الجمهورية اللبنانية
مكتب وزير الدولة لشؤون التنمية الإدارية
مركز مشاريع ودراسات القطاع العام

Republic of Lebanon
Office of the Minister of State for Administrative Reform
Center for Public Sector Projects and Studies
(C.P.S.P.S.)

Monitoring Biological diversity

Flora of the Natural Reserve of Ehden

The Protected Areas Project
Ministry of Environment
Beirut. LEBANON

Part II
(May 8, 1999)

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GreenLine
A Scientific Association for Conservation

FOREWARD

The objectives of this second part of the Flora Monitoring workshop is to focus on practical work in plant identification and methods for flora monitoring.

The aim of this second phase is also to clarify all pending issues from the first meeting and to initiate the monitoring program. The flora monitoring team strongly feels the importance of capacity building of the management teams, if successful, this workshop would hopefully lead to continuity and reinforcement of the monitoring program objectives and management strategies. Therefore, your active participation and contribution in this workshop are highly appreciated.

Flora Monitoring Team

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I- Preliminary steps to taxonomic identification

II- Monitoring of Flora

I- PRELIMINARY STEPS TO TAXONOMIC IDENTIFICATION

A-INTRODUCTION

Taxonomy is the science of the classification of organisms according to their resemblance and differences. It includes delimiting, describing and grouping species and nomenclature or giving names to the described entities.
Plant taxonomy has two aims:

- to identify all kinds of plants
- to arrange the kinds of plants into a scheme of classification that will show their true relationship

One aspect of taxonomy is documentation, which includes the preservation of living fossil floras in a museum or herbarium, including type specimens and illustrations.
The importance of taxonomy is not only in identifying and relating organisms, but also in storing and retrieving information.
Biological classification used today is based on the work of the biologist Carolus Linnaeus (1707-1778). In the linneaen system, each species is assigned two names; the name of the genus or generic name and the name of the species or specific epithet; e.g. the scientific name of the Lebanese Cedars is *Cedrus libani*.

B- ANGIOSPERMS

Angiosperms (flowering plants) constitute the subdivision of seed plants. They are the most dominant, numerous and successful plants living today and include about a quarter of a million of species in about 300 families. They produce flowers, fruits and seeds.

B.1 Criteria used in classification of angiosperms

↪The presence or absence of petals
If present, whether united or separate
↪The position of the ovary in relation to perianth (hypogenous, perigenous or epigynous flowers)
↪The numbers of petals
↪The union of parts
↪The nature of the perianth (=calyx and corolla)
↪The nature of the fruit (is related to the nature of the gynoecium)
↪The morphology of the seed
↪ Vegetative characters (roots, stems and leaves)

B.2 Classification

The angiosperms are divided into two classes:
Dicotyledons (dicots) and monocotyledons (monocots).

- **Dicots**

Embryo: with 2 cotyledons

Flowers: in 4 or 5, or in multiple of 4 or 5.

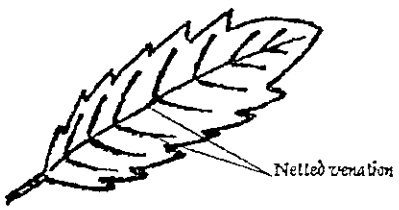
Leaves: netted venation (petiole: +/-)

Growth form: herbaceous or woody

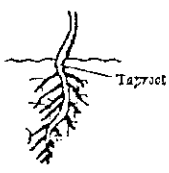
Vascular system: in a ring

Roots: taproot

Embryo.



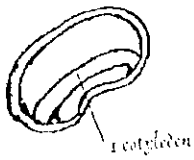
Leaf.

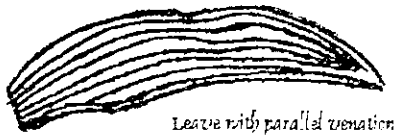


Root.

- **Monocots**

Embryo: with 1 cotyledon (embryonic seed leaf)



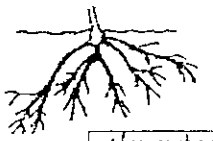


Flowers: in 3 or multiple of 3

Leaves: usually, parallel venation (petiole seldom develops)

Growth form: mostly herbaceous a few arborescent (palms)

Vascular system: vascular bundles scattered

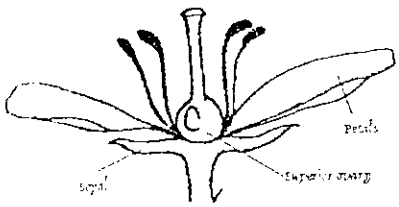


Absence of a principal root system, fibrous root

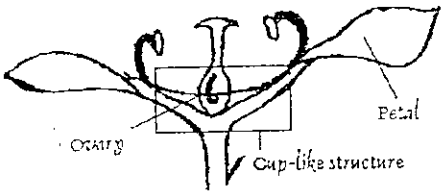
Roots: fibrous

B.2.1 Type of flowers in terms of the disposition of the ovary

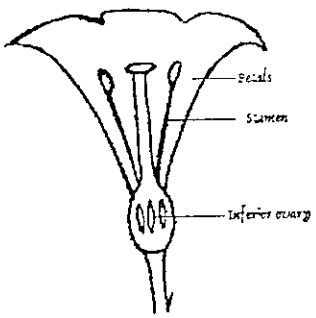
↪ ***Flower parts situated below the ovary:*** flowers with superior ovary (Hypogenous flowers). The sepals, petals and stamens are inserted at the base of the ovary and free from it.



↪***Flower parts situated around the ovary:*** flowers with half-inferior ovary (Perigenous flowers). The sepals, petals and stamens are inserted on the rim of a shallow or deep cup-like structure called hypanthium (floral tube or cup).



↪ ***Flower parts situated above the ovary:*** flowers with inferior ovary (Epigenous flowers). The sepals, petals and stamens appear to arise upon the ovary.



B.3 DICOT

B.3.1 *Brassicaceae* Family

– The Mustard Family –

Growth form: Annual or perennial herb with pungent watery acrid sap.

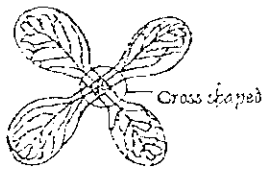
Flowers: regular 4-merous, perfect

* ovary is superior,
* Calyx: 4 separate sepals
* Corolla: 4 separate 'clawed' petals; arranged diagonally (cross-shaped),
* pistil one of two united carpels,
* Stamens: 6
* Inflorescence: flowers usually in racemes (sometimes, corymbose)

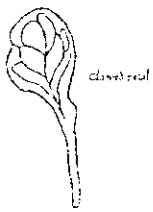
Leaves: alternate, simple (or pinnately lobbed).

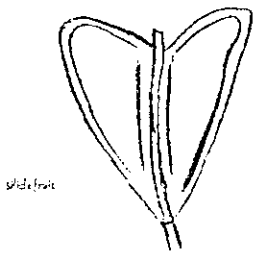
Fruit: a two valved silique or silicle.

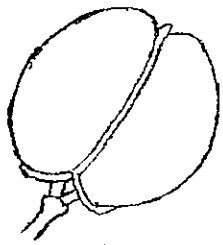
Important members: radish, turnip, cabbage, Cornflower, rapeseed oil, white mustard and stocks.



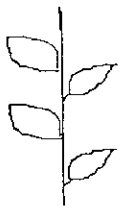
Corolla







Silique



Alternate leaves

B.3.2 *Apiacaea* Family (Umbelliferae)

– The parsley family –

Growth form: Annual, biennial or perennial herbs or shrubs. Aromatic

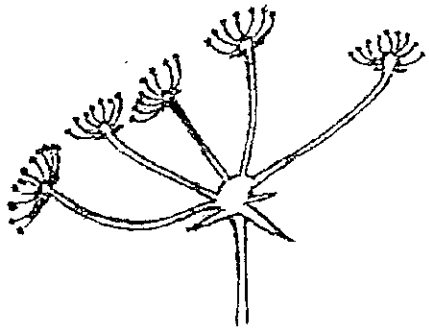
Flowers: regular 5-merous, perfect, small;

* ovary is inferior (no hypanthium) ;
* Calyx 0 or 5 sepals;
* corolla 5 separate;
* pistil 1 0f 2 united carpels (or 5) (style 2, 5 or absent)
* stamens: 5 (alternate with petals)
* Inflorescence: often in umbels

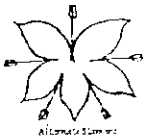
Leaves: alternate (or basal); usually compound

Fruit: schizocarp, splitting into one seeded fruit (merocarps)
(A schizocarp derived from a two to many-carpellate gynoecium that split into two or more one-seeded segments).

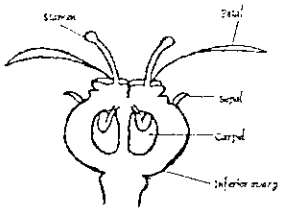
Important members: carrot, parsley, celery, caraway, fennel, coriander, anise, cumin and English ivy.

