceae	1.8
32	*Tamarix jordanis*	Tamaricaceae	1.8
33	*Peganum harmala*	Zygophyllaceae	1.8
34	*Salvia dominca*	Labiatae	1.7
35	*Calotropis procera*	Asclipiadaceae	1.6
36	*Notoceras bicorne*	Curciferar	1.6
37	*Lycium shawii*	Solanaceae	1.4
38	*Ziziphus spina-christi*	Rhamnaceae	1.3
39	*Balanites aegyptiaca*	Balanitaceae	1.2
40	*Prosopis juliflora*	Leguminaceae	1.1

From (Table 4.10) the highest abundant species is *Malva parviflora* and this is refered to it is patchy distribution, where as *Prosopis juliflora* is the lowest abundant and this is due to it is random distribution.

4.2.4. Recorded species that have medical values:

It is interesting to mention that the following species have medical values:

1- *Atriplex halimus*.
(a) Insecticidal to Culex larvae, cotton leatworm.
(b) Treatment of D.M (diabetes).

2- *Malva Parviflora*.
(a) Antimicrobial activity intreatment of skin disorders against Staph aureus and Funges (*Trichophyton mentagrophytes*).
(b) Anti-inflammatory by inhibiting Coxi activity.

3- *Prosopis Juliflora*.
(a) Alkalod Juliflorine is a potent natural peripheral inhibitor of acetylcholine esterase and Ca^{+2} channel blocker "Aleading candidate for Alzhemers disease therapy".
(b) Treatment of D.M in Israel.

Chapter Five

Conclusion and Recommendations

5.1 Conclusion

The study area is about 22 km^2 located in the southern part of Jericho district between the following positions:

1- North eastern: 36R 0737730 / UTM 3525810 with elevation -333
2- North western: 36R 0732248 / UTM 3526839 with elevation -255
3- South western: 36R 0731285 / UTM 3522079 with elevation -219.
4- South eastern: 36R 0736553 / UTM 3523392 with elevation -315.

The study was conducted from October 2005 to April 2006 to investigate the status of plant diversity in the studied area from both sides flora and vegetation analysis.

From the survey it was found that there are 40 species belong to 22 families. The result showed a predominance of the family Compositeae, followed by the family Chenopodiaceae, while the least family was Zygophyllaceae.

Analysis of chorological spectrum of the collected plant species showed a predominance of Mediterranean and Mediterranean / Irano-Turanean chorotypes. Otherwise other chrological types such as: Pluriregional, Mediterranean / Irano-Turanian /tropical regions and Saharo-Arabian / Sudanian were poorly represented in the study area.

The collected plant species are classified according to their life forms into four types which are (a) theophytes, (b) Phanerophytes, (c) Hemicryphytes, and (d) Chamaephytes. Analysis of the biological spectrum of collected plant species according to Runkiaer system of life forms of plants (Runkiaer, 1934) and (O. W. Archibold, 1995) showed a predominance of theophytes, followed by Phanerophytes.While the least life form is Hemicryphytes.

The conducted vegetation analysis included estimating the following biological indicators: frequency, abundance, and density. The highest density is for *Malva parviflora*; where as the least dense species is *Salvia dominca*. The most frequent species recorded is *Seidlitzia rosmarinus*, while the least frequent species is *Salvia dominca*.The most abundance species is *Malva parviflora*, while the least abundant speices recorded is *Prosopis juliflora*.

5.2 Recommendations

Regarding the importance of the study area which is characterized by special geographic and climatic factors. In addition, to the bad military impacts and the environmental situation in the study area, it is importanct to consider the following recommendation.

1- Developing and implementing a comprehensive plan for preserving biodiversity and for sustainable use of its components.

2- Establishing a network of protected areas for the preservation of ecosystems, species and genetic resources which are capable of functioning ecologically and which are related to other open spaces such as agricultural fields.

3- Rehabilitating damaged ecosystems in order to promote improving biodiversity.

4- Coordinating the implementation of the plan among all stakeholders including governmental and non-governmental bodies, private sector, community groups and other target populations.

5- Utilizing legislation, rules, procedures, budgetary allocations and other regulatory measures to establish methodologies for conservation of biological diversity and for sustainable use of resources.

6- Advancing public awareness concerning the advantages of biodiversity conservation and sustainable development.

7- Promoting knowledge and expertise through formal and non-formal education, ongoing research, and increased institutional capabilities.

8- Harmonizing national action with international and regional conventions, activities and plans.

9- Implementing the precautionary approach through measures intended to forecast, prevent and combat the causes for reduction or loss of biodiversity at source.

10- Integrating traditional knowledge on the conservation of biodiversity..

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5.4 Appendices

Appendix (3.1): Sampling sites coordination.

