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AL-QUDS UNIVERSITY

DIVERSITY AND SYSTEMATIC STUDY OF WILD MEDICINAL *ALLIUM* SPECIES IN SOME REGIONS OF WEST BANK

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Thesis Approval

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Master thesis submitted and accepted, Date: ____/____/ 2008

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3- External Examiner: Dr. Raed Alkowni… ..Signature:_____

Jerusalem –Palestine

1429/ 2008

Dedication

To my husband "*Amin*", my children's *"Yasmeen and Mohammad"* who endured the pain and stress of household chores to make my study successful. I am equally grateful to my parents and my family who always inspired and encouraged me to pursue the higher education.

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

Nareman Odeh Abu Al-soud

Date: 8th of June 2008

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I wish to thank the MOA and UNDP for providing me this generous scholarship. Without which, it would have been impossible for me to pursue this kind of study in Al-Quds University. It is gratefully acknowledge. Also, I would like to thank my colleagues in MOA for helping me in field works.

Abstract

In the Palestinian context, there's no in depth studies deal with this field except the Palestina Flora. This study was published in 1984, and tackled almost all wild plants species in the historic Palestine.

The present study was carried out in four agro-ecological zones in the West Bank, an in-depth field survey was carried out in the semi-coastal lands, high central lands, eastern slope and arid areas, between March 2007 to July of the same year. The study's objective is to seek the wild *Allium* species and to study the detecting species in terms of their diversity, abundances, and morphological features.

The main findings of this study were as follows; ten wild *Allium* species were detected in the different agro-ecological zones in the West Bank. The detected species are: *A. ampeloprasum, A. phanerantherum, A. hierochuntinum, A. paniculatum, A. pallens, A. desertorum, A. stamineum, A. neapolitanum, A. negevense* and *A. schubertii*.

Also, the study findings revealed and stressed on the differences among wild *Allium* species in terms of abundances in the studied areas. For instance, *A. ampeloprasum* and *A. stamineum* were the most dominant species in the studied areas while *A. negevense and A. schubertii* were the less dominant species comparing to the others found species. Furthermore, 95 specimens of different *Allium* species were collected, dried, poisoned, and mounted at the Life Science's Laboratory in An- Najah National University. A special taxonomy key was set up for the detected wild *Allium* species as well.

Finally, the study areas are rich in the wild *Allium* species as they are available, diversified and dominantly existing in the West Bank areas. However, the wild *Allium* species need more in-depth researches, investigations and studies, as to be conserved, developed and managed in a sustainable manner as a promising and vulnerable sub-sector.

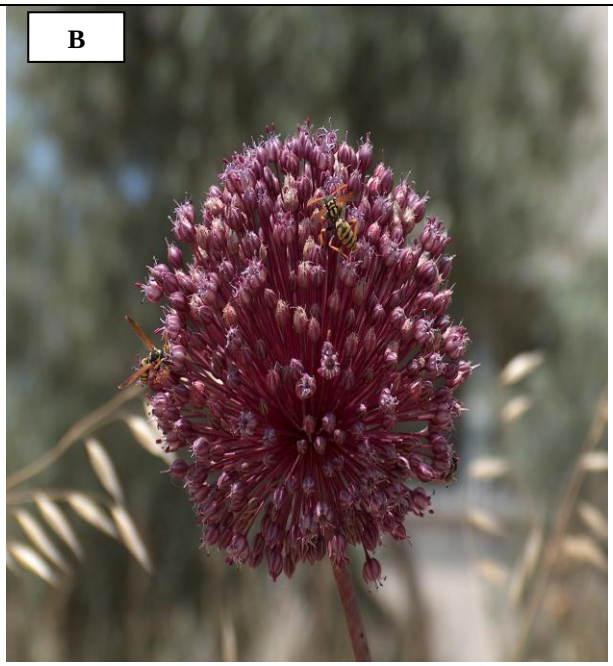
List of Abbreviations

PNA	Palestinian National Authority
MOA	Ministry of Agriculture
WB	West Bank
GS	Gaza Strip
cm	Centimeter
mm	millimeter
MAPs	Medicinal and Aromatic Plants
a.s.l.	Above sea level
b.s.l.	Below sea level

3. Plates:

A list of selected images of the detected wild *Allium* Species

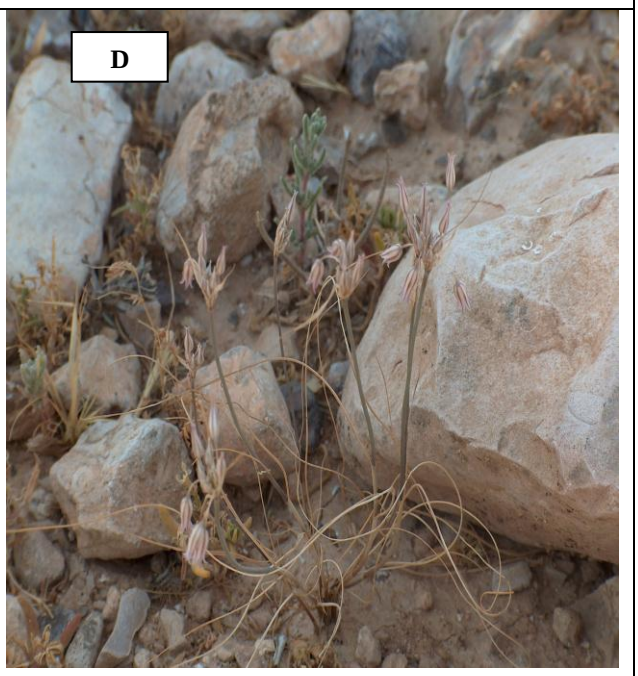
Allium ampeloprasum



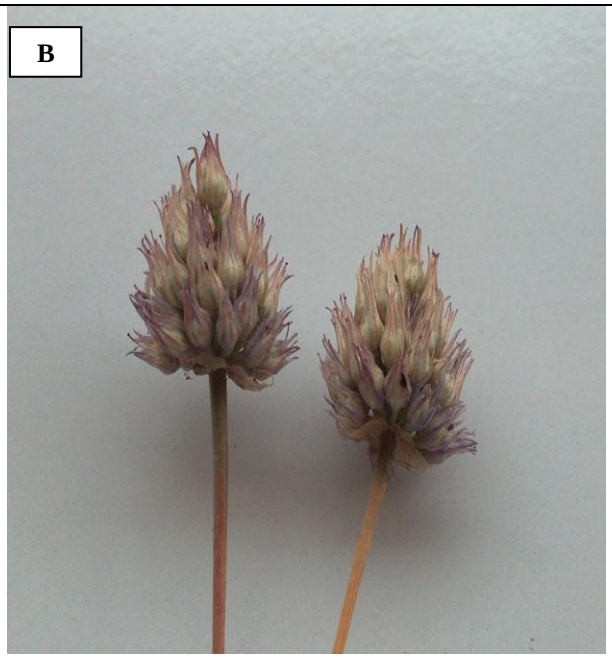
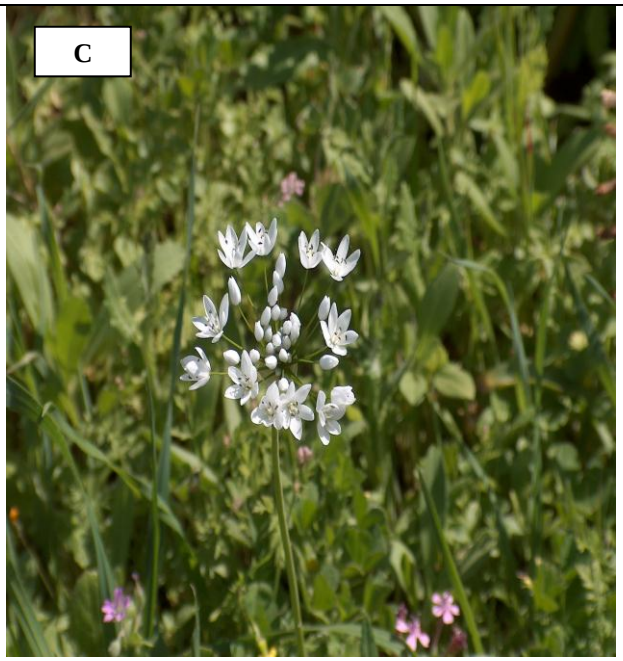
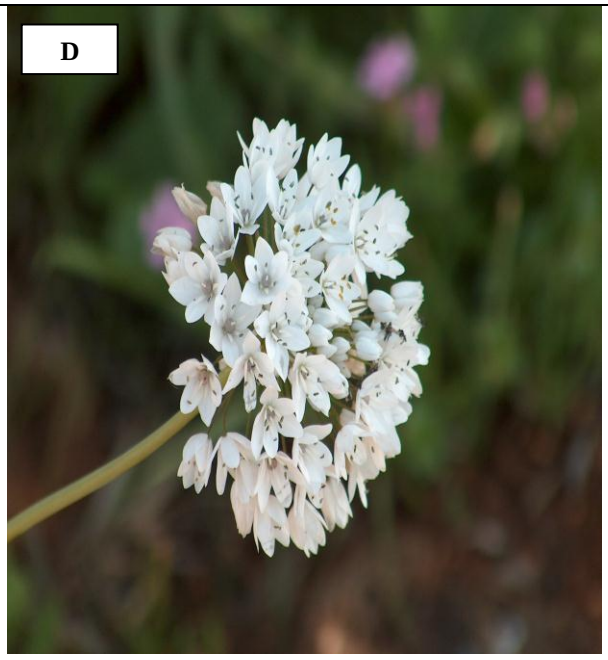
Allium ampeloprasum

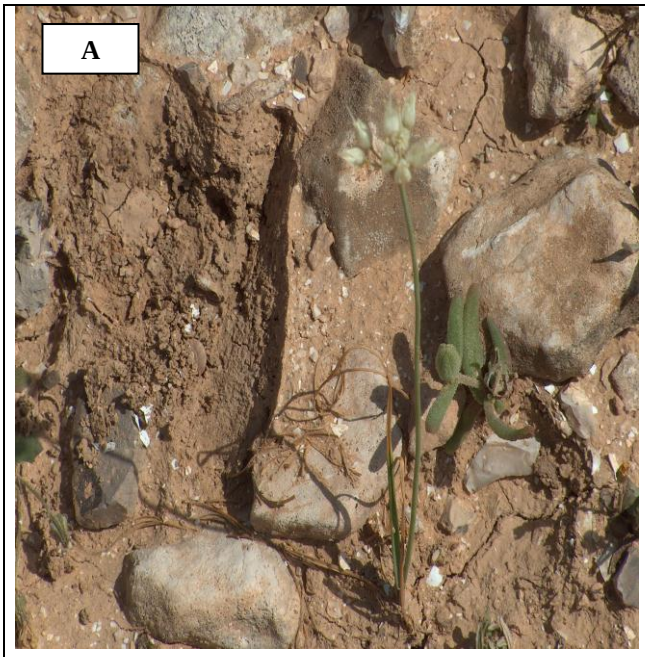
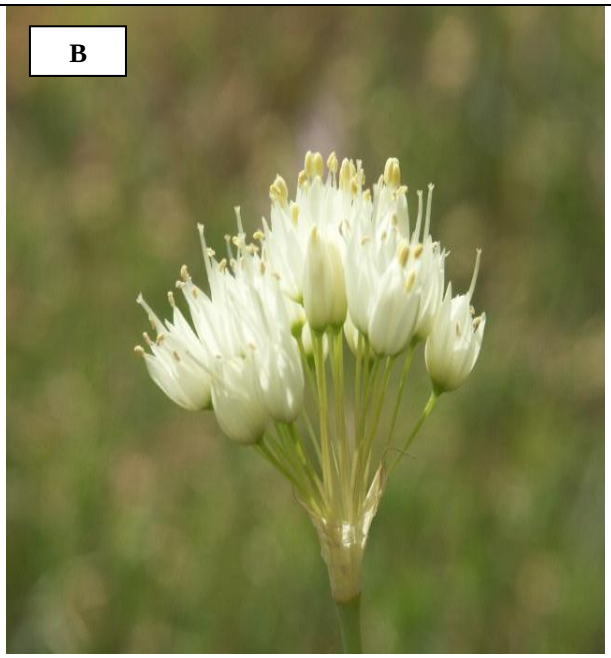
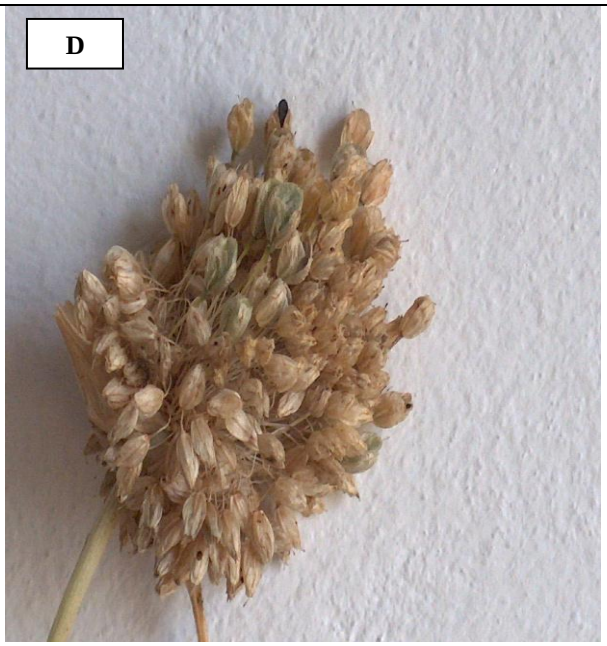
Allium dedertorum