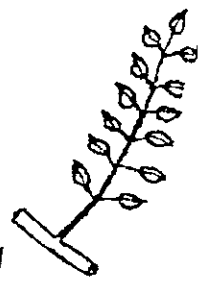


Compound umbel



Simple Umbel





Compound leaf

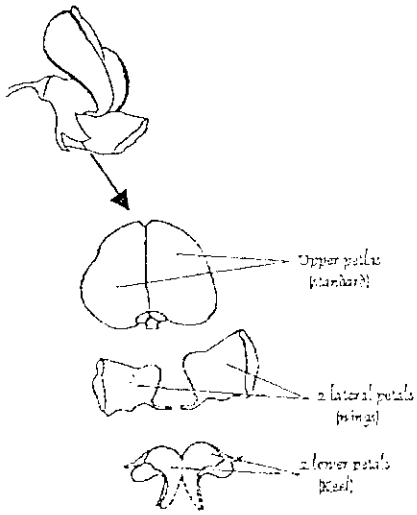
B.3.3 *Fabaceae* Family (Leguminosae)

–The Pea Family –

Growth form: Herb, shrub or trees.

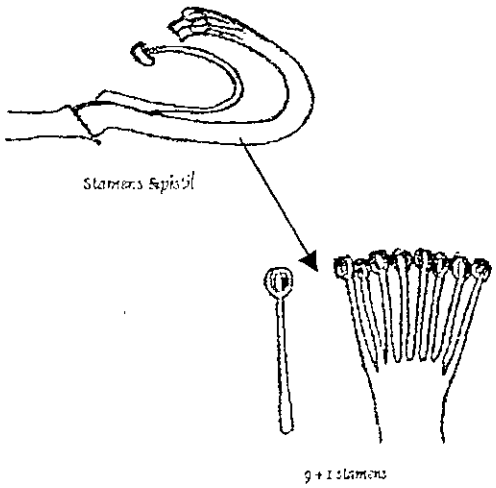
Flowers: regular to irregular 5-merous, usually perfect; tubular, bilabiate with 2-lobbed upper lip and 3-lobed lower lip

- Ovary is superior, (hypathium present or absent),
- Calyx synsepalous (united) with 5 lobes, tubular
- Corolla: 5, distinct or the lower 2 petals +/- united (papilionaceous flowers)
- 1 carpel: style 1, stigma 1.
- Stamens: often 10 filaments distinct, or united in a tube (monadelphous) or 9 united and one free

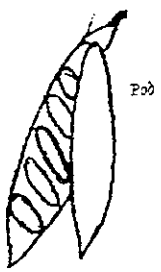


Leaves: usually alternate, pinnate (or bipinnate); sometimes palmetely compound; sometimes with tendrils; stipulate.

Fruit: a legume (pod) that splits along two lines.



Important members: Pea, alfalfa, clover, common bean, faba bean, soybean, chickpea, lentil, peanut, acacia and mimosa.



B.3.4 *Asteraceae* Family (Compositae)

– The Sunflower Family –

Growth form: Annual to perennial herbs or sometimes shrubs.

Inflorescence: in heads subtended by an involucre of bracts (phyllaries)

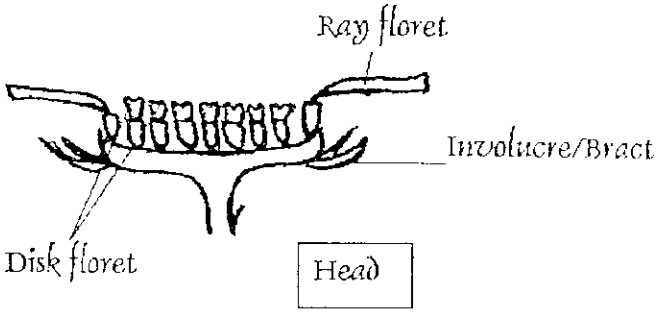
Flowers: regular or irregular, perfect or imperfect

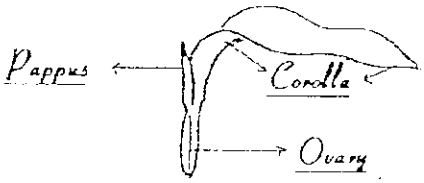
* Ovary is inferior, 1-celled and contains one ovule (1 seed at maturity)
* Calyx: absent or modified into a pappus of scales, awns or bristles (never green)
* Corolla: 5 or 3 united sometimes bilabiate or with a single lip (1 pistil with two united carpels, style one with two branches)
* Stamens: 5 filaments distinct; anther united into a tube around the style

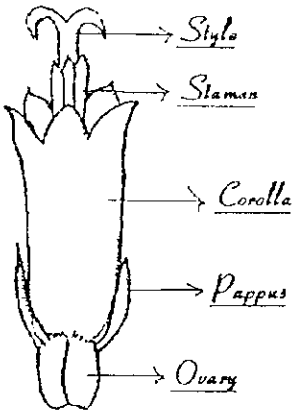
Leaves: alternate or sometimes opposite.

Fruit: an achene

Important members: Sunflower, safflower, artichoke, lettuce, chamomile, aster, zinnia, dahlia and chrysanthemum.







Stamens

Different types of flower heads:

* *Ligulate head:*

Only ligulate or ray florets e.g lettuce, dandelion

Discoid head:

Only tubular or disk florets. E.g. Circuim spp.

* *Radiate head:*

Disk florets in the center, surrounded by ray florets at the margin.
E.g. Sunflower, dahlia

For notes

B.3.5 *Lamiaceae* Family
– The mint family –

Growth form: mostly aromatic herb or shrub

Stems: usually four-angled, square

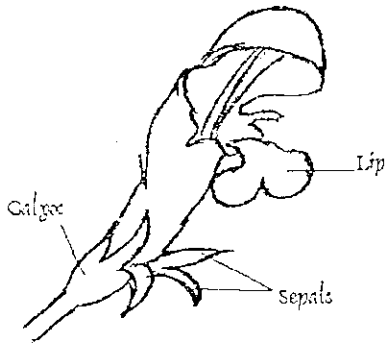
Flowers: irregular 5-merous, perfect, tubular, bilabiate with 2-lobed upper lip and 3-lobbed lower lip.

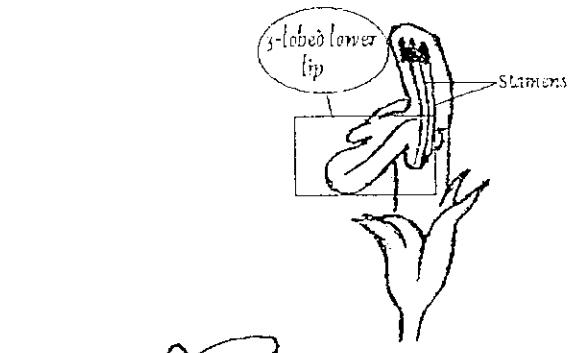
* Ovary is superior, 4-lobed (two carpels, but due to false partitions appear 4)
* Calyx: synsepalous, united with 5 lobes
* Corolla: sympetalous (united) with 5 lobes
* Stamens: 2 or 4 didynamous (=stamens in 2 pairs of unequal lengths); filaments attached at their base to corolla

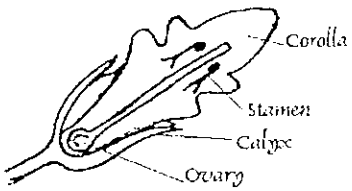
Leaves: opposite simple, (deeply divided or pinnate), aromatic.

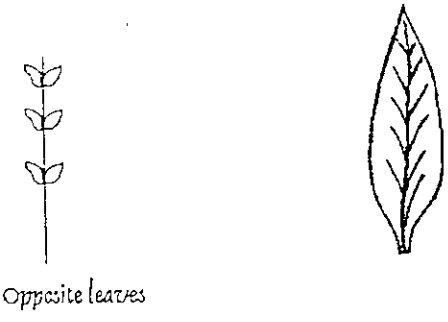
Fruit: a schizocarp splitting into 4 1-seeded nutlets

Important members:
peppermint, spearmint, thyme, sage, lavender, basil.








Opposite leaves


Ovary (xsection)

B.4 MONOCOTS

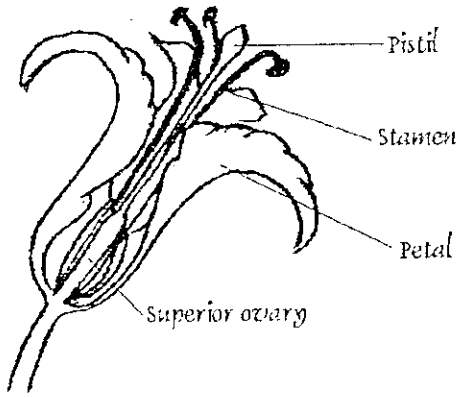
B.4.1 Liliaceae family

– The lily family –

Growth form: Most are perennial herbs from bulbs, tubers or rhizomes

Flowers: perfect

* ovary superior ,
* stamens usually 6
* pistil 1 (1or 3 united carpel)
* Perianth:6-parted , 3 petals and 3 petaloids sepals



Leaves: with parallel-veined leaves.