NORTH	NORTH_PG	EAST	EAST_PG
36R0733867	194715	UTM3524879	138123
36R0733926	194710	UTM3524624	137868
36R0734055	194916	UTM3525496	138736
36R0736451	197272	UTM3523587	136779
36R0735761	196576	UTM3523310	136516
36R0735114	195951	UTM3524335	137554
36R0735464	196319	UTM3525233	138444
36R0737487	198352	UTM3525811	138981
36R0732495	193344	UTM3524862	138134
36R0731765	192623	UTM3525290	138577
36R0731825	192683	UTM3525293	138578
36R0731892	192749	UTM3525272	138556
36R0732074	192930	UTM3525213	138493
36R0731955	192827	UTM3526010	139292
36R0732423	193292	UTM3525877	139150
36R0732884	193740	UTM3525254	138518
36R0732892	193749	UTM3525264	138528
36R0733441	194298	UTM3525317	138569
36R0733633	194491	UTM3525359	138607
36R0733278	194135	UTM3525313	138569
36R0733017	193871	UTM3525137	138398
36R 0731591	192390	UTM 3522420	135711
36R 0732567	193372	UTM 3522717	135988
36R 0733665	194479	UTM 3523203	136452
36R 0734932	195747	UTM 3523291	136514
36R 0732877	193703	UTM 3523758	137023
36R 0734356	195167	UTM 3523065	136300
36R 0731726	192560	UTM 3524137	137425
36R 0732694	193497	UTM 3522629	135898
36R 0735836	196684	UTM 3524908	138112
36R 0732742	193622	UTM 3526417	139683
36R 0734458	195327	UTM 3525890	139121
36R 0736794	197648	UTM 3525249	138433
36R 0736504	197371	UTM 3525868	139058
36R 0736007	196836	UTM 3523992	137193
36R 0734593	195443	UTM 3524981	138210
36R 0733238	194104	UTM 3525740	138996
36R 0733462	194283	UTM 3523529	136782
36R 0736651	197479	UTM 3523964	137157
36R 0731773	192587	UTM 3523174	136461
36R 0736956	197809	UTM 3525181	138362
36R 0732088	192926	UTM 3524350	137630
36R 0737730	198595	UTM 3525810	138975
36R 0732248	193137	UTM 3526839	140115

36R 0731285	192077	UTM 3522079	135377
36R 0736553	197370	UTM 3523392	136580

Appendix (3.2): Key to the families.

1-Spore producing plants……..…….....**Sinoptridaceae**

1-Seed producing plants ……...……..…2

2- Plant producing cones, not producing flowers; seeds not enclosed within Fruit …….....……..….**Pinaceae**

2- Plant not producing cones, producing flowers; seeds enclosed within fruit……....3

3- Monocot plants; leaves parallel veined; flowers 3- merous ….…….……..4

4-Leaves ovate – oblong to sagittate –hastate or cordate; inflorescence spadix……..……..**Araceae**

4- Leaves linear or oblong - lanceolate , inflorescence not spadix…...…….....5

5-Ovary superior……..…….…….…….....6

6-Flowers small, reduced; perianth simple, green, not petaliod…….....7

7- Perianth segments 6; stamens 6, fruit capsule …….....….**Juncaceae**

7- Perianth segments 2; stamens 3; fruit caryopsis……..... **Germinat**

6-Flowers conspicuous; perianth of whorls at least the inner one petaloid ……..**liliaceae**

5-Ovary inferior ……. ….……..…...8
..

8- Leaves oblong – lanceolate; flowers zygomnorphic, showy 1-2, Filaments absent; ovary 1-locular ……**Orchiaceae**

8- Leaves linear; flowers actionmorphic; stamens 3, filaments present; ovary locular ……...……...….**Iridaceae**

3- Dicot plants; leaves net veined; flowers 4 or 5- merous ……...……....……9
.

9- Perianth not differentiated into sepals and petals …….……10

10-Ovary superior ..……...……...……..……...11

11- Plants herbaceous, leaves simple.....…….……..…..…12

12- Ovary 3-locular; plant with milky juice .....….....**Euphorbiaceae**

12- Ovary 1-locular; plant without milky juice……...….. ...13

13- Plants with stinging hairs; with ochreate stipules; tepals 4; stamens 4…...……**Urticaceae**

13-plants with stinging hairs, without ochreate stipules, tepals 5 or 6; Stamens 4-8……...……...…….……...**polygonaceae**

11- Plants shruby or trees; leaves compo ……...……...…..**Anacardiaceae**

10-Ovary inferior ….……...……..14

14-Annual herbs, fruit nut –like drups…….**Thelligonaceae**

14- Perennial herbs, shrubs or trees fruit drupe, nutlets or an acorn ……...…….....…15

15- Herbs or shrubs, leaves linear, entire, existpulate; flowers hermaphrodite or unisexual, solitary or in cymes ; fruit drupe or nutlets ……..……...…….…….**Santalaceae**

15-Evergreen or deciduous trees, leaves ovate, dentate (rarely entire), Stipulate ; flowers unisexual , inflorescences catkin, fruit an acorn……..……...……...……**Fegaceae**

9- Perianth differentiated into sepals and petals …….……16

16- Petals free ……..……..…….……..17

17- Ovary superior …….……...…….……18

18- Pistils many . free …….…….……..19

19-Leaves opposite , succulent ; stamens 5-10 ……**Crassulaceae**

19- Leaves alternate, not succulent; stamens many and spirally arranged ……**Ranunculaceae**

18- Pistil one, simple or compound …..……20

20- Pistil simple; fruit legume …….....……...21

21- Sepals united; corolla differentiated into standard, wings and keel; stamens united (monodeiphous or diadelphou) ……...…….... **Leguminosae**

21- Sepals free; petals not differentiated into standard, wings and keel ; stamens free …..…...……. **Caesalpiniaceae**

20- Pistil compound (2 or move united carpels); fruit not legume ……..……..…….. 22

22- Stamens and petals inserted on a desk lining the calyx cup or on upper edge of calyx cup , so flowers pergynous ….……23

23- Stamens numerous……...……..…...**Rosaceae**

23- Stamens less than 15 ……..…..……24

24- Stamens as many as petals ……..… **Rhamnaceae**

24- Stamens twice as many as petals ……25

25-Herbs; leaves simple; fruit capsule…….... **Lythraceae**

25- Trees or shrubs; Leave Compound; fruit drupe ……...……..……. **Anacardiaceae**

22- Stamens and petals inserted at the base of pistil (hypogenous) ...……...… 26

.