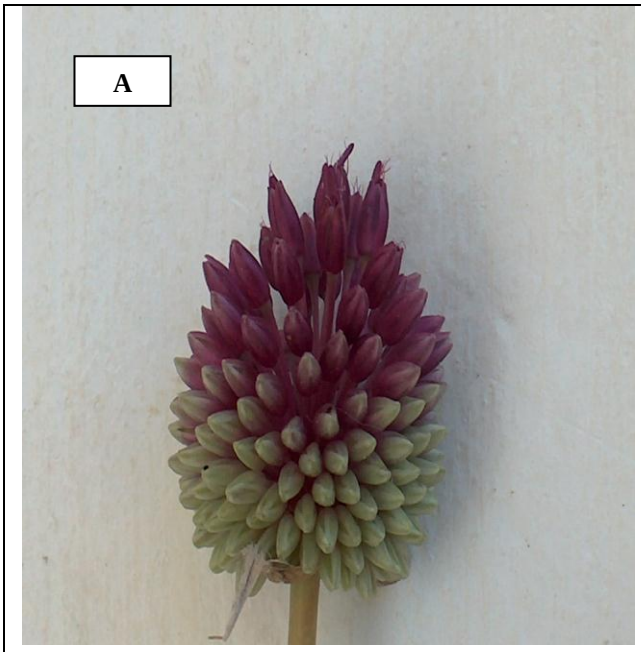
Plate 1



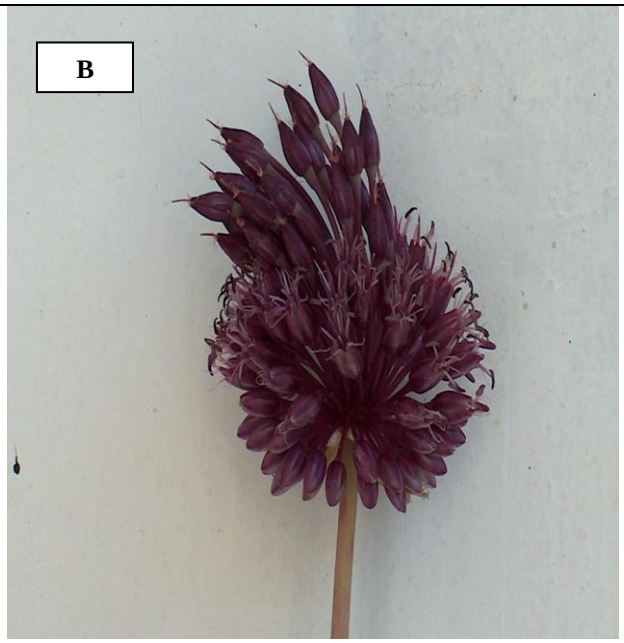
Allium desertorum

		
Allium hierochuntinum		*Allium hierochuntinum*
		
Allium neapolitanum	**Plate 2**	*Allium neapolitanum*

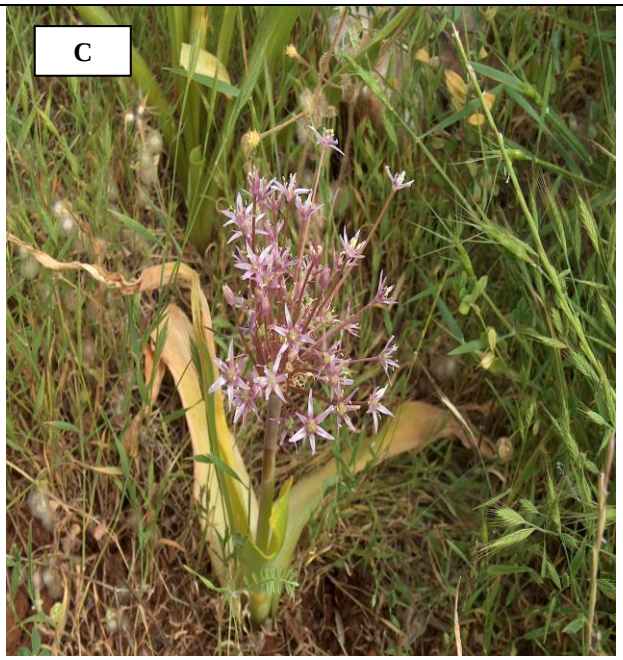
		
Allium negevense		*Allium negevense*
		
Allium pallens	**Plate 3**	*Allium pallens*



Allium phanerantherum

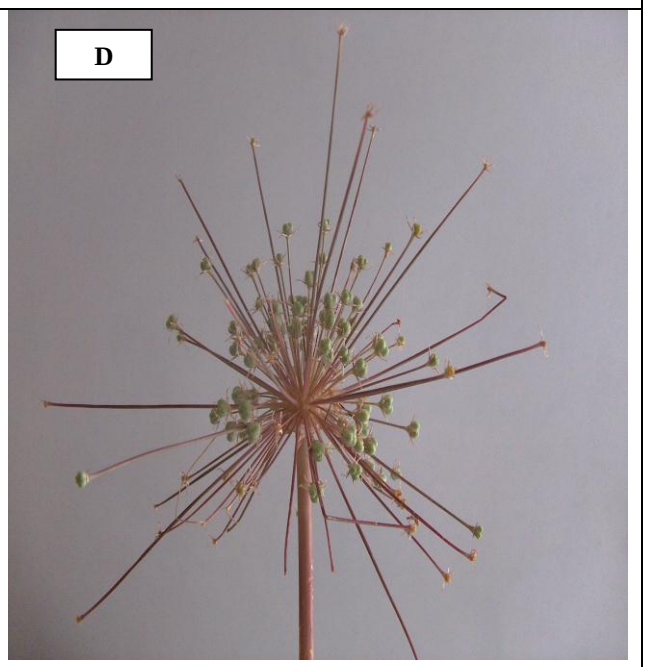


Allium phanerantherum

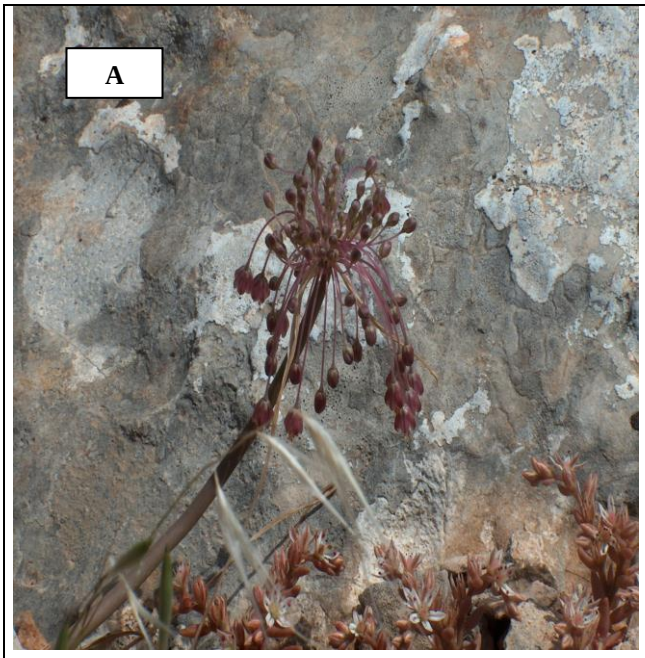


Allium schubertii

Plate 4



Allium schubertii

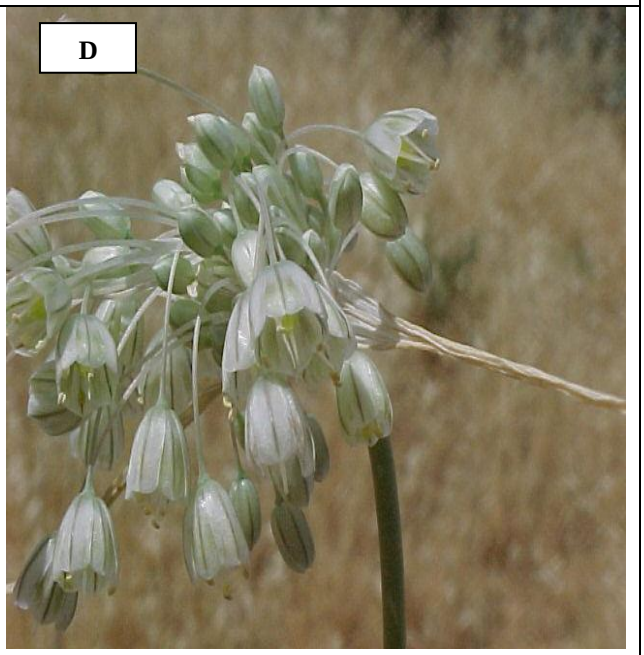


Allium stamineum

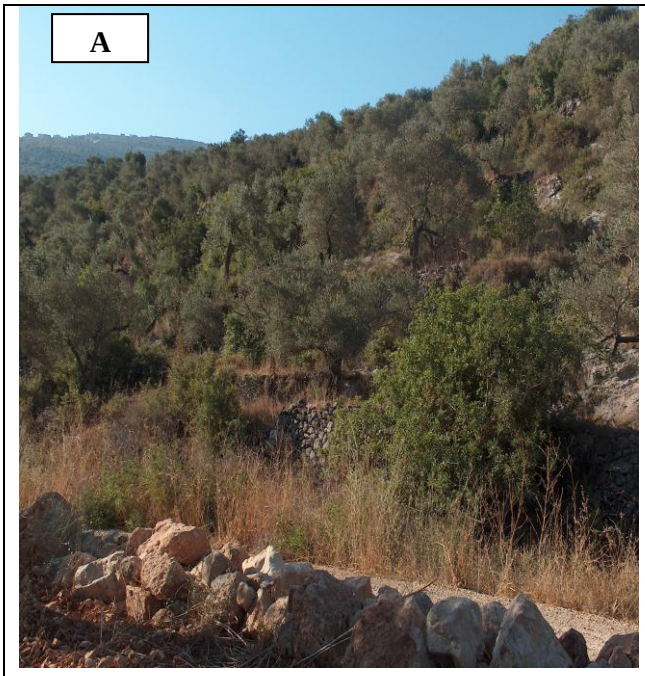
Allium stamineum

Alliujm paniculatum

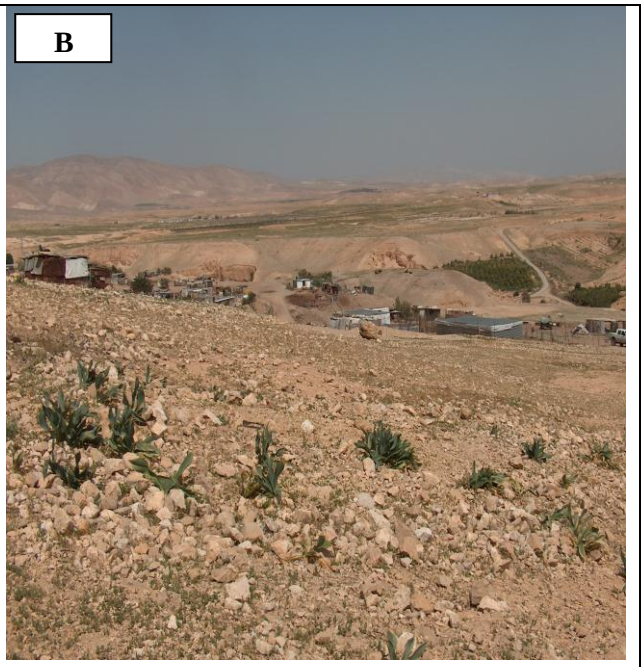
Plate 5



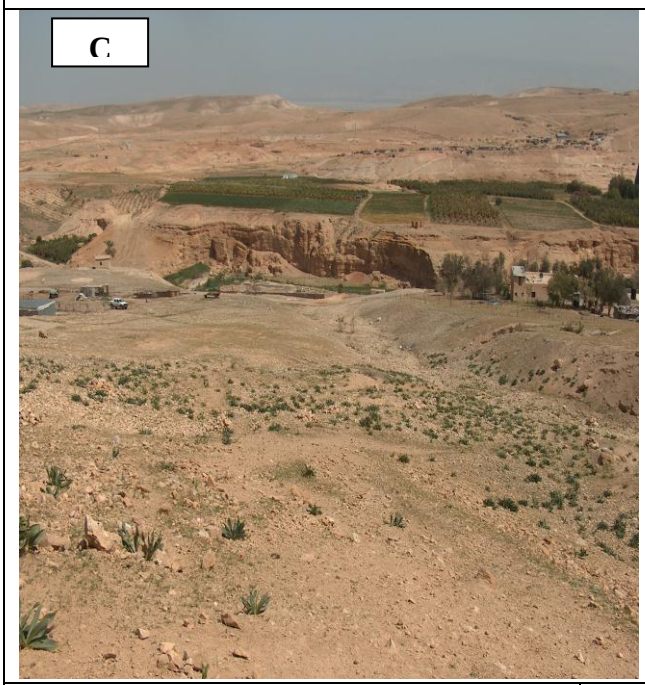
Allium paniculatum



Natural habitats of *Allium- Salfit*

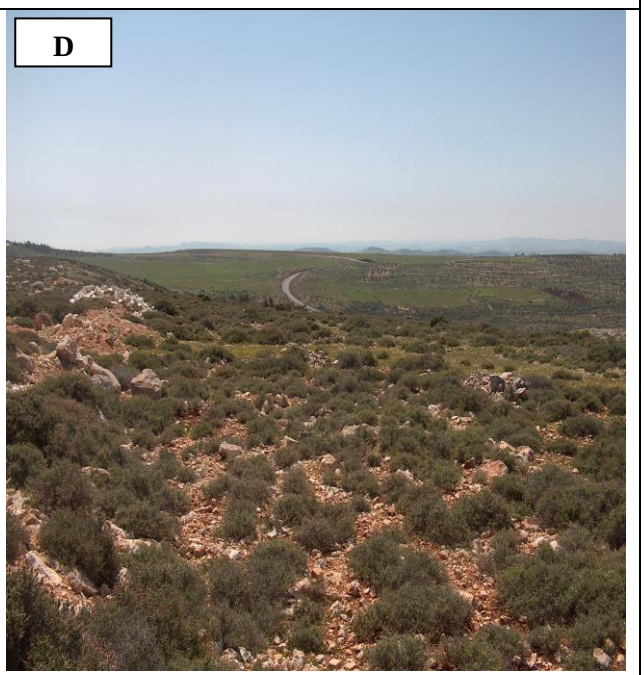


Natural habitats of *Allium- Al-nuameh*



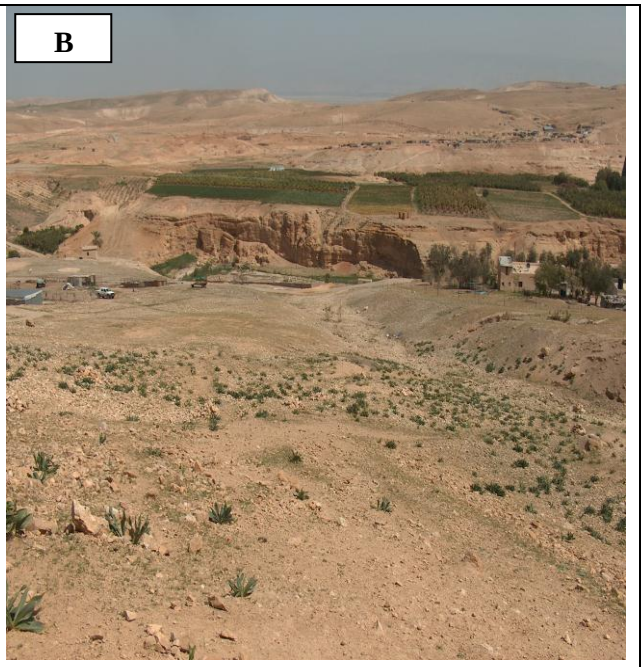
Natural habitats of *Allium- Al-Auja*

Plate 6

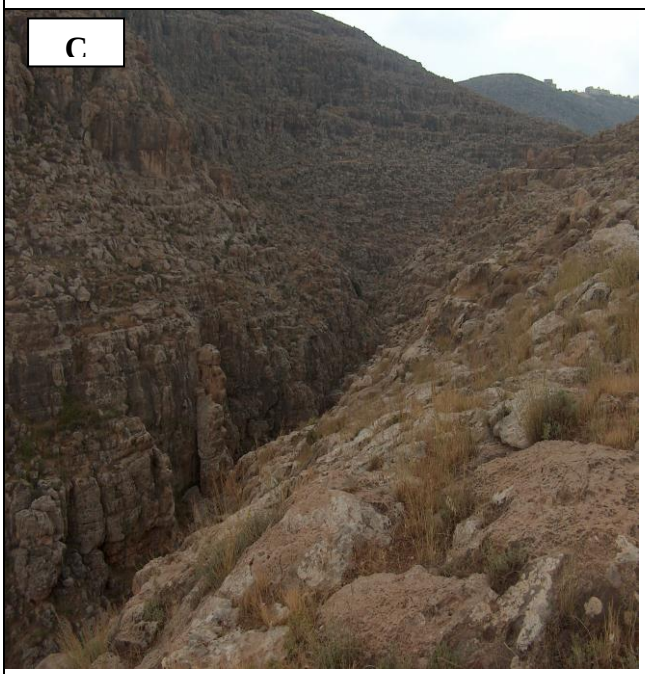


Natural habitats- *High Central Lands*

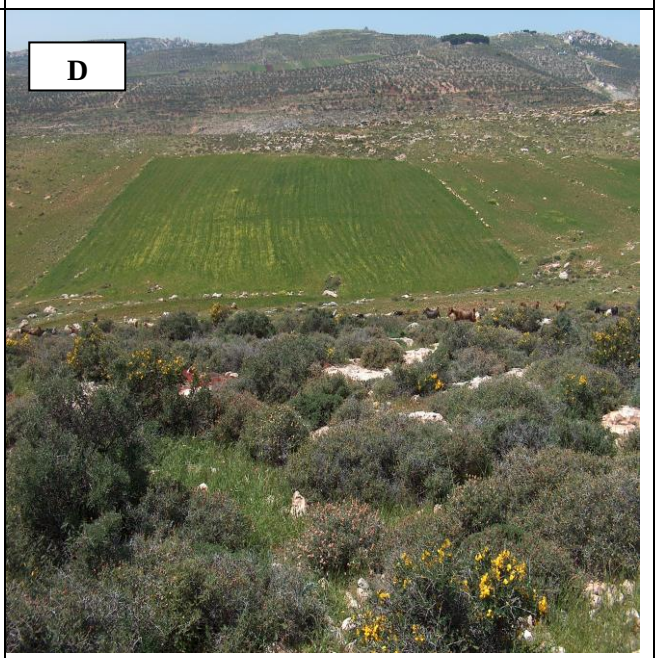
Natural habitats of *Allium-Azmout Plain*



