Part II

FRUIT

The FRUIT

(Fructus)

A fruit may be defined as the whole product of the development of the gynaecium as a result of fertilisation. Sometimes other parts of the flower in addition to the gynaecium participate in the production of the fruit.

Classification of fruits: Fruits are classified into:

1- True fruits: When a fruit is formed from the gynaecium of a single flower alone

2- False fruits: When other parts of the flower take part in its formation

3- Composite (or collective) fruits: The fruit is formed from the whole inflorescence and not from a single flower and in such case it is a composite or a compound or a multiple or a collective fruit, where all the flowers of the inflorescence or their ovaries increase in size as a result of fertilisation and become aggregated together and form a single mass of small fruits.

1- True Fruits

A) Simple: It is formed from a single ovary (i.e. from monocarpellary or syncarpous gynaecium with one pistil) as Senna Pods, Wheat, Fennel, Citrus,.. etc.

B) Aggregate: It is formed from an apocarpus gynaecium (i.e. more than one pistil) as Star Anise.

A) Simple Fruits: They include

1- Dry Fruits

I- Simple, Dry, Dehiscent Fruits:

They have dry pericarp. They usually remain attached to the plant and split when ripe to set free the enclosed seeds. This group includes the following types:

a- Legume : A fruit formed from monocarpellary ovary which splits along both dorsal and ventral sutures as Senna Pods.

b- Follicle: It is formed from monocarpellary ovary which dehisces by inner suture only. Follicles commonly occur in aggregates as in Star anise.

FRUITS

- A- True
  - I- Simple fruits (From sigle flower with simple ovary)
    - Dry Fruits (with leathery or woody pericarp)
      - A. Dehiscent
        1. Follicle
        2. Legume
        3. Siliqua
        4. Capsule
           - By valves
           - By Lid (Pyxis or pyxidium)
           - By holes (apical or Basal)
      - B. Indehiscent
        1. Achene *
        2. Grain *
        3. Cypsela.
        4. Samara
        5. Nut *
      - C. Schizocarpic
        1. Lomentum
        2. Cremocarp *
        3. Carcerulus
    - Succulent Fruits (with succulent fleshy pericarp)
      - Berry
      - Drupe
  - II- Aggregate fruits (From single flower with apocarpous ovary
    - of achenes
    - of follicles
- B- False
- C- Composite (From whole Inflorescence)
  - Strobile syconus
  - Sorosis

c- Capsule: A fruit derived from a syncarpous ovary, formed of two or more united carpels. It is a many-seeded fruit. Capsules dehisce in various ways:

-By valves, produced by longitudinal slits through the ventral suture as in Linum or along the midribs of the carpillary walls (dorsal suture) as in Cardamom.

-By lid, produced by transverse slits throwing off the upper part of the fruit (the lid) as in Hysocyamus. It is termed Pyxis.

-By holes or pores as in Poppy.

d-Siliqua: It is a many-seeded fruit, the ovary is unilocular formed of two carpels, becoming bilocular through the formation of false septum. It splits by two valves from base to apex as in Mustard.

II- Simple, Dry, Indehiscent Fruits:

The pericarp becomes dry, usually detached but not splitting when ripe. This group includes the following types:

a-Achene: A one-seeded fruit, formed of one carpel. The pericarp is free from the testa. Achenes are usually small and aggregated together in groups as in Strawberry.

b-Caryopsis or Grain: It is an achene in which the pericarp and testa are fused together as Wheat and other Graminacious fruits.

c-Nut: It is similar to an achene but usually bigger and typically formed from two or three carpels. The nut has a hard and woody or leathery pericarp as Chestnut.

d-Samara: It is a winged, one-seeded fruit, formed of one carpel as Elm or of more carpels as Rumex. The wings are membranous developments from the pericarp.

e-Cypsela: It is one-seeded fruit, formed of two carpels; the ovary is inferior, unilocular, the pericarp and testa are free as fruits of Compositae.

III- Simple, Dry, Schizocarpic or Splitting Fruits:

They have dry pericarp. They are two-to many seeded, bi to multilocular fruits. As they ripen, they split up into a number of one-seeded, indehiscent parts called mericarps. They include several types but the most familiar type is:

Cremocarp: A fruit formed of bicarpellary ovary. The ovary is inferior and bilocular, The cremocarp splits longitudinally between the two locules into two one-seeded indehiscent mericarps as in the Umbelliferae, e.g. Caraway, Fennel.. etc.

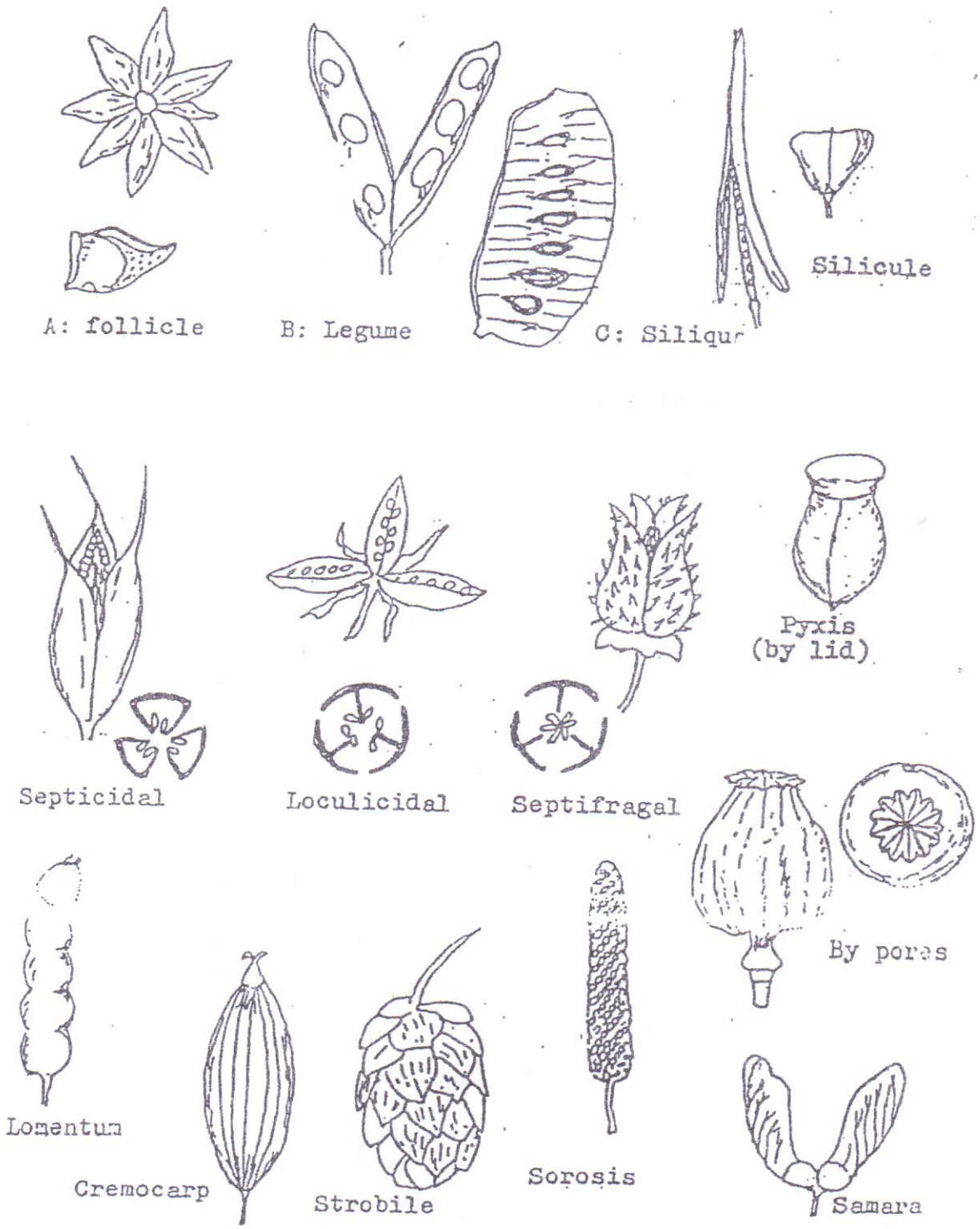

Fig. 16: Types of fruits .