26- Calyx irregular ……..…..……**Cistaceae**

26- Calyx regular ……...…….…… 27

27- Stamens more than 10 ……...……..…..28

28- Stamens free ; ovary 1- located ……..…….29

29- Herbs; sepals 2 or 6; petals 6; fruit capsule ….…….……30

30- Flower actinomorphic, solitary; sepals 2 ……...…...…….……**Papaveraceae**

30- Flower zygomorphic , in racemes : sepals 6

..…… **Resedaceae**

29- Shrubs; sepals 4; petals 4; fruit berry

……..……...…… **Capparaceae**

28- Stamens fused ; ovary 2 to many – loculed

……..……..……31

31- Perennial herbs; leaves opposite, sessile;

Stamens tridelphous …….....**Hypericaceae**

31- Herbs or shrubs; leaves alternate; petiolate;

stamens mondelphous……..…**Malvaceae**

27-Stamens 10or less ……...……...…….32

32-Flower actinomorphic ……..…….…….33

33- Ovary 1-loculed ……..…..34

34- Leaves simple, opposite; Petals 5;

stamens10 ; nodes Swollen
placentation free central

……...**Caryophyllaceae**

34- Leaves pinnatisect or compound,

alternate; petals 4 or 6; stamen2-6;

nodes not swollen; placenta ion not

free central ……..…...…….35

35-Annual herbs; leaves 2-3

pinnatisect; sepals 2; petals

4; stamen 4 or 2; placenta ion

parietal; fruit a Loment

…….…….. **Hypecoaceae**

35-Perennial herbs or sherubs;

leaves simple or compound ;

alternate; sepals 3-6; petals

4-6; stamens 4 or 6 or

more; placenta ion basal;

fruit berry, follicle, or

membranous-vesicular capsule

…….…..… **Berbidace**

33-Ovary 2 to 5-loculed……..…….……36

36- Fruit indehiscent..…….**Graniaceae**

36- Fruit dehiscent…….....……...37

37-Flower 5-merous; stamens 5;

ovary 5-celled; styles 5; fruit

capsule ……...…...……. **Linaceae**

37-Flowers 4-merous; stamens 6

tetradynamous; ovary 2-celled

style 1; fruit siliqua or

silicle …….……. **Cruciferae**

32-Flower zygomorphic ……..…38

38- Leaves compound, sepals 2; stamens 4

ovary 2-celled …...……**Polygalaceae**

17-Overy inferior; inflorescence umbel; fruit schizocarp ……...**Umbelliferae**

16-Patels united…...……..……39

39-Ovary superior……..……...……...…….40

40-Corolla actinomorphic ……...…….....……41

41- Ovary 1-locueld ……..……..42

42- Corolla lobes very deeply lobed appear look like free ;

style 1; fruit many seeded capsule; circmscissle.....**Primulaceae**

42-Corolla shallowly lobed; styles 5; fruit 1-seeded capsule or

an achene …..…….……**Plumbaginaceae**

41-Ovary 2-many loculed ……...……...….43

43-Fruit dehiscent capsule; leaves usually basal rosette ;

flower in cylindrical or globular spikes ……. **Plantaginaceae**

43-Fruit indehiscent berry or nutlets (rarely capsule); leaves

not basal; inflorescence not spike …….....……..44

44- Inflorescence scorpoid monochasial cyme; plant heavily

hairy or strigoes; style gynobasic; fruit nutlets

……..…..…….……..**Boraginaceae**

44- Inflorescence not scorpoid, plant glabrous or pubescent but Neither heavily hairy nor strigoes, style terminal; fruit berry (rarely capsule) ……..……...….45

45 – Shrubs or trees, stamens 10; carpals 5; locules 5;

fruit berry ……...……...…….46

46 Plant glabrous; bark red; inflorescence panicle;

calyx deeply lobed; corolla urceolate with short lobes fruit many seeded berry…….……**Ericaceae**

46-Plant hairy or pubescent; bark grey; inflorescence

cymose ;calyx very shortly lobed ; corolla deeply

lobed; fruit 1-2 seeded drupe…..……..**Styracaceae**

45- Herbs or shrubs; stamens 5; carpals 2; locules 2; fruit

berry or capsule …….……..…….47

47- Twinning or climbing plants sepals' free, unequal;

filaments often dilated at base fruit capsule

…….....……..**convolvulaceae**

47- Erect or spreading herbs or shrubs; sepals united;

equal; Filaments not dilated at base; fruit berry,

(rarely capsule) …….……..……..**Solanaceae**

40- Corolla zygomorphic ……...……...……..48

48-Fruit nutlets; style gynobasic …….……...……..49

49- Plants densely hairy or strigose; not aromatic, stem rounded;

leaves alternate, inflorescence scorpoid monochaisal cyme

……..…….....**Borginaceae**

49-Plants glabrous or pubescent; aromatic, stem tetragonal;

leaves opposite, inflorescence verticillasters …….....**labiatae**

48- Fruit capsule; style terminal …...……50

50-Parasite plants with scale leaves; flowers not spurred;
ovary 1-locular……...……...……..**Orobanchaceae**

