

MINISTRY OF HEALTH OF THE REPUBLIC OF UZBEKISTAN

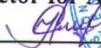
TASHKENT PHARMACEUTICAL INSTITUTE

**METHODICAL MANUAL FOR CONDUCTION OF STUDY-FIELD
PRACTICE ON BOTANY
FOR STUDENTS ON THE 2-COURSE OF PHARMACEUTICAL FACULTY**

Tashkent 2017

MINISTRY OF HEALTH OF THE REPUBLIC OF UZBEKISTAN

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S.U. Aliev
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Record № _____



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**Specialty: 5510500 – Pharmacy (all directions)
 5111000 – Professional education**

Tashkent 2017

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Methodical manual for conduction of study - field practice on botany.

Hours of educational field practice :**72**Methodical manual was discussed on the Methodical Council of Department of Pharmacognosy
on the "10" of March in 2017 Record № 18**Head of the department, professor:****F.F. Urmanova**

Methodical manual was discussed on the Methodical Council of pharmacy faculty on the " 17 " of May in 2017 Record № 10.

Chairman of Methodical Council:**M.A. Tojiev**

Methodical manual was discussed on the Central Methodical Council of the Tashkent pharmaceutical institute on the " 30 " of May in 2017 Record № 10

Chairman of Central Methodical Council:**S.U. Aliev**

Methodical manual was discussed on the Academic Board of the Tashkent Pharmaceutical Institute on the "13" of June in 2017 Record № 11

Scientific Secretary:**V.R. Khaydarov**

Tasks and objectives of study-field practice on botany

Summer study-field practice on botany is an integral part of botany course (study program); it is a study-process organization form, directly oriented on professional-practical training of pharmaceutical faculty students.

The aim of study-field practice is imprinting, advancement and deepening the knowledge of morphology, systematics, ecology and geography of plants, cultivating power of observation, accuracy, insistence, responsibility, attention, ability to orientate in the wild (nature), love of nature;

- *The tasks of study-field practice are the following:*
- Obtaining skills to apply knowledge considering botany on practice;
- Familiarization with diversity of plant species, flora and vegetation of the region;
- Obtaining skills on application of key to Central Asian plants;
- Familiarization with methods of collection and drying of medical plants, assembling of herbarium;

Execution plan for conduction of study-field practice for pharmaceutical faculty students

№	Topic of lesson	Hours
1.	Tasks and objectives of study-field practice, familiarization with traffic regulations, safety techniques training. During the study-field practice training of students the rules of preparation of herbarium materials from vegetative and generative parts of plants, teaching the methodic of drying. Training the rules of journalization.	6
2.	The students will visit Botanic garden named after F.N.Rusanov under the University of genetic fund of plants and animals AS RUz and familiarization with plants of European-Crimea, Caucasian, North America, Central America, Central and Eastern Asia flora.	6
3.	Familiarization with various life-forms of medical plants, vegetating at the section of medical plants in Botanic garden.	6
4.	Familiarization with decorative, cultivated and wild-growing plants vegetating at the section of plant systematics in Botanic garden.	6
5.	Familiarization with uncommon plants, brought from tropical and subtropical continents, vegetating in the greenhouse of Botanic garden.	6
6.	Familiarization with cultivated agricultural plants, vegetating on the territory of research station of Tashkent Agrarian University.	6
7.	Familiarization with plants vegetating on the experimental site for medicinal plants at Tashkent Pharmaceutical University and execution of agro-technical works.	6
8.	Excursion to Nature Museum of Uzbekistan.	6

9.	Familiarization with rare and declining plant species, recorded into the "Red Book of Uzbekistan".	6
10.	Specification of families, genus and species of plants in herbariums, prepared by students with the help of the key.	6
11.	Forming the material for herbarium.	6
12.	Evaluation of students' knowledge, obtained during the practice.	6
	Total:	72

Rules and order of execution of study-field practice on botany

1. During the practice it is necessary to perform all the instructions of the head strictly.
2. Before the beginning of the field practice the students familiarize with safety rules, listen to instructions and sign in a special journal.
3. At the territory of Botanic garden and nearby it the students should keep the discipline and cleanliness; collection of plants for herbarium is prohibited as well as the damage of already existing plants.
4. During the practice the students' also listen to the course of culture and awareness-raising information on planned topics.

Order of journalization

1. The journal is an essential work and report document about being in training (practice).
2. As a journal there would be used an album.
3. The front page of a journal would be filled in in accordance with the example (Appendix 1).
4. After filling the front page in this journal there would be placed a schedule of student's work, which would be compiled in the first day of the practice (training).
5. A student must record into this journal all types of practice every day.
6. The journal reflexes all held discussion of a teacher, individual observations of students, there would be recorded data considering morphological description of plants, life-forms of studied plants, drawings, systematical signs, flower formulas, families, genus, species, their names in Latinic and Russian.
7. Records in this journal are approved by the head of the practice.
8. At submission of examination on summer practice a student submits his journal to the academic department.

The journal should be filled in in accordance with the following plan

1. Objective of field practice.
2. Plan of field practice.

3. Order of herbarium preparation.
4. Determination of plants.
5. Study of plant life-form.
6. List and description of studied plants.

Rules of plants collection and preparation

Herbarium (from Latin *herba* - herb) – is collected and dry by this or that way plant (or its part), fixed on hard paper or carton of specific format.

Compilation of herbarium is very important and necessary work during study of botany. During its execution students study to recognize plants in nature, distinguish them from each other, accurately determine their names, familiarize with their economic value.

The work on herbarium compilation includes collection of plants in nature, drying and compilation of collections.

During excursions plants are collected into special botany folders or polyethylene bags with hands. Little plants – lichen, moss and etc. could be saved just during the excursion between pages of notepad or notebook.

Collected plants obligatory should have all their parts. The only exclusion (growth).

In general, plants are collected together with flowers, and some of them – with flowers and fruits (representatives of Ranunculaceae, mustard family). Fern should be collected (preferably) with sporangiums, and horsetail and clubmoss with sporogenous locusts. Bryophytes could be detected quite exactly together with sporangiums.

In those cases, when plants are large-scale or have wide crown and could be placed on herbarium list, it is allowed to collect them by parts. So, besides the upper part of these plants it is necessary to have also middle and bottom parts, where could be located leaves with various forms and size. And alternatively small plants is recommended to collect in several exemplars.

Plants should be collected during dry weather. Roots should be immediately shaken and cleaned from soil. It is allowed to wash roots only in case if such plants are vegetating in wet places. During very dry weather, after collection, lichen should be moistened by water and if this wouldn't be done, their extremely dried up thallomes can disperse before they would be put into herbarium.