2- Succulent Fruits:

These fruits have part or most of the pericarp formed of a fleshy tissue. They are usually indehiscent but in some cases the soft part of the pericarp during ripening may split or peal off leaving the seed or seeds exposed as Nutmeg or enclosed in the hard endocarp as Almond. This group includes the following types:

a-Drupe: A fruit derived from one or more carpels. The ovary is superior or inferior unilocular. The epicarp is leathery; the mesocarp is fleshy, the endocarp is hard and woody and encloses one seed as Almond, Olive, etc.

b-Berry: A fruit formed from one or more carpels and the pericarp is entirely fleshy. It is usually many seeded as Nux vomica, Capsicum Coloeynth, Orange, Lemon, ..etc. Special terms which are sometimes used are pepo for berry of the Cucurbitaceae and hesperidium for that of the orange and similar rutaceous fruits.

B) Aggregate Fruits: They are formed from an apocarpous gynaecium and thus formed of a collection of fruits arranged on a single receptacle, generally called etaerio, being etaerio of achenes as Strawberry, or etaerio of follicles as Star Anise.

2- False Fruits

They are derived from mature ovary or ovaries of a single flower, accompanied by other parts of the same flower which on ripening become usually swollen and fleshy. In Apple, pear,etc., the receptacle has become fleshy, constituting the main part of the fruit, and enclosing the leathery or hard pericarp. In such case is termed the pome. Strawberry and Mulbery are other examples of false fruits with swollen receptacles.

3- Composite Fruits

Composite fruits include the following types:

A) Strobile: A fruit derived from a scaly inflorescence named strobile. One or two achenial fruits are present in the axile of each scale as Hops.

B) Sorosis: A fruit derived from a spike. It is formed of a swollen, usually fleshy axis and shows the fruits fused together by the fleshy perianth as Mulberry. Sometimes the fruits are partly embedded in the thickened axis and fused together by the swollen bracts as Long Pepper.

C) Syconus: A fruit, consisting of a succulent hollow receptacle, within which are enclosed achene-like bodies formed from numerous female flowers lining the receptacle as Figs.

Characters of Fruits:

Macroscopical features:

-The most important of these are the type, shape, colour, dimensions, surface characters, odour, taste, ...etc.

-The fruit usually shows two, mostly distinct scars one at the base, marking the attachment to the stalk or to the parent plant, the other mostly apical and minute, marking the remains of the style and stigma.

-Externally, the surface of the fruit may be:

1- Smooth as Capsicum.

2- Glabrous as Fennel, Cardamom, Pepper, ...etc.

3- Pubescent as Anise.

4- Rough or granular as Citrus.

5- Spiny as Stramonium, Castor

6- Striated as Cardamom, Senna ...etc.

7- Ridged as Umbelliferae.

8- Reticulated (due to drying) as Black pepper

Structure of fruit: -

The fruit consists of the swollen and modified ovary wall known as pericarp, enclosing the seeds, which are arranged on the placenta.

The wall of the pericarp is divided into three regions; the epicarp, the endocarp and the mesocarp.

A) Pericarp

1- The epicarp

It is the outer region of the pericarp. It may be thin and membranous as in Umbelliferae, leathery as in Banana, thick and hard as in Colocynth.

-The epicarp is usually formed of:

a- The outer epidermis only as *Capsicum minimum* or

b- The outer epidermis with one or more modified hypodermal layers as Colocynth.

2-The endocarp

It is the inside region of the pericarp. It may be: very thin and membranous as in Date, thick and either leathery as in Cassia Pods. or hard and woody forming the stone of the fruit as in Olive.

-The endocarp may be formed of:

a- The inner epidermis only as in Capsicum, Fennel.

b- The inner epidermis in addition to several hypodermal layers as in Olive forming the woody structure (the stone enclosing the seed).

3-The mesocarp:

It is the region in between the epicarp and endocarp, which contains the vascular strands. It may be sueculent as in Prune, parenchymatous as in Colocynth, or may consist of several layers of different types.

B) The placenta: It differs in structure from the pericarp. It may be knob-like, cord-like, membranous or enlarged as sometimes filling the cavity of the fruit. It may be soft, and pithy in dry fruits, or soft and fleshy in succulent fruits.

Microscopical features:

The pericarp shows the following structure: The outer epidermis of the pericarp (epicarp), have the characters of the epidermis structure in general, but with a few or no stomata.

The outer epidermis is generally covered with thick cuticle, which may be smooth as Fennel, or distinctly striated as in Caraway, Capsicum .. .etc.

The epidermal cells are usually free of contents, but in certain fruits they contain calcium oxalate prisms as in Pepper, Coriander & *Ammi visnaga* , Caraway...etc.

The epidermis of the pericarp may bear trichomes, which then offer valuable diagnostic features as in Anise and Senna pods.

-The tissue subjacent to the epidermis (mesocarp), is in many cases, a parenchymatous traversed by fibrovascular bundles. In this tissue, sclerenchymatous cells or groups of cells are often found as in Pepper and Cubebs

Also secretory tissue of various kinds may be present, all of which are of high importance e.g. oil cells as in Pepper and Cubebs, oil glands as in Orange, oil duct as in most umbelliferous fruits or laticeferous vessels, as in Poppy capsules. Calcium oxalate, starch and other cell contents contribute their share to the characteristics of drug.

-The inner epidermis of the pericarp, is often developed in a characteristic way, exhibiting usually marked characters..

In Capsicum fruits, the inner epidermis consists of parenchyma containing numerous large islands of lignified sclerenchyma; each island corresponding in extent to a giant cell in the hypopermal layer.

In many umbelliferous fruits, the inner epidermis is usually developed as parquetry layer formed of groups of narrow parallel cells often or sometimes variously oriented as in Fennel, resembling the appearance of the parquetry floor.

The inner epidermis may be wholly formed of thickened pitted lignified cells as in Pepper, the thickening is unequal forming beaker shaped cells and appearing in sections as horse shoe thickening; in Cubebs, Hyoscyamus, ...etc., the cells are equally thickened

In the inner epidermis stomata and trichomes are occasionally found, stomata being usually fixed and the guard cells are boldly curved.

The placenta is usually formed of thin-walled parenchyma with wide intercellular spaces, usually free of contents although starch and calcium oxalate crystals may be present.

Umbelliferous Fruits

General Characters of Umbelliferous Fruits

The family Umbelliferae (Apiaceae) includes about 270 genera and 2700 species. The following characterize the fruits of the family.

Morphological Features:

1) The fruit is true, simple, dry, schizocarpic, cremocarp that splits upon drying into two indehiscent one seeded mericarps.

2) The apex of the fruit is crowned with a conical structure named stylopod (represents the remains of the style, stigma and nectary disc).

3) The fruits are derived from inferior ovary as clear from the presence of remains of floral parts just beneath the stylopod at the fruit apex.

4) When the fruit splits, it divides vertically into two mericarps. Each mericarp has a flat surface, the commissural surface, and a rounded surface, the dorsal surface.

5) Surface of the cremocarp is characterized by the presence of 10 primary ridges (5 on each mericarp).

6) Each mericarp is one-seeded. The seed is attached by its testa to the pericarp so that it completely fills the locule.

7) The seed is apically placented and contains a small embryo that is embedded in an oily endosperm. It is derived from anatropous ovule; consequently, a fine vascular strand, the raphe, extends on the commissural surface of each seed.