50- Autotrophic; without scale leaves; flowers some times

spurred; ovary 2-locular……..……..**Scrophulariaceae**

39- Ovary inferior….……...…….51

51- Inflorescence head (Capitulum); ovary 1-loculed ……..…….52

52- Stamens 5; anthers connate ……...……...……..**Compositae**

52- Stamens 4; anthers free ……..……**Dipsacaceae**

51- Inflorescence not head; ovary 2-5 loculed...……...…….53

53- Creeping or climbing herbs; leaves palmately veined, with

tendrils ……...…….……**Cucurbitaceae**

53- Erect herbs or shrubs, leaves pinnately veined; no tendrils

……..……..……..…….54

54- Calyx 4- lobed; corolla 4-lobed, stamens 4, carpals 2;

locules 2, (rarely 1 carpel; 1 locule) ; fruit mericarps
……..……..**Rubiaceae**

54- Calyx 5-lobed, corolla 4-lobed; stamens 3 or 5; carpals 3;

fruit capsule or an achene ……..……55

55- Calyx 5-lobed, corolla 5-lobed, stamens 5, ovary 3-

carpeled; 3-locular; fruit capsule ..…..……**Campanulaceae**

55- Calyx 6-lobed, corolla 5-lobed, stamens 3, ovary 3-

carpeled; one fertile and two sterile, fruit an

achene……..……..….**Valerianceae**

Appendix (5.1): Distribution of the species within each line.

	Recorded Species	L1	5	L6	L7	L8	L9	L10
1.	*Calendula palaestina*	16	25	0	24	0	19	14
2.	*Calendula tripterocarpa*	15	23	0	16	0	23	22
3.	*Notabasis syriaca*	0	0	2	2	1	1	0
4.	*Sonchus oleraceus*	1	0	0	3	0	3	4
5.	*Anthemis bornmullri*	0	0	0	4	2	2	3
6.	*Hydipnois rhagadioloides.*	0	0	0	0	1	0	0
7.	*Lactuca orientalis*	2	0	0	3	5	4	5
8.	*Launaea nudicaulis*	11	16	0	15	0	11	14
9.	*Rostaria pyrethea*	0	0	0	0	0	0	0

10.	*Balanites aegyptiaca*	0	0	0	0	0	0	0
11.	*Tamarix titragyna*	0	1	1	0	0	0	0
12.	*Tamarix jordanis*	1	1	0	0	0	0	1
13.	*Salvia dominca*	1	0	0	1	0	0	0
14.	*Solanum incanum*	2	1	2	0	1	0	0
15.	*Solanum luteum*	0	0	0	0	0	0	0
16.	*Lycium shawii*	0	1	1	0	0	0	0
17.	*Ochradenus baccatus*	0	2	0	1	0	1	0
18.	*Cardaria draba*	2	0	0	1	3	2	4
19.	*Mathiola aspera*	2	1	0	2	3	2	1
20.	*Notoceras bicorne*	0	0	1	0	1	0	0
21.	*Salsola virmiculata*	0	2	2	0	1	2	0
22.	*Malva parviflora*	25	19	0	20	12	19	22
23.	*Chaetoscididium trichosprmum*	2	0	0	0	1	1	2
24.	*Peganum harmala*	3	4	0	1	0	0	1
25.	*Verbascum jordanicum*	0	0	0	1	2	1	2
26.	*Verbascum sinaiticum*	0	0	0	0	0	1	1
27.	*Calotropis procera*	1	2	1	1	0	0	0
28.	*Withania somnifera*	0	0	0	1	0	2	0
29.	*Ranunculus asiaticus*	0	0	0	9	11	0	15
30.	*Atriplex halimus*	0	1	2	0	0	2	0
31.	*Chenopodium murale*	0	0	0	2	4	2	3
32.	*Seidlitzia rosmarinus*	2	1	1	0	2	1	0
33.	*Androcymbium palastinum*	0	0	4	0	0	0	0
34.	*Prosopis juliflora*	0	0	0	0	0	0	0

35.	*Ziziphus spina-chiristi*	0	0	1	0	0	0	0
36.	*Glinus lotoids*	0	0	0	2	3	1	3
37.	*Cleome drosrrifiora*	0	0	0	1	0	1	0
38	*Euphorbia peplus*	6	2	2	2	3	6	4
39	*Pteranthus dichotomus*	5	9	0	0	1	0	1
40	*Avena sterilis*	5	4	0	3	2	0	2

L11	L12	L13	L14	L15	L16	L17	L18	L19	L20
12	22	19	0	0	0	0	0	15	16
6	9	11	0	0	0	0		20	18
0	3	4	2	0	4	6	5	3	0
5	0	3	1	4	4	4	3	5	0
0	13	0	0	16	0	0	0	0	16
2	3	4	6	2	2	3	6	4	0
0	0	0	0	0	6	5	5	3	0
15	13	22	0	0	11	12	0	22	25
9	11	0	0	6	0	0	0	0	23
0	0	0	0	0	0	0	0	0	0

0	0	0	0	0	0	1	0	0	1
0	0	0	0	1	1	0	0	0	1
0	0	0	0	0	0	0	0	0	0
1	0	0	0	1	0	0	0	0	2
0	2	1	1	1	2	3	6	4	0
1	0	0	0	0	0	0	0	1	2
4	0	0	2	3	0	0	5	0	15
0	3	5	6	4	6	4	5	6	0
2	0	0	4	3	0	0	0	0	6
0	0	0	0	1	0	0	0	0	1
2	0	0	0	1	0	0	0	0	3
12	32	26	0	0	65	55	49	52	46
0	4	6	5	0	9	11	8	15	5
1	0	0	0	2	0	0	0	0	2
0	5	6	2	0	2	3	1	0	0
0	1	1	2	0	2	3	1	2	0
2	0	0	1	1	0	0	1	0	2
0	2	3	2	0	2	1	3	0	0
4	0	3	0	5	0	3	0	6	9
2	0	0	0	1	0	0	1	0	3
0	4	5	2	0	2	3	5	2	0
3	0	0	0	1	0	0	0	0	3
6	0	0	0	4	0	0	3	5	6
0	0	0	0	0	0	0	0	0	1
1	0	0	0	0	0	0	0	1	1