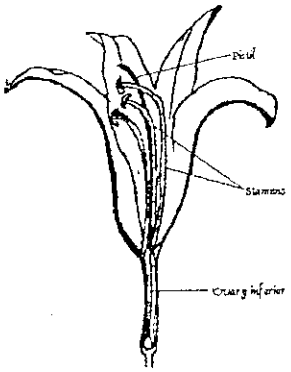
Fruit: a 3-parted capsule

Important members: Lily of the valley, tulip, fritillarias, hyacinth, onion and garlic

B.4.2 Iridaceae family

– The iris family–

Growth form: most are perennials herbs from bulb, corms or rhizomes



Flowers: Perfect

* ovary inferior,
* stamens 3,
* pistil 1 (3 carpels)
* Perianth: 3petals and 3 petaloid sepals

Leaves: with parallel veined leaves

Fruit: 3-parted capsule

Important members: Iris, gladiolus, crocus and freesia

B.4.3 *Poaceae* Family (Gramineae)

– Grass family –

Growth form: Grasses and grass like plants

Stems: with hollow internode and jointed nodes; circular in cross section

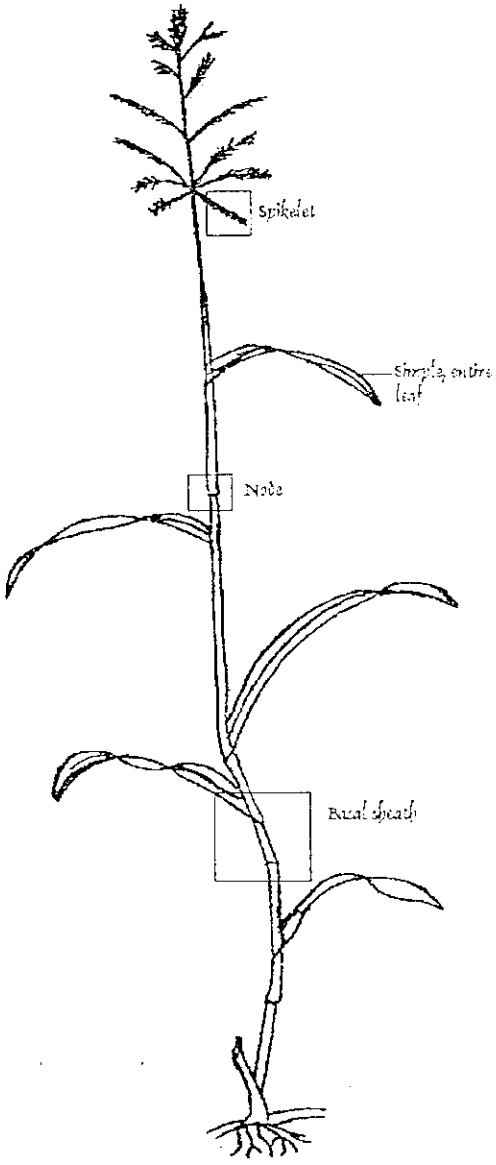
Flowers: small and inconspicuous, perfect or imperfect, irregular

* ovary is superior, one-celled and one-seeded
* Stamens: 6, 3 or fewer
* Perianth: 6-parted (3 petal and 3 petaloids sepals)
* Inflorescence: consists of spikelets

Leaves: simple entire, with parallel-veined, two-ranked with open basal sheath.

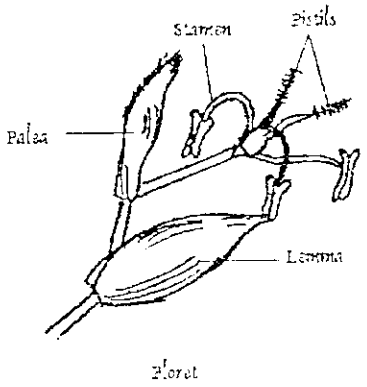
Fruit: grain (caryopsis)

Important members: Wheat, oat, rice, corn, barley, blue-grass and bamboo.

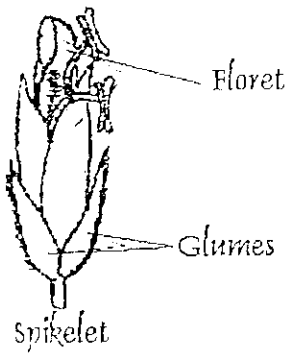


Spikelet: Each flower is subsessile between 2 bracts=lemma and palea, the whole forming a floret (false flower)

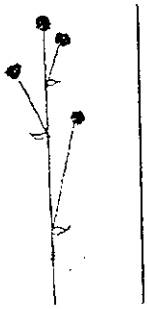
Florets: 1 to many, bearing at the base two empty bracts = glumes. The florets and the glumes form a spikelet. The spikelet can be arranged in racemes or panicles.

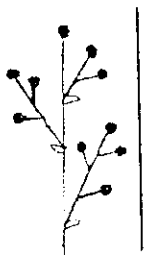


Floret



Spikelet


Racemes


Panicles

II- MONITORING OF FLORA

A-INTRODUCTION

Monitoring is not simply the creation of inventories and lists of names. Monitoring involves **surveying, sorting, cataloguing, quantifying and mapping** of entities such as genes, individuals, populations, species, habitats, biotopes, ecosystems and landscapes or their components. Synthesis of this information provides a snapshot of the state of biodiversity and baseline information for the assessment of change. **Recording these changes is monitoring**.

Inventorying and surveying are considered as tools and not end products (Glowka & al., 1994; Article 7). They are **the basic tools** for implementing monitoring programs, which serve the objectives and aims of any management strategy and conservation policy.

How can we define priority species in an ecosystem?

A healthy ecosystem is defined as being 'stable and sustainable', maintaining its vigour, organization and autonomy over time and its resilience to stress.

Studies indicate that in most situations there is not enough information and knowledge to select priority species (Simberloff, 1998).

Selection of priority species such as keystone species, indicator species and others, is a difficult challenge since ideally one should adopt a holistic approach in which ecosystem health is monitored, and that would include all organisms and components at once.

Therefore, perseverance, patience and assiduity are essential for a successful long term monitoring process.

B. FLORA MONITORING IN THE *EHDEN* FOREST RESERVE

B. 1 General description on *Ehden* forest reserve

The forest of *Ehden* is situated at the base of Mount Makmel, which is located on the north-western slopes of the Mount Lebanon Chain, it extends from 1250m to 1900m range of altitude. Its climate is typically Mediterranean, characterised by wet winter and hot, dry summers. The hot summer conditions are alleviated by the fog that bathes the forest Reserve and preserves the wetness of the superior layer of litter.

The forest reserve is located in the Oro-Mediterranean zone including a lower-Mediterranean zone and a montane zone where different plant communities ranging in the *Cedretea libani orientalia* alliances thrive (Zohary, 1973, Abi-Saleh & al., 1996, Sattout, 1999).

The forest reserve includes different sub-regions (Annex I) quite different in their vegetation composition and floristic richness. It comprises *Qornet es Snaoubar*, *Qornet el Aassi*, *Dahr Tnoub Aali*, *Wadiane Ghamiqa*, *Jouit*, *Arid el Moghr*, *Jouar el Jafi*, *Wadi el Baq* and *Wadi Qiami*. The lack of formal boundaries for these sub-regions is compensated by the change in vegetation type, clearly observed when exploring the forest.

Tree species encountered in the different plant associations observed in the reserve are *Cedrus libani*, *Abies cilicica* Tchilh. (Ehden is reported as the southern most limit of this species), *Pinus brutia* Ten. (Extending from 1250m to 1450m), *Juniperus excelsa* M. B., *Juniperus oxycedrus* L., *Quercus calliprinos* Webb, *Q. infectoria* Oliv., *Cotoneaster nummularia* Fisch. &Mey., *Lonicera nummulariifolia* Javb. & Spach. These species are widespread throughout the subregions. In contrast, *Q. cerris* L., *Q. pinnatifida* C. Gmel., *Q. cedrorum* Ky., *Styrax officinalis* L. are found as sparse populations in the forest reserve, while *Cercis siliquastrum* is found in the low edges of the *Pinetum brutiae* association. Moreover, the fauna expands its richness in the forest including important pollinators such as numerous butterflies and bee species, birds, mammals, and rodents all observed during spring and summer explorations.