Histological Features:

1) Epicarp is usually one row (epidermis).

2) Glandular trichomes are rare, while non-glandular trichomes occur as unicelluar to multicellular having a shaggy or stellate-form.

3) The fruits are characterized by the presence of schizogenous secreting ducts (vittae) in the mesocarp, containing volatile oil or bitter principles; they are six in number in each mericarp.

4) The vascular bundle is bicollateral fibro-vascular bundle and sometimes accompanied by reticulate parenchyma cells. They are five in number in each mericarp and located in the mesocarp in primary ridges.

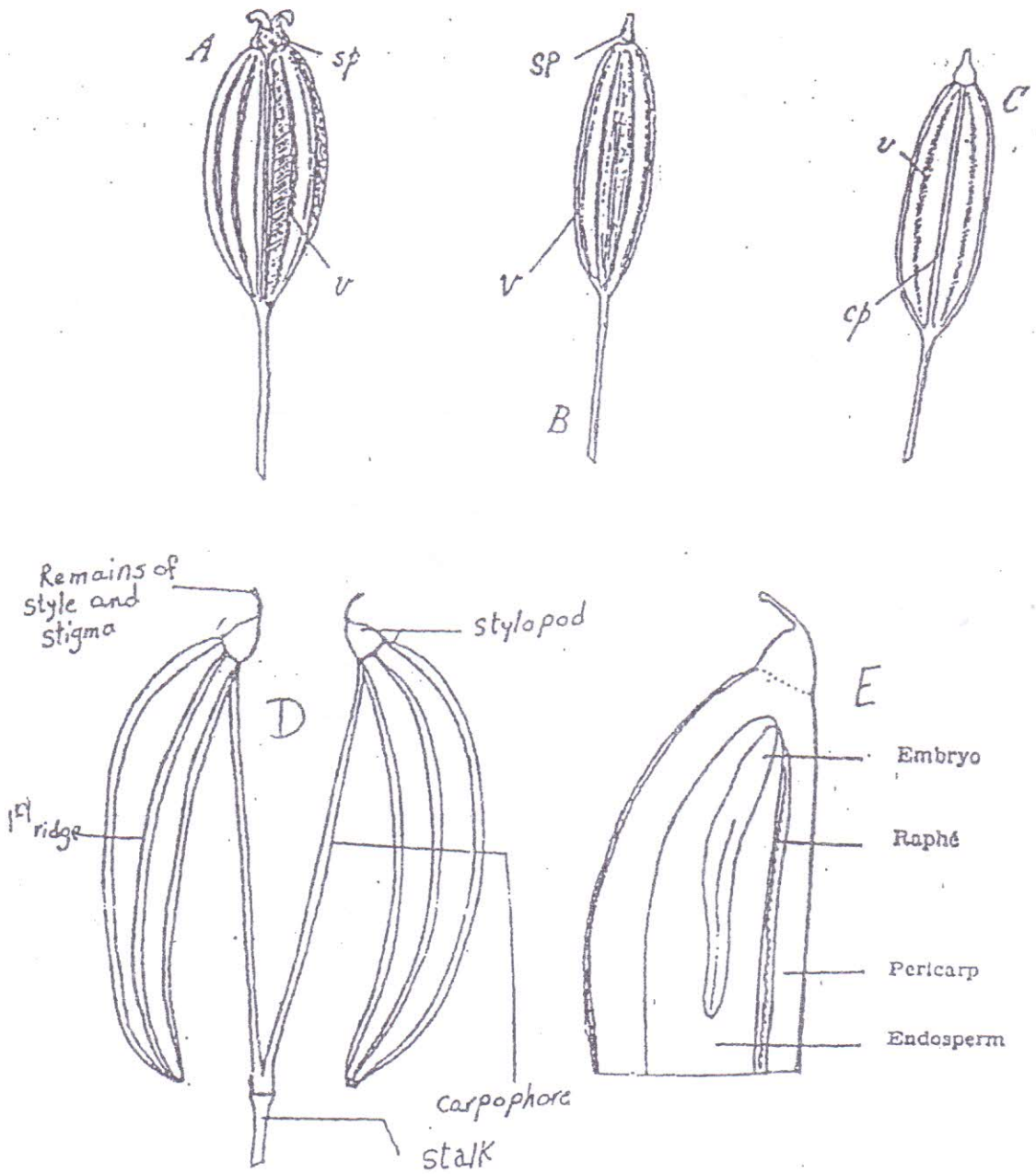

Fig. 3. Cremocarp. A. lateral view. B. dorsal view; C. commisural surface of a mericarp: D. splitted one showing carpophore supporting two mericarps; E, part of a median L.S. in mericarp. cp, carpophore; sp, stylopod; v, vitta.

5) The endocarp is composed of one row of narrow elongated cells. It appears in surface view as parallel cells, arranged in groups, either in parquetry or non-parquetry manner (parallel).

6) Endosperm is composed of thick cellulosic cells containing fixed oil and aleurone grains. Each aleurone grain contains a globoid and one or more microrosette crystals of calcium oxalate.

7) According to the character of the seed on the ventral side it is described as:

a) Orthospermous: When the endosperm is flat on the ventral surface, e.g. Fennel.

b) Colospermous: When the endosperm is concave on the ventral surface, e.g. Coriander.

c) Campylospermous: When the seed has a longitudinal groove on the ventral surface, e.g. Hemlock.

8) Testa is formed of brownish, single row of polygonal, flattened cells followed by a hyaline layer of obliterated cells.

1- Fennel Fruit

Thamarul Shamar

Names: Foeniculum, Fructus Foeniculi

Origin: Fennel is the dried ripe fruit of *Foeniculum vulgare* Mill (Fam. Apiaceae). It contains not more than 4 per cent of foreign organic matter, and yields not less than 1.4 % v/w of volatile oil.

Description

A. Morphology The Fruit:

Cremocarp: It is often entire. cylindrical or nearly so, attached to a slender pedicel, 2 to 10 mm. long, sometimes separated into its two mericarps.

Mericarp: It is elliptical. tapering slightly towards both ends, 5 sided, the commissural side being the wider 4 to 12 mm. long and up to 4 mm. broad, crowned with a short conical stylopod, yellowish-green to yellowish-brown. Externally, it is glabrous, and marked with 5 paler, prominent primary ridges. Commissural side, flat and shows 3 narrow pale brown, longitudinal areas, separated by 2 dark brownish areas over the vittae, internally, mericarp shpws a pericarp containing usually 6 brown yittae, 4 in the dorsal side and 2, in the commissural side, large oily, orthospermous endosperm and a small apical embryo.

Fennel fruits have sweet aromatic odour and sweet agreeable aromatic taste

B. Histology:

Epicarp: It consists of thick-walled, rectangular, polygonal, colourless cells, with smooth cuticle, few stomata and no hairs.

Mesocarp: It consists of rather thick-walled, somewhat brownish, parenchyma, traversed longitudinally by 6 large schizogenous vittae, appearing elliptical in transverse sections and possessing brown epithelial cells, and in the ridges by vascular bundles each having one inner xylem strand and two lateral phloem strands, and accompanied by strongly lignified fibers and lignified, reticulate thickened walls cells.