2	0	0	1	2	0	0	0	3	4
1	0	0	0	2	2	1	3	0	1
2	0	0	0	1	0	0	0	1	2
1	0	0	0	2	0	0	2	2	3
1	2	0	3	1	1	2	0	0	2

L21	L22	L23	L24	L25	L26	L27	L28	L29
0	0	11	0	0	21	0	0	0
0	0	16	0	0	15	0	0	0
7	5	0	4	0	0	0	0	0
6	0	0	4	0	6	0	0	0
2	0	11	0	5	9	0	0	0
0	0	0	0	1	1	0	2	0
0	0	2	0	0	3	1	2	1
1	3	0	2	2	0	1	0	1
0	0	25	0	0	24	0	0	0
0	0	1	0	0	1	0	0	0

0	0	1	0	0	3	3	1	3
0	0	0	0	0	4	3	2	2
0	0	1	0	0	0	0	0	0
0	0	1	0	0	3	2	0	1
5	3	0	4	3	0	0	0	0
0	0	1	0	0	1	0	0	1
0	0	14	0	0	5	9	0	0
11	5	13	0	4	5	0	0	0
0	0	6	0	0	0	0	0	0
0	0	2	0	0	0	0	0	0
0	0	2	0	0	1	2	1	3
29	36	48	0	0	33	11	0	0
0	5	8	0	2	4	0	0	0
0	0	2	0	0	3	2	0	1
5	8	0	7	0	0	0	0	0
4	1	0	3	0	0	0	0	0
0	0	2	0	0	1	2	0	1
2	0	0	4	0	0	2	0	0
0	0	15	0	0	14	7	0	0
0	0	2	0	0	3	2	1	2
4	3	0	4	0	0	0	0	0
0	0	2	0	0	2	1	2	3
0	0	17	0	0	8	0	0	0
0	0	0	0	0	1	1	0	0
0	1	1	0	0	0	1	0	1

0	0	3	0	0	2	3	2	1
4	5	0	4	1	0	0	0	0
4	0	6	0	0	0	0	0	0
3	0	4	0	0	0	0	0	0
0	0	2	1	0	0	2	0	0

L30	L31	L32	L33	L34	L35	L36	L37	L38
0	0	0	0	0	0	0	24	0
0	0	0	0	0	0	0	0	0
2	4	3	4	0	2	4	0	0
4	3	3	2	0	0	0	5	0
6	3	0	3	0	0	0	0	0
0	2	2	1	0	0	0	1	2
0	1	0	3	0	2	0	0	0
3	2	1	2	0	0	0	12	0
0	0	0	0	0	0	0	0	0

0	0	0	0	0	0	1	0	0
0	0	0	1	2	0	3	1	0
0	0	1	0	1	0	1	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	3	0	2	0	0
2	1	2	3	0	0	0	1	0
0	0	0	0	1	0	1	0	0
0	0	0	0	3	0	8	0	0
3	4	2	3	0	2	0	0	2
0	2	0	1	0	2	0	2	0
0	0	0	1	1	0	3	0	0
0	0	0	0	2	0	2	0	0
15	0	35	0	0	45	0	44	0
4	0	3	0	0	3	0	2	0
0	0	0	0	2	0	0	0	0
2	1	0	2	0	3	0	0	0
2	0	1	2	0	0	0	0	0
0	1	0	0	2	1	2	0	0
0	0	1	0	1	1	3	0	0
0	0	0	5	11	4	0	16	0
0	0	0	0	3	0	2	0	1
3	4	4	0	0	3	0	0	2
0	0	1	0	3	0	3	0	0
0	0	0	0	9	0	14	0	0
0	0	0	0	0	0	0	0	0

0	0	0	0	0	1	2	0	0
0	0	0	0	4	0	3	0	0
0	1	0	0	3	0	2	0	1
0	0	0	0	4	0	5	0	0
0	0	0	0	7	0	12	6	0
0	0	0	1	2	0	5	0	0

L39	L40	L41	L42	L43	L44	L45	L46	L47
0	12	0	0	15	14	0	22	0
0	0	0	0	7	8	0	11	0
0	0	0	0	0	0	3	0	0
0	2	0	0	5	0	0	4	0
0	0	0	0	0	11	0	13	0
1	0	0	0	1	3	1	0	0
0	0	0	3	0	0	1	0	2
0	11	0	3	0	1	0	1	0

0	22	0	0	0	24	0	0	0
0	0	0	0	0	0	0	0	0
1	0	1	6	0	0	0	2	0
0	2	0	3	0	0	1	0	0
0	0	0	0	0	0	0	0	0
0	1	2	1	0	1	0	0	0
1	0	0	0	0	0	0	2	0
0	0	0	1	0	0	0	1	0
0	0	0	0	0	0	0	14	0
0	0	2	0	0	0	3	0	0
0	0	0	0	0	0	0	0	0
1	0	0	2	0	0	0	1	0
0	0	1	3	0	0	0	1	0
54	46	0	0	0	0	33	45	0
0	3	0	0	0	0	6	7	0
2	0	0	1	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	1	0	3	0	1	0	2	0
2	0	0	1	0	0	1	2	0
0	22	0	0	11	14	0	22	0
0	0	1	1	0	0	0	1	0
0	0	0	0	2	0	5	0	8
1	0	0	3	0	0	0	2	0
0	0	0	0	0	0	4	0	0