Plants should be put to drying, preferably, in that moment when their vegetative parts slightly drooped but still save their forms (in 1,5-3,0 hours after collection), e.g. just after coming back from excursion.

Each plant should be firstly softened by steam and then placed onto newspaper sheet in one exemplar such a way, that all its parts were naturally distributed along the sheet. If the plant is high and it couldn't be placed as it is higher than the width of a newspaper sheet? It should be bended two times such a way, that upper parts of the plant were directed to the top. Each plant should be accompanied by temporary label (any form), written by pencil, where should be stated a place of plant collection and name of the species (even if it is temporary, provisional).

Plants should be dried in a special “botany press”. For this aim the plant distributed across half of newspaper sheet is covered by the second half of the sheet and placed on 5 or 6 dry newspapers. At the top of it there would be placed 3 or 5 more newspaper sheets, which serve as filters, absorbing water from the plant. So, interchanging newspaper sheets and insertions there would be placed up to 30 plants into one press.

Than this press is tied by tight cords. It is recommended to dry plants in shadow in areas with sufficient air intake, in attic, near open window. The press is located such a way, that all its sides could dry equally. Usually it is hinged or set on edge. It is not recommended to put the press near heating units. However, in cases if the weather is bad, plant in the press are dried in special drying units.

Special attention should be paid to regular re-laying of plants. The following regime of inserts change is recommended: in 2 hours after first laying, than after 4, after 8 (on the next day) and than after one day. At each new change of inserts the plant shouldn't be moved out of newspaper sheets. Only at the first re-laying it is allowed to check and correct arrangement of parts on the sheet.

For compilation of herbarium are usually used standard sheets of hard paper or thin cards size of 42x28 cm.

Plants are arranged on the paper closer to its left side as in the bottom at the right there should be some place for label. All damaged, wrinkled and unnecessary parts of plants are removed.

Plants are fixed on herbarium paper by needle with white thread such a way, that beads are on the back side of the sheet. It is not allowed to pull the thread from one bead to another. Number of places for fixing is determined practically. Made typographically label size of 9x13 is located in right bottom corner.

Herbarium list is covered (on top) by polyethylene film, edges of which should be turned to the back side with width of turn 0,5-1 cm. Edges are fixed by white thread, so the tacks on front side should be 1 cm width, and the distance between tacks should be 2 cm (thread on back side) and these tacks should be as close to edges of twice turned back polyethylene sheets, as possible. Edges of polyethylene film on the back side should be accurately bended diagonally and firmly sewed on. At a label, with a help of black ink, there should be written Latinic and Russian names of family and species, place of collection and are of vegetation, date of collection, surname of collecting student and person, who classified the specie of this plant (Appendix 2).

Classification of Plants

In order to determine family and specie it is necessary to use several plants. During the procedure of classification it is necessary to pay attention to morphological structure of plants, their differential characteristics, flower formula, formulae of leaf, fruits, stem, and root system.

After classification of family, genus and species of plants it is necessary to draw this plant into the album.

Using special literature students should determine family, genus and specie of the plant.

If it is necessary to determine to which family should be classified this plant, firstly there should be read a “thesis”. If the signs, stated in it are not the same with signs of the plant, it is necessary to read “antithesis”. If the signs in “thesis” and “antithesis” are seen at the plant, it is necessary to pay attention to number at the right side of the book. If these numbers are also present at the left side of the book, so in this case determination is continued with the help of “thesis”.

If in “thesis” and “antithesis” in the end is stated the name of the family instead of number, classification is considered to be finished.

Genus and species are determined in the same manner.

Morphological characteristics of plants

The materials, collected during field practice, should be attentively observed. There should be determined family, genus and specie of a plant. So a special attention should be paid to its life-form, structure of vegetative and generative parts. For this aim there should be taken 9-10 plants with various life forms. General view of this plant should be sketched. Morphological characteristics of this plant should be recorded into the journal.

Morphological description of plants

1. Life-forms of plants

- a) Tree
- b) Bush
- c) Herbaceous plant (plurannual, biennial and annual)
- d) Monocotyledon
- e) Dicotyledonous
- f) Monoecious
- g) Dioecious

2. Root system

- a) Main root, secondary roots
- b) Vertical root, racemose root
- c) Modified root (pip, root plant)

3. Stem

- a) Woody, grassy
- b) Vertical, climbing, vine, creeping, prostrate
- c) Branching of the stem: dichotomous, monopodial, simpodial, false dichotomous
- d) Smooth, villose
- e) Along crossing cut: round, ribbed, triangular, quadrangular and etc.

- f) Stem modifications: above-ground (spiculas, flagellum, tendrils), under-ground (rootstock, tuber, bulb)
4. Leaf
- 4.1. *Simple*
 - a) Petiolate
 - b) Sessile
 - c) Sheathing
 - d) With stipulas
 - e) Without stipulas
 - f) Shape of lamina: linear, lanceolata, acerose, egg-shaped, reverse-egg-shaped, round, oval, arrow-shaped, clypeate
 - 4.2. *Complicated*
 - a) With stipulas
 - b) Without stipulas
 - c) Shape of lamina: tricomound, palmately compound, paripinnate, imparipinnate, pinnately decompound
 - 4.3. *Shape of leaf edge*
 - a) Smooth-edged
 - b) Sawed
 - c) Serrate
 - d) Sinuate
 - e) Crenate
 - 4.4. *Leaf arrangement*
 - a) Alternating
 - b) Decussate
 - c) Verticillate
 - 4.5. *Leaf modifications*
 - a) Spines
 - b) Tentaculas
 - c) Flagellums

5. Inflorescences

- 5.1. *Simple monopodial*
 - a) Spica
 - b) Spadix
 - c) Raceme
 - d) Corymb
 - e) Umbel
 - f) Anthode
 - g) Ament
 - h) Capitulum
- 5.2. *Compound monopodial*

- a) Compound spica
 - b) Compound umbel
 - c) Panicle
- 5.3. *Sympodial inflorescences*
- a) Monochasium (twist, bend)
 - b) Dichasium
 - c) Pleiochasium
- 5.4. *Simple single flowers*
- 6. Flower**
- a) Actinomorphic (right)
 - b) Zygomorphic (not right)
- 6.1. *Perianth*
- a) Compound (double)
 - b) Simple (calycine, corollaceous)
 - c) Bare
 - d) Calyx: with united segments, aposepalous or choriphyllous
 - e) Corolla: gamopetalous, dialyphyllous
 - f) Stamen (quantity)
 - g) Pistil: apocarpous, monocarpous, cenocarpous (quantity of carpels)
 - h) Ovary: upper, lower, semi-lower
 - i) Flower formulae
- 7. Fruits**
- 7.1. *Dry*
- a) Bean
 - b) Pod, silicle
 - c) Nut, coccus
 - d) Caryopsis
 - e) Seed pod
 - f) Capsule
- 7.2. *Fleshy*
- a) Simple
 - b) False
 - c) Compound
 - d) Bacciform
 - e) Collective fruit