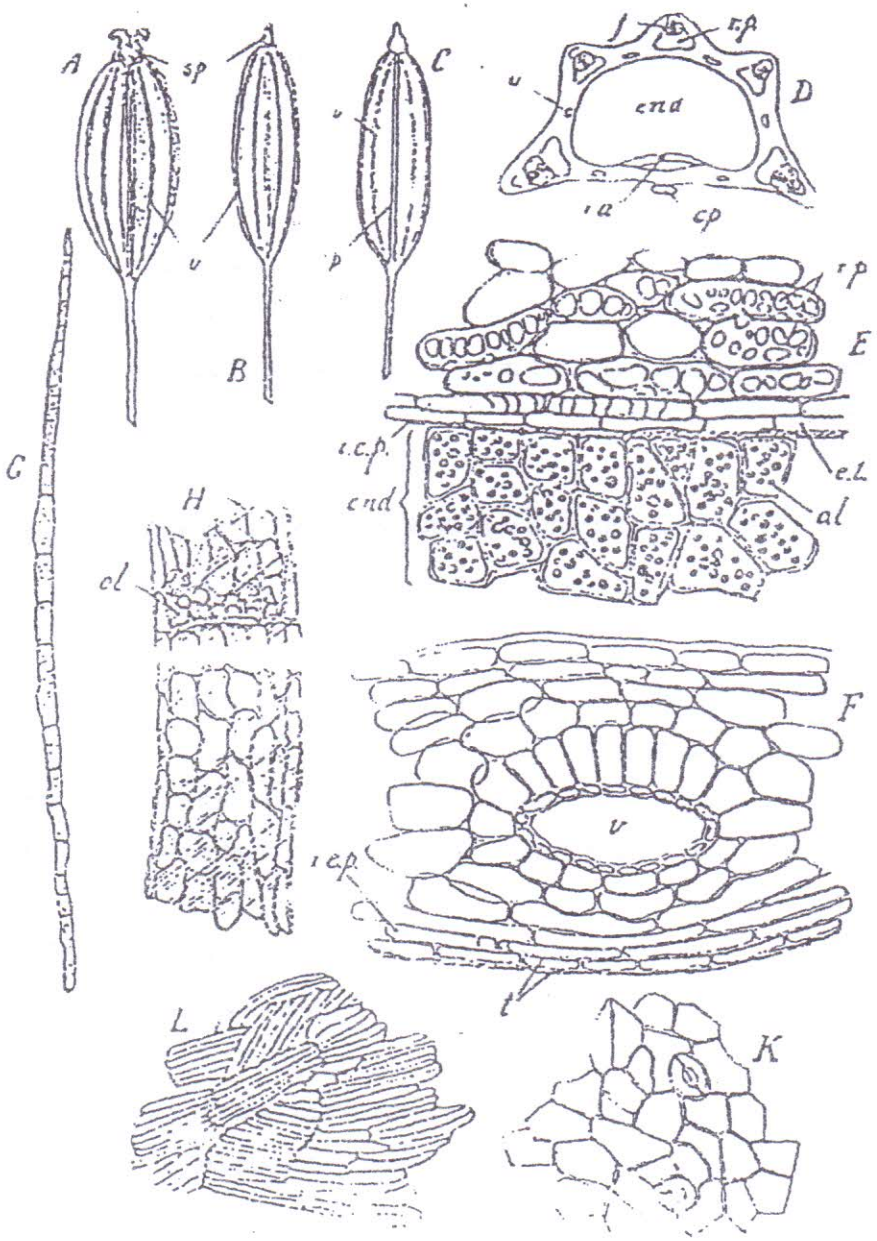

Fig. 18: Fennel fruit. A lateral view of a cremocarp B. dorsal view of a cremocarp C. commissural surface of a mericarp. D, diagram of a transverse section of a mericarp. E, transverse section of part of pericarp within a vascular strand and part of endosperm F, transverse section of pericarp including a vitta G. an entire vitta. H, part of a vitta, showing segmentation and epithelium L, parquetry layer in surface view. K, outer epidermis of pericarp al, aleurone grain; cp, carphophore; end, endosperm, e.t. epidermis of the testa; f, fibres; i.e.p., inner epidermis of pericarp, ol, volatile oil; ra, raphe; r.p, reticulate parenchyme, sp, stylopod; t, testa; v, vitta.

Endocarp: It is composed of very narrow, thin-walled cells, mostly 4 to 6 μ thick, arranged in groups of 5 to 7, many of these groups being variously oriented (parquetry structure).

Endosperm: It is formed of somewhat thick-walled polygonal cellulosic parenchyma containing much fixed oil, and several aleurone grains, up to 6μ in diameter, enclosing a globoid, and one or more micro-rosette crystals of calcium oxalate, about 3 μ in diameter.

Carpophore: It is often not split, with very thick-walled sclerenchyma in 2 strands.

Powder

Powdered Fennel is yellowish-brown to greenish-brown, having a sweet aromatic agreeable odour and taste. Microscopically, it is characterized by:

1- Colourless fragments of thick-walled polygonal endosperm cells containing globules of fixed oil and aleurone grains containing micro rosette crystals of calcium oxalate

2- Fragments of epidermal cells of the pericarp, usually polygonal with smooth cuticle and very few stomata; few fragments with yellowish-brown vittae, 100 to 200 μ wide, generally crossed by the cells of the endocarp

3- Occasional parenchymatous cells of the mesocarp with lignified reticulate thickening generally accompanied by narrow fibers with numerous oblique simple pits

4- Hairs and starch granules are absent.

Constituents:

1- Essential oil (4 - 6 %), containing trans- anethole, fenchone, estragol (methyl chavicol), α- and β- Pinene, α - phellandrene, limonene, camphene and others.

2- Fixed oil (17-20%) of which 60-75% is petroselinic acid.

3- Flavonoids: Kaempferol, quercetin, iso quercetin and rutin

4- Protein (16-20%), minerals (relatively high Ca and K), sugars and vitamins.