0	0	0	1	0	0	0	0	0
0	1	0	0	0	0	0	1	0
0	0	0	4	0	0	0	1	0
1	0	0	0	0	0	0	0	0
0	4	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
2	4	0	0	0	0	0	5	0

L48	L49	L50	L51	L52	L53	L54	L55	L56
0	0	0	11	22	0	0	32	34
0	0	0	5	7	0	0	21	25
6	0	0	0	0	4	5	0	0
5	0	0	0	0	4	6	3	0
0	0	0	9	6	0	0	21	11
2	0	0	0	0	3	0	6	9
0	0	0	3	3	0	3	0	0

13	0	0	0	0	14	0	26	15
0	0	0	0	26	0	0	25	22
0	0	1	0	0	0	0	0	0
0	3	1	0	2	0	0	1	2
0	1	0	0	1	0	0	2	0
0	0	0	0	0	0	0	0	0
0	0	0	0	3	0	0	0	2
2	0	1	0	0	2	0	0	0
0	0	0	0	1	0	0	0	0
0	0	12	0	16	0	0	32	0
5	0	4	0	0	3	3	0	0
0	0	0	0	5	0	0	9	0
0	0	0	0	1	0	0	0	0
0	2	0	0	3	0	0	0	1
32	0	0	27	42	22	21	32	26
4	0	3	4	0	3	0	8	5
0	0	0	0	2	0	0	2	1
2	0	0	0	0	2	4	0	0
0	0	0	0	0	0	0	0	0
1	0	0	1	2	0	0	2	0
0	1	0	0	2	0	0	0	2
0	0	0	0	14	0	0	12	21
0	0	0	0	1	0	0	0	3
2	0	0	3	0	2	0	0	0
0	2	0	0	2	0	0	0	2

0	0	0	0	25	0	0	24	16
0	0	0	0	0	1	0	1	0
0	0	0	0	1	0	0	0	0
0	0	0	0	3	0	0	2	0
0	0	0	0	0	0	0	1	0
0	0	0	0	12	0	0	15	11
0	0	0	0	9	0	0	5	9
0	0	0	0	6	0	0	14	0

L57	L58	L59	L60	L61	L62	L63	L64	L65
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0

0	0	0	0	0	0	2	5	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	2	1	0	2	1	0
0	4	0	2	0	3	1	0	2
0	3	0	2	0	1	0	1	2
0	0	0	1	2	0	0	0	0
0	2	1	0	0	3	0	0	0
0	0	0	0	0	0	0	0	0
2	1	0	2	1	2	0	0	1
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	2	1	2	1	0	0	0	0
0	2	1	2	1	3	0	0	2
0	0	0	24	22	0	0	0	0
0	0	0	0	0	0	0	0	0
3	2	1	1	2	1	0	1	1
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
3	2	1	3	2	1	1	1	1
0	3	2	2	1	2	1	0	0
0	0	0	12	25	0	5	0	0
2	3	1	1	2	3	0	1	2
0	0	0	0	0	0	0	0	0

4	3	5	3	2	4	0	1	2
0	0	0	0	0	0	0	0	0
0	1	0	1	0	2	1	1	0
0	1	0	3	1	1	0	1	0
0	3	2	2	0	0	0	0	3
0	2	1	0	0	0	0	0	2
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	4	0	2	2	0	3	0	2

L66	L67	L68	L69	L70	L71	L72	L73	L74
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0

0	0	0	0	2	3	0	0	0
0	2	1	0	3	2	2	3	2
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
1	2	1	0	1	4	3	2	3
0	3	1	2	1	2	3	1	2
0	0	0	0	0	0	0	0	0
0	2	1	0	3	2	1	2	3
0	0	0	0	0	0	0	0	0
2	0	1	0	2	0	3	0	2
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	2	0	1	0	2
3	2	1	3	4	2	2	2	3
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
2	2	0	1	3	3	1	0	3
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
2	1	0	0	2	0	2	0	2
0	0	0	0	0	0	0	0	1
0	0	0	0	4	2	0	0	0
2	1	2	4	3	2	2	1	2

0	0	0	0	0	0	0	0	0
3	3	2	1	4	2	3	2	4
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	1
0	0	0	0	0	0	0	0	0
0	0	0	2	3	2	2	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	3	3	0	0	0	4

L75	L76	L77	L78	L79	L80	L81	L82	L83
0	0	0	0	21	26	0	32	0
0	0	0	0	19	25	0	22	0
0	0	0	0	0	0	0	0	0
0	0	0	0	11	16	0	0	0

0	0	0	0	15	0	0	0	0
0	0	0	0	0	2	0	0	0
3	1	0	2	4	0	0	0	4
0	0	0	0	21	16	0	0	0
0	0	0	0	36	0	0	0	0
0	0	0	0	0	0	0	0	1
0	2	0	1	0	1	0	0	4
0	0	0	1	0	2	0	0	2
0	0	0	0	0	0	0	0	0
0	2	2	1	0	0	2	3	2
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	2
0	0	0	0	16	7	0	22	0
0	0	0	0	0	0	0	0	0
0	0	0	0	3	2	0	1	0
0	1	2	0	2	1	0	2	0
1	0	2	1	0	3	0	1	2
0	0	0	0	45	42	0	25	0
0	0	0	0	7	5	0	0	0
1	2	0	1	0	1	0	0	2
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	1	0	2	0	2	0	0	1
2	0	1	0	0	3	0	0	2
0	0	0	0	14	25	0	0	0