During field-practice for collection of herbarium there would be used plant of the following families:

1. Pea family – Fabaceae
2. Apiaceae family – Apiaceae
3. Sunflower family – Asteraceae

4. Plantain family – Plantaginaceae
5. Nightshade family – Solanaceae
6. Rose family – Rosaceae
7. Horsetail family – Equisetaceae
8. Lamiaceae family – Limiaceae
9. Polygonaceae family – Polygonaceae
10. Mallow family – Malvaceae
11. Brassicaceae family – Brassicaceae
12. Poaceae family – Poaceae
13. Pinaceous family – Pinaceae
14. Birch family – Betulaceae
15. Gourd family – Cucurbitaceae
16. Alliaceous family – Alliaceae
17. Lily family – Liliaceae
18. Magnolia family – Magnoliaceae
19. Hypericeae family – Hypericeae
20. Ranunculaceous family – Ranunculaceae

During examination students should show the following knowledge and skills:

1. Perform and submit individual task on herbarium process (10 pages).
2. Student submits the journal, filled in during field practice.
3. Know characteristics of plant species, studied individually and recorded into the journal.

Questions of summative assessment

1. Which types of roots systems, considering genesis and shape, are existing?
2. Which plants can be characterized by vertical root system?
3. Which plants could be characterized by fibrous root system?
4. Give examples of monopodial type of stem branching.
5. Give examples of simpodial type of stem branching.
6. Give examples of dichotomic type of stem branching.
7. Modifications of branches.
8. Give examples of annual herbaceous plants.
9. Give examples of biennial herbaceous plants.
10. Give examples of perennial herbaceous plants.
11. Give examples of woody, bushy and semi-bushy plants.
12. Morphological structure of leaf.
13. Shape of laminas.
14. Distinctive features of simple and compound leaves.
15. Arrangement of leaves on stem.
16. Modifications of leaves.

17. Types of leaves venation pattern (parallel – nerve, arc-nerve, palmatinerved, penni-nerved and anastomosing).
18. Give examples of compound leaves.
19. Main shapes of simple entire leaf and lamina edge.
20. Give examples of actinomorphic flower.
21. Give examples of zygomorphic flower.
22. From which parts consists the flower.
23. Perianth and its various shapes.
24. Latinic names of flower parts.
25. Classification of inflorescences.
26. Simple monopodial inflorescence.
27. Compound monopodial inflorescence.
28. Simpodial inflorescence.
29. By which features are usually classified fruits?
30. Dry and fleshy fruits
31. Structure of dry indehiscent fruits
32. Structure of dry dehiscent fruits.
33. Defined and false fruits
34. Which plant families have defined, false, fleshy, dry and compound fruit?
35. Which family can be described by the following characteristic features: quadrangular stem, opposite leaves, bisexual flowers, stamen usually 4, 2 of them are longer and 2 shorter?
36. Which family could be determined by the following features: calathid inflorescence, outside the calathid are located leaves, which are usually called involucre?
37. Which family can be described by the following characteristic features: individual flowers, large, bisexual, arranged in leaf axils and have actinomorphic double perianth?

Appendix №1

Sample of front page design

Journal of study-field practice on botany
of pharamaceutical faculty 2-course student
_____ group_____

(Surname, initials)

Duration of training from _____ 20__

Till _____ 20__

Head of practice (training)_____

(Surname, initials)

Appendix №2

Sample of herbarium label

Pharmacognosy academic department

Family _____
 Genus _____
 Specie _____
 Place of collection _____
 Who collected _____
 Who classified _____
 Time of collection _____
 Number of herbarium _____

Appendix №3

Situational questions

1. Determine types of root systems of plants, stated in the table

№	Types of roots	Racemose root	Vertical root	Root crop	Tubercular root	Buttress roots
1	Corn					
2	Carrot					
3	Wheat					
4	Camel's-thorn					
5	Radish					
6	Georgina					
7	Sweet potato					
8	Cotton					
9	Oat					
10	Wild Apricot					

2. Determine the shape of lamina of plants stated in the table

№	Name of plants	Acerose	Oval	Reniform	Cordate	Linear	Obovoid	Lanceolate	Linear-ovoid
1	Wild Apricot								
2	Willow								
3	Wheat								
4	Pine tree								
5	Mallow								
7	Pear tree								
8	Ulmus ,elm tree								
9	Dock								

3. Give right definitions of leaf nervation types and their arrangement on bine

№	Leaf nervation	Arc	Parallel	Dichotomic	Pinnate	Plamate
1	Shakle					
2	From foundation of lamina to its top goes the main nerve, from which					

3	branch another nerves under this or that degree Nerves come from foundation of leaf joining to each other near top of leaf					
4	Main nerve is absent. From foundation of lamina palmately branch several big first-order nerves.					
5	Nerves come from foundation of leaf in parallel					
№	Arrangement of leaves on bine	Spiral or alternating	Opposite	Verticillate		
1	From each node of stem comes one leaf					
2	At each node arranged oppositely to each other two leaves					
3	Each node has three or more leaves					

4. Give right definition to specified types of spring branching

№	Types of spring branching	Monopodial	Simpodial	Dichotomic	False dichotomic
1	Upper spring gemma at some stage die back but there starts enhanced growth of one or several lateral gemmas				
2	Simultaneous development of two opposite lateral springs combined with dying back of upper gemma (growing point)				
3	Upper part of main axis branch out forcipately and gives birth to two or more axis of next order				
4	Terminal bud functions during the whole life growing into main spring (first-order axis) at which in acropetal order develop axes of next order.				