Natural habitats of *Allium- Jericho*



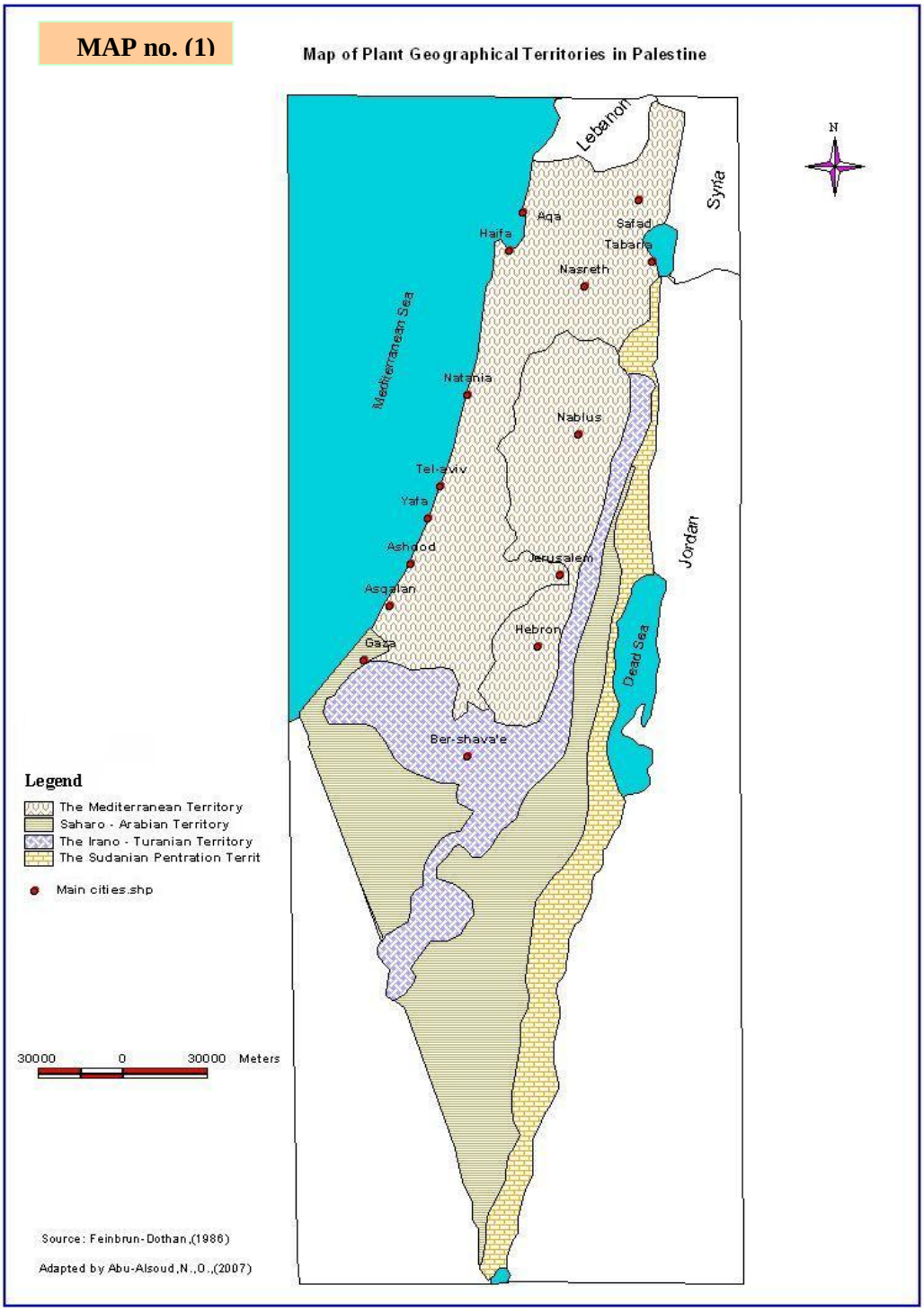
Natural habitats of *Allium- Eastern slope*



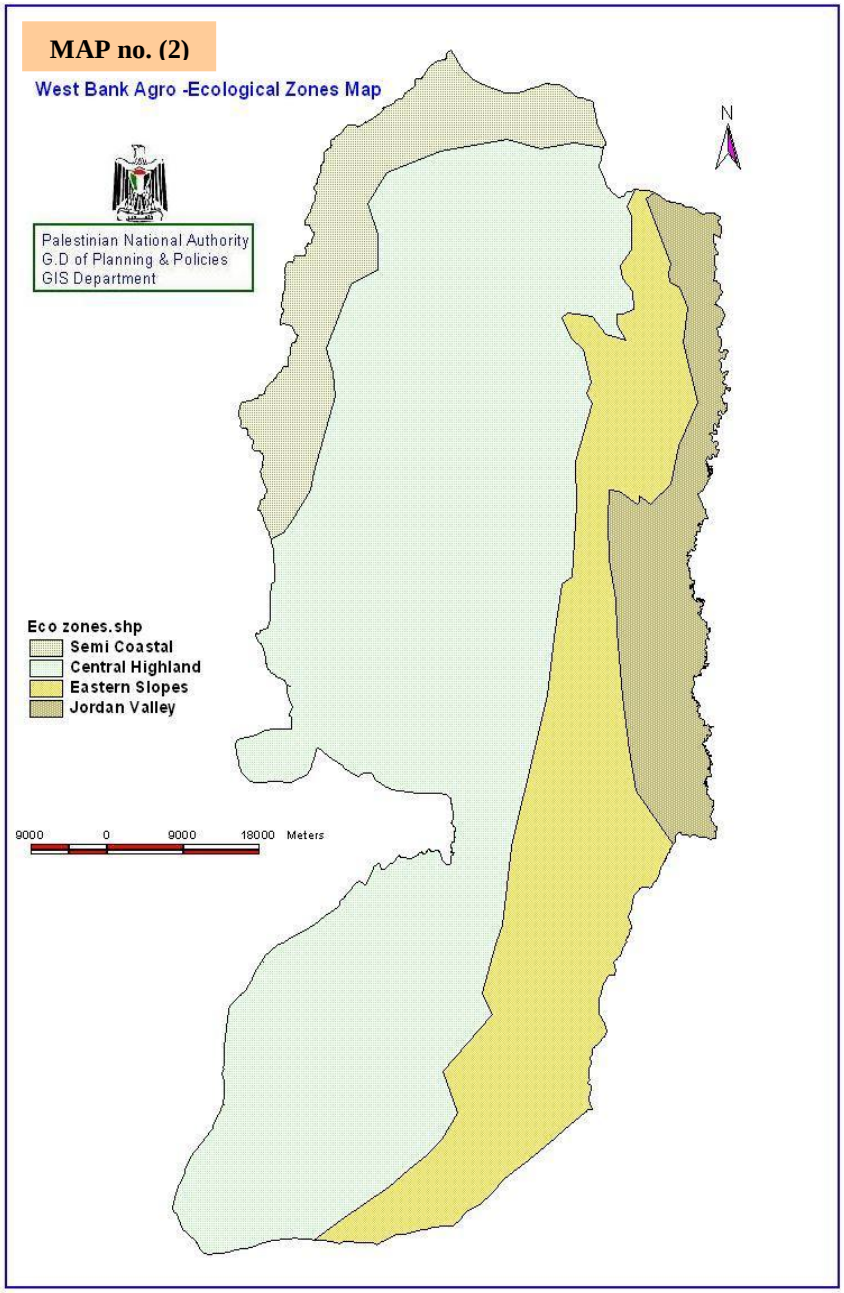
High Central Mountains- Ramallah

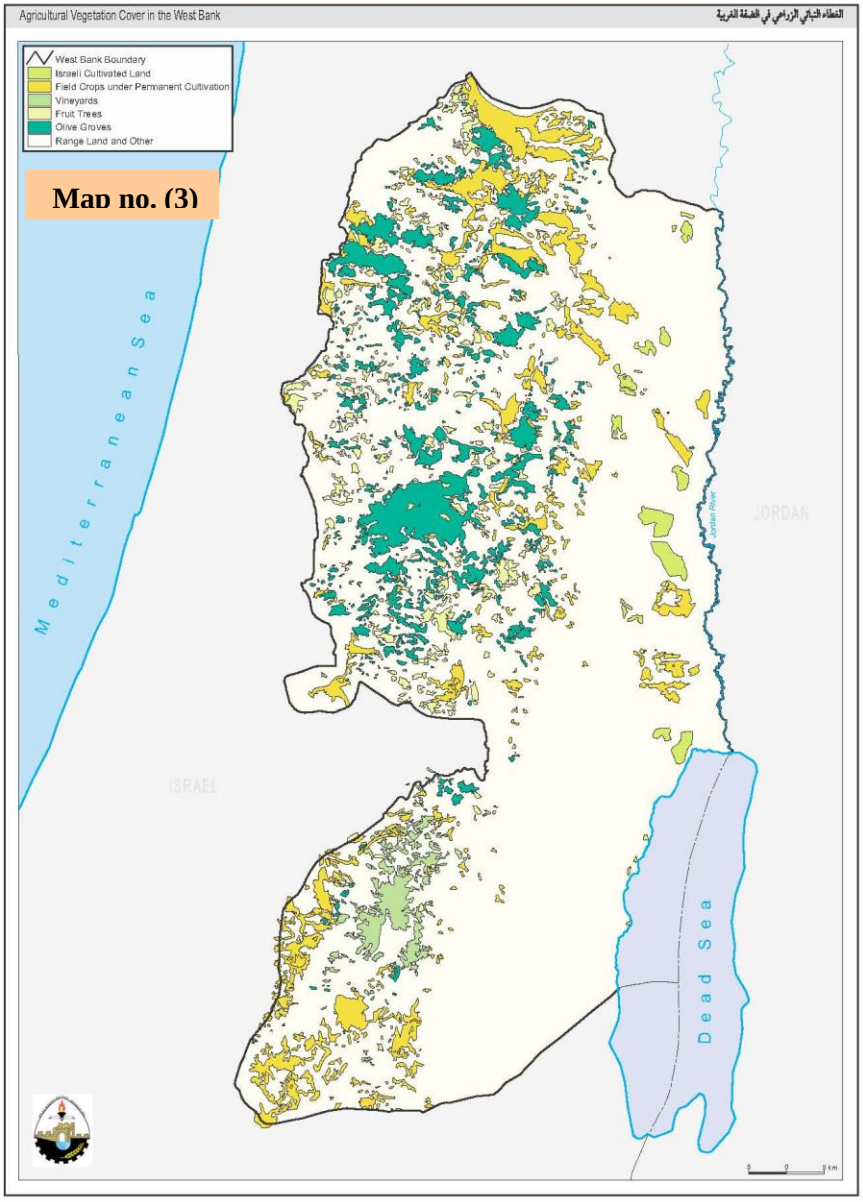
Plate 7

4. List of Geographical Maps:



MAP no. (2)


West Bank Agro -Ecological Zones Map
N
Palestinian National Authority
G.D of Planning & Policies
GIS Department
Eco zones.shp
Semi Coastal
Central Highland
Eastern Slopes
Jordan Valley
9000 0 9000 18000 Meters



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الملخص

يعتبر جنس البصل (*Allium*) من أكثر الأجناس النباتية الزهرية عدداً في العالم. لا يوجد حتى الآن دراسات معمقة حول جنس البصل في فلسطين باستثناء دراسة (*Palestina flora*)، نشرت عام 1984 حيث تناولت معظم النباتات البرية في فلسطين.

أما الدراسة الحالية فقد أجريت في أربع مناطق مناخية مختلفة من الضفة الغربية في فلسطين وهي التالي: المنطقة شبه الساحلية ومنطقة الجبال الوسطى ومنطقة السفوح الشرقية والمنطقة الجافة. ولتحقيق غايات الدراسة الحالية فقد اجري مسح ميداني منظم استهدف كافة أجناس البصل البري المختلفة في موطنها الأصلي، حيث تم إجراء المسح المذكور خلال الفترة الممتدة من آذار إلى تموز من عام 2007. والهدف الأساسي من هذه الدراسة هو البحث عن أجناس البصل البرية من حيث التنوع والتوزيع ودراسة الشكل الخارجي للعينات المجموعة من اجل التمكن فيما بعد من إعداد مفتاحاً تصنيفاً خاصاً بأجناس البصل المختلفة. ومن أهم نتائج الدراسة المتحققة هو العثور على نحو (10 أنواع من جنس البصل البري) يمكن إجمالها كالتالي:

A. ampeloprasum, A. phanerantherum, A. hierochuntinum, A. paniculatum, A. pallens, A. desertorum, A. stamineum, A. neapolitanum, A. negevense, A. schubertii.

ومن نتائج الدراسة الأخرى هو تحديد فروقاً جوهرية في تواجد ووفرة أنواع البصل البري المختلفة حيث كان على سبيل المثال: نوع *A. ampeloprasum* و *A. stamineum* من أكثر الأنواع تواجداً. بينما نوعا البصل الـ *A. negevense, A. schubertii.* أقلها تواجداً. ومن جهة أخرى، تم جمع وتجفيف وتسميم وحفظ وإعداد مفتاح لـ (95 عينة) من عينات البصل البري المجموعة وهي الآن موجودة لدى مختبرات كلية العلوم الحياتية في جامعة النجاح الوطنية في نابلس.

وأخيراً تعتبر مناطق الدراسة غنية بأصناف البصل البري المختلفة، ولكنها تحتاج إلى مزيد من التحقق والدراسة والأبحاث العلمية المتخصصة، وذلك من اجل القدرة على المحافظة عليها، وإدارتها بطريقة مستدامة كقطاع مستقبلي واعد.