0	2	1	1	0	2	0	0	3
0	0	0	0	0	0	0	0	0
0	2	1	2	0	2	0	2	1
0	0	0	0	15	12	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	1
3	0	3	4	0	0	3	2	0
2	1	0	2	2	3	0	0	0
0	0	0	0	2	5	0	2	0
0	0	0	0	4	5	0	3	0
0	0	0	0	5	6	0	5	0

L84	L85	L86	L87	L88	L89	90	L91	L92
0	0	0	0	0	0	0	11	0
0	0	0	0	0	0	0	9	0
0	0	0	0	0	0	0	0	0

0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	15	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	14	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	2	0	0	0	2	0	0
0	0	1	0	0	0	2	0	1
0	0	0	0	0	0	0	0	0
0	0	2	0	3	0	3	0	2
0	0	0	0	0	0	0	0	0
0	0	1	0	1	0	3	0	0
0	0	0	0	0	0	0	15	22
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	2	3
0	0	3	0	2	0	3	0	2
0	0	2	0	1	0	2	0	2
0	0	0	0	0	0	0	25	21
0	0	0	0	0	0	0	4	2
0	0	1	0	2	0	3	0	2
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	1	0	0	0	1
0	0	0	0	0	0	0	6	0

0	0	0	0	0	0	0	11	24
0	0	2	0	0	0	3	0	2
0	0	0	0	0	0	0	0	0
0	1	1	0	0	1	5	0	3
0	0	0	0	0	0	0	0	0
0	0	0	0	0	1	0	0	0
0	0	0	0	0	1	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	2	0
0	0	0	0	0	0	0	4	0
0	0	0	0	0	0	0	0	6

L93	L94	L95	L96	L97	L98	L99	L100	L101
25	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0

0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0
0	0	0	2	2	0	2	1	2
0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0
25	0	0	1	0	0	0	0	0
0	0	0	0		0	0	0	0
3	1	1	4	0	0	2		
2	0	0	3	2	3	0	1	2
0	0	0	0	2	4	0	0	0
2	1	2	5	3	2	2	3	1
0	0	0	0	0	0	0	0	0
1	1	0	1	0	2	2	0	2
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
3	0	0	2	0	0	2	1	2
2	3	2	0	3	2	2	3	2
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
3	0	1	2	2	3	2	1	1
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
3	0	0	3	2	2	0	1	0

2	0	0	0	0	0	2	1	2
0	0	0	0	0	0	0	0	0
0	2	1	4	2	3	0	12	2
0	0	0	0	0	0	0	0	0
2	2	1	3	3	4	2	3	1
25	0	0	0	0	0	0	0	0
0	1	0	0	0	1	0	0	0
1	1	0	2	1	2	0	0	0
0	0	0	4	3	2	0	0	0
0	0	0	1	0	0	0	0	0
6	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0

L102	L103	L104	L105	L106	L107	L108	L109	L110
0	0	0	33	0	0	0	34	0

0	0	0	25	0	0	0	24	0
0	0	0	33	0	0	0	35	0
0	0	0	8	0	0	0	5	0
0	0	0	11	0	0	0	9	0
0	2	2	1	2	1	1	2	0
0	0	0	0	0	0	0	0	3
0	0	0	22	0	0	0	25	0
0	0	0	42	0	0	0	34	0
0	0	0	0	0	0	0	0	1
		2	0	0	0	1	1	2
4	0	0	2	0	0	2	3	1
0	0	0	0	0	0	0	0	0
2	1	3	2	4	2	3	2	3
0	0	0	0	0	0	0	0	0
0	1	1	2	1	2	0	2	1
0	0	0	32	0	0	0	26	0
0	0	0	12	0	0	0	14	0
0	0	0	5	0	0	0	9	0
1	1	0	0	0	0	2	3	0
1	3	2	1	0	2	3	2	2
0	0	0	45	0	0	0	36	0
0	0	0	6	0	0	0	0	0
2	1	1	1	2	3	0	2	1
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0

0	1	1	0	2	0	1	2	0
0	1	0	2	1	0	1	2	0
0	0	0	12	0	0	0	21	0
1	3	2	0	1	1	2	2	2
0	0	0	0	0	0	0	0	0
2	3	2	3	1	2	3	2	2
0	0	0	4	0	0	0	6	0
0	0	0	0	0	0	0	1	0
1	0	0	2	0	0	0	0	0
0	2	0	0	0	0	3	2	0
0	2	0	0	0	0	2	3	0
0	0	0	5	0	0	0	6	0
0	0	0	0	0	0	0	4	0
0	0	0	6	0	0	0	5	0

L111	L112	L113	L114	L115	L116	L117	L118	L119

0	0	35	0	46	0	22	0	0
0	0	26	0	25	0	11	0	0
0	0	0	0	0	0	0	0	0
0	0	11	0	6	0	5	0	0
0	0	0	0	0	0	4	0	0
0	3	2	0	3	3	2	2	1
0	0	5	3	6	3	0	2	1
0	0	22	0	19	0	18	0	0
0	0	32	0	16	0	19	0	0
0	1	0	0	0	0	2	0	0
0	3	0	2	0	4	3	0	0
0	1	0	3	0	3	2	0	0
0	0	0	0	0	0	0	0	0
1	2	4	2	5	2	1	2	2
0	0	0	0	0	0	0	0	0
0	1	0	1	1	2	2	0	0
0	0	26	0	19	0	15	0	0
0	0	0	0	0	0	0	0	0
0	0	8	0	6	0	6	0	0
0	0	0	0	0	2	1	0	1
1	1	2	2	3	2	3	1	2
0	0	45	0	38	0	22	0	0
0	0	6	0	4	0	4	0	0
2	1	1	3	1	2	3	1	2
0	0	0	0	0	0	0	0	0