5. Give right definition of specified inflorescence types

№	Name of inflorescence	Simple botryoid	Compound botryoid. Panicle and its derivatives	Compound raceme and its derivatives
1	Panicle			
2	Anthela			
3	Compound corymb			
4	Raceme			
5	Spadix			
6	Spike			
7	Simple umbel			

8	Anthodium			
9	Calathidium			
10	Corymb			
11	Triple raceme			
12	Double raceme			
13	Double spike			
14	Double umbel			

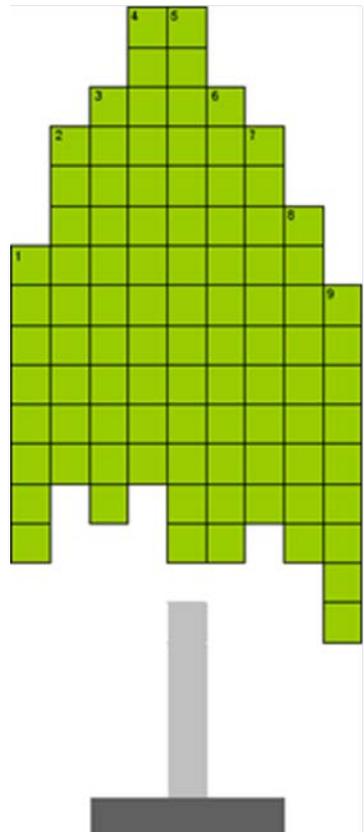
6. Define families of specified plants

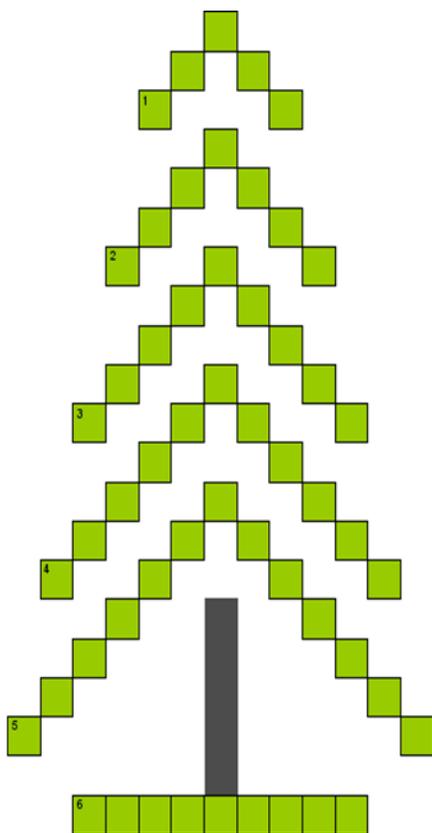
№	Name of plants	Astera- ceae	Solana- ceae	Ammia- ceae	Malva- ceae	Lamia- ceae	Rosa- ceae	Legumi- nosae	Rannun- culaceae	Cruci- fers
1	Wild carrot									
2	Common licorice									
3	Plum									
4	Sweatweed									
5	Blindweed									
6	Dandelion									
7	Fennelflower									
8	Belladonna									
9	Cotton									
10	Bloodroot									
11	Common meliot									
12	Ferula									
13	Stramonium									
14	Mint									
15	Origanum									
16	Garden sage									

7. Determine types of fruits for specified plants

№	Name of plants	Types of fruits – dry or fleshy					
		Fruit aggregate	Aggregate nut	Aggregate-accessory fruit	Fleshy fruit aggregate	Wild strawberry(fleshy aggregate nut with thalamus)	Cinarodium (fleshy aggregate nut with hypanthium)
1	Peony						
2	Magnolia-vine						
3	Wild						

	strawber- ries						
4	Strawberry						
5	Dog rose						
6	Magnolia						
7	Ranunculus						
8	Adonis						
9	Tormentil						
1 0	Raspberry						
1 1	Blackberry						
1 2	Stone bramble berries						
1 3	Globe- flower						





Crossword puzzle 1.

Crossword puzzle 2.

Crossword puzzle “Plant families№ 1”

1. Representatives of this family are vegetating as in tropics and semitropics, as well as in regions with moderate climate. The family includes many decorative species (iris, cornflags, saffron and etc.) and also a number of medical, edible, ethereal-oil, tinctorial plants. Perennial plants with underground rootstocks and bulbous tubers. Fruits – capsule with many seeds.
2. The family includes species of herbaceous and woody plants, vegetating all over the world, especially in tropics. Many species of cotton, side, hibiscus, sweat-weed are cultivated as textile, oil, vegetable, feed, medical and decorative plants. For this family the characteristic feature is alternating leaf arrangement, presence of scale leaf bracts and calyche. Flowers, usually have

double pentamerous perianth, many stamens, one pistil. Has superior ovary. Fruits – capsules or polyachenium.

3. Representatives of this family are vegetating all over the world. They are herbaceous plants, semi-bushes and bushes with glandular hair or oil-glandules. Stems are quadrangular, leaf arrangement is opposite, leaves are simple, entire. Corolla is gamophyllous of 5 petals. The fruit is dry.

4. Generally herbaceous plants, vegetating in Eurasia and South America. Valeriana was included into this culture.

5. Perennial herbaceous plants with dense fibrous white roots. Leaves are wide-ovary. Flowers are small and unattractive. Fruits – bilocular ovoid seed cases.

6. Generally herbaceous plants vegetating all over the world. Some species are cultivated as decorative and medical plants. One of the representatives of this family is red digitalis used for treatment of cardiovascular diseases. It is decorative.

7. Widespread family in temperate zones of both hemispheres. Some plants are used as the most important essential-oil species, another as decorative. Essential oil is used in perfume and food industry, where it can replace rose oil.

8. Is widespread all over the world and especially in various dry regions of Northern hemisphere. Inflorescence – compound umbel. There are many important plants among them: food, spicy, essential-oil, medical. Some species are very poisonous.

9. Is widespread mainly in regions with moderate climate in Northern hemisphere. They include food, spicy, pot herbs, tinctorial, insecticide plants, but the most known are medical and decorative plants. One of the representatives – nutmeg flower.

Crossword puzzle “Plant families № 2”

1. Almost all representatives of this species are herbs. Has grass-culm. Small flowers are arranged into one or several spicules, forming compound inflorescence. Fruit – seed box. Seeds with rich endosperm and adjacent to it small coraculeat the one end of this seed.

2. Representatives of this family are widespread almost all over the world, one of the most economically important group of plants. Many representatives of this family are widely used as medical, technical and decorative plants, are valuable as melliferous plants. They can be characterized by symbiosis with nitrogen-fixing legume bacterium, which improves soil reclamation, by nitrogen enrichment.

3. Up to 1500 species, generally widespread in Northern hemisphere. Some species are cultivated as food and decorative plants.

4. Are vegetating as in tropics and semi tropics, as well as in regions with moderate climate. The family includes many decorative species (iris, cornflags, saffron and etc.) and also a number of medical, edible, ethereal-oil, tinctorial plants. Perennial plants with underground rootstocks and bulbous tubers. Fruits – capsule with many seeds.

5. Bushes with simple leaves and alternating leaf arrangement. Calyx of 5 calyx lobes, fasciated into a tube, growing adjacent to ovary. 5 stamens. Fruits – fleshy plurispermous berries.

Seeds with endosperm. Some species are classified as edible (berry) plants, some of them are classified as decorative.