B.2 Monitoring Priorities

The priorities suggested by the management team were:

a. Determine if the *Juniperus oxycedrus* is expanding and dominating other plant species
b. Determine the expansion trend of *Abies cilicica* (expanding South or retreating North)
c. Effect of lichens on plant health
d. Impact of visitors along the trails
e. Status assessment of ten endemic plants
f. Status assessment of threatened and rare plants
g. Status assessment of wild relative crops
h. Status assessment and monitoring of very important medicinal plants

i. Based on our discussion with LNCRS research team member, it was suggested to monitor *Erodium acaule,* a plant well known to thrive in degraded forest areas (Mouterde, 1970)
j. A recent study was conducted on *Origanum libanoticum* Boiss. In Ehden. A follow up of this study would give a second year data about this species and would be useful as a model. In addition, *O. libanoticum* is a plant known to be endemic and a wild relative to Origanum species which is widely used in culinary and known to have medicinal uses.

Below are detailed methods for priorities a, b, c, d, I and j. The remaining priorities will be addressed following scientific report of LNCRS with respect to which species are endemic threatened, rare, wild relatives and important medicinal plants.

B.3 - MATERIALS & METHODS

☞ *Equipment*

The equipment and materials needed for the fieldwork are cited in the previous manual.

Check your materials and equipment and complete them before any exploration trip in the field. Don't forget your survey forms.

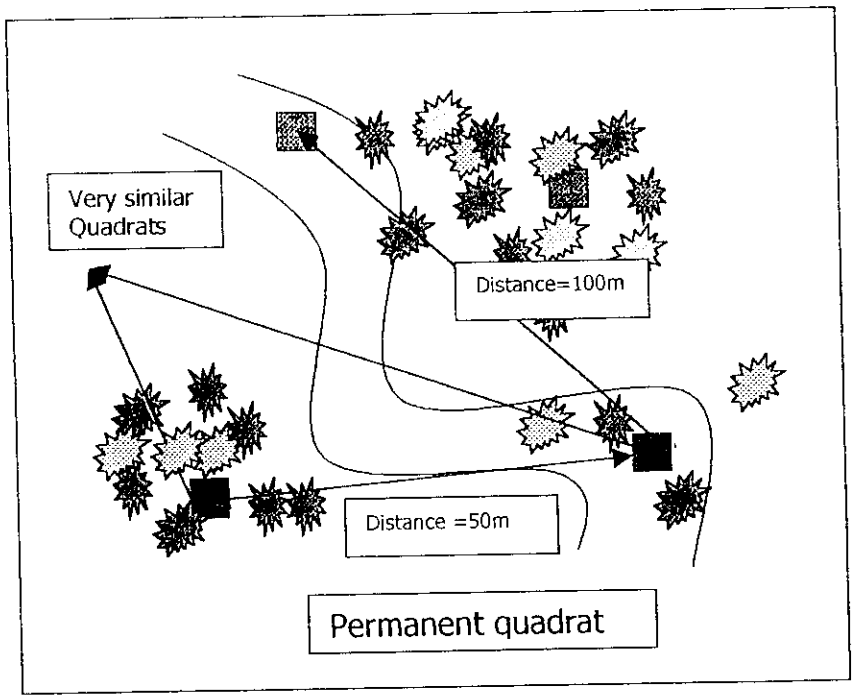
B.3.1 Methodology for monitoring the impact of visitors on trails

These survey forms were designed to collect the most useful data for monitoring and GIS analysis. The regular and consistent completion of these forms over several years and subsequent analysis of the data is expected to show the changes occurring in the status of the selected plant species in terms of population density and distribution.

- ***Permanent quadrat*** method is the one adopted when assessing the impact of visitors along the trails. Permanent plots are essential for monitoring the changes in population dynamics and the growth of individual plant species.

They will be fixed at different altitudes along the trails, a duplicate of the quadrat containing the same or very similar plant association is selected within the habitat at 50 meters distance or 100 meters depending on the changes in vegetation type.

Different quadrat will be fixed in *Ain el Naassa* where dense population of different *Orchidaceae* plant species is observed during exploration, another one will be located in the valleys.



The survey form includes:

The survey form includes:

* ***Date and site description*** including sampled site, longitude, latitude and altitude, slope exposure, and approximate degree of steepness
* ***Ecological site characteristics***: describing whether the samples were taken from a forest (dense tree population), woodland (mix of sparsely spread trees and shrubs), shrubland (prevalence of shrubs), forest clearing or forest margins (borders of the reserve).
* ***Land physiography*** including hillsides, valley bottom, mountaintop,
* ***Disturbance factors***: Evidence of any physical disturbance of the sampled site.
* ***Density*** of selected species is defined by recording the number of individual plant species.
* ***Notes***: Finally, any specific observation can be noted.

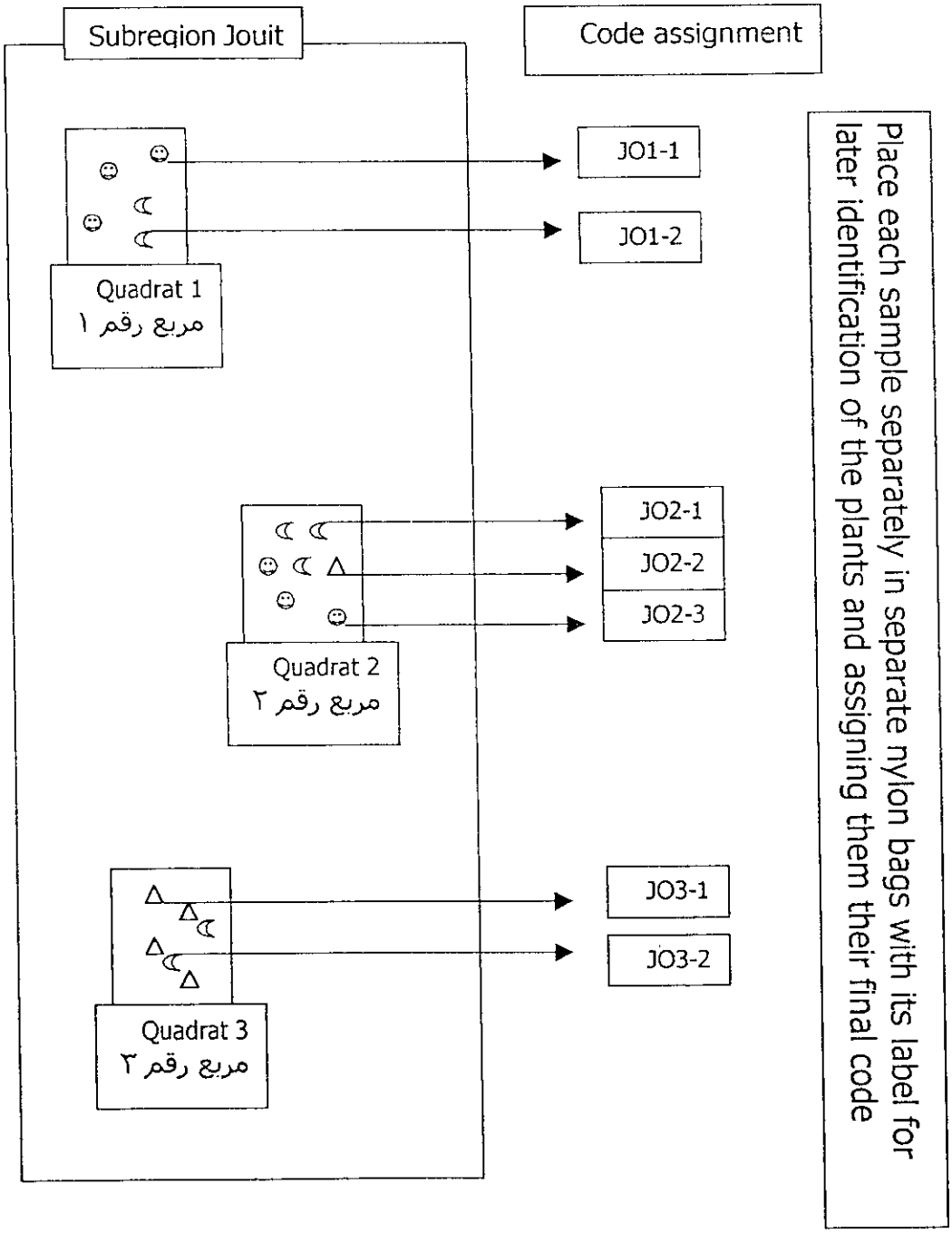
☞ *Coding system*

The management team along with GL has developed a coding system to differentiate between the various regions in the Reserve and to facilitate computerization of the data and its analysis.
It was agreed that every sampling site would be labeled with the first two or three letters of the region name. As shown below:

Arid el Moghr and Dahr el Moghr: **AeM**
Qornet es Snaoubar: **QS**
Qornet el Aassi: **QeA**
Wadi Qiame: **WQ**
Wadi el Baq: **WBq**
Jouar el Jafie: **JeJ**
Dahr Tnoub Aali: **DTA**
Wadiane el Gamiqa: **WeG**
Jouit: **JO**

In addition, each sampling site within the same region would be assigned a number. For example, if you sample from 5 different sites in Jouit then the samples will all have the following label: JO1, JO2, JO3, JO4 and JO5.