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CHAPTER ONE

1. Introduction:

Palestine is located at a bio geographic cross roads between the European, Asian and African continents, the Mediterranean and Red seas and a number of botanical zones. These facts give Palestine a historic centre of crop diversity and a high biodiversity value. As well as center for wild plant biodiversity, *(Arij, 2006).*

Bulbous plants which produce leaves and flowers during winter and spring and survive the unfavorable summer conditions, favor the climate of Mediterranean, which is characterized by a hot, arid summers and moist, cool winters, (Polluin and Huxley, 1967).

The genus *Allium* is one of the largest in the world flora, about seven hundred *Allium* species can be found in the northern hemisphere. This genus in the past belonged to Lily family (Liliaceae), but now with the advances in systematic research it belongs to Alliaceae family. (Fragman-Sapir, 1985). The most widely used of *Allium* are: onion (*Allium cepa*), garlic (*Allium sativum*), leeks (*Allium porrum*), chives (*Allium schoenoprasum*), and shallots (*Allium ascalonicum*), (Sengputa *et al*. 2004).

Allium was a name used by the Romans for garlic, (Wendelbo and Stuart, 1985). Most of *Allium* species are tall plants, umbrella like inflorescence and all of the flower stalks emerge from one point. The bulbs are common in all *Allium* species, which is the storage organ for nutrients and water, and the reproductive organ, enable the plant to survive during drought years and to bloom in different seasons, (Fragman-Sapir, 1985).

Different *Allium* species have been used as medicine since ancient times. Regular consumption of some *Allium*s has several beneficial health effects. Studies have shown that higher intake of *Allium* products reduce the risks of several kinds of cancers. Organosulfur compounds and other compounds present in *Allium* are considered to be responsible for the beneficial effects of *Allium*, In general different *Allium* species are usually used against headache, cold, and stomachache, lungs problems, which are mostly applied as fresh or after boiling. (Sengputa *et al*. 2004).

This research was carefully chosen after several consultation meetings undertaken with local key specialized persons from different institutions, universities and research studies Moreover a special trip to Jordan was made in order to explore and capitalize on the Jordanian experience and to collect all information, studies, reports, existing in Jordanian Universities, Research Centers, Governmental Organizations concerning with *Allium* species and their opinions on meaningful research topics.

The search for data and the research trip to Jordan revealed that there is a serious lack of information (studies, reports, and research) concerning *Allium* species as an important wild species in Palestine by Palestinian experts. Also, there is no sufficient or up-to-dated

information concerning *Allium* species in the West Bank regions. Also Palestinian relevant institutions are in serious shortage of qualified staff who, can actually deal with this important area of research and/or contribute effectively in developing this promised sub-sector.

This research is necessary to improve the Palestinian key stakeholders' knowledge of how many wild *Allium* species we have in our ecosystem and how they interact and distribute on different agro-ecological zones. Without this research no approaches could be developed for monitoring and forecasting human and environmental impacts on Palestinian ecosystem, including *Allium* species, which is the core of current and future sustainability initiatives.

Plant species in W.B. are becoming increasingly rare, due to ongoing destruction and fragmentation of their natural habitat caused mainly by over-exploitation of wild species, and the detrimental climatic and environmental changes. Habitat destruction comes from a broad range of sources. This include unplanned urban expansion, overgrazing, and over-exploitation; deforestation, and unplanned forestry activities; destruction and drought, invasive alien species, pollution and contamination.

This is in addition to the political conditions, including the division of Palestinian accessible areas, land confiscation, and the Israeli settlements and the building of the Separation Wall. Such factors have been causing huge changes in plant and animal species composition, distribution, and density, and thus the loss of such valuable heritage.

This research intends bridge an important gap in the area of wild species in terms of existing species, their distribution on different ecosystem, and classification. This type of research is vital not only in supporting the Palestinian initiatives undertaken in conservation, utilization and sustainable uses of wild species (of which *Allium* species), but also in paving the way for other potentially significant research on Alliums.

Different objectives were posed as to be substantially answered by this study, the first one deals with the existence of different wild *Allium* species in W.B.. The second one is what are the differences in existing *Allium* species in the different studied regions?

Two main assumptions were made for the purpose of this study; the first is the agro-ecological zones have to some extend different impacts on *Allium* species distribution and abundances. The second one is the central high lands is richer in biodiversity than other regions.

In regard of the study structures, it consists of six main chapters in addition to the annexes, tables, maps and pictures which are attached at the last part. The first chapter deals with the study introduction including a brief presentation on the study background, objectives, justifications, assumptions, and the study main parts. The second chapter covers Literature reviews that have been made related mainly to *Allium* species.

The third chapter tackles the materials and methods (sites visits, collecting specimens, pressing, poisoning and mounting specimens). The fifth chapter focuses on the main results of

the study including discussions of the study results and the conclusions. The last chapter is going to high lights the study main conclusions and recommendations.

2. Research Statement:

The importance of this study stems from the serious short of information and references in regard of *Allium* Species in W.B.. Moreover, the absence of Palestinian experience in *Allium* taxonomy. However, *Allium* species in Palestine had been addressed by *Palestina Flora* in 1984 as well as other few scientific studies conducted in the past, which provided general description on *Allium* species and their habitats. By doing so, we will be able to count on our own efforts and scientific resources in future endeavor.

Allium species are considered to be particularly difficult to define and classify. This is due to the minor morphological differences among *Allium* species and different sections. (Omar, 2006).

Therefore, special attention, in the Palestinian context, much be given to this field by carrying out high scientific researches, in-depth studies. Besides, train qualified researches in this field.

This study would contribute in conserving medicinal plants resources with special emphasis on *Allium* species. That would be attained by identifying and studying existing species, their geographical distribution, available species, status, and obstacles.

Literature indicates that wild *Allium* species are not only important from the medicinal points of view but also economically, as they used as edible, medicinal, fodder, etc. In spite of such high economic value, there is hardly any document available, which contains comprehensive information on the diversity, distribution, habitat preference, nativity, endemism, status and taxonomy of the species of *Allium* in the west bank. The following question is the core study that is going to be answered:

What is the current status of the Palestinian medicinal *Allium* species in W. B., availability, geographical distribution and taxonomy?

3. Objectives:

This research is a biodiversity and systematic study of *Allium species* existing in the W.B.. This study is therefore, aimed at studying the current status of the Palestinian medicinal *Allium* species in the W. B.. in their different agro-ecological zones, in terms of the available medicinal wild *Allium* species, their geographical distribution, abundance and taxonomy. Also, the study aims at documenting the survey findings and serves as a dependable scientific reference in this field for further in-depth researches.

4. Target species:

All wild *Allium* species prevailing in the defined target area are considered as target species.

5. Target area

According to what mentioned above, the target area of the present systematic and ecological study is defined, (map no. 3) according to different geographical and ecological locations available in the W. B. as follows:

- **Semi coastal region:** Qalqilia and it's around.
- **Central high mountains:** Salfit and Nablus districts.
- **Eastern slope region:** Eastern parts of Ramallah.
- **Arid region:** Jericho district and it's around.

6. Description of Study Area:

West Bank is located to the East of Mediterranean Sea between 29° and 33° North Latitude and between 350° and 390° Longitude. The total land area is estimated at 5.88 million dunums. The climate of W.B. is Mediterranean, with a long, hot, dry summer and a rainy winter and a drier-than-spring autumn season. Accordingly, the climate of the W.B. is classified as an eastern Mediterranean climate. The temperature increases towards the south and towards the east, with rainfall ranging from 100 to 600 mm annually, depending on the location. (Palestinian Agriculture Matrix, 1999)

Both Land and water are natural resources in W.B. which determine the feasibility of agriculture. Four agro-ecological zones determined by location, rainfall and altitude can be distinguished in W. B. are shown in Table (1).

Table (1): Agro-ecological Zones of W.B. (ESCWA and FAO, 1994)

Location	Area ('000 dunums)
Central Highlands	3,500
Semi Coastal Region	400
Eastern Slopes	1,500
Jordan Valley	400
Sub-total West Bank	5,800

The general features of the study area, the West bank four agro-ecological regions, could be briefly described as follows:

The Central Highlands Zone: This area extends from Jenin in the north to Hebron in the south. It is mountainous rising up to 1000 m above sea level. It is mostly hilly and rocky, and soils are often shallow. The average annual rainfall is about 400 mm. (Palestinian Agriculture Matrix, 1999)

The Semi-coastal Zone: It is a narrow strip contains parts of Jenin, Tulkarem and Qalqilia districts with altitudes of 100 to 300 m above sea level. The average annual rainfall is 600 mm. Much of the soils is heavy alluvial and consists of silt and loam derived from a variety of parent materials. (Palestinian Agriculture Matrix, 1999)

The Eastern Slopes Zone: this zone is transitional zone between the Central Highland and the desert areas of the Jordan Valley. It extends from the eastern parts of Jenin district to the Dead Sea in the south. This zone is a semi arid climate because of the lack in rain fall; which is less than 300mm. The total area of this zone is approximately 1,500,000 dunums, elevation ranges from 800 m above sea level to approximately 150 m above sea level. (Palestinian Agriculture Matrix, 1999)

The Jordan Valley Zone: it is a narrow strip between the Eastern Slopes and the Jordan River, it is about 70 Km long and locate 400 m below sea level. The annual rainfall is lower than 200 mm, winter is mild and summer is hot. This zone is the most important irrigated area in the W. B. due to the availability of ground water resources in forms of springs and ground water wells. Hot summer and warm winter characterize this climate zone, (Palestinian agriculture matrix, 1999)

7. Hypothesis:

The first hypothesis: Wild *Allium* species are, to some extent, differently available in the four different agro -ecological zones of the W. B..
The second Hypothesis: there is a correlation between the existing wild *Allium* species and their habitats due to the impact of the prevailing climatological and environmental conditions.

The Third Hypothesis: the high central land in the W. B. is richer than other areas in terms of existing *Allium* species, diversity and their abundances.

The forth hypothesis: The expected number of wild *Allium* species which is expected to be found is much less than the existing number of wild *Allium* species in the whole area and regions of historic Palestine, since the northern and southern regions of the later were not surveyed.

8. Research Limitations:

Time: the present research was conducted within the vegetative and flowering seasons of wild *Allium* species, as of the March 2007 and July of the same year. That, in its turn, would allow collecting fresh samples according to the research objectives (i.e. whole plants, leaves, bulbs, flowers).

Location: Some locations in the fourth agroecological zones of the West bank are not being able to reach due to the Israeli imposed restrictions and measures (i.e., areas around Israeli settlements, closed military areas, by-pass roads).Also some times the wild pigs were the main obstacle from reaching a site.

Species: All Wild *Allium* species prevailing in the defined study area were targeted and given more attention and focus during the field survey.

CHAPTER TWO

2. Theoretical background

2.1. Literature Reviews:

The first scientist who recognized, described and named the genus ***Allium*** is Linnaeus, He recorded 30 species in his book *Species Plantarum*,(Linnaeus, 1757).

Bossier in his Flora Orientalis, described 139 species of ***Allium***,(Bossier, 1881).

Post in his "*Flora of Syria, Palestine and Sinai*" cited 48 species of ***Allium***, the common species between Jordan Syria Palestine and Sinai were also identified according to Post in the aforesaid study. Out of which 9 species were recorded in this study, (Post, 1933).

Mouterde in his book, "Nouvelle Flore Liban et de la Syria", described morphologically three species of *Allium* in Lebanon and Syria. Those were *A. birkinshawi*, *A. myrianthum* and *A. asclepiatum*, (Mouterde, 1966).

Allium ampeloprasum received a great biosystematics attention to solve the difficulties in its classification and the wide variations in its morphological structures, (Bothmer, 1974).

Tackhlom according to her book "Students Flora of Egypt" provided full description of the genus *Allium*. Moreover, she recognized 24 species and provided a key for their identification and short morphological characterization for each species, (Tackhlom, 1974).

The first attention for the genus ***Allium*** in Jordan was by Al-Eisawi. He recorded 22 species of ***Allium*** in the list of Jordan Vascular Plants, (Al-Eisawi, 1982).
Kollmann in "Flora of Turkey" performed a full description of the genus ***Allium*** through this study 141 specimens were recorded. Detailed description and a key to both ***Allium*** section and ***Allium*** specimens were associated. Moreover, synopsis of sections and species were introduced,(Kollmann, 1984).

Meikle in his book "Flora of Cyprus" described the genus ***Allium***. He provided a key of a 19 species, followed by a morphological characterization of the recorded species, (Meikle, 1985).

Wendelbo and Stuart revised the genus ***Allium*** in "Flora of Iraq" recognized 39 species. They constructed a detailed key for the recorded species in Iraq. Additionally, they provided a full description of the genus and each species. (Wendelbo and Stuart,1985).

Fragman-Sapir in an article about "Wild ***Allium*** species in Israel" introduced a short description of the genus ***Allium*** and illustrated some of the wild species associated with a brief description of each. He concluded that no less than 39 different wild ***Allium*** species grow in and around Israel, (Fragman-Sapir, 1985).

Feinburn-Dothan in "Flora Palestina" described and introduced a key for 29 species of the genus ***Allium***. This work was based on fresh and herbarium specimens. This study included a full description and citation of the recorded species in Palestine, (Feinbrun-Dothan, 1986).

Several years later, Feinbrun-Dothan and Danin described in their book "Analytical Flora of Eretz-Israel" the genus ***Allium***. They indicated in their study the presence of 39 species in Palestine. A key associated with summarized description of the recorded species were introduced, (Feinburn-Dothan and Danin, 1991).

Mathew in the "Royal Botanic Gardens" made a review of *Allium* section. His work included the description of the 114 species in this section considering the economically important garlic and leek, as well as their wild relatives. He constructed a key to the species. Moreover, names and synonyms were introduced, (Mathew, 1996)

Brullo *et al*. introduced *A. daninianum* as new ***Allium*** species to science, including description and illustration. They pointed out in their study that it has been mingled with *A. stamineum*, (Brullo *et al*, 1996).

Brullo *et al*. introduced A. oporinanthum as a new species from the NW Mediterranean area, (Brullo *et al*, 1997).

Al-Eisawi in his book "Field Guide to Wild Flowers of Jordan and Neighboring countries" recorded eight species of ***Allium*** in Jordan, which are: *A. neapolitanum, A. orientale, A. erdelii, A. rothii, A. truncatum, A. aschersonianum, A. stamineum* and *A. schubertii*. He provided a morphological description and geographical distribution of the recorded species. Moreover, his book included colored photographs of the eight species in their own wild habitat (Al-Eisawi, 1998).

Morphological study of the genus ***Allium*** in Saudi Arabia was carried out by Chaudhary. This study was part of the Flora of the Kingdom of Saudi Arabia". He recognized the presence of 12 species of the genus ***Allium***. A key for the recognized species as well as morphological description were provided, (Chaudhary, 2001)

In Jordan a research was conducted on ***Allium*** species by Omar G., She studied existing ***Allium*** species in different Jordanian locations. Their distributions, taxonomy, leaf anatomy, leaf surface, pollen grains, chromosome counts and molecular analysis were studied. A new species to science was introduced through this study which is *A. naqabense*; also 6 new records were added to Jordan Flora these records are *A. papillare, A. carmeli, A. decainse, A. albotanicatum, A. scorodoprasum,* and *A. callidictyon.* (Omar, 2006)

2.2. Allium Medicinal Usage:

The most important *Allium* species used economically are onion and garlic; they are wild wide used as spices, vegetables and as medicinal plants. They play a very important role in the daily diet. In Asia they can be seen in every home garden. This is true for the Palestinian people, where young fresh plants and dry bulbs are offered at every local market and are used as

medicinal plants. Locally there is a lack of information about the medicinal uses of *Allium* species.