6. One of taxonomic units.

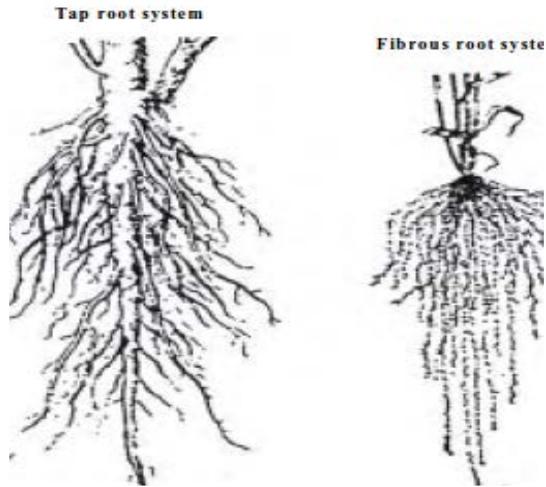


Fig 1. Types of root system

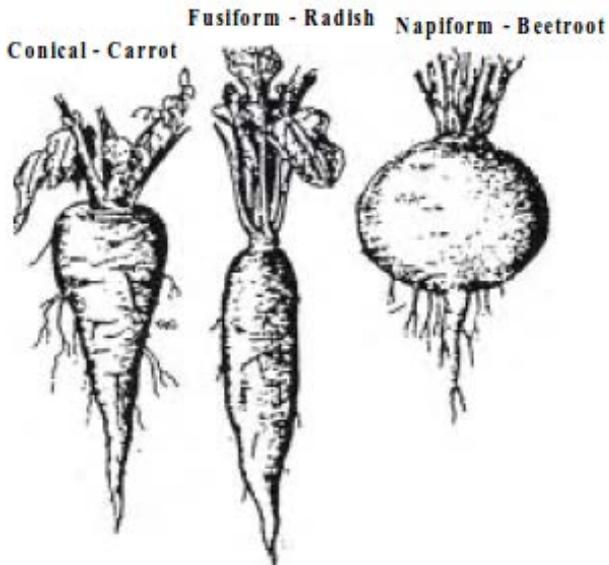


Fig 2. Storage roots.

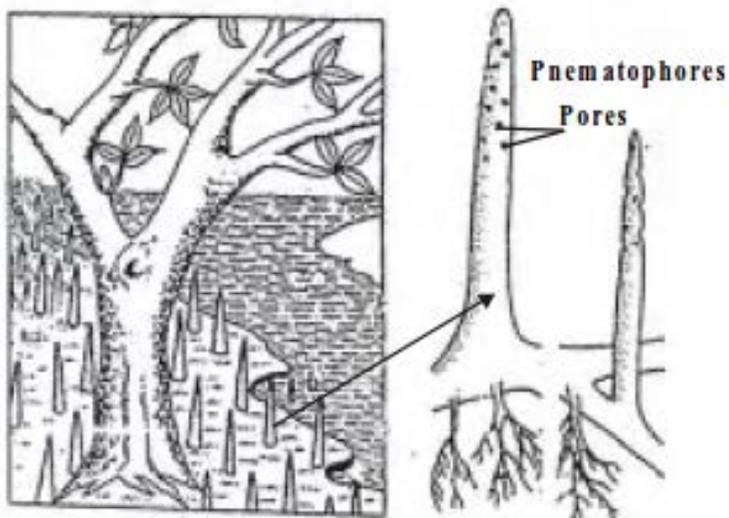


Fig 3. Respiratoru roots.

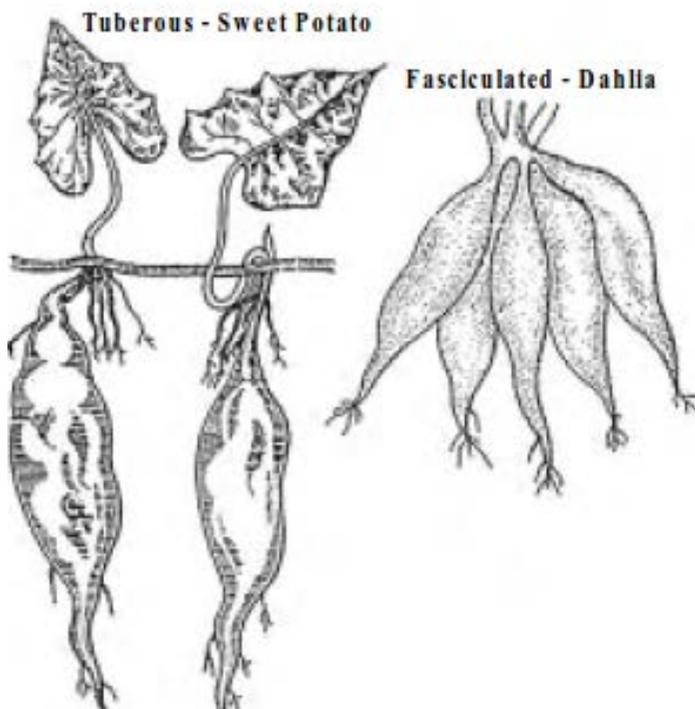


Fig 4. Adventitlous roots.

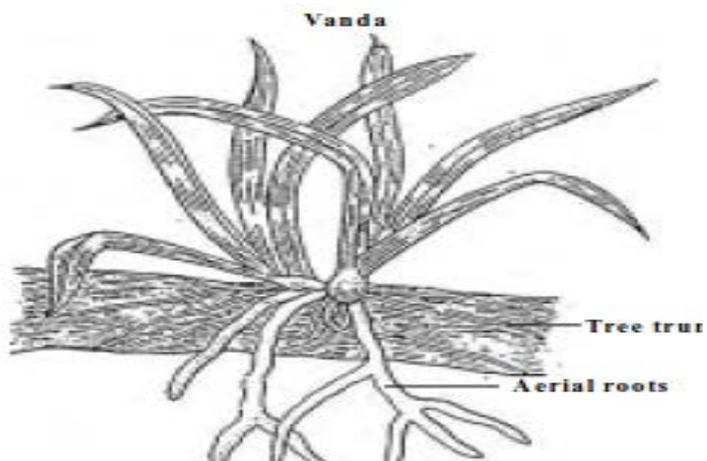


Fig 5. Epiphytic root.

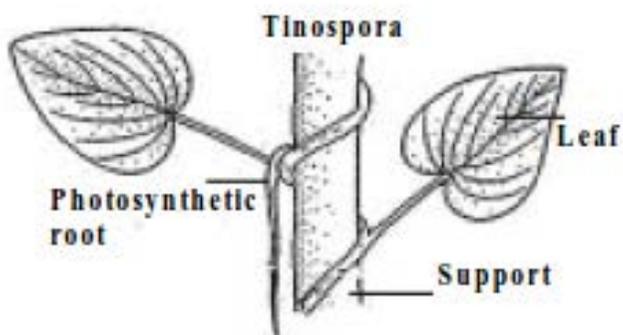


Fig 6. Photosynthetic root.