Within each site every kind of plant (i.e. different plant species) would be assigned a number. For example, if you find 4 different looking plants in the quadrat then each plant will be labeled as follows: JO1-1, JO1-2, JO1-3, JO1-4. After counting the number of each kind of plants separately, take a small sample including flowers and leaves place each one separately in a small nylon bag with a label of the plant code that you have assigned.



Demonstration of the coding system

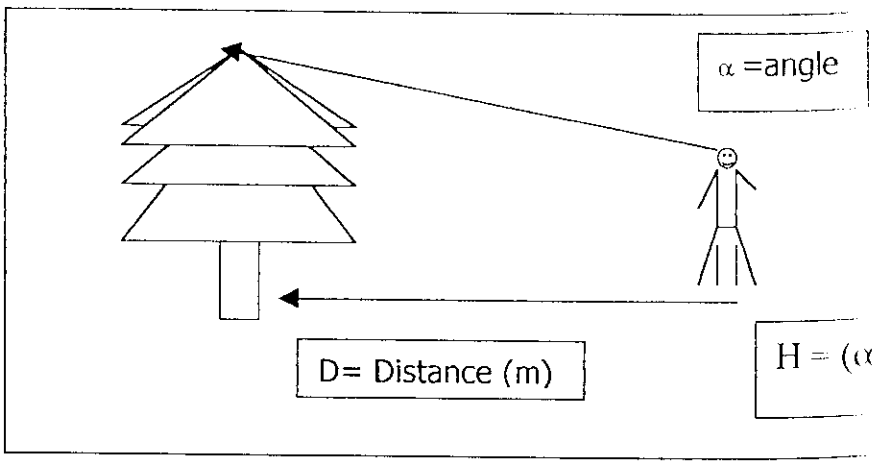
B.3.2 Methodology Characterizations of the tree communities in the *Ehden* forest (Annex II).

☞ *Survey forms*

It is the baseline data for defining the age structure and location of [illegible] tree species.

The survey form includes:

- The ***location*** of the tree species including the name of the [illegible] within the forest reserve (using site code previously devised) [illegible] the site description including altitude, longitude, latitude [illegible] exposure.
- The ***morphological characteristics*** of the tree [illegible] Circumference at breast height (at 1.50 m.). In addition to [illegible] (measured as the distance between the point where the [illegible] standing and the second point defined by the tree and the angle [illegible] from the same point where the individual has considered the [illegible] this with a clinometer. The calculation of the tree height will be [illegible] according to the equation shown below.



- The ***age structure***: trees are grouped in four categories, namely established seedling (0.5 m), juvenile (defined as young non [illegible] tree), reproductive adult (cone/fruit bearing trees), aged (very old trees)
- Presence or absence of ***lichens*** on the tree trunks and branches
- The type of ***disturbance factors*** if any (such as the animal species visitors, grazing and others).

The objective of this study is to monitor the regenerative process and their conservation scale.

B.3.3 Methodology for monitoring selected plant species (Annexe III)

- ***Non Permanent Quadrats***

Randomly chosen plots will be sampled every 100 m while following the belt transect method.

This method is used to assess the distribution of *Erodium acaule* and *Origanum libanoticum*. ***Belt transect method*** will be defined relying on the difference in elevation ranges, vegetation types including habitats and microenvironment, slope exposure and difference in soil texture and structure. It will be used when monitoring selected plant species

This methodology (B.3.3) will rely on the survey forms presented above (B.3.1)

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Annex I. Inventory of the Flora of Ehden Forest Reserve and Ehden village (Mouterde, 1970) [Cont'd]

Plant name	Bloom date
Centaurea cheirolopha *	V-VII
Centaurea cyanoides	III-VI
Centaurea eryngioides	V-VII
Centaurea iberica *	V-VII
Centaurea solstitialis	IV-VI
Centaurium erythrea	IV-X
Centranthus longiflorus	VI-X
Cephalorrhynchus tuberosus *	V-VI
Cerastium brachypetalum	IV-VI
Cerastium glomeratum	II-V
Cerastium inflatum	IV-V
Chardinia orientalis *	IV-V
Cirsium lappaceum	VI-IX
Cirsium libanoticum	VI-X
Cirsium phyllocephalum	VII-X
Clematis flammula	IV-VIII
Clypeola jonthlaspi	I-V
Cnidium orientale *	V-VIII
Colutea cilicica *	IV-VII
Conium maculatum *	IV-VI
Consolida hohenackeri	VII-VIII
Convolvulus arvensis	IV-VIII
Convolvulus cantabrica	IV-X
Convolvulus scammonia	IV-VII
Convolvulus stachydifolius *	IV-VI
Convolvulus stenophyllus	V-VII
Coridothymus capitatus	
Cornus australis *	V-VI
Coronilla emeroides	II-VI
Coronilla varia ssp. libanotica *	V-IX
Corydalis solida *	III-V
Cotoneaster nummularia *	V-VI
Cousinia libanotica **	VII-IX
Crepis foetida	IV-IX
Crepis reuteriana	
Crocus cancellatus	VIII-IX
Crocus ochroleucus	X-XII
Crucianella macrostachya	V-VIII
Cruciata coronata	IV-VII
Crupina crupinastrum	IV-VI
Cuscuta europaea var. indica	VI-VIII
Cyclamen coum	II-IV
Cyclamen persicum	X-V
Daphne oleoides	IV-IX
Digitalis ferruginea	VI-VIII
Doronicum orientale *	IV-VI
Echinops viscosus	V-VIII
Echium glomeratum	V-VIII
Epilobium parviflorum	VI-IX
Epilobium tetragonum	VI-IX
Eremostachys laciniata	III-V
Eremurus libanoticus	IV-VI
Erodium acaule	II-IV
Erodium cicutarium	12 Month
Eryngium glomeratum	VI-VIII
Erysimum goniocaulon	III-VI
Erysimum repandum	III-V
Euphorbia aleppica	VI-X
Euphorbia aulacosperma	XII-VII
Euphorbia falcata	III-VII
Euphorbia macroclada	IV-VIII
Euphorbia macrostegia *	III-VI

* Plants found in the *Ehden* forets reserve

** Endemic plant species

Annex I. Inventory of the Flora of Ehden Forest Reserve and Ehden village (Mouterde, 1970)

Plant name	Bloom date
Acantholimon libanoticum	Summer
Acer tauricolum *	Spring
Achillea falcata	IV-VII
Achillea Kotschyi	VI-VIII
Achillea membranacea	V-VI
Adonis flammea	III-VI
Aethionema coridifolium *	V-VII
Agrimonia eupatoria	V-VIII
Agrostemma githago	IV-V
Alcea acaulis	IV-V
Alcea apterocarpa	VI-IX
Alcea setosa	V-VI
Alkanna prasinophylla	V-VI
Allium cassium Boiss.	V-VII
Allium chloranthum Boiss.	VIII-IX
Alyssum contemptum	II-IV
Alyssum mouradicum	V-VI
Alyssum murale	IV-X
Alyssum repens	IV-VI
Amaranthus hybridus	V-XII
Amaranthus retroflexus	Summer-Autumn
Anagallis arvensis	12 month
Anarrhinum orientale	V-VIII
Anchusa hybrida	II-VI
Andrachne telephioides	III-VIII
Anemone blanda	III-V
Anthemis cotula	IV-VI
Anthemis cretica *	VI-VII
Anthemis hyalina	IV-VI
Anthriscus lamprocarpa	III-V
Arabis montbretiana	III-IV
Asperula arvensis *	III-IV
Asperula stricta	V-VII
Asphodelus brevicaulis	spring
Asphodelus liburnicus	spring
Asterolinon linum-stellatum	II-IV
Astragalus coluteoides *	V-VIII
Astragalus cruentiflorus *	VI-VIII
Astragalus echinus *	VII-VIII
Astragalus ehdenensis *	V-VI
Astragalus emarginatus	VI-VIII
Astragalus gummifer	V-VIII
Astragalus pinetorum	V-VII
Astragalus suberosus	III-IV
Astragalus trichopterus	VI-VII
Asyneuma rigidum	VII-IX
Asyneuma virgatum *	Summer
Atriplex rosea	V-IX
Aubrietia libanotica *	IV-VII
Berberis libanotica	V-VI
Brunnera orientalis	III-V
Bulbillaria gageoides	IV-VI
Bunium elegans	IV-VIII
Bunium pestalozzae *	VI-VIII
Bupleurum gerardii	V-VI
Bupleurum linearifolium	VII-VIII
Calamintha origanifoiia *	V-IX
Calamintha vulgaris	VI-VIII
Callipeltis cucullaris	III-V
Campanula peregrina	VI-IX
Campanula stricta	VI-X
Campanula trichopoda	V-IX