Internationally the studies revealed that some kinds of *Allium* species could be used against cancer, fever, headache, kidney problem, stomach problems, tuberculosis, against skin disease and wounds, tooth ache, sense of fear, anemia and seeds are eaten to increase appetite,.

2.2.1 Main compounds in Allium responsible for its medicinal effects:

Many studies have been made to identify the compounds responsible for the medicinal effects in *Allium*. These studies revealed that the medicinal effect of Alliums mainly because of the following compounds:

1. Soluble allyl sulfur compounds
These substances suppress carcinogen formation. (Minler, 2001)

2. Selenium compound in *Allium*
This substance can prevent cancer in Rat. (Department pf surgical oncology, 1994)

3. Flavonoid and biflavonoid compounds like Quercetin and Rutin
These compounds prevent cancer. (Department of Medicine, 2006)

CHAPTER THREE

3. Materials and methods

3.1. Interviews with key informants:

Key informants interviewed in order to obtain general information about the expected locations where *Allium* species could be found. Photos of different *Allium* species were presented to the key informants to help them in recognizing *Allium* species and then identifying their possible sites within each district, at the level of target location. The key informants included various groups: local people, experts, MOA technical employees, Bedouins, etc. (table 2.1)

3.2. Tools and Equipments used in the field Survey:

i) Field note book.
ii) Photos for different *Allium* species as a guiding field manual.
iii) Digging tool for up rooting the plants.
iv) Transparency plastic bags.
v) GPS device.
vi) Digital camera.

3.3. Frequent sites visits and verification:

1. Random field visits of about more than 40 visits were made to the target locations to explore and search for wild *Allium* species in their habitats in different regions of W.B..
2. Those visits started as the beginning of March 2007, and extended to mid of July, 2007.
3. Photographed the visited sites as well as for the available *Allium* species each in its own habitats.
4. The detected wild *Allium* species were collected carefully with a digging tool and uprooting the plants to get the entire plants. One or two samples of each *Allium* species per site were collected.
5. Record data about visited sites, such as (GPS records and date of collection were recorded).
6. Field notes on the characters of taxonomic importance (i.e., color of perianth segments and stamens; shape of the umbel and flowers, shape and structures of leaves, structure of outer bulb tunics and shape of bulblets, if present) were recorded in the spot.
7. The collected plant specimens were placed into plastic bags each specimen was placed into a separate plastic bag with full labeling considering date and site of collection.
8. Collected *Allium* specimens were pressed simply in the field to preserve their parts and structures.
9. Collection number was given to each *Allium* specimen collected from a particular location at a particular date.

3.4. Pressing of collected specimens

1. The collected specimens must be kept dry to avoid fungal infection and changing in plants color.
2. If direct pressing was not possible, specimens must be kept in a cool dry place.
3. The specimens were laid between newspapers sheets for dryness. The number was associated with the specimens.
4. Several layers of specimens could be placed in the presser.
5. Specimens were compressed tightly as much as possible.
6. Then left to dry.
7. Newspapers are changed from time to time to ensure complete dryness of the specimens.

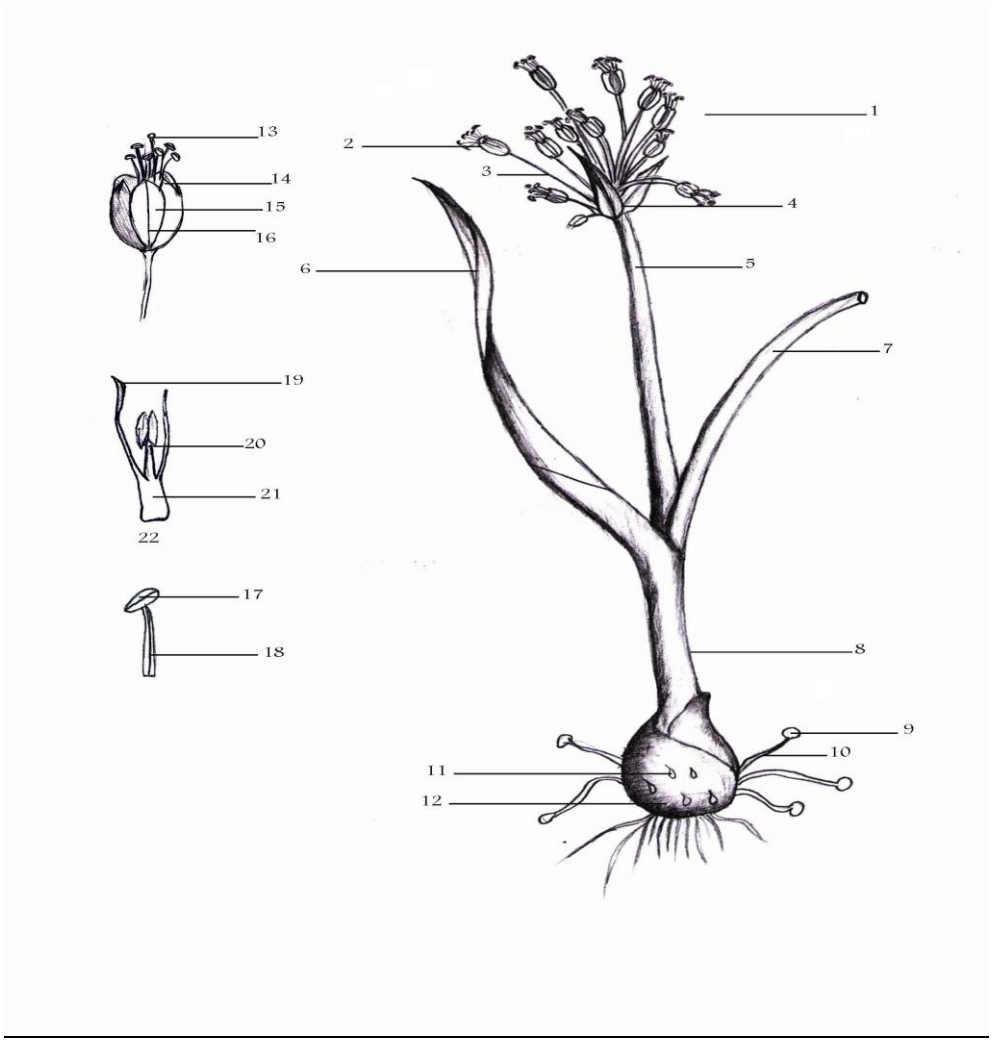
3.5. Taxonomical analysis of the collected specimens

The analysis of the collected wild *Allium* specimens was carried out depending on the following:

3.5.1. Morphological analysis of the collected specimens:

The morphological study of *Allium* specimens was mainly on the freshly collected specimens from different target locations distributed over W.B.. The different parts of *Allium* specimens examined are :(umbel, perianth, pedicel, spathe, stem, leaves, sheath, bulb, bulblets, style, anther, and filament.).

<u>Figure no. (1):</u> Schematic draw showing morphological parts of *Allium* and their terminology:



1. Umbel
2. Perianth
3. Pedicel
4. Spathe
5. Stem
6. Flat leaf
7. Hollow leaf
8. Sheath
9. Non-sessile bulblet
10. Stolon
11. Sessile bulblet
12. Bulb
13. Style
14. Inner perianth segment
15. Outer perianth segment
16. Med vein
17. Anther
18. Simple filament
19. Lateral cusps
20. Antheriferous cusps
21. Basal lamina
22. 3-Cuspidate filament

3.5.2 Identification of detected specimens

Plant specimens' identification needs a lot of time and efforts. First using dissecting microscope for the minor parts of the plants, then confirm this identification by photographs of relevant studies and the flora of the region, such as: Flora Palestina (Zohary. 1996. and Feinburn – Duthan 1991), Flora of Egypt (Tackholm, 1974), Flora of Syria, Palestine and Sinai (Post,1933), List of Jordan Vascular plants (Al-Eisawi, 1982) Field Guide to wild flowers of Jordan and neighboring countries (Al-Eisawi,1998).Flora of Iraq vol. 2&3 (Townsend & Evan Guest, 1966-1974), Flora Orientalis (Bossier, 1881) and Flora of Turkey Vol. 3 & 4 & 5(Davis *et al*,1963) then the identification was confirmed by Ghadeer Omar.

3.5.3. Poisoning of Allium specimens:

The poisoning process aimed at protecting the dried plants specimens from different potential risk such as: insect attacks and any other damages. The specimens were completely dipped in a poisonous solution before being mounted.

The used chemical mixture solution was consists of 150 gm of mercuric chloride HgCl, and 350 gm of ammonium chloride NH4Cl. It was dissolved in very little amount of water to 10 liters of 96% (commercial) alcohol, (Tackholm, 1974).

3.5.4. Mounting the specimens:

Once the specimens were pressed, dried and poisoned completely, they were carefully mounted on herbarium sheets, (these sheets are made of stiff cardboard). Then, the specimens were placed on the cardboard and fixed by small clips for support. A herbarium label was stick to the lower right corner of each specimen sheet. Also, the labeled sheets were kept in An-najah national university, faculty of science.

CHAPTER FOUR

4. Results:

The study's results are going to be presented in accordance with the set out study objectives. That means, the first part of the results will focus and high lights the issue of the detected wild *Allium* species, their diversity and abundances over the different agro-ecological zones in the W.B.. The second results part, will give more attention and investigation over wild *Allium* species taxonomy and classifications. In this respect, an in-depth taxonomical key will be presented in this part of the study.

4.1. The detected wild *Allium* species in the study areas:

The field survey was conducted over the different four agro-ecological zones in the W.B.. It commenced at the first half of the March 2007 till July 2007, as to collect different wild *Allium* specimens during the vegetative growing season of the wild *Allium* species. Accordingly, and by carrying out intensive and hard work surveillance, it was able to find around ten wild *Allium* species in the study areas. The recorded wild *Allium* species are the following:

1. ***A .ampeloprasum***
2. ***A. phanerantherum***
3. ***A. desertorum***
4. ***A. pallens***
5. ***A. paniculatum***
6. ***A. stamineum***
7. ***A .neapolitanum***
8. ***A. negevense***
9. ***A. hierochuntinum***
10. ***A. schubertii***

4.2. Wild Allium species diversity and their abundances over the study areas:

A total of 10 species of wild *Allium* species, all *Allium* are herbs, were recorded from the forth agro-ecological zones in the W.B.. These species were distributed between 360 m b.s.l.to 900 m a.s.l. and within different habitats. The most recorded wild *Allium* species (7 species) were distributed in the high central lands followed by the eastern slopes region (4 species), arid regions (5 species), and semi-coastal lands (2 species). Three species were only found in one habitat, (Table 2).

The detected species in the four agro ecological zones were different in terms of their abundances and distributions. Table 2 is going to present and explain the common name, distribution and abundance of each wild *Allium* species according to the four study areas.

Table (2.1): Wild *Allium* species distribution and their Abundance

No	Species	Distribution area (*)
1.	*Allium ampeloprasum*	1 2 3
2	*Allium phanerantherum*	2
3	*Allium hierochuntinum*	4
4	*Allium paniculatum*	2 3
5	*Allium pallens*	2 4
6	*Allium desertorum*	4
7	*Allium stamineum*	1 2 3 4
8	*Allium neapolitanum*	2 3
9	*Allium negevense*	4
10	*Allium schubertii*	2

*(*) **Distribution area:** (1) Semi coastal region, (2) Central high mountains, (3) Eastern slope region (4) Arid region*

Table (2.2) Wild *Allium* species distribution in the different regions

No.	Region	Species detected	No. of species detected
1.	Semi coastal region	*A. ampeloprasu and A. stamineum*	2
2.	High central lands	*A. ampeloprasum, A. phanerantherum, A. paniculatum, A. pallens, A. stamineum, A. neapolitanum, and A. schubertii*	7
3.	Eastern slopes	*A. ampeloprasum, A. paniculatum, A. stamineu and , A. neapolitanum*	4
4.	Arid region	*A. hierochuntinum, A. pallens, A. stamineum, A. negevens and A. desertorum*	5

According to the results mentioned in tables (2.1) and (2.2), it has been noticed that the wild *Allium* specie *A. stamineum* was fully detected in the four study areas. The *A. ampeloprasum*

was also found in all the studied areas except in the arid region, Jericho. *A. schubertii* and *A. phanerantherum,* were recorded only in the central high lands.

The wild *Allium* species *A. negevense, A. desertorum and a. hierochuntinum* were only found in the arid area. It has been found that all *Allium* species detected in the arid area were, to some extent, their vegetative growth and biomass is little and short.

In the semi coastal region only two species (i.e., *A. ampeloprasum and A. stamineum*) were found. More precisely, no *Allium* species were detected nearby the separation wall (the semi coastal region) and it's around. It has been noticed that, the agricultural practices have severely impacted the wild *Allium* species distribution, availability and abundances.

In conclusion, the high diversity of the species in the high central lands may be due to diversity in soil, climate and geography giving rise to many micro and macro habitats. The information on occurrence, altitudinal range, life forms, habitats, and endemism helps in identifying the distribution pattern of diversity, habitat preference and conservation values of the species. However, the high species diversity in the high central lands habitat indicates high preference by the species of *Allium*.

Also, it has been observed that the wild *Allium* species distribution, flowering time and their availability were, to some extent, different according to the *Allium* species natural habitats themselves. These data set up the testable hypothesis that these differences reflect real distribution over different regions.

4.3. Wild *Allium* species classification, taxonomy & their morphological characteristics:

The features of floral morphology are the most important characters in the classification of flowering plants. Different morphological parts of the plants are used and described. The basic similarity of the reproductive features like flowers, fruits and seeds within the various species, genera, and families is maintained by the successful reproduction of natural selection, so these structures are ideal for characterization of taxonomic groups, (Jones and Luchsing, 1979).

Using all the morphological characters for classification and identification is the most accurate and reliable because each morphological part has its own advantages and limitations. The genus *Allium* is characterized by a tall, erct inflorescence; all the flowers stalks emerge from one point. The *Allium* bulb function is the storage and as a reproductive organ at the same time, the buds form grows between the bulb scales and form the bulblets. Those bulblets develop on the edge of the bulb and exposed to the sides of the mother plants, (Fragman-Sapir, 1985).

The study taxonomical aspect is one of the most important study's objectives that need to be in-depth investigated and studied, because of the complexity of doing taxonomy for wild *Allium* species and the lack of adequate experience in this area. Therefore, special attentions and focus were given to this part as to be able to setting out the wild *Allium* species classification, characteristics and subsequently developing a special taxonomical key. As a

result of this study, the following sub-titles are comprehensively going to present what has been achieved and reached in this area.

4.3.1. Synopsis of taxa:

Family: Alliaceae J.G. Agardh
Genus: Allium L.
Subgenus: Rhizirideum (W. D.J Koch) Wendelbo
Section Allium Sec. *Alliotypus* Dumort.
Species:

1. *A. ampeloprasum* L.
2. *A. phanerantherum* Boiss. & Hausskn.
3. *A. hierochuntinum* Boiss.