Fig 7. Parasitic root.

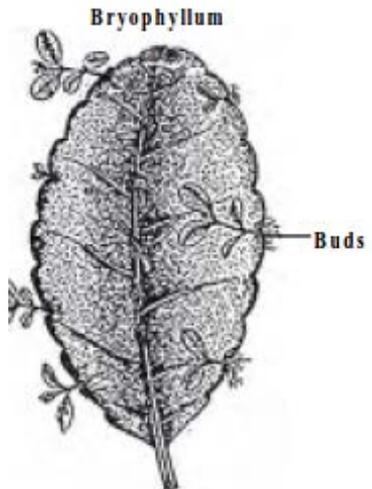


Fig 8. Epiphyllous bud.

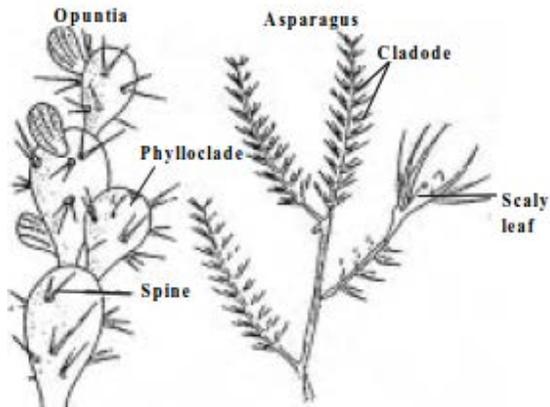


Fig 9. Phylloclade and Cladode.

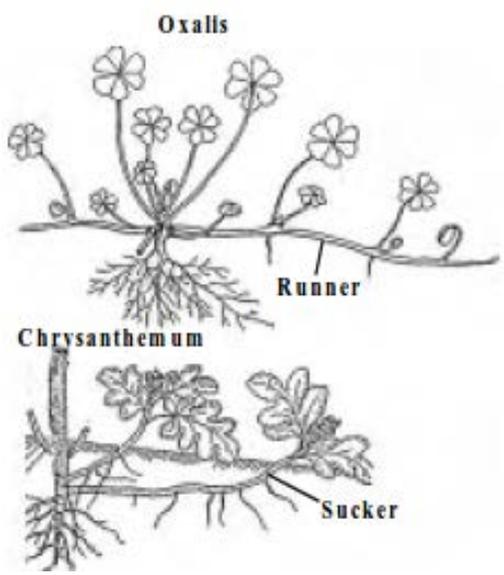


Fig 10. Runner and Sucker.

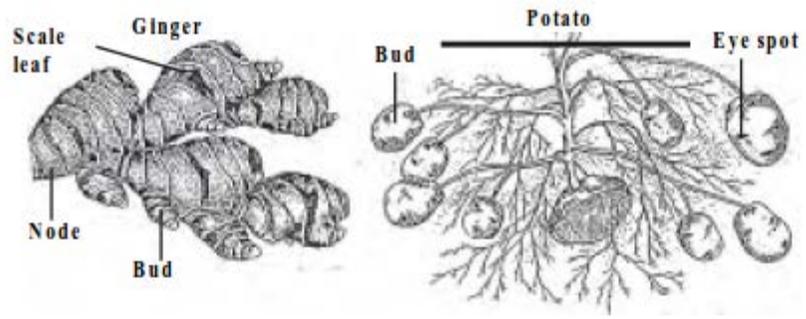


Fig 11. Rizome and Tuber.

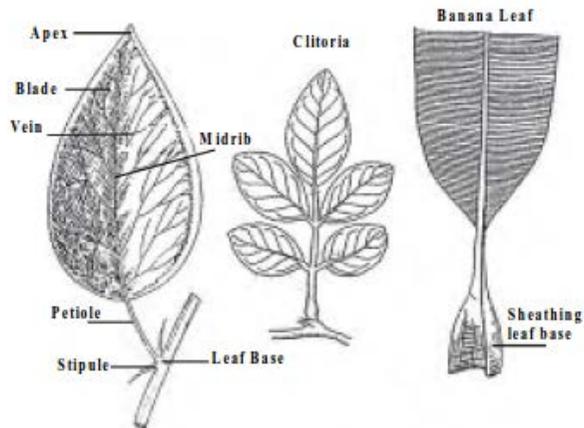


Fig 12. Parts of typical leaf and Sheathing leaf base.

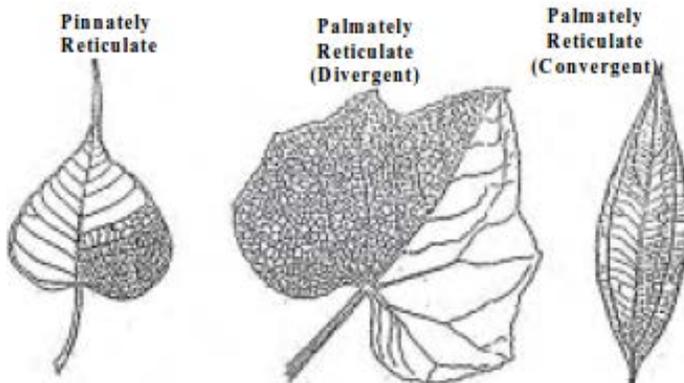


Fig 13. Types of Reticulate Venation.

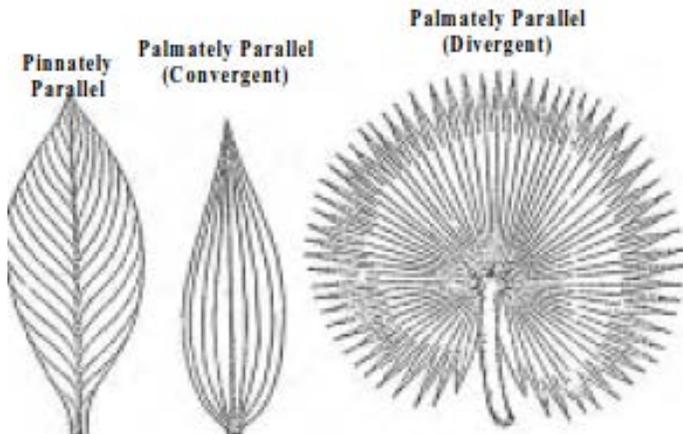


Fig 14. Types of Parallel Venation

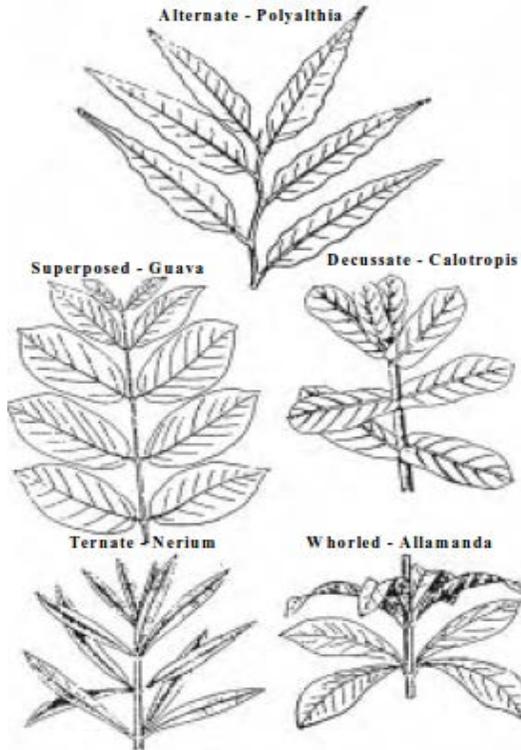


Fig 15. Types of Phylltaxy.