* Plants found in the *Ehden* forets reserve

** Endemic plant species

Annex I. Inventory of the Flora of Ehden Forest Reserve and Ehden village (Mouterde, 1970) [Cont'd]

Plant name	Bloom date
Ferula cassii *	V-VIII
Ferulago frigida	VI-VII
Fibigia eriocarpa	II-IV
Ficaria ficaroides *	IV-VI
Filago eriocephala	III-V
Fritillaria acmopetala*	III-V
Fumana arabica *	II-IV
Fumaria kralikii	I-V
Galium canum	V-VII
Galium jungermannioides	V-VIII
Galium libanoticum	VI-VII
Galium prusense	IV-VII
Galium verticillatum	IV-VI
Galium verum	VI-VII
Garhadiolus hedypnois *	III-V
Genista libanotica	V-VII
Geranium crenophilum	IV-VIII
Geranium libani *	III-VI
Geranium tuberosum	II-VI
Geum urbanum *	V-VIII
Gladiolus segetum	III-V
Hedera helix *	Autumn-Winter
Heldreichia bupleurifolia	VI-VIII
Helichrysum sanguineum	III-VI
Heliotropium lasiocarpum	V-IX
Herniaria glabra ssp. microcarpus	III-VII
Herniaria incana	V-VII
Hesperis kotschyana *	V-VI
Hieracium bauhinii	V-VIII
Hymenocarpus circinatus	IV-V
Hypecoum imberbe	II-V
Hypericum lydium *	IV-VII
Hypericum perforatum	V-VII
Hypericum scabrum *	V-VII
Hypericum tetrapterum *	VI-X
Inula salicina	VI-VIII
Ixiolirion tataricum	IV-V
Lactuca saligna	VI-XII
Lactuca serriola	VI-IX
Lamium truncatum	II-V
Lapsana communis	VI-IX
Lathyrus digitalus var. ovalifolius *	III-VI
Lathyrus inermis *	IV-VI
Lathyrus libani *	V-VI
Laurus nobilis	III-IV
Lecoquia cretica	III-IV
Legousia pentagonia	IV-V
Leontodon asperrimus	V-VII
Lepidium latifolium	IV-VI
Lepidium spinescens	IV-V
Linaria aucheri *	V-VII
Linum carnosulum **	VI-VII
Lonicera etrusca	IV-VI
Lonicera nummulariifolia	VI-VII
Lotus gebelia var. libanoticus	IV-VII
Lygia aucheri	VI-XII
Lythrum junceum	IV-VI
Malabaila secacul *	IV-VI
Malus trilobata *	V-VI
Malvella sherardiana	III-VI

* Plants found in the *Ehden* forets reserve

** Endemic plant species

Annex I. Inventory of the Flora of Ehden Forest Reserve and Ehden village (Mouterde, 1970) [Cont'd]

Plant name	Bloom date
Marrubium radiatum	IV-VIII
Matricaria aurea	Spring
Medicago falcata	V-VII
Medicago lupulina	III-VI
Medicago minima	II-IV
Melandrium album **	V-VIII
Mentha longifolia	VI-X
Mentha microhylla	VI-XII
Mercurialis annua	
Michauxia campanuloides	V-VIII
Micromeria amana	Summer
Micromeria barbata *	Summer-Autumn
Micromeria graeca	V-IX
Minuartia meyeri	III-V
Muscari comosum	III-VI
Muscari pinardi	III-V
Myosotis reflacta	IV-VI
Nasturlium officinale	II-VII
Nepeta cilicica	VI-IX
Nepeta italica	V-IX
Nepeta nuda	Summer
Nigella cillaris	IV-V
Nigella oxypetala	V-VI
Noaea mucronata	VII-VIII
Nonea obtusifolia	II-IV
Onobrychis cornuta *	V-VII
Onosma aucherana *	IV-V
Onosma sericea	V-VI
Origanum libanoticum * **	Spring-Summer
Origanum libanoticum x Origanum syriacum*	Spring-Summer
Origanum syriacum	VI-XII

Plant name	Bloom date
Orlaya platycarpos	IV-V
Ornithogalum circinatum L.	IV-V
Ornithogalum divergens	III-IV
Ornithogalum libanoticum	III-V
Ornithogalum narbonense	III-V
Orobanche ramosa	12 month
Orobanche schultzii	
Pallenis spinosa	III-VI
Papaver rhoeas	III-VI
Peltaria angustifolia *	Spring
Peucedanum depauperatum	V-VIII
Phagnalon kotshyi *	VI-IX
Phagnalon rupestre	III-IV
Phlomis brevilabris **	V-VIII
Phlomis chrysophylla	V-VIII
Picris echioides	V-VII
Pimpinella anthriscoides *	VI-VII
Pistacia palaestina	II-IV
Plantago lanceolata	III-IX
Platanus orientalis *	II-III
Polygala supina *	III-VI
Potentilla geranioides	Summer
Potentilla libanotica *	VI-VIII
Poterium polyganum	IV-V
Poterium verrucosum	IV-V
Prangos asperulla	V-VI
Primula vulgaris	III-IV
Prunella vulgaris	VI-VIII
Prunus mahaleb *	IV-VI
Prunus prostrata *	IV-V
Prunus ursina	III-V

* Plants found in the *Ehden* forets reserve

** Endemic plant species

Annex I. Inventory of the Flora of Ehden Forest Reserve and Ehden village (Mouterde, 1970) [Cont'd]

Plant name	Bloom date
Puschkinia scilloides var.libanotica	IV-V
Putoria calabrica	V-VI
Ranunculus arvensis	II-V
Ranunculus cuneatus	IV-V
Ranunculus demissus	V-VIII
Ranunculus hierosolymitanus	III-V
Rapistrum rugosum	IV-VI
Reichardia glauca	V-VIII
Rhagadiolus edulis *	III-VI
Rhagadiolus stellatus	III-IV
Rhamnus catharica *	Spring
Rhamnus libanotica *	V-VI
Ribes orientale *	V-VI
Rochelia disperma	IV-V
Rosa canina *	Spring
Rosa dumetorum *	Spring
Rosa orientalis *	Spring
Rosularia libanotica	V-VII
Rubia aucheri *	IV-VI
Rubus hedycarpus *	Spring-Summer
Salvia microstegia	VI-IX
Salvia multicaulis	III-V
Salvia sclarea	V-VII
Salvia tomentosa	VI-IX
Salvia viscosa	V-VII
Samolus varterandi	V-VII
Satureia cuneifolia	VI-VII
Scandix pecten-veneris	II-III
Scariola orientalis	VIII-IX
Scorzonera mollis	III-VIII
Scrophularia peyronii	IV-VII
Scutellaria brevibracteata	V-IX
Scutellaria utriculata	Summer
Sedum album	VI-VIII
Sedum hispanicum *	III-VI
Sedum pallidum *	IV-VII
Senecio vernalis	XI-V
Serraluta cerinthifolia	V-VIII
Sideritis libanotica var. incana	VII-VIII
Sideritis perfoliata	V-IX
Silene conoidea	III-V
Silene grisea	VI-VII
Silene italica	IV-VI
Silene makmeliana	V-VIII
Siler trilobum	VI-VII
Smyrniopsis syriaca *	IV-VI
Solenanthus stamineus	V-VI
Sorbus flabellifolia *	V-VI
Sorbus torminalis *	IV-V
Spartium junceum	IV-VI
Stachys distans	III-X
Stachys ehrenbergii	VI-VII
Stachys viticina	VI-IX
Stellaria media ssp.media	I-V
Steptorhamphus tuberosus	VIII-IX
Sterbergia pulchella Boiss. & Bl. *	End of autumn
Taraxacum microcephalum	Summer
Taraxacum serotinum	Summer-Autumn

* Plants found in the *Ehden* forets reserve

** Endemic plant species

Annex I. Inventory of the Flora of Ehden Forest Reserve and Ehden village (Mouterde, 1970) [Cont'd]

Plant name	Bloom date
Teucrium orientale	VI-VIII
Thlapsi brevicaule	IV-VII
Thlapsi microstylum *	IV-VI
Thymbra spicata	IV-V
Torilis chrysocarpa	Spring
Torilis leptophylla	III-VI
Tragopon longirostris	IV-VII
Trifolium arvense	IV-VII
Trifolium clusii	III-IV
Trifolium echinatum	IV-VI
Trifolium lagrangei	IV-VI
Trifolium modestum	VI-IX
Trifolium plebeium *	IV-VII
Trifolium repens	12 Month
Trifollium stellatum	III-V
Trigonella hierosolymitana	III-V
Trigonella spicata	IV-VI
Tulipa aleppensis*	III-V
Tulipa montana	III-V
Tulipa oculis-solis	III-V
Turgenia latifolia	IV-V
Turgeniopsis foeniculacea	IV-V
Tussilago farfara *	I-VI
Umbilicus erectus *	V-VI
Umbilicus intermedius	III-V
Valeriana dioscoridis *	I-IV
Valerianella coronata	III-V
Valerianella muricata	II-IV
Valerianella vesicaria	III-IV
Verbascum cedreti	V-VIII
Verbascum gailladotii	V-VIII
Verbascum leptostachyum	IV-VIII
Veronica anagallis-aquatic	III-IX
Veronica anagalloides	V-VI
Veronica orientalis	III-VII
Veronica polifolia	V-VII
Veronica polita	XI-V
Veronica syriaca	I-V
Vicia palaestina	III-V
Vicia peregrina	II-IV
Vicia tenuifolia *	V-VII
Viola ebracteolata	II-V
Xerabthemum cylindraceum	V-VI
Xeranthemum inapertum *	V-VII

* Plants found in the *Ehden* forets reserve
** Endemic plant species

Appendix II. Characterization of the tree communities (Samples).