Section: Codonoprasum Reichenb.

4. *A. paniculatum* L.
5. *A. pallens* L.
6. *A. desertorum* Forssk.
7. *A. stamineum* Boiss.

Section: Molium G. Dom ex Koch

8. *A. neapolitanum* Cyr.
9. *A. negevense* Kollmann

Section: Kaloprasum C. Koch.

10. *A. schubertii* Zucc.

4.3.2. Key to the sections of *Allium*:

1. Inner filaments 3-cuspidate ……...Sect. ***Allium***
1. All filaments simple

2. Leaves sheathing stem more than lower 1/4 of its length

3. Spathe only partially opening, persistent, sheathing base of parallel pedicels; Spathe valves shorter than umbel, not extending into long appendages……. **Sect. *Brevispatha*.**

3. Spathe opening down to base, rarely caduceus, not sheathing base of pedicels; at least one spathe valve longer than umbel, extending into long appendages……**...Sect. *Codonoprasum.***

2. Leaves sheathing stem less than lower 1/4 of its length

4. Leaves with sheaths not subterranean, above soil level …… **Sec. *Molium***

4. Leaves with sheaths subterranean, just reaching soil level

5. Perianth segments not erect, reflexed; stem usually longer than leaves……..…**Sec. *Kaloprasum***

4.3. 3. Key to the Species of *Allium:*

1. Leaves flat
  2. Spathe caduceous; bulblets, many, sessile; anthers exerted, inner filament longer than the perianth ……...***A. ampeloprasum***
  2. Spathe persistent; no bulblets; anthers included; inner filament shorter than the perianth.
    3. Outer tunics membranous; stem 3-quetrous; umbel lax
……...….***A. neapolitanum***

    3. Outer tunics careaceous; stem teret or semi teret; umbel dense
      4. Umbel size 5-7 cm; bulb diameter 1-1.5 cm; bulb globose; perianth yellow; anthers yellow…….…….…….***A. negevense***
      4. Umbel size up to 35 cm; bulb diameter 2.5 -4 cm; bulb ovoid; Perianth pink; anthers violet…….……...***A. schubertii***
1. Leaves hollow
      5. Inner filaments 3-cuspidate;
        6. Outer tunics membranous, no neck; stem length 60-90 cm; anthers pale yellow, sub exerted,……...……...***A. phanerantherum***
        6. Outer tunics reticulate-fibrous, short neck; stem length 13-40 cm; anthers purple, included…….…….……..……..***A. hierochuntinum***
      5. Inner filaments simple;
        7. Anthers exerted
          8. Spathe level shorter than umbel; umbel dense; outer tunics grayish; stem length 30-50 cm ; pedicels sub equal …….…….……***A. pallens***
          8. Spathe level longer than umbel; umbel lax; outer tunics blackish or ash grey; stem 12-23 cm; pedicels unequal…….…….……...***A. stamineum***
        7. Anthers included
            9. Perianth campanulate; outer tunics membranous; inner tunics membranous, white……..……***A. paniculatum***
            9. Perianth narrowly urceolate; outer tunicsthick bark-like; inner tunics striate, yellowish……...…….….……...***A. desrtorum***

4.3.4. Description of *Allium* species:

Sect. *Allium*. Sect. *Alliotypus* Dumort., Fl. Belg., 1: 140 (1827). Sect. *Porrum* (Mill.) Reichenb. In Mössler, Handb. 2 (1): 541 (1827). Sect. Crommyum Webb & Berth. Subsect. *Porrum* Boiss., Fl. Orient., 5:299 (1882).

Bulb ovoid or subglobose. Leaves linear, flat and solid or teret to semiterete and hollow. Spathe 1-2 valved, usually beaked and caduceus, rarely persistent. Perianth campanulate to ovoid; segments connivent. Filaments unequal; outer usually simple, rarely denate or 3-cuspidate; the inner with broader flat basal lamina, 3-cuspidate; the median cusp anther bearing, the lateral cusps sterile, usually much elongated. Ovary with distinict nectariferous pores; ovules 2 in each locule.

***1. Allium ampeloprasum* L., Pl., 1: 294 (1753); Boiss., Fl. Orient., 5: 232 (1882); Post, Fl. Pal.,** 2 (2): 634 (1933); Vvedensky, in Fl. U.R.S.S., 4: 253 (1935); Anth., In Notes Roy. Bot. Gard. Edinb., 18: 299 (1935); Feinber., Pal. Jour. Bot. Jerusalem, ser., 3: 6 (1943); Zoh., in Dep. Agr. Irak Bull., 31: 35 (1950); Blakelock, in Kew Bull., 8: 209 (1953) p.p.; Täckholm & Dar, Fl. Eg., 3: 64 (1954);Wendelbo, in Fl. Iraq, 2 :150 (1964); Rawi, in Dep. Agr. Iraq Tech. Bull., 14: 185 (1964); Mout., Nouv. Fl. Lib. Syr., 1:263, t. 82, 3 (1966); Wendelbo, in Fl. Iran., 76: 59, t. 6 f. 82, 3 (1966); Wendelbo, in Fl. Iran., 76: 59,.t. 6 f. 82 (1971); Kollmann, Israel Jour. Bot., 20:13-20 & 263-272 (1971); Kollmann, Caryologia, 25 (3): 295-312 (1972); Bothmer, Opera Bot. (Lund), 34: 21 (1974). [Plate 1, A & B]
Syn.: *A. halleri* G. Den, Monogor. *Allium*, 1: 15 (1827).
A.ampeloprasum L. var. *leucanthum* (C.Koch) Ledeb., Fl.Ross., 4: 164 (1852). Feinbr., Pal. Jour. Bot., Jerusalem. ser., 3: 19, f.9-12 (1943); Wilde-Duyfjes, Revis. *Allium* Africa, 67, t.10 & 11 (1976).

Lecotype: (designated by Wilde-Duyfjes, in taxon, 22: 59, 1973): a specimen collected by Newton, originating from an old cultivated stocks on steep Holm island, England (BM-Hb. Sloan 152 folio 153).

Bulb 2-7 cm in diameter, broadly ovoid or subglobose; outer tunics papery, easily split, ash-grey; inner tunics membranous, transparent white; bulblets 0.3-0.6 cm in diameter, numerous, yellowish, nearly sessile and remaining croded close to mother bulb even after disintegration of bulb-tunics. Stem 50-160 cm length, stout. Leaves 3-9, 1.0-3.0 cm broad, linear, keeled, flat, glabrous, sheathing lower 1/3-1/2 of stem, shorter than stem. Spathe up to 9 cm, caduceus, 1-valved, long beaked in bud. Umbel globose, 6-11 cm in diameter , many flowered, dense; pedicels purple, reddish., lilac or green, subequal-unequal, several times as long as perianth segments, bracteolate. Perianth cup-shaped or broadly campanulate; segments 0.4-0.5 cm length, somewhat remote from one another laterally (not overtopping), white, purple, lilac or green, with distinict or without a green midvein, more or less scabrous at back; outer segments mostly oblong-lanceolate concave, subacute; the inner broadly ovate, obtuse and apiculate. Filaments purple, white or lilac, subexerted, ciliate at base; outer filaments simple, the inner 3-cuspidate; median cusp of inner filament shorter than lateral cusps; lateral cusps; thin and twisted; anthers exerted, purple or yellow. Ovary green, style exerted. Capsule 0.4-0.5 cm, depressed globose. Fl. April-may.

Habitat: cultivated and disturbed ground, fields, vine yards between rocks and almost common.

Area: Mediterranean and Irano- Turanian.

Distribution: Qalqilia, Ramallah, Nablus, Salfeet, Eastern slopes.

Specimens examined: Salfeet 67-829 E, 66-459 N. 30.April. 2007; N.Abu-Alsoud 22. Ramallah 69-306 E, 54-587 N, 5.May. 2007; N.Abu-Alsoud 24. Ramallah 81-883 E, 54-675 N; 16.May 2007; N. Abu Al-soud 43. Nablus 79-625 E, 80-886 N; 21. June 2007; N. Abu Al-soud 50,51,52. Salfeet 67-883 E, 606-218 N; 5. July 2007; N. Abu Al-soud 53. Salfeet 68-000 E, 66-015 N; 9. July 2007; N. Abu Al-soud 55

***2. Allium desertorum* Forssk., Fl. Aeg Arab., 1:72 (1775); Kollman, in Notes Roy. Bot. Gard.** Edinb., 33: 437-440 (1975). [Plate 1, C&D]

Syn.: *A. modestum* Boiss., Diagn. Ser., 1 (13): 33 (1854)., Boiss., Fl. Orient., 5:261 (1882); Post, Fl. Pal., 2:640 (1933); Feinbr., Pal. Jour. Bot. Jerusalem ser., 4:155(1948).

Bulb 1-1.5 cm in diameter, ovoid-oblong; outer tunics thick, bark-like, splitting into strips or fibers (membranous), grayish-black, the inner membranous, striate, yellowish. Stem 8-18 cm, striate. Leaves 3-4, 0.1-0.2 cm broad, subtriquetrous, teret, canaliculated, striate, hollow, glabrous, sheathing 3/4 of stem, as long as or longer than stem. Spathe persistent, 2-valved; valves equal or unequal with cylindrical appendages, shorter than umbel. Umbel effuse, nodding in bud, 2-3 cm in diameter, usually few-flowered; pedicels unequal, 1 1/2-3 times as long as perianth segments length, not bracteolate. Perianth narrow, urceolate; segments adnate to each other at base, 0.5-0.7 cm length, greenish-gray to pinkish-white, with greenish or reddish midvein, oblong-lanceolate, acute, recurved at tip. Filaments included, white, dilated at base, subulate towards tip, adnate to perianth segments at base; anthers included, white-yellowish. Ovary green, globose; style included. Capsule 0.3 cm, depressed-globose, enclosed in perianth. Fl. March-April.

Habitat: Deserts.

Area: Saharo-Sindian.

Distribution: Jericho.

Specimens examined: Jericho, 91-866 E, 44-793 N; 21. April. 2007. N.Abu-Alsoud 6, 7, 8.

***3. Allium hierochuntinum* Boiss., Fl. Orient., 5:244 (1882); Feinbr., Pal. Jour. Bot. Jerusalem.** ser., 3: 14 f.33 (1943); Fl. Pal., 2 (2): 637 (1933). [Plate 2, A&B]
Syn.: *A.ascalnicm* L., Amoen. Acad., 4: 454 (1759) *nom. Confus*; Stearn, Bull. Brit. Mus. (Bot.), 2: 181 (1960).

Bulb 0.9-2 cm in diameter. Ovoid-oblong; outer tunics reticulate-fibrous, pale brown; inner tunics membranous, creamy-whitish. Stem 13-40 cm length, teret. Leaves 3-4, 0.1-0.2 cm broad, filiform, subteret, subcanaliculate, hollow, glabrous,sheathing almost 1/2 of stem, shorter than or as long as stem. Spathe persistent, purplish, 2-valved; valves ovate-triangle, subacute, much shorter than umbel. Umbel subglobose, 2-3 cm; pedicels unequal; outer pedicels very short, the inner as long as longer than perianth, bracteolate. Perianth cylindrical-campanulate; segments 0.6-0.9 cm length, blue or blue-violet, lanceolate, subacute. Filaments included, white; inner filaments 3-cuspidate, the median cusp about 1/2 length of lateral cusps; outer filaments simple; anthers included, purple. Ovary green, oblong to subglobose; style included. Capsule 0.2-0.3 cm, globose. Fl. March-May.

Habitat: deserts, Jericho area.

Area: Irano –Turanean and Saharo-Sindian

Distribution: Jericho.

Specimens examined: Jericho, Nuweameh alfuka, at the right side of the road up the hill, 21. March. 2007; N.Abu-Alsoud. 3.91-866 E, 44-793 N, 21. April. 2007. N.Abu-Alsoud 9, 10,11.

4. *Allium neapolitanum* Cyr., Pl. Rar. Neap., 1:13 t.4 (1788); Boiss., Fl. Orient., 5: 274 (1882); Post, Fl. Pal., 2: 644 (1933). [Plate 2, C&D]

Syn.: *A. album* Santi, Viaggio Montam., 1: 352, f.7 (1795).
A.lacteum Sm. In Sibth. & Sm., Prodr. Fl. Graec., 1:226 (1809).
A. sulcatum DC. In Redoutr, Lilac., 8: t. 482 (1815).
A. sieberianum Schultes & Schultes fil., Syst. Veg., 7:1099 (1830); wilde-Duyfjes, Revis. Allium Africa, 1: 23, t.30 (1976); Rix & Phillips, Bulb Book, 1:138 (b) & 142 (a) (1981).

Type: the illustration by Cyrillc, Pl. Rar. Neap., 1: t.4 (1788)

Bulb 1-2 cm in diameter, subglobose; outer tunics membranous or crustaceous, brown; inner tunics membranous, white. Stem 20-40 cm length, triquetrous, rarely teret. Leaves 2-3, 0.5-2.5 cm broad, broadly linear, attenuate-acuminate, keeled beneath, flat, sheathing lower 1/4 of stem, usually shorter than stem; blade and sheath glabrous, often blade scabridulous at margins,. Spathe persistent, 1-valved, ovate, acuminate, shorter than umbel. Umbel fastigiated or hemispherical, 5-8 cm in diameter, many-flowered, nodding in bud; pedicels subequal, 1.5-2 times as long as perianth segments, not bracteolate.Perianth stellate; segments white, 0.7-1.2 cm length, broadly elliptic-ovate, obtuse. Fialments simple, included, 1/2 times as long as perianth segments, white, flattened, tapering towards tip, acute; anthers included, pale green; style included. Capsule 0.5 cm, depressed globose, enclosed within perianth segments. Fl. March-April.

Habitat: shady and rocky places, usually between olive trees and road sides.

Area: Mediterranean

Distribution: Nablus, Salfeet [Plate 6, A]

Species examined: Nablus An-najah street; 8. March. 2007; N. Abu-Alsoud 1. East of Azmout village, at the right side of the road, beside a water canal; 8. March. 2007; N. Abu-Alsoud 2. 67-766 E, 66-268 N; 1.April. 2007; N.Abu-Alsoud 5.

5. *Allium negevense* Kollmann, Israel Jour. Bot., 18: 69, f.3 (1969). [Plate 3, A&B]
Bulb about 1-1.5 cm in diameter, globose; outer tunics coriaceous, brownish-grey, the inner membranous, white. Stem 20-45 cm length, teret. Leaves 2-4, 0.6-1.5 cm broad, linear, canaliculated in lower part, flat, sheathing lower 1/4 of stem, almost basal, shorter than stem; sheath and lower blade surface along its veins minutely velutions; upper face of blade glabrous or sub-glabrous. Spathe persistent, whitish-creamy, 1-valved, 1-3 lobed, acuminate, shorter than umbel. Umbel fastigiated, becoming more or less globose after anthesis, 5-7 cm in diameter; pedicels subequal, 2-3 times as long as perianth segments, not bracteolate. Perianth

narrowly campanulate; segments 1-1.5 cm length, milky white, greenish at base, erect, oblong, acute or obtuse. Filaments simple, yellowish-white, included; anthers included, greenish-yellow. Ovary green, globose; style sub exerted. Capsule 0.4-0.5 cm, depressed globose, enclosed in perianth. Fl. March-April.