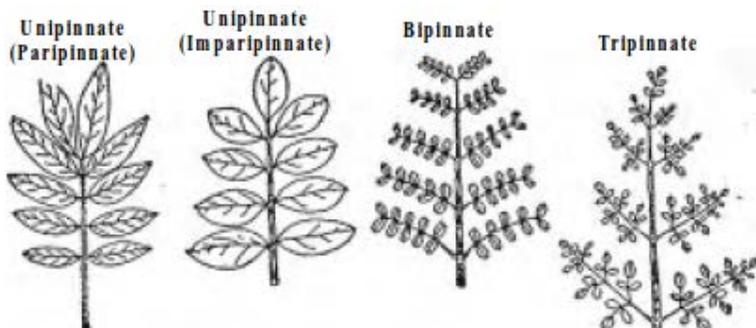


Fig 16. Types of Pinnately compound leaves

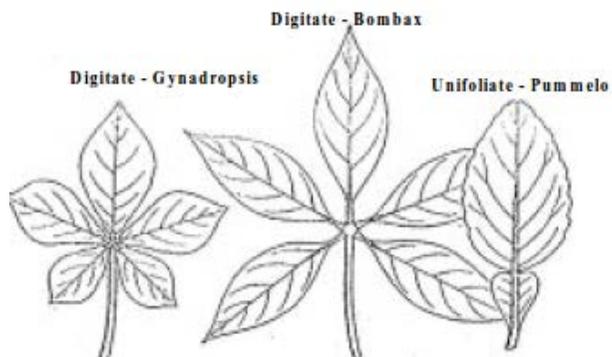


Fig 17. Types of Palmately compound leaves.

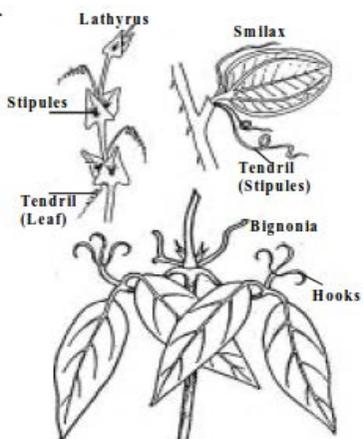
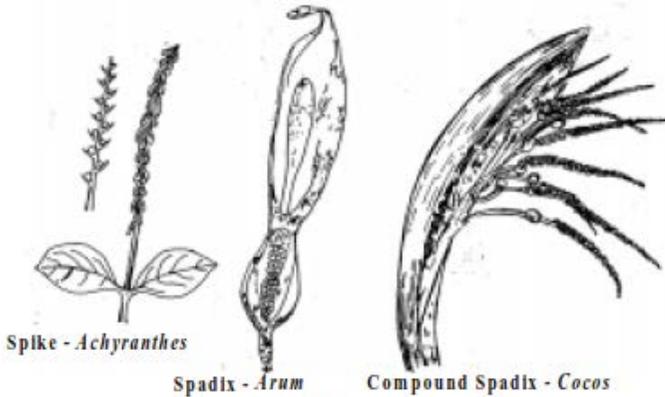
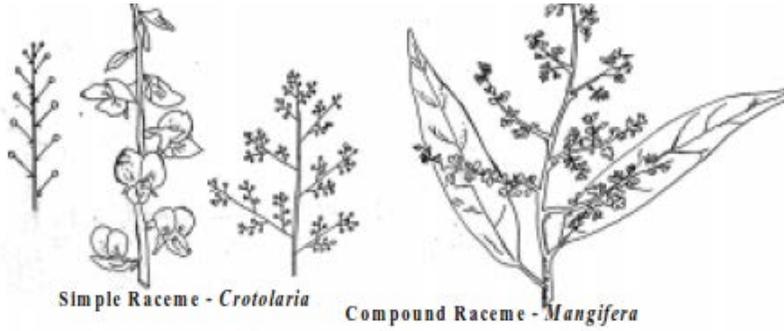


Fig 18. Leaf Tendrill and Leaf Hooks



Main Axis Elongated

Fig 19. Types of Racemose Inflorescence.

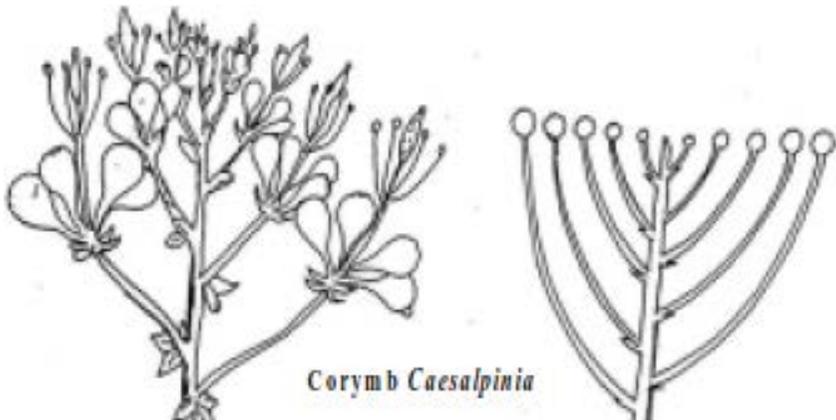


Fig 20. Main Axis Shortened.