Forest Reserve		Date	

Subregions				
Sample code				
Tree Species				
Site Description				
Altitude				
Longitude				
Latitude				
Tree Height				
Distance (m)				
Angle (degrees)				
Trunc circumference				
at 1.5m				
Age Stucture in (10x10m) quadrat				
Established seedling				
Non bearing				
Reproductive adult				
Senescent				
Disturbance Factors				
Key animal species				
Visitors				
Grazed areas				
Lichens				
	Yes No	Yes No	Yes No	Yes No
Notes				

Annexe III.Survey form for monitoring selected species (Sample).

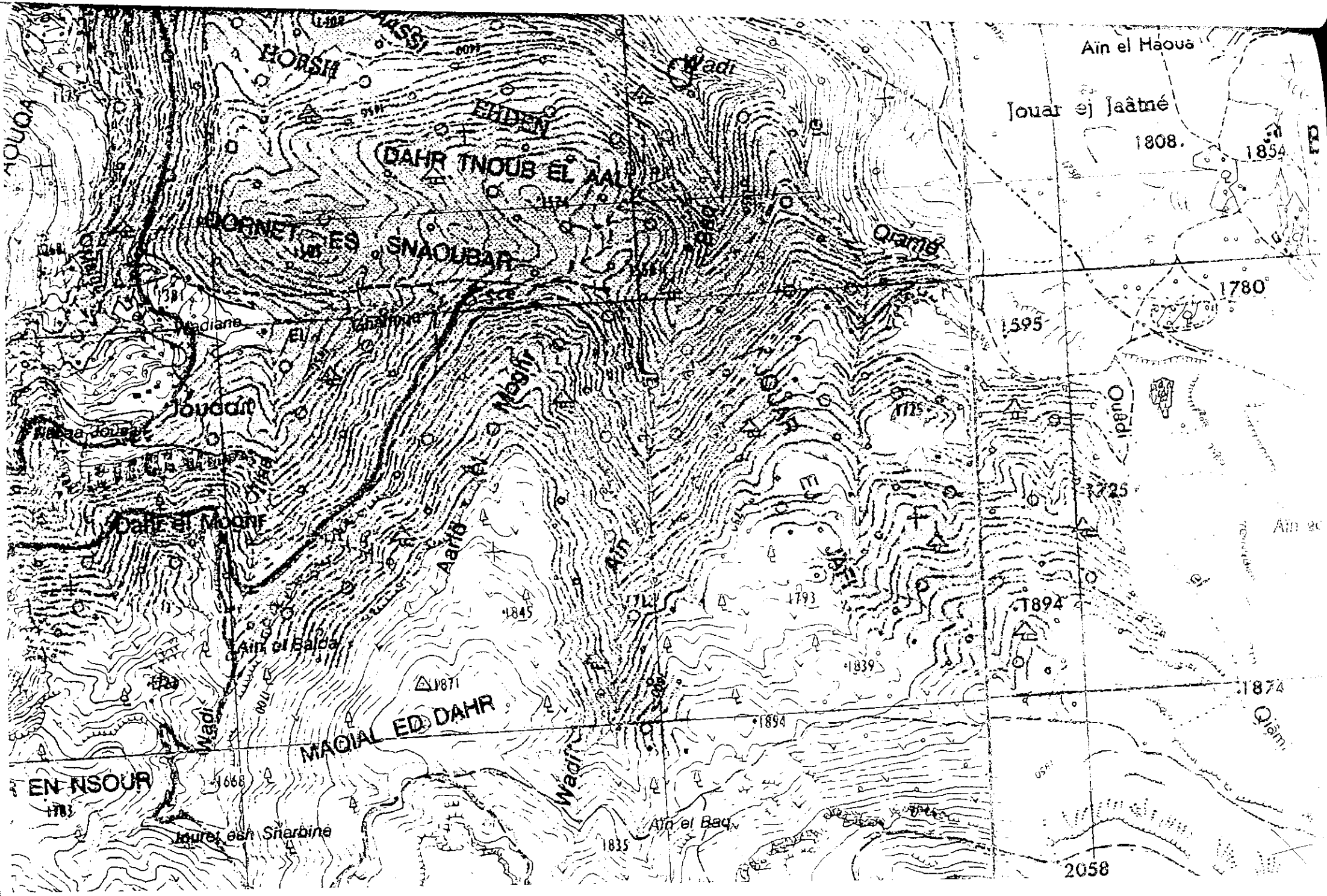
Name of the reserve	Ehden	Al-shouf	Palm Island		Date
Subregion					
Monitoring site code					
Altitude					
Longitude					
Latitude					
Slope	Steep	Steep	Steep	Steep	Steep
	Flat	Flat	Flat	Flat	Flat
	Inclined	Inclined	Inclined	Inclined	Inclined
Exposure	N E	N E	N E	N E	N E
	S W	S W	S W	S W	S W
Habitat	mainly trees	mainly trees	mainly trees	mainly trees	mainly trees
	mainly shrubs	mainly shrubs	mainly shrubs	mainly shrubs	mainly shrubs
	mainly herbs	mainly herbs	mainly herbs	mainly herbs	mainly herbs
Site physiography	Mountaintop	Mountaintop	Mountaintop	Mountaintop	Mountaintop
	Mountain bottom	Mountain bottom	Mountain bottom	Mountain bottom	Mountain bottom
	Mountain side	Mountain side	Mountain side	Mountain side	Mountain side
Sun	Sunny	Sunny	Sunny	Sunny	Sunny
	Partial	Partial	Partial	Partial	Partial
	Shaded	Shaded	Shaded	Shaded	Shaded
Soil stoniness	High	High	High	High	High
	Medium	Medium	Medium	Medium	Medium
	Low	Low	Low	Low	Low
Disturbance	Animal	Animal	Animal	Animal	Animal
	Soil erosion	Soil erosion	Soil erosion	Soil erosion	Soil erosion
	Desertification	Desertification	Desertification	Desertification	Desertification

Annexe III.Survey form for monitoring selected species (Sample) [Cont'd].

Soil sample	Yes	Yes	Yes	Yes	Yes
	No	No	No	No	No
	Code	Code	Code	Code	Code

Selected plant sepcies for monitoring					
Plant name					
Number					

Notes					


Ain el Haoua
Jouar ej Jaâtmé
1808.
1854
1780
1595
1725
1894
1874
2058
DAHR TNOUB EL AAL
SNAOUBAR
Jouaar
Dahr el Mogmf
Ain el Balda
MAQIAL ED DAHR
EN NSOUR
Jouret esh Shaabine
Ain el Baq
1871
1845
1793
1839
1894
1668
1835

الجمهورية اللبنانية
مكتب وزير الدولة لشؤون التنمية الإدارية
مركز مشاريع ودراسات القطاع العام
Republic of Lebanon
Office of the Minister of State for Administrative Reform
Center for Public Sector Projects and Studies
(C.P.S.P.S.)

مراقبة التنوع البيولوجي

الفلورة في محمية اهدن الطبيعية

مشروع المحميات الطبيعية

وزارة البيئة
بيروت. لبنان

ألجزء الثاني
(٨ أيار، ١٩٩٩)

ستوت السا.،سلمى نشابة تلحوق و خزامى كنيعو.
ألخط الأخضر
جمعية علمية للحفاظ على البيئة

ب-كاسات البذور أو وعائيات البذور

وعائيات البذور (الزهريات) هي شعبة تتضمن أقسام النبات ذات البذور في ثمرة. انهم الأكثر انتشارا وسيطرة ونجاحا في عالم النباتات في أيامنا هذه.وبالإضافة إلى ذلك تتضمن الشعبة هذه ما يوازي ربع مليون نوع موزعة على ٣٠٠ فصيلة. تكمن خصائصهم بانهم يزهرون،يعطون بذور ويثمرون.