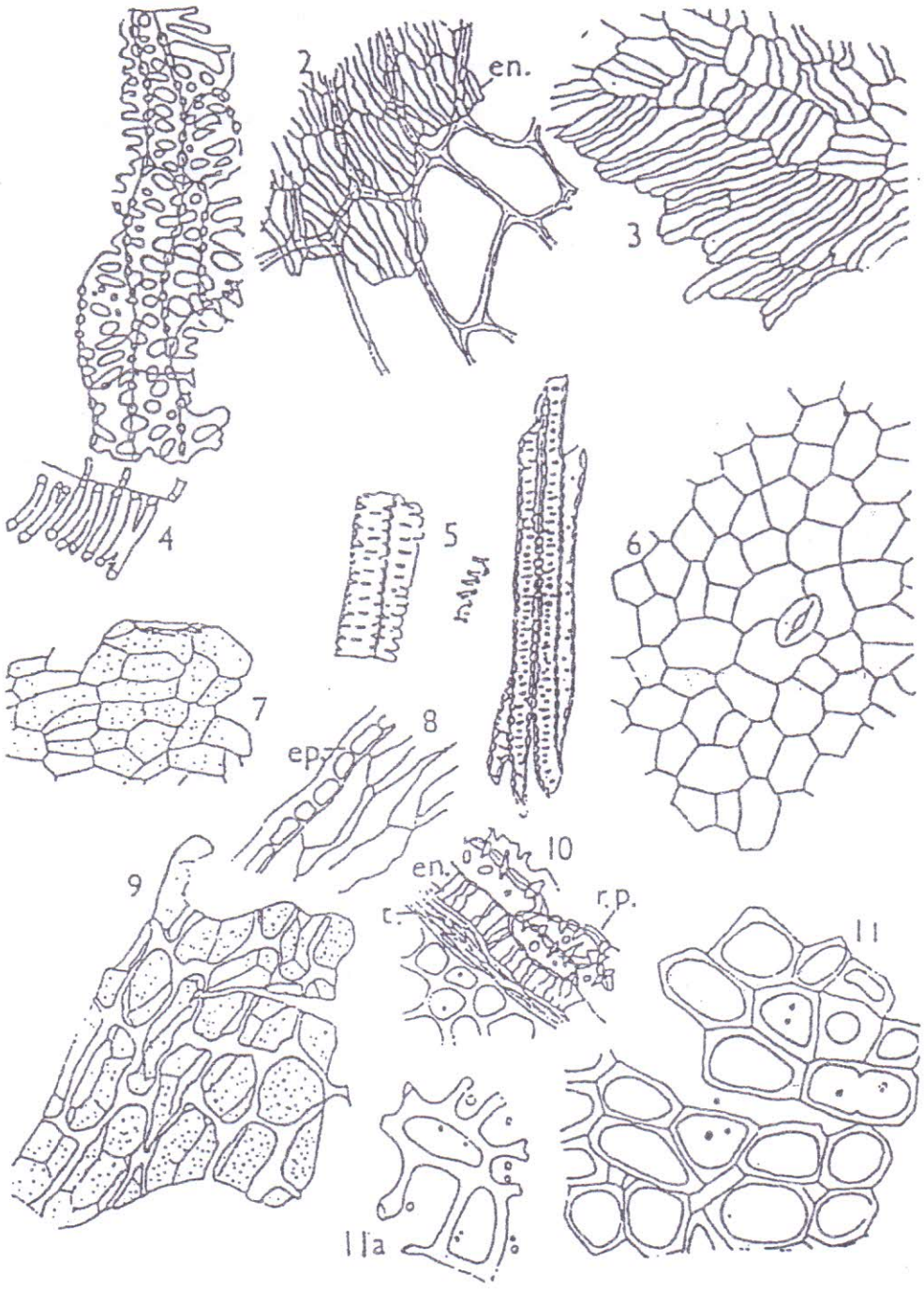

Fig. 19. Powdered Fennel.1,reticulate parenchyma; 2,3,endocarp cells; 4,5,elements of vascular bundle 6,epicarp; 7,9,fragments of vittae; 10,part of pericarp and seed in sectional view; 11, endosperm.

Uses and Actions:

1 It is carminative (helps to release gas from stomach and bowels). It regulates the peristaltic function of GIT and relieves the associated pain and cramping.

2- It promotes the functions of liver, spleen and kidneys and also clears the lungs (anethole and fenchone have been shown to have a secretolytic action in the respiratory tract). So, an infusion of the fruits may be taken as a gargle for sore throats and as a mild expectorant.

3- It promotes the breast-milk production (lactagauge), and has anti inflammatory effect. .

4- Fennel fruit is used medicinally with purgatives to allay their tendency of gripping

5- The fruits have a long standing reputation as an aid to weight loss.

Contraindications

- Fennel in high doses is a uterine stimulant therefore contraindicated in pregnancy

Side effects:

-In rare cases, allergic reactions affecting skin and respiratory system.

2-Ammi visnaga

Thamarul Khellah

Names: Fructus Ammi visnaga, Visnaga fruit, Fruits de khella, Bizrul Khellah.

Origin: *Ammi visnaga* fruit is the dried ripe fruit of *Ammi visnaga* Lam. (Fam. Umbelliferae= Apiaceae). It contains not more than 3 % of foreign organic matter, and yields not less than 0.5 % of the bitter principle, khellin.

Description:

A. Morphology:

The Fruit:

Cremocarp It is usually separated into its mericarps, rarely entire with a part of the pedicel attached.

Mericarp: It is small, ovoid, about 2 mm. long and 1 mm. broad, brownish to greenish-brown, with a violet tinge, externally, glabrous, marked with 5 distinct, pale brownish, rather broad primary ridges, 4 inconspicuous dark secondary ridges, carpophore is simple (c.f. A. *majus)* and is crowned at apex by pyramidal stylopod bearing at its apex a reflexed style (0.5 mm long). Internally, the mericarp shows a pericarp with 6 vittae, 4 in the dorsal and 2 in the commissural side, a large oily orthospermous endosperm and a small apical embryo.

Ammi visnaga has a slightly aromatic odour and an aromatic, bitter, slightly pungent taste

Histology:

Epicarp consists of polygonal cells, elongated on the ridges, with occasional crystals of calcium oxalate prisms, anomocytic stomata and finely striated cuticle, no hairs.

Mesocarp: It is formed of parenchyma traversed longitudinally by the schizogenous vittae in the secondary ridges regions, each surrounded by large slightly radiating cells, and in the primary ridges regions by bicollatral fibro vascular bundles, each

forming a crescent around a comparatively large empty vittae and accompanied by reticulate, lignified cells. **Innermost layer of the mesocarp** consists of large, polygonal, brown-walled cells, with thick porous inner walls.

Endocarp: It is composed of narrow tangentially elongated cells. Some of these being regularly arranged in groups variously oriented (indistinct parquetry), and adhering to the brown seed coat.

Seed coat, brown, formed of similar, but wider and somewhat shorter cells. Endosperm: consists of polygonal, thick-walled, cellulosic parenchyma, containing fixed oil and numerous small oval aleurone grains, each enclosing a minute, rounded globoid and a microrosette crystal of calcium oxalate. Carpophore: split, passing at the apex into the raphe of each mericarp; traversed by a vascular strand of fibres and spiral vessels.

Powder:

Powdered *Ammi visnaga* fruit is brown, having a slightly aromatic odor and an aromatic, bitter and slightly pungent taste. Microscopically, it is characterized by:

1- Fragments of pericarp with few brownish pieces of vittae, reticulate cells, vessels and fibers.

2- Fragments showing the inner porous cells of the mesocarp crossed by, and intimately united with, endocarpal cells, which are found in groups some of them, being differentially oriented.

3- Fragments showing cells of the brown seed coat.

4- Numerous fragments of endosperm.

5- Aleurone grains, 4 to 10 microns in diameter containing micro-rosette crystals of calcium oxalate 2 to 5 microns in diameter

Constituents:

1- Furanochromones (y-pyrones) (2 - 4%), named: Khellin (0.3 -1.2%), visnagin (0.05 - 0.3%), khellol (0.3 - 1 %) and its glucoside.

2- Pyranocoumarins (Visnagans) 0.2 - 0.5%), named: Visnadin, samidin and dihydrosamidin.

3- Traces only of the furanocoumarins: xanthotoxin and ammidin.