Habitat: stony and calcareous ground, Deserts.

Area: West Irano-Turanian.

Distribution: Jericho area

Species examined: Jericho, Nuwemeh elfuka 10 m to the main side of the road; 21. April. 2007. N.Abu-Alsoud 4.

6. Allium pallens L**., Sp. Pl., 2 (1): 427 (1762); Wilde-Duyfjes, Taxon, 22:74 (1973**). [Plate 3, C&D]
Syn. : *A. coppoleri* Tineo,. Cat. Pl. Horti Panorum., 1: 275 (1827); Feinbr., Palest. Jour. Bot. Jerusalem ser., 4: 154 (1948); Tackholm & Dar, Fl. Eg., 3: 72 (1954); Mout., Nouv. Fl. Lib. Syr., 1:275, t.87, 3 (1966); Stud., Fl. Eg. Eg. 2(1):652 (1974).*A. pallens* L. var. coppoleri (Tineo) Parl., Fl. Ital., 2:550 (1857).

Syn: *A. paniculatum* L. var. pallens (L.) Gren. & Godr., Fl. Fr., 3: 209 (1855); Boiss., Fl. Orient., 5: 260 (1882); Post, Fl.Pal., 2:640 (1933).
A.paniculatum L.subsp. pallens (L.) Richt., Pl., exs. No. 107 (1924); Grosshein, in Fl. U.R.S.S., 4: 208 (1935); Wendelbo, in Fl. Iran., 76:62, t.6 f.36 (1971).
A. stamineum Boiss. Var. *nigro-pedunculatum* Opphr., Florula Transiord., 158, Bull. Soc. Bot. Geneve ser., 2 (22): 277 (1931).
Syn: *A. amblyanthum* Zahar., Biol. Gallo-Hellen., 6:53 (1975).

Lecotype: (wilde-Duyfjes in Taxon, 22: 74, 1973) Hb. S-Linn. 139
Bulb 1.0 cm in diameter, round; outer tunics membranous, grayish, the inner membranous, white. Stem 30-50 cm length, teret. Leaves 3, 0.1-0.2 cm broad, filiform, hollow, glabrous, sheathing about 1/2 of stem, as long as or somewhat shorter than stem. Spathe persistent, 2-valved; valves narrowly ovate or lanceolate at base, each contracted above base into a slender appendage, shorter than umbel. Umbel subglobose to hemispherical or fastigiated, compact, 3-4 cm in diameter; pedicels more or less equal, 1-2 times as long as perianth segments length, milky white to pale greenish-white, often with greenish midvein, slightly broader above middle, truncate, rounded at apex, apiculate. Filaments simple, included, white; anthers subexerted, purplish. Ovary green, globose; style included. Capsule 0.4 cm. Fl. May-June.

Habitat: steppes and arid places between olive trees.

Area: Mediterranean

Distribution: Nablus

Species examined: Nablus 80-200 E, 82-326 N; 27. May. 2007; N. Abu Al-soud 15. Nablus, 1 km to the north of Azmoot village, between rocks; 9. May. 2007; N. Abu Al-soud 26, 27.

Nablus, Sarra village; 9. May. 2007; N. Abu Al-soud 28, 29. Nablus, 1 km to the north of Azmoot village, between rocks; 6. June. 2007; N. Abu Al-soud 44.

***7. Allium phanerantherum* Boiss. & Hausskn., in Boiss., Fl. Orient., 5: 235 (1882); Feinbr.,** Pal. Jour. Jerusalem ser., 3: 11, f.20 (1943); Mout., Nouv. Fl. Lib. Syr., 1:267 (1966); Wendelbo, Fl. Iran., 76: 51, t.5 f.69 (1971); Kollmann, Notes Roy. Bot. Gard. Edinb., 33: 305 (1974). [Plate 4, A&B]

Syn.: *A. davisianum* Feinbr., Pal. Jour. Bot. Jerusalem ser., 3: 13, ff.4 & 23 (1943) emend.; Kollmann; Notes Roy. Bot. Gard. Edinb., 31: 121 (1971).

A.descendens auct. non L. (1753) nec Sm. In Sibth. & Sm. (1823); Feinbr., Pal. Jour. Bot. Jerusaem ser., 3: 12, f.22 (1943); Ic: Mout., Nouv. Fl. Lib. Syr., 1:Atlas t.83 f.6 (1966); Rech. fil., Fl. Iran., 76: t.5 f.69 (1971).

Type : Turkey C6 Adnan: Amanus, western slope between Kargous (Karagöz) and Bagajak (Yakacik), 800-1600 m, Pinetum halepense, 1 vii 1932, Eig & Zohary (holo. HUJ).

Bulb 1-2.5 cm in diameter, subglobose; outer tunics membranous, pinkish; inner tunics membranous, white. Stem 60-90 cm, teret. Leaves 2-5, 0.1-0.4 cm broad, teret, hollow, glabrous, sheathing lower 1/2 of stem, shorter than stem. Spathe persistent, 1-2 valved, reflxed, split into several lobes, shorter than umbel.Umbel globose to ellipsoid, 2.5-4 cm in diameter; pedicels unequal, 2-3 times as long as perianth segments, not bracteolate. Perianth subcoriacous, umbiliacate at base, tubular to oblong-ovoid; segments pale green, 0.3-0.4 cm length; the outer oblong-elliptic, obtuse, cymbiform; the inner ovate, subacute. Filaments subexeted, white; inner filaments 3-cuspidate; median cusp; of inner filaments shorter and somewhat thicker than the longer finer lateral cusps; basal lamina ciliolate, about as long as cusps; outer filaments simple; anthers exerted, pale yellow. Ovary green, oblong; style distinctly exerted. Capsule 0.4 cm, oblong, overtopped by perianth. Fl. May-June.

Habitat: Calcareous rocky places and deserts.

Area: Mediternaen and West Irano-Turanian.

Distribution: Nablus

Specimens examined: West of Nablus, Sarra village, 20. June. 2007; N.Abu- Alsoud 45, 46,47.

8. *Allium schubertii* Zucc., in Abh. Maths. –Phys. Akad Wiss. (München), 3:234, t. 3 (1843)**,** Ic: Bot. Mag. 124: t. 7587-8 (1898); Wilde-Duyfjes, Revis. Allium Africa 1: t. 36 (1976). [Plate 4, C&D]

Type: [Palestine] crescit in Palestine planitie Jesreel prope Nazareth (holo. M-Hb. Zuccarini). Bulb 2.5-4.0 cm in diameter; ovoid; outer tunics cariaceous, brown; inner tunics membranous, white. Stem 40-50 cm long, erect, stout, hollow. Leaves 4-8, 5-7 cm broad, lorate-lanceolate, flat, glabrous, scabridulous on margins, sheathing stem basally, shorter than stem. Spathe persistent, 1-valved, 2-3 lobed, shorter than umbel. Umbel hemispherical-subglobose, up to 35

cm in diameter, many flowered, polygamous; pedicels very un equal several times much longer than perianth segments length, rigid; flowers on longest pedicels generally sterile, staminate, usually with reduced ovary, rarely hermaphrodite, not bracteolate. Perianth stellate; segments 0.7-1.0 cm long, mauve-purple, lanceolate, subacute. Fialaments simple, included, purple; anthers included, pale yellow. Capsule 0.6-0.8 cm, globose. Fl. March-May.

Habitat: Olive fields, Heavy alluvial soil.

Area: East Mediterranean.

Distribution: Nablus (Azmout village).

Species examined: Nablus 79-625 E, 80-886 N; 25. April. 2007; N. Abu Al-soud 14. 79-625 E, 80-886 N; 9. May. 2007; N. Abu Al-soud 25.

9. *Allium stamineum* Boiss., Diagn. Ser., 2(4): 119 (1859); Boiss., Fl. Orient., 5:639 (1882); Wendelbo, Fl. Iran., 76:63, t.6 .88, 17 f.l. (1971). [Plate 5, A&B]

Bulb 1.0-2.0 cm in diameter, ovoid-rounded; outer tunics membranous, blackish-grayish, the inner tunics membranous brownish-white, both torn into stripes. Stem 12-23 cm length, teret, flexuose, mostly stout. Leaves 2-4. 0.1 cm broad, filiform, hollow, glabrous, sheathing 1/3-1/2 of the stem, reaching or mostly longer than the stem or even the umbel level. Spathe persistent, 2-valved; valves very unequal, each valve tapering into aslender appendage, each fresh not fully opening valve has lanceolate base with distinct nerves, both longer than umbel. Umbel lax, 2.5-8 cm in diameter, usually many flowered; pedicels unequal, several times longer than perianth segments length, not bracteolate. Perianth campanulate; segments 0.4-0.5 cm length, pinkish rarely greenish, with distinct purple midvein, in touch to each other at their base, oblong-elliptic or ovate, the outer rounded at apex, the inner obtuse. Filaments simple, distinctly exerted, 1 1/2-2 times as long as perianth, white-purplish, adnate to perianth at base; anthers distinctly exerted, yellow. Ovary green, subglobose; style exerted. Caosule 0.3-0.4 cm, depressed-globose. Fl. March-May.

Habitat: almost all types of habitats, eroded and stone slopes, limestone and mountain sides under olive trees, between rocks. Mediternean mainly.

Area: Mediterranean

Distribution: every where in W.B.

Specimens examined: Jericho, 91,838 E, 44-835 N; 21. May. 2007; N.Abu-Alsoud 12,13. Nablus 79-974E , 82-236 N; 27. April; N.Abu Al-soud 16. Salfeet 67-875 E, 66-311 N; 30. April. 2007; N. Abu Alsoud 17,18. Salfeet 67-938 E, 66-303 N; 30. April. 2007; N. Abu Alsoud 19,20,21. 48-594 E, 73-775 N; 5. May. 2007; N. Abu Alsoud 23. Nablus (1 km north of Azmout village under olive trees; 9. May. 2007; N. Abu Alsoud 30, 31,32.Nablus (1 km north of Azmout village between rocks; 9. May. 2007; N. Abu Alsoud 33,34,35. Ramallah 54-106 E, 40-854 N; 13. May. 2007; N. Abu Alsoud 38. Ramallah 79-953 E, 55- 591 N; 16. May.

2007; N. Abu Alsoud 39. Ramallah 80-716 E, 55- 598 N; 16. May. 2007; N. Abu Alsoud 40,41,42.Salfeet 69-625 E, 65-223 N; 5. July.2007; N. Abu Alsoud 54.

***10. Allium paniculatum*:** L., Syst. Nat., 10 (2): 978 (1759); Sp. Pl., 2 (1): 428 (1762); Regel, in Acta Hort. Petrop., 2: 191 (1875); Boiss., Fl. Orient., 5: 259 (1882) p.p.; Nab., in Publ. Fac. Univ. Masaryk, 105: 35 (1929); Post, Fl. Pal., 2 (2): 640 (1933); Vvedensky, in Fl. U.R.S.S., 4: 205 (1935); Zoh., in Dep. Agr. Irak Bull., 31: 36 (1950); Rawi, ibid. Tech. Bull., 14: 186 (1964); Mout., Nouv. Fl. Lib. Syr., 1:274, t.87, 1 (1966); Wendelbo, in Fl. Iran., 76: 60 t.6 f.83 (1971); Osorio-Tafall & Seraphim, List Vasc. Plants Cyprus, 1: 22 (1973). [Plate 5, C&D]
Type: (Hungary) in rupibus calcareis Banatus, freuns ad thermas Herculis (holo. PR; topotype, 2 viii 1813, anon., PR). [Plate 5, C& D]

Bulb 1.5-2.0 cm in diameter, ovoid-rounded; outer tunics membranous, grayish-brownish, the inner membranous, white. Stem 20-77 cm, teret. Leaves 3-5, 0.1-0.3 cm broad, flattened, semiteret, canaliculated, prominently ribbed on lower face, often withered before anthesis, hollow, glabrous, sheathing 1/2-2/3 of stem, as long as or longer than stem. Spathe persistent, 2-valved; valves unequal in length, ovate to narrowly lanceolate at base, each valve contracted above base into along selender appendage; one or mostly both valves much longer than umbel. Umbel usually fasiculate, lax, varying in shape, 3.5-6.0 cm in diameter, many flowered; pedicels very unequal, the outer cuving outwards, the inner erect, both seversal times as long as perianth segments length, not bracteolate. Perianth obconical-campanulate or cylindrical; segments greenish-white to pale green at fresh state, to flesh coloured to pale rose with deeper-coloured nerves in the dried state, 0.4-0.6 cm length, narrowly obovate-oblong, usually truncate-rounded, sometimes apiculate-slightly notched. Filaments simple, included, scarcely as long as perianth segments, white, linear-subulate, adanate to the segments; anthers slightly exerted or included, yellow to greenish-yellow. Ovary green, ellipsoid; style included. Capsule about 0.5 cm, depressed globose, emarginated, tapering at base. Fl. May.

Habitat: Rocky shady places, hill sides, olive fields.

Area: Mediterranean

Distribution: Nablus

Species examined: West of Nablus, Sarra village, 20. June. 2007; N. Abu Al-soud 48, 49.

4.3.5. Morphological characters of *Allium* studied Taxa:

The different morphological characteristic of found wild *Allium* species are going to be presented at the following results' tables. Tables (3a-3o) include the full characteristics of wild *Allium* species such as: bulb diameter, bulb shape, bulblets, tunics neck formation, outer tunics colour, outer tunics texture, inner tunics colour, inner tunics texture, stem length and shape, leaves shape, leaves number, leaves flat, leaves hollow, leaves width, leaves level, leaves texture, umbel size, umbel nature, umbel, umbel shape, pedicels, perianth shape, spathe, stamens, capsule, etc.