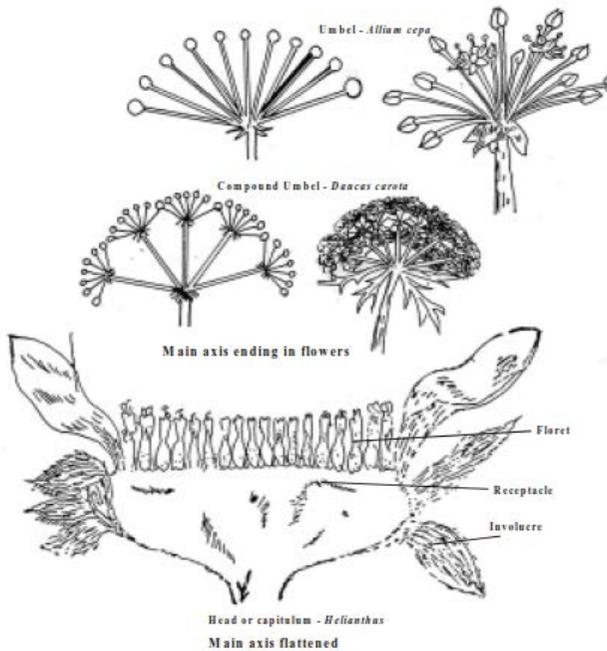


Fig 21. Types of Racemose Inflorescence.

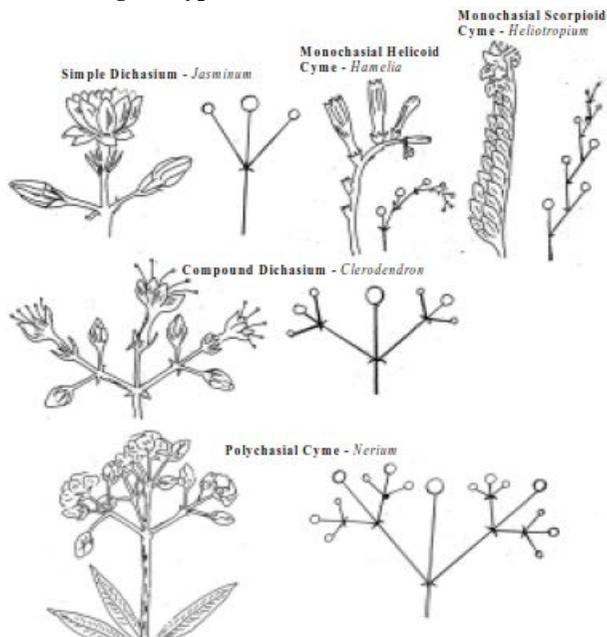


Fig 22. Types Cymose Inflorescence.

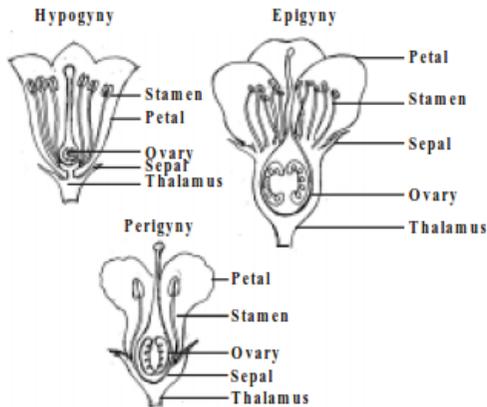


Fig 23. Insertion of floral leaves.

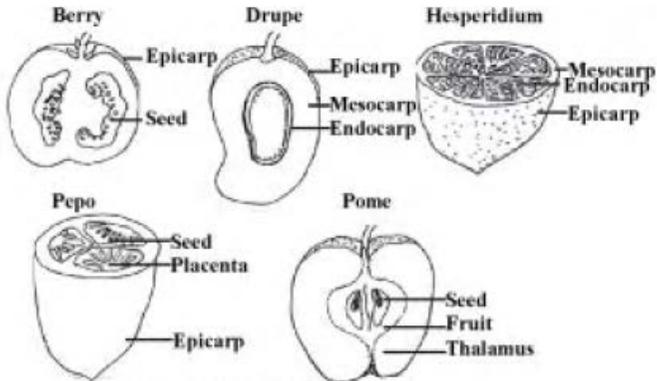


Fig 24. Simple fleshy fruits.

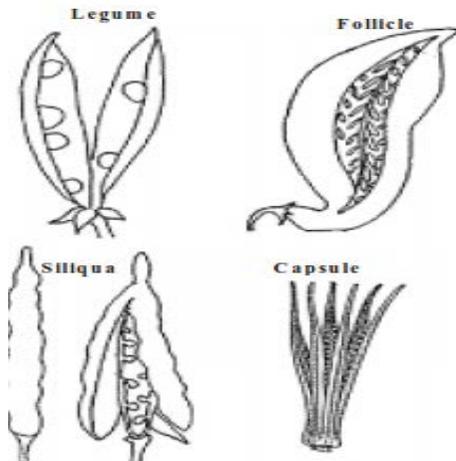


Fig 25. Dehiscent dry fruits.

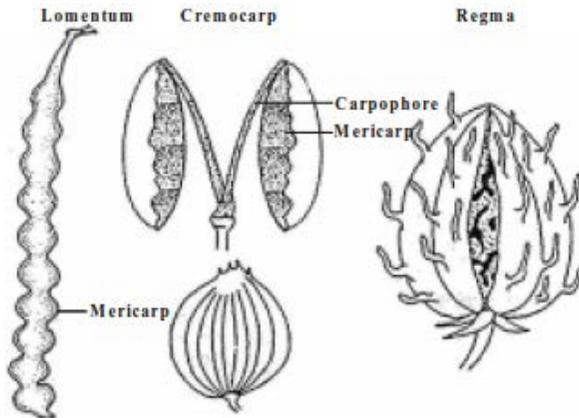


Fig 26. Schizocarpic dry fruits.

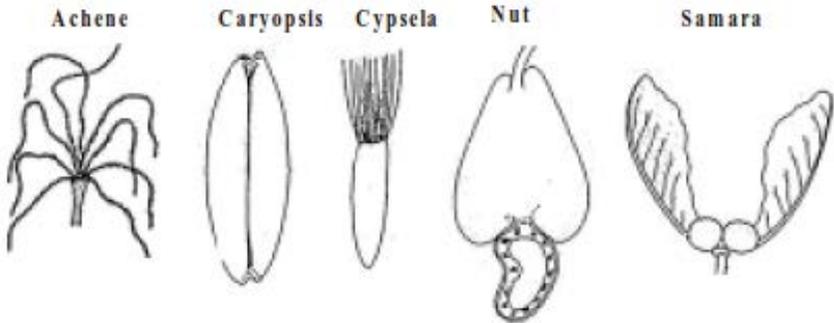


Fig 27. Indehiscent dry fruits.

Polyalthia

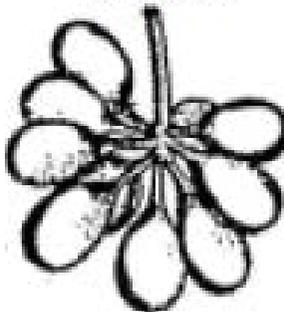


Fig 28. Aggregate Fruit.

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