4- Flavonoids: quercetin and isorhamnetin and their 3-sulphates, kampferol

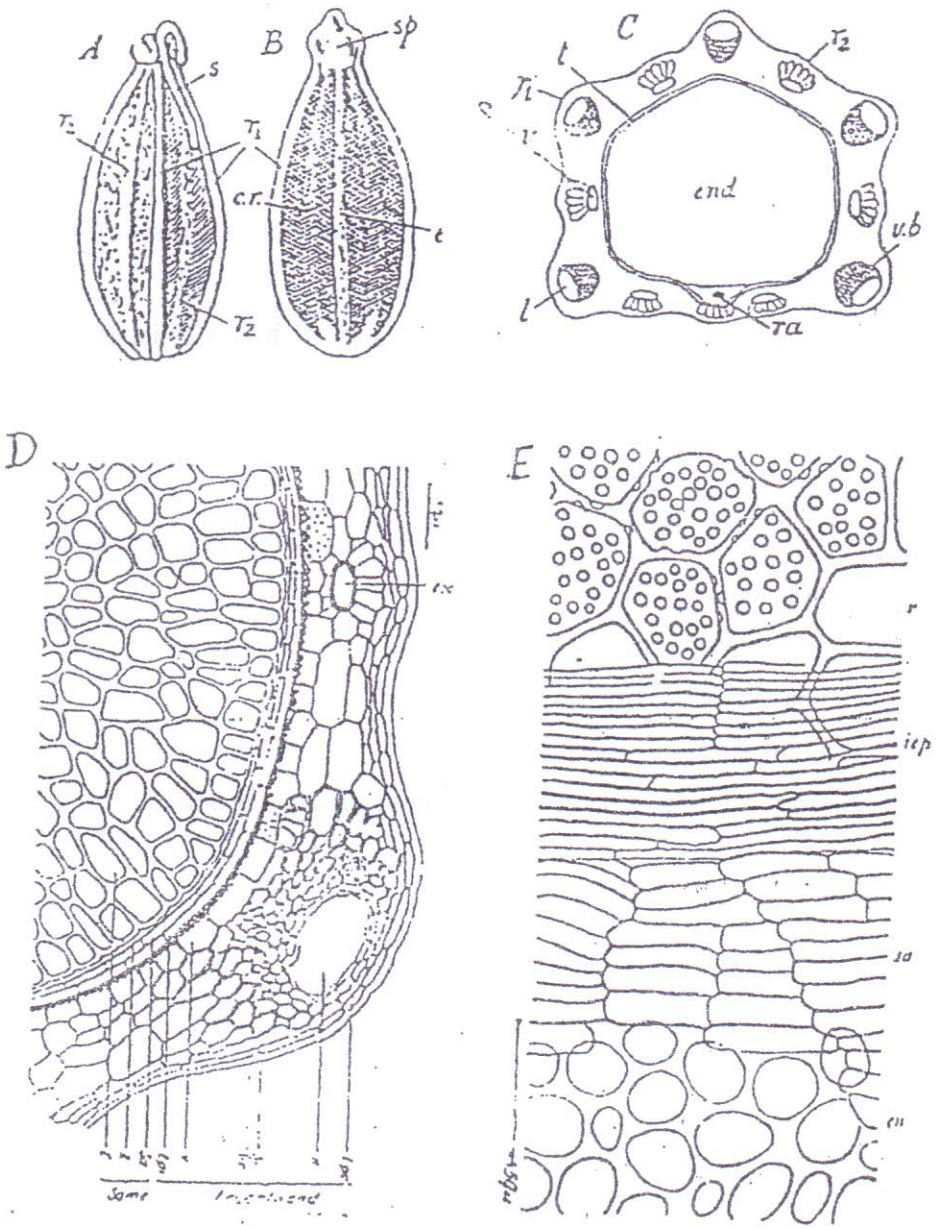

Fig. 20. Ammi visnaga. A,entire cremoarp; B,commisural of a mericarp; C.diarammatic T.S.: D,detailed T.S. of a mericarp; E,isolated elements from the fruit. C.r, ridge over vitta; e,elevation over raphe; end endosperm; l, schizogenous duct; r_1,primary ridge; r_2, scondary ridge; ra,raphe; s,style; sp,stylopod; t,testa: v,vitta; v.b,vascular bundle; i.ml,innermost layer of mesocarp; en,endocarp: e.s,epidermis of testa; r.p.,reticulate parenchyma.

5- Essential oil (0.02 - 0.03%): containing camphor, carvone, α-terpineol and linalool along with cis- and trans-linalool oxides.

6- Fixed oil (12 -18%) and protein (12 -14%).

Uses and Actions:

The drug acts as a spasmolytic especially on the muscles of the bronchi, GIT, biliary tract, urogenital system and the coronary vessels. On the basis of these actions, it is used for:

1- Whooping cough, cramp-like conditions of GIT, biliary colic, and painful menstruation.

2- It is used for the removal of small bladder and kidney stones by relaxing the muscles of the ureter.

3- It also reduces the pain caused by the trapped l stones and helps ease the stone down into the bladder.

4- The drug relaxes the coronary arteries, helps to improve the blood supply to the heart muscle and thereby eases angina pectoris

5- It is now given for bronchial asthma and is safe even to children. Khellin may also have a role to play in the treatment of vitiligo and psoriasis./

6- It acts as diuretic

Contra indications

In pregnancy due to emmenagouge and uterine stimulating activity of khellin

Side effects

1- Photodermatitis in sensitive individuals

2- Prolonged use or an overdose may cause nausea, vertigo, constipation, lack of appetite, headache, allergic symptoms (itching) and sleeplessness

Chemical. Tests:

Boil about 0.1 g. of *Ammi visnaga* fruits with 5 ml of water for a miute, stram add 1 to 2 drops of this decoction to 1 ml solution of sodium hydroxide (1 in1) and shake, a rose red color is produced within 2 minutes (c.f. *Ammi majus)*

3- Ammi majus

Names: Fructus Ammi majus, Ammi majus, Bizrul khella Al- shetani

Origin: It is the dried ripe fruits of *Ammi majus* L. (Fam. Apiaceae).

A- Morphology: The Fruit:

Cremocarp: It is nearly cylindrical, usually separated into its mericarps, rarely entire with a part of the pedicel attached.

Mericarp It is small, five sided, slightly narrow near the apex, about 2 to 2.5 mm and about 0.75 mm, crowned by the stylopod, and showing reflexed. style, greyish brown to reddish brown in colour without a violet tinge. (c.f. A. *visnaga).* Externally: rough, glabrous, marked with five primary ridges, alternating with four dark brown prominent secondary ridges. Internally the mericarp shows a pericarp with 6-vittae, 4 in the dorsal and 2 in the commissural side, a large orthospermous oily endosperm and a small apical embryo. The carpophore is forked (c.f. A. *visnaga).*

The fruits have a faint aromatic odour and very pungent and slightly bitter taste.

B- Histology:

Ammi majus has more or less similar structure to A. *visnaga,* except in the following points:

1- Ammi majus is larger in size about 3mm long and 1.5mm wide.

2- The mericarp is oval oblong almost cylindrical with yellowish brown outer surface but with no violet tinge.

3- The outer surface is glabrous and marked with 5 distinct primary ridges and 4 prominent secondary ridges.

4- The epidermal cells are papillosed, covered with thick or distinctly striated cuticle and containing prisms and clusters of calcium oxalate.

5- The vascular bundles appear in T.S. oval or circular and not accompanied by ducts.

6- The innermost layer of the mesocarp consists of non-porous equally thickened brown cells.

Powder:

Powdered *Ammi majus* is yellowish-brown, strongly pungent and slightly bitter and characterized microscopically by the presence of:

1- Fragments of pericarp with few brownish pieces of vittae, vessels and fibres.

2- Fragments of the endocarpal cells, showing distinct parquetry structure and crossed by non porous brown thickened parenchymatous cells.

3- Fragments of the epicarp covered with striated cuticle and containing prisms and clusters of calcium oxalate.

4- Fragments showing cells of the brown seed coat.

5- Numerous fragments of the endosperm.

6- Aleurone grains, 4 -12μ in diameter, contain micro rosette crystals of calcium oxalate and a globoid, and oil droplets.

7- Absence of hairs or starch grains.

Constituents

1- Psoralene (furanocoumarin bitter principle): The most important is xanthotoxin (ammoidin) (1.06)

2- In addition to other related bitter principles, imperatorin (Ammidin) 0.8% and bergapten (majodin) (0.3%).

3- Fixed oil and protein

Uses and Actions

Psoralene stimulates pigment production in skin exposed to UV light. It is used externally, in the form of liniments and lotions made of alcoholic extracts of fruits as well as ammoidin, for treatment of vetiligo (leukodermia) alopecia and psoriasis.

Contraindications

-In sensitive persons it may cause photodermatitis

Side effects:

- Excess of the drug cause. nausea, diarrhea and headache

Chemical Tests:

1- Boil about 0.1gm of *Ammi majus* fruit with 5 ml of water for a minute, strain, add 1 to 2 drops of this decoction to 1mL solution of sodium hydroxide (1 in 1) and shake, no rose red colour is developed (c.f. *Ammi visnaga).* .

2- The alcoholic extract of A. *majus* fruit (1 in 10), gives a blue fluorescence in ultraviolet light (due to furanocoumarin content) (c.f. A. *visnaga),*

4- Anise Fruit

Thamarul Yansoon

Names: Fructus Anisi, Anisum, Anason, Anasur, Aniseed, Semen anisi

Origin: Anise consists of the dried ripe fruit of *Pimpinella anisum* L. (Fam. Apiaceae). It contains not more than 3 per cent of foreign organic matter, and yields not less than 1.5 % v/w of volatile oil

Description

A- Morphology

The Fruit: It is cremocarp, partly separated into its mericarps, often entire, remaining attached to a slender pedicel, 2 to 12 mm. long.