ب.١- المقاييس المعتمدة في تصنيف النباتات

- حضور أو غياب تويجيات. في حال وجودها أهي أحادية أو ازدواجية.
- موضع المبيض: سفلي، محاط أو علوي الأسدية.
- عدد التويجيات.
- اتحاد الأقسام.
- طبيعة الكم (= كأس وتويج)
- طبيعة الثمرة (هي مرتبطة بطبيعة الوزيم)
- شكل البذرة
- الميزات الخضرية (الساق، الأوراق والساق)

ب.٢-تصنيف وعائيات البذور

تقسم هذه الشعبة إلى صفين:

- ذات الفلقتين

الفوف: ذات فلقتين

الأزهار:عدد ٤ أو ٥ أو *٤ أو *٥

الأوراق:تعرق شبكي (ذنيب :+/-)

النمو:عشبي أو خشبي

النظام الوعائي:الأوعية في حلقة

الجذل:جذر وتدي رئيسي

- ذات الفلقة الواحدة

الفوف: فلقة الواحدة

الأزهار:عدد ٣ أو *٣

الأوراق:عادة تعرق متواز (ذنيب نادر النمو)

النمو:الأكثرية عشبي والأقلية شجري

النظام الوعائي:الاوعية فيحزمة وعائية

الجذل:متفرع ،ليفي

ب.٢,١-أنواع الأزهار

- **أجزاء الزهرة موجودة تحت المبيض :**أزهار سفلية المبيض هي أزهار ذات مبيض عالي، أي الكأسية، التويجية والسداة مدرجة على قائمة المبيض وغير مرتبطة به.
- **أجزاء الزهرة موجودة حول المبيض:** زهرة محيطية. الكأسية،التويجية والسداة قائمة على حافة بنية شبيهة بالفنجان المسطح أو العميق.
- **أجزاء الزهرة موجودة فوق المبيض:**زهرة علوية المبيض.قاعدة الكأسية، التويجية والسداة تقع فوق المبيض.

ب.٣-النباتات ذات الفلقتين

• فصيلة الصليبيات

أو فصيلة الخردل

نباتات سنوية أو معمرة تتميز برائحة نسغ لاذعة

الزهرة: منتظمة عدد ٤ كاملة

- ✓ كأس: ٤ كأسية
- ✓ التويج:٤ متفرقة،تويجية مخلبية
- ✓ زهرة سفلية المبيض،مدقة واحدة مؤلفة من خباءين
- ✓ سداة:٦
- ✓ نظام الازهرار:عنقودي وفي بعض الأحيان عذقي

الأوراق: متعاقبة بسيطة

الثمرة:ذات صمامين خردلية أو خربدلية

أهم النباتات:منشور،خردل،بزر اللفت،قرنبيط،ملفوف،لفت،فجل.

• فصيلة الخيميات

أو فصيلة المقدونس

نبات سنوي عطري،أو أعشاب أو جنبة معمرة

الزهرة: منتظمة،عدد ٥،كاملة،صغيرة

- ✓ كأس:٥ أو ٥ كأسية
- ✓ تويج:٥ متفرقة
- ✓ علوية الأسدية،مدقة واحدة مؤلفة من خباءين
- ✓ سداة:٥ متعاقبة مع تويجية
- ✓ نظام الازهرار:حيمة

الاوراق:متعاقبة، عادة مركبة

الثمرة:مشققة الخباء

أهم النباتات:جزر،مقدونس،كرفس،شمار،كزبرة،أنيسون،كمون،لبلاب متسلق.

- **فصيلة القرنيات**

عشب،جنبة أو أشجار

الزهرة:منتظمة إلي غير منتظمة،عدد ٥،كاملة أنبوبية،

- ✓ ذات شفتين العليا مفصصة إلى اثنين أما السفلية إلى ٣.
- ✓ متحدة الكأسيات،مفصصة إلى ٥،أنبوبية.
- ✓ التويج:٥،(فراشي الزهر)،سفلية المبيض
- ✓ خباء ١،مدقة ١
- ✓ سداة:عدد ١٠،مئبر مفرق أو متحد في أنبوب (أحادية الاخوّة) أو ٩ أحادية وواحد منفرد.

الاوراق:متعاقبة،ريشية وفي بعض الأحيان كفي التركيبة،مزودة بالمحالق،أذنية.

الثمرة:قرن

أهم النباتات:لوبياء،فاصوليا،برسيم،بسلة،صوية،حمص،عدس،فول،سنط،ميموزا.

- **فصيلة المركبات**

أعشاب سنوية أو معمرة وفي بعض الأحيان جنبة

الأزهار:منتظمة أو غير منتظمة،كاملة أو غير كاملة

- ✓ نظام الازهرار:رؤوس مرتكزة على قناب
- ✓ كأس:غائب أو محول الى مظلة مؤلفة من شعيرات
- ✓ تويجة ٥أو ٣ متحدة،ذات شفتين أو شفة واحدة
- ✓ سفلية المبيض،خلية واحدة ،المبيض يحمل بويضة واحدة.(مدقة مؤلفة من خباءين)
- ✓ سداة:٥،شعيرات متفرقة متحدة في أنبوب حول المدقة.

الأوراق:متعاقبة أو متقابلة

الرأس:

رأس ممثل بزهيرة:زهيرة بسيطة أو زهيرة شعاعية مثال على ذلك خس،طرخشقون

رأس قرصي:زهيرة أنبوبية أو على شكل قرص

راس شعاعي:زهيرة ذات قرص في الوسط،محاط بزهيرات شعاعية على الحافة.

- **فصيلة الشفويات**

أو فصيلة النعناع

عشب أو جنبة عطرية

الساق:٤ زوايا،مربع

الازهار:غير منتظمة،كاملة، عدد ٥

- ✓ انبوبية،ذات شفتين،الشفة العليا مفصصة الى اثنين اما السفلى الى ثلاث
- ✓ كأس:متحدة الكأسيات
- ✓ التويجية:متحدة الويجيات
- ✓ سفلية المبيض، مجزأة الى أربعة،الشعيرات متصلة الي ركيزة التويجية

الأوراق:متقابلة،بسيطة،بعطرية

الثمرة:مشقق الخباء.

أهم النباتات:نعناع،نعنع بلدي،صعتر،قويسة،خزامى،حبق،اكليل الجبل،مردكوش.

ب.٤-النباتات ذات الفلقة الواحدة

- فصيلة الزنبقيات

معظم النباتاتها معمرة، تنمو من بصلة،جزمور أو درنة (عسقول).
الزهرة:كاملة،
- ✓ علوية الأسدية، سدات عدد ٦،
- ✓ مدقة ١ (١ أو ٣ مجموعة في خباء)
- ✓ كمّ: ٦-أجزاء (٣ تويجيات، ٣ تويجية كأسية)

الاوراق: ذات تعرق متواز.
الثمرة:جرو،مجزأة الى ٣.
أهم النباتات: بوقية،زنبق الوادي، حزامى،ياقوت،بصل وثوم.

- فصيلة السوسنيات

نباتات معمرة، تنمو من بصلة، جعثين أو جذمور.
الزهرة:كاملة،كأسية
- ✓ كمّ:٣ تويجيات و٣ تويجية
- ✓ سفلية المبيض،
- ✓ ٣ سداة، مدقة ١ (خباء عدد ٣).

الأوراق: متوازية التعرق.
الثمرة:خباء مجزأ ٣.
أهم النباتات:سوسن،دلبوت أو سيف الغراب،زعفران.

- **فصيلة النجيليات**

معظم النباتاتها عشبية.
الساق:دائري يتميز بأنبوبة جوفاء وعقد.
الزهرة:صغيرة جدا،كاملة او غير كاملة،غير منتظمة
- ✓ سفلية المبيض،١-خلية و١-بذرة
- ✓ سداة:٦أو ٣
- ✓ كمّ:٦ اجزاء (٣ تويجيات و٣ تويجية كأسية)

نظام الزهرار:مؤلف من سنيبلات.
الأوراق:بسيطة،كاملة،متوازية التعرق، في صفين مع ورقة غمدية أساسية مفتوحة.
الثمرة:بذرة (برّة)
أهم النباتات:قمح،شوفان،أرّز،شعير،خيزران أو قصب،عشبة الكلأ المرجية.

سنيبلة:تتألف من زهرة لاطئة بين قنابة سفلية وحرشفة زهرية وكل ذلك يؤلف زهيرة.
الزهيرات:١ أو أكثر،مزودين في الأسفل بعصفة. الزهيرات والعصفة تؤلفان السنيبلة (السنيبلة تصف في عنقود أو عثكول).