0	0	0	0	0	0	0	0	0
1	1	2	0	2	3	2	0	1
1	0	2	0	1	2	3	0	0
0	0	12	0	16	0	12	0	0
1	2	1	2	3	3	2	1	1
0	0	0	0	0	0	0	0	0
1	2	2	1	3	3	2	1	2
0	0	22	0	0	0	0	0	0
0	1	0	0	1	1	2	0	0
0	0	1	1	0	2	2	0	0
0	0	0	0	0	0	0	3	2
0	0	0	0	0	0	0	2	1
0	0	0	0	0	0	2	0	0
0	0	0	0	0	0	5	0	0
0	0	6	0	4	2	3	0	0

120	L121	L122	L123	L124
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
2	1	2	0	2
2	2	2	2	1
0	0	0	0	0
0	0	0	0	0
0	0	1	0	0
0	1	2	0	0
0	1	2	0	0
0	0	0	0	0
1	3	3	2	2
0	0	0	0	0
1	1	1	1	1
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
1	0	2	1	1
1	3	2	2	3
0	0	0	0	0
0	0	0	0	0
1	2	3	2	1

0	0	0	0	0
0	0	0	0	0
1	2	2	0	0
0	0	0	0	0
0	0	0	0	0
1	3	2	3	2
0	0	0	0	0
3	2	4	2	3
0	0	0	0	0
1	0	0	0	0
0	0	1	0	0
0	0	2	2	2
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0

ملخص

النباتات والتحليل الخضري لمنطقة أريحا

تقع منطقة الدراسة (التي يبلغ مساحتها 22 كيلومتر مربع) في الجزء الجنوبي لمدينة أريحا. يبلغ المعدل الكلى لهطول الأمطار حوالي 200 ملم/سنة, حيث يتركز في أشهر الشتاء. يتراوح معدل درجات الحرارة العليا في الأشهر الباردة 19 درجة مئوية والحارة 38 درجة مئوية, بينما يتراوح معدل درجات الحرارة الدنيا من 7 إلى 22 درجة مئوية.

هدفت الدراسة بحث الوضع الحالي للتنوع الحيوي وذلك بالاعتماد على الجمع العينات ,وصفها, ترتيبها في قائمة, و عمل تحليل (vegetation). وبناء على ذلك تم التعرف على 40 نوع تعود إلى 22 عائلة مختلفة. بينت النتائج أن عائلة Compositeae هي العائلة الشائعة, حيث تشكل 20 % من العائلات الأخرى, كذلك ينتمي لهذه العائلة 8 أصناف. يلي هذه العائلة عائلة Chenopodiaceae التي تشكل 10 % من كل العائلات, والتي ينتمي لها 4 أصناف.

بالاستناد إلى chorotype تنين أن عينات منطقة الدراسة تنقسم إلى 12 صنف. دلت الدراسة أن 8 عينات والتي تشكل 17.5 % تنتمي إلى Mediterranean / Irano-Mediterranean, يليها عينات Mediterranean التي تساوى نوع في نسبة العينات. Turanean chorotype

تصنف العينات حسب life forms إلى 4 أصناف وهى على التوالي Theophytes, Phanerophytes, Hemicryphytes, and Chamaephytes . دلت النتائج إلى أن 42.5 % من العينات تنتمى الى Theophytes يتبعها نوع Phanerophytes مع 17 عينة, التى تشكل 30 % مع 12 عينة. Theophytes هو أعلى نوع وذلك لأنها لا تحتاج إلى متطلبات كبيرة للنمو كذلك أنها تنمو في عدة أنظمة ecological .

استنادا إلى تحليل vegetation تتراوح بين 0.097 و 12.258 نبتة/خط. species density تبين أن كانت أعلى كثافة هي عينة *Malva parviflora* يليها *Calendula palaestina* والتي تتراوح Salvia *dominca* الكثافة فيها إلى 5.52 نبتة/خط, بينما أقل كثافة هي عينة . دلت النتائج أن frequent هو لعينة frequency لهذه العينات يتراوح بين 5.56 إلى 66.13 %. تبين أن أعلى التى تشكل 61.3 % من العينات, بينما *Atriplex halimus* , يليها عينة *Seidlitzia rosmarinus* أكثر من غيرها *Seidlitzia rosmarinus*. يعود وجود عينة *Salvia dominca* أقل عينة كانت هي أقل بسبب أن توزيعها هو على شكل *Salvia dominca* إلى أن توزيعها هو عشوائي, بينما مجموعات.

للعينات تتراوح بين 1.1 إلى 33 نبتة/خط, وأن عينة abundance دلت النتائج إلى أن Malva مع 22 نبتة/خط, بينما أقل عينة *Rostraria perythea* هي أكثر تواجد, يليها عينة *parviflora* أكثر من غيرها إلى أن *Malva parviflora*. يعود وجود عينة *Prosopis juliflora* كانت هي أقل وذلك إلى أن توزيعها هو *Prosopis juliflora* توزيعها هو على شكل مجموعات, بينما عشوائي.