Cremocarp is pear-shaped, enlarged at the base and tapering at apex, somewhat laterally compressed, 3 to 6 mm. long and 2 to 3 mm broad, crowned with a ring-like disc, stylopod, and the remains of two diverging styles grayish or greenish-gray, seldom grayish-brown. Externally, rather rough to the touch due to the presence of numerous very short, stiff hairs. Each mericarp has 5 very slightly raised filiform, pale brown primary ridges. The commissural surface is nearly flat, with two dark brownish longitudinal areas, containing vittae, separated by a middle paler one. **The mericarp** shows a pericarp with numerous branched vittae in the dorsal and usually 2 large ones in the commissural side, a large oily endosperm, not deeply grooved on the commissural surface, and a small apical embryo

The fruits have a strong aromatic, agreeable and characteristic odour, and a sweet, strongly aromatic taste

B- Histology:

Epicarp: consists of cells with striated cuticle, many of which project into short, conical, curved, thick-walled unicellular, sometimes bicellular non-glandular hairs, with bluntly pointed apex and finely warty cuticle.

Mesocarp: formed of thin-walled parenchyma traversed longitudinally by numerous schizogenous vittae with brown epithelial cells and in each primary ridge, by a small vascular bundle accompanied by a few fibres and shows a patch of porous or reticulate lignified cells existing only in the middle of the commissural side, but not in the ridges

Endocarp: It is composed of narrow, tangentially elongated thin-walled cells (parallel), except when adjacent to the reticulate cells in the mesocarp, where it is formed of porous, lignified and pitted cells

Seed-coat: It consists of one layer of tangentially elongated cells with yellowish-brown walls, closely adhering to the endocarp except when separated by a large cavity along the commissural surface.

Endosperm: It is formed of polygonal thick-walled cellulosic cells, containing fixed oil and many aleurone grains, each enclosing one globoid and one or two microrosette crystals of calcium oxalate.

Carpophore: split, passing at the apex into the raphe of each mericarp; traversed by vascular strands of fibers and spiral vessels.

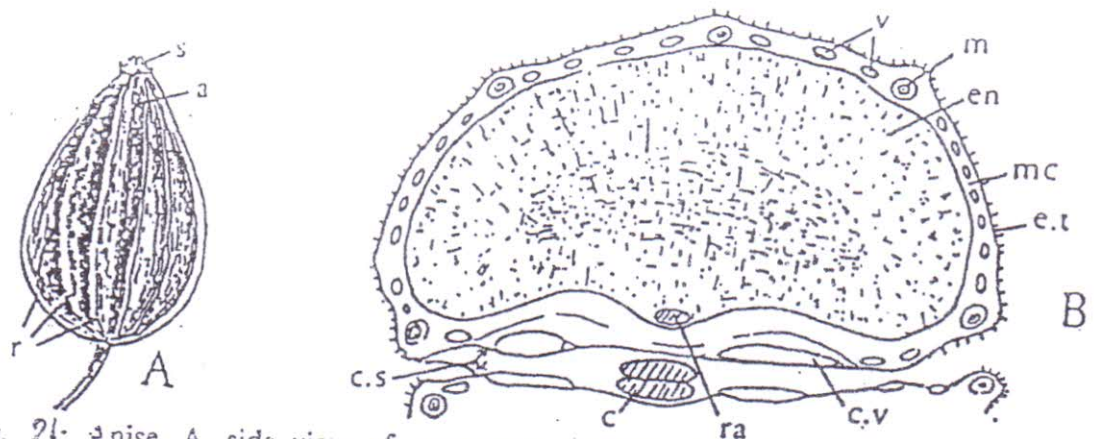

Fig. 21: Anise. A, side view of cremocarp showing line of attachment to the two mericarps, B, transverse section of mericarp; a,line of attachment of mericarps; c, carpophore; c.s, commissural surfaces; c.v. commissural vitta; en, endosperm; e.t, epicarp bearing trichomres; m, meristele; mc,mesocarp; r.three of five primary ridges of one mericarp; ra, raphe; s, stylopod; v, vittae.

Powder:

Powdered Anise is gray, greenish-brown or yellowish-brown, having a strong aromatic agreeable and characteristic odour and a sweet strongly aromatic taste. Microscopically, it is characterized by presence of:

1- Numerous almost colourless fragments of endosperm.

2- Abundant minute oil globules.

3- Numerous warty simple hairs 25 to 200 μ long and 10 to 15 μ broad.

4- Fragments of pericarp with yellowish-brown comparatively narrow branching vittae, usually crossed by the cells of the non parquetry endocarp.

5- Few fibers and very scanty pitted lignified parenchyma.

6-Aleurone grains, 2 to 15 mostly *6to* 10 μ in diameter

7- Calcium oxalate micro-rosette crystals

Constituents:

1-Essential oil (1.5-5%) containing:

- Trans- anethole (80-90%) of the oil that is chiefly responsible for the taste and smell.
- The isomeric methyl chavicol (1':2%), which also smells. like anise but doesn't taste sweet.
- Anisaldehyde (1%).
- Sesquiterpene hydrocarbons (2%) and less than 1%monoterpene hydrocarbons (1%)
- The dimers of anethole (dianethole) and anisaldellyde(Dianisoine).

2- Fixed oil, protein and coumarins.

Uses and Actions:

1- Anise is used as expectorant and carminative

2- It has long been used for relieving colic in children.

3- It is used also in hard dry cough where expectoration is difficult. So, it may be used in bronchitis and in whooping cough.

4- It also has a sedative action.

5- In folk medicine, it is used as lactagauge, emmenagauge.

6- Oil is also employed in food and drink industry as flavoring agent.