Table (3): Morphological characters of *Allium* studied Taxa

Taxon No.	Taxon	Bulb diameter	Bulb shape	Bulblets
1	*Allium ampeloprasum*	2.0 – 7.0 cm	Broadly ovoid - subglobose	Many, sessile, yellow
2	*Allium phanerantherum*	1.0 – 2.5 cm	Subglobose	No
3	*Allium hierochuntinum*	0.9 – 2.0 cm	Ovoid – oblong	No
4	*Allium paniculatum*	1.5 – 2.0 cm	Ovoid – globose	No
5	*Allium pallens*	1.0 cm	Globose	No
6	*Allium desertorum*	1.0 – 1.5 cm	Ovoid – oblong	No
7	*Allium stamineum*	1.0 – 2.0 cm	Ovoid – globose	No
8	*Allium neapolitanum*	1.0 – 2.0 cm	Subglobose	No
9	*Allium negevense*	1.0 – 1.5 cm	Globose	No
10	*Allium schubertii*	2.5 – 4.0 cm	Ovoid	No

Cont. table (3):

Taxon No.	Tunics neck formation	Outer tunics colour	Outer tunics texture	Inner tunics colour	Inner tunics texture
1	*No*	Ash - grey	Papery	White	Membranous
2	*No*	Grayish	Membranous	White	Membranous
3	*Yes short*	Pale brown	Reticulate – fibrous	White	Membranous
4	*No*	Grayish – brown	Membranous	White	Membranous
5	*No*	Grayish	Membranous	White	Membranous
6	*No*	Grayish – black	Thick park – like, splitting into splits or fibrous	Yellowish	striate
7	*No*	Blackish or ash – gray	Torn into strips	White	Membranous
8	*No*	Dirty brown	Membranous, crustaceous	creamy	Membranous
9	*No*	Brownish - grey	Cariaceous pitted	White	Membranous
10	*No*	brown	Cariaceous	White	Membranous

Cont. table (3):

Taxon No.	Stem		Leaves			
	Stem length (cm)	**Stem shape**	**Leaves No.**	**Leaves width**	**Leaves flat**	**Leaves hollow**
1.	50-160	Stout	Up to 3-9	0.5-2.5	Flat	-
2	60-90	Teret	Up to 3-4	0.1-0.4	-	Hollow
3.	13-40	Teret	Up to 3-4	0.1-0.2	-	Hollow
4	20-77	Teret	Up to 3-5	0.1-0.3	-	Hollow
5	30-50	Teret	Up to 3	0.1-0.2	-	Hollow
6	8.0-18.0	Steriate, flexuose	Up to 3-4	0.1-0.2	-	Hollow
7	12.0-23	Teret, flexuose, mostly stout	Up to 2-4	About 0.1	-	Hollow
8	20-40	3-quetrous	Up to 2-3	0.5-3	Flat	-
9	20-45	Teret	Up to 2-4	0.6-1.5	Flat	-
10	40-50	Erect, stout	Up to 4-8	5.0-7.0	Flat	-

Cont. table (3):

Taxon No.	Leaves		
	Leaves shape	**Sheathing level on the stem**	**Leaves level**
1	Linear, keeled	Sheathing lower 1/3-1/2	Shorter than stem
2	Teret, cylindrical	Sheathing lower 1/2	Shorter than stem
3	Filiform	Sheathing up to 1/2 or less	Shorter or as long as the stem
4	Flattened, prominently ribbed on lwer face	Sheathing lower 1/2-2/3	As long as longer
5	Filiform	Sheathing about1/2	As long as stem or slightly shorter
6	Subtriquetrous, slender, canaliculated, striate	Sheathing 3/4 of stem	As long as or longer
7	Filiform	Sheathing lower 1/3-1/2	Reaching and sometimes overtopping the umbel
8	Broadly linear, attenuate-acuminate, keeled beneath	Sheathing lower 1/4 of stem	Shorter than stem
9	Linear, canaliculated in lower part	Sheathing lower 1/4 of stem	Shorter than stem
10	Lorate-lanceolate	Sheathing stem baselly	Shorter than stem

Cont. table (3):

Taxon No.	Leaves	
	Leaves texture	**Leaves sheath texture**
1	Glabrous	Glabrous
2	Glabrous	Glabrous
3	Glabrous	Glabrous
4	Glabrous	Glabrous
5	Glabrous	Glabrous
6	Glabrous	Glabrous
7	Glabrous	Glabrous
8	Glabrous	Glabrous
9	Densely and miutely velutions along veins on lower face, while upper face of blade glabrous or subglabrous	Densely and ninutly velutions along veins
10	Glabrous, scabridulous on margins	glabrous

Cont. table (3):

Taxon No.	Spathe	
	Spathe persistence and level in in respect to umbel	**Spathe locules**
1	Caduceous	1-valved
2	Persistent, shorter than umbel	1-valved
3	Persistent, shorter than umbel	2-valved
4	Persistent, longer than umbel (both or only one)	2-valved, each contracted above base into a long appendage, unequal
5	Persistent, shorter than umbel	2-valved; valves narrowly lorate or lanceolate
6	Persistent, shorter than umbel	2-valved; valves equal or unequalwith cylindrical appendage
7	Persistent, longer than umbel	2-valved, each valve tapering into a slender appendage
8	Persistent, shorter than umbel	1-valved
9	Persistent, shorter than umbel	1-valved (1-3 lobed), lobes acuminate
10	Persistent, shorter than umbel	1-valved; 2-3 lobed

Cont. table (3):

Taxon No.	Umbel			
	Umbel size	**Umbel nature**	**Umbel shape**	**Umbel flowers density**
1	6-11	Dense	Globose-spherical	Many flowered
2	2.5-4.0 cm	Dense	Globose-ellipsoid	Many flowered
3	2-3 cm	Dense	Subglobose	Many flowered
4	3.5-6 cm	Lax	Variable	Many flowered
5	3-4 cm	Dense	Subglobose to hemispherical	Many flowered
6	2-3 cm	Nodding in bud	Effuse	Few-many flowered
7	2.5-8.0 cm	Lax	Variable	Many flowered
8	3-8 cm	Lax	Fastigiated-hemispherical	Many flowered
9	5-7 cm	Dense	Fastigiated, becoming more or less globose after anthesis	Many flwered
10	Up to 35 cm	Dense	Hemispherical to subglobose	Many flwered

Cont. table (3)

Taxon No.	Pedicels		
	Pedicels equality	**Pedicels**	**Pedicels practeoles**
1	Subequal	Several times longer than perianth	No
2	Unequal	2-3 times as long as perianth	No
3	Unequal	Outer pedicels very short, the inner as long as or somewhat longer than perianth	Yes
4	Very un equal	--	No
5	Equal	--	No
6	Unequal	1 1/2-3 times as long as perianth	No
7	Unequal	Several times longer than perianth	No
8	Subequal	--	No
9	Subequal	2-3 times as long as perianth	No
10	Very unequal	--	No

Cont. table (3):

Taxon No.	Pedicels	
	Pedicels colour	**Other characters**
1	Purple, reddish, lilac or green	Radiating from the umbel
2	purple	Different levels the longest at the centre and the shortest at the peripheral base of umbel
3	Purple	-
4	Whitish-green	Outer pedicels curving outwards and the inner erect
5	Greenish	-
6	Dirty green	-
7	Greenish-pinkish	-
8	Dark green	-
9	Dirty yellow	-
10	Dark-green-yellowish	-

Cont. table (3):

Taxon No.	Perianth shape	Perianth outer / inner limb equality	Perianth outer limb size	Perianth outer limb shape
1	Cup-shaped or broadly campanulate	Subequal	0.4-0.5	Oblong-lanceolate, concave, subacute
2	Subcoriaceous, umbilciliate at base, tubular-oblong-ovoid	Unequal	0.3-0.4	Oblong-elliptic, obtuse, cymbiform
3	Cylindrical-campanulate	Equal	0.6-0.9	Lanceolate, subacute
4	Campanulate or cylindrical	Equal	0.4-0.8	Narrowly obovate to oblong, usually obtuse, may apiculate
5	Narrowly campanulate	Equal	0.3-0.4	Narrowly obovate, truncate, apiculate
6	Narrowly urceolate	Equal	0.5-0.7	Oblong-lanceolate, acute, somewhat recurved at tip
7	Campanulate	Equal	0.4-0.5	Oblong-elliptic or ovate, rounded
8	Steallate	Equal	0.7-1.2	Elliptic-ovate, obtuse
9	Narrowly campanulate	Equal	1.0-1.5	Erect, oblong, acute or obtuse
10	Stellate	Equal	0.7-1.0	Lanceolate, sub acute

Cont. table (3):

Taxon No.	Perianth inner limb size	Perianth inner limb shape	Perianth surface texture	Perianth limb colour
1	0.4-0.5	Broadly ovate, obtuse and apiculate	Scabrous	White, purple, lilac or green
2	0.3-0.4	Ovate, suacute	Glabrous	Pale green-white
3	0.6-0.9	Lanceolate, subacute	Scabrous	Blue violet
4	0.4-0.6	Narrowly obovate to oblong, usually obtuse, may apiculate	Glabrous	Pale green to whitish
5	0.3-0.4	Narrowly obovate oblong, truncate, apiculate	Glabrous	Milky-white to pale greenish-white
6	0.6-0.7	Oblong-lanceolate, acute, somewhat recurved at tip	Glabrous	Pinkish-white or pink
7	0.4-0.5	Oblong-elliptic or ovate, obtuse	Glabrous	Pinkish, rarely greenish
8	0.7-1.2	Elliptic-ovate, obtuse	Glabrous	White
9	1-1.5	Erect, oblong, acute or obtuse	Glabrous	Milky-white, greenish at base
10	0.7-1.0	Lanceolate, subacute	Glabrous	Mauve-purple

Cont. table (3):

Taxon No.	Perianth	
	Mid vein	**Additional distinguishable characters**
1	With or without green mid vein	Perianth segments somewhat remote from one another laterally
2	Green	-
3	Purple	-
4	Green	Perianth segments become flesh coloured to pale pink in drying
5	Greenish	-
6	Greenish or reddish	-
7	Distinict darker pink	-
8	Abscent	-
9	Indistinct	-
10	Purple	-

Cont. table (3):

Taxon No.	Stamens		
	Anthers		Filaments
	Anthers colour	Anthers exsertion	Inner filament nature
1	Purple, yellow	Exserted	3-cuspidate, median cusp shorter than the lateral thin twisted lateral ones
2	Pale yellow	Subexerted	3-cuspidate, median cusp shorter than the lateral thin twisted lateral ones
3	Purple	Included	3-cuspidate, median cusp about 1/2 length lateral cusp
4	Pale yellow	Included	Simple
5	Purplish	Sub exserted	Simple
6	White-yellow	Included	Simple
7	Yellow	Exserted	Simple
8	Pale green	Included	Simple, flattened, tapering towards tip
9	Greenish- yellow	Included	Simple, flattened, tapering towards tip
10	Pale yellow	Included	Simple

Cont. table (3):

Taxon No.	Inner filaments		Outer filaments		
	Inner filament length	Inner filament teeth	Outer filament nature	Outer filament length	Outer filament teeth
1	Longer than the perianth	Yes	Simple, flattened, tapering toward tip	Longer than perianth	Yes
2	Somewhat longer than perianth	Yes	Simple, flattened, tapering toward tip	Slightly longer than perianth	Yes
3	Shorter than perianth	No	Simple, flattened, tapering toward tip	Shorter than perianth	No
4	Shorter than perianth	No	Simple	Shorter than perianth	No
5	Shorter than perianth	No	Simple	Shorter than perianth	No
6	Shorter than perianth	No	Simple, subulate towards tip	Shorter than perianth	No
7	1 ¼ -2 times as long as perianth	No	Simple	1 1/4-2 times as long as perianth	No
8	Shorter than perianth	No	Simple, flattened, tapering toward tip	Shorter than perianth	No
9	Shorter than periath	No	Simple, flattened, tapering toward tip	Shorter than perianth	No
10	Shorter than perianth	No	Simple	Shorter than perianth	no

Cont. table (3):

Taxon No.	Style exertion	Ovary shape	Capsule			Flowering
			Shape	Size cm	Enclosing in perianth	
1	Exserted	Globose	Depressed-globose	0.4	Shorter than perianth	April-May
2	Subexserted	Oblong	Oblong	0.4	Enclosed and overtopped by perianth	May-June
3	Included	subglobose	Globose	0.2-0.3	Enclosed totally in perianth	March-May
4	Included	Ellipsoid	Depressed-globose	0.5	Shorter than perianth	May
5	Included	Globose	Globose	0.4	Shorter than perianth	May-June
6	Included	Globose	Depressed-globose	0.3	Shorter than perianth	March-May
7	Distinictly exerted	Subglobose	Depressed-globose	0.3-0.4	Enclosed in persistent perianth	March-May
8	Included	Globose	Depressed-globose	0.5	Enclosed in persistent perianth	March-April
9	Somewhat exceeding stamens	Globose	Depressed-globose	0.5	Much shorter and and enclosed in perianth	March-April
10	icluded	globose	globose	0.6-0.8	Not enclosed in perianth	March-May

4.4. Storage & documentation of the detected *Allium* specimens:

The present and last part of the study results is going to tackle and deal with the storage and the documentation process of the collected and dried wild *Allium* species, as follows:

Around 95 specimens were dried and stored by using relied and dependable scientific approaches and techniques. In this respect, each specimen was given a code and a serial number as to facilitate the specimens' documentation and management. To maximize the scientific benefits, the collected and stored specimens are accessible for every concerned body, researchers and institutions, as for their own investigation and studies. The stored specimens, as aforementioned, would serve as a scientific and reliable reference for the existing wild *Allium* species in the W.B. regions.

Any interested people or /and institutions, might be able to access to, and refer to the stored wild *Allium* at the life science laboratory of An-najah National University, by asking and consulting with Dr. Ghadeer Omar, as a supervisor of my work since the beginning of this study and in her capacity as a professor of biology at Al-Quds and An-najah National University.

CHAPTER FIVE

5. Conclusion and Recommendations:

5.1 Conclusion

The study area was four agro-ecological zones:

1. semi coastal region
2. central high lands
3. eastern slopes
4. Arid region

The study was conducted through the flowering season of Alliums started from March- July 2007.

The detected specimens were classified according to the flora of the regions.

10 wild Allium species were detected in the study area and these species are:

1. *A .ampeloprasum*
2. *A. phanerantherum*
3. *A. desertorum*
4. *A. pallens*
5. *A. paniculatum*
6. *A. stamineum*
7. *A .neapolitanum*
8. *A. negevense*
9. *A. hierochuntinum*
10. *A. schubertii*

Allium stamineum was detected in the four agro ecological zones which could be due to very little requirements to grow as; it grows on a very little soil on a rock.

A. ampeloprasum was detected in three agro ecological zones with tow different umbel color purple and green.

The semi coastal region shows the less number of *Allium* species were detected. Only 2 species were detected in this region, which could be due to the agricultural practices, using of pesticides and the separation wall.

The central high lands shown the highest number of *Allium* species detected, 7 *Allium* species were found in this area.

Allium species are not known among the Palestinian People, most of the persons interviewed didn't recognize them.

5.2: Recommendations

Recommended actions regarding the wild *Allium* species as an important flowering family and a wide-spread one in the W.B. areas are as follows:

Populations of scarce wild *Allium* species should be identified, and genetic material preserved appropriately using resource protection, and the establishment of gene banks conserving the diversity in genetic material from various localities. Also, a research into the sustainable management and harvesting or overgrazing of wild *Allium* species at both the population and individual plant level should be undertaken.

Further in-depth and comprehensive researches and studies should be undertaken in the field of wild *Allium* species, diversity, conservation and sustainable management in W. B.. Also, it is necessary to include the wild *Allium* species in any biodiversity and conservation future projects.

There should be a reorientation of research investment regarding medicinal plants, with a shift from pharmacological studies to research which identifies effective methods of sustainable conservation and management. Sustaining their growth and removing the expected risks currently affecting their habitats and growth.

A protected research and public oriented-garden or/ and a herbarium should be established by collecting all wild *Allium* species from their own habitats existing and distributed all over the W.B.. This garden will serve as an ex-situ genetic conservation laboratory, as well as a powerful mean for the public, students and researcher's awareness.
That is needed, also, because very few local people, I met during the implementation of the field survey process, have a good knowledge and experience regarding wild *Allium* species. Moreover, *Allium* species are a promising wild plant needs more investigation and studies.

Build on the expertise of institutions and researchers which have already developed extensive knowledge in wild plants production, diversity, taxonomy and conservation.

Inform policy and decision- makers of the negative impact of current policies, Israeli occupation measures, and regulations on wild *Allium* species status, conservation, sustainability, economic development and biodiversity.

Some wild *Allium* species (i.e., *A. ampeloprasum* and *A. phanerantherum*) could be worked on, by undertaking in-depth scientific researches and hybridization, as a well adapted genetic material to produce beautiful and commercial indoor and ornamental flowering plants.