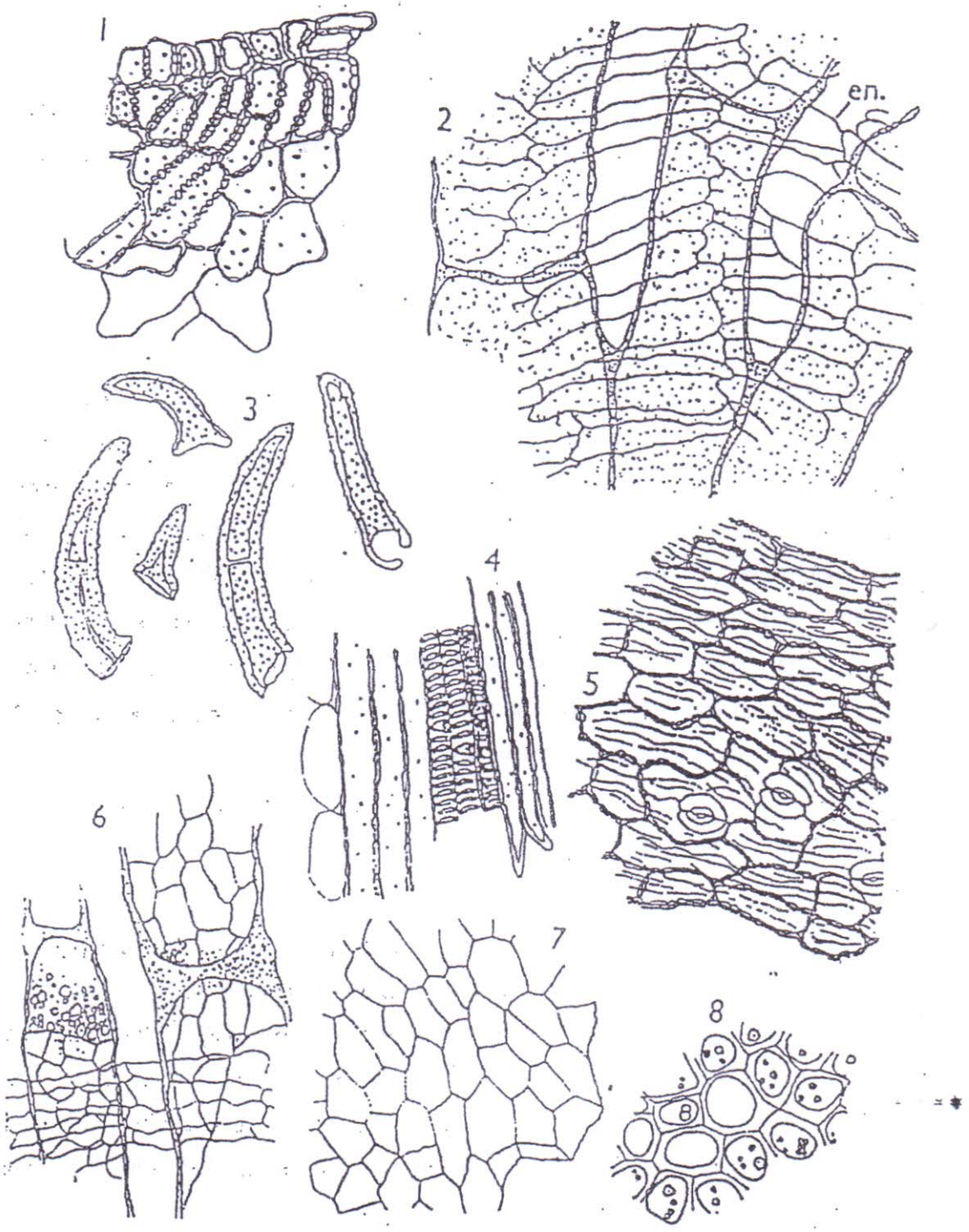

Fig. 22 Powdered Anise. 1,lignified pitted cells; 2 6,branched vittae with endocarp cells; 3,coveing trichomes; 4,fragment of vascular strand; 5,epicarpcells; 7,testa in surface view; 8,endosperm.

Coriander Fruit
Thamarul Kozbara

Names: Fructus Coriandri, Coriandrum

Origin: Coriander is the dried ripe fruit of *Coriandrum sativum* Linne (Fam Apiaceae). It contains not more than 5 % of foreign organic matter and yields not less than 0.3 % *v/w* of volatile oil

Description:

A- Morphology

The Fruit: cremocarp, usually entire, nearly globular 2 to 5 mm. in diameter, brownish-yellow, or brown sometimes with a purplish tint; externally: glabrous marked with 10 inconspicuous wavy primary ridges, and 8 more prominent, straight secondary ridges; usually crowned by a short conical stylopod and the remains of the sepals. The pericarp is usually remaining attached by the margin, concave on the commissural sides; internally: the pericarp shows no vittae in the dorsal, but only 2 on the commissural side of each mericarp, and an almost complete ring of sclerenchyma in the dorsal side, a large colospermous oily endosperm and a small, curved, apical embryo.

Coriander has an aromatic odour and an aromatic spicy and characteristic taste.

B) Histology

Epicarp consists of small, thick-walled cells, and showing occasional small prismatic crystals of calcium oxalate, few stomata of cruciferous type and no hairs.

Outer zone of mesocarp consists of few layers of tangentially elongated parenchymatous cells usually collpased, showing degenerated vittae as tangentially flattened cavities and longitudinally traversed by 10 vascular strands with small spiral vessels. In the ripe fruit, the outer layers of the mesocarp with the dorsal vitta.e are usually absent.

Middle zone of mesocarp, formed of a broad layer of sclerenchyma consisting of strongly lignified pitted, fusiform fibres in 2 bands crossing each other at right angles, one running longitudinally and the other tangentially.

Inner zone of mesocarp, formed of 2, sometimes 3 rows of large, tangentially elongated thin-walled parenchyma with wide intercellular spaces and innermost layer

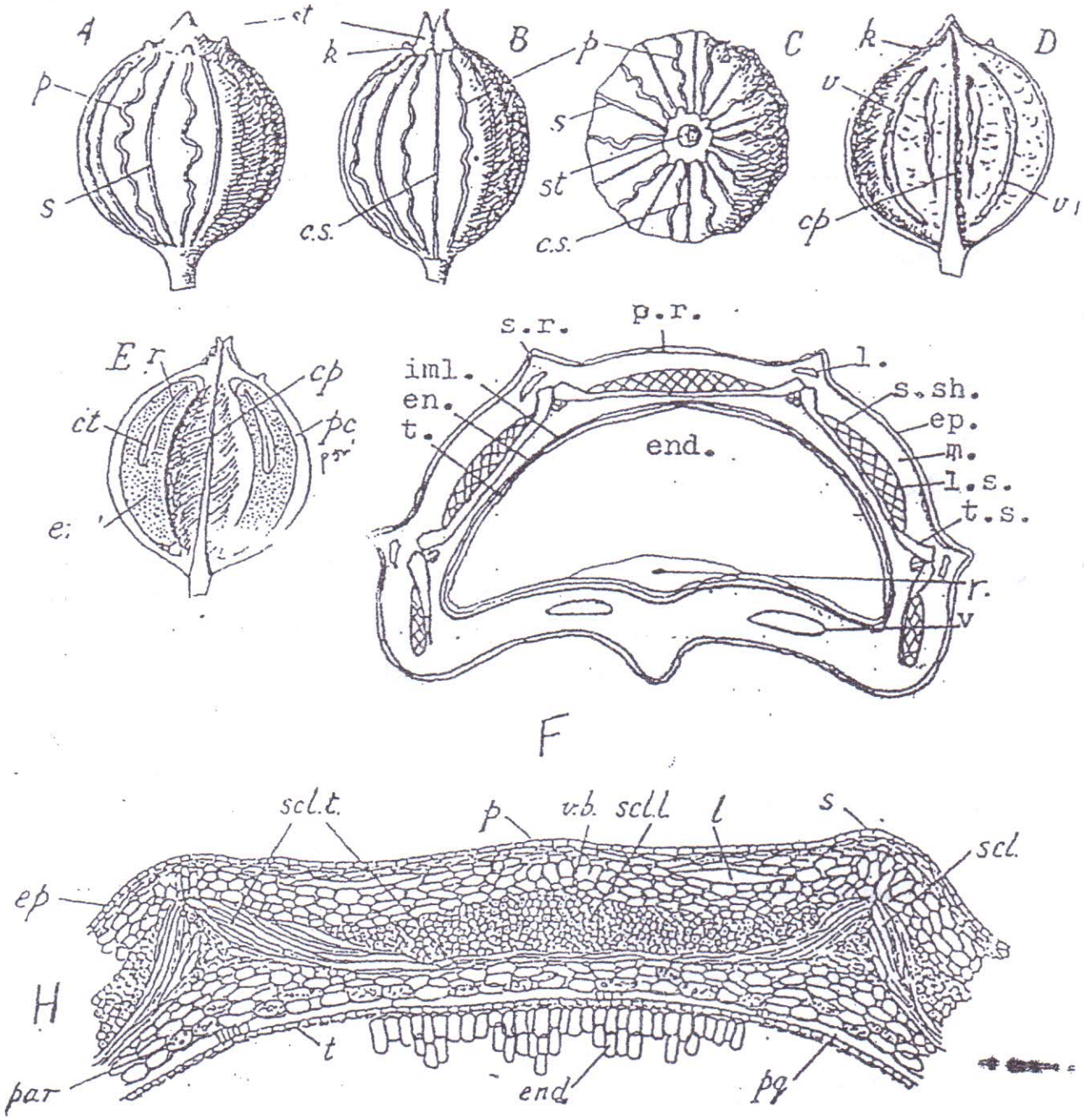

Fig. 23: Coriander. A,B&C,entire fruit in side and top view; D,commisural surface of mericarp; E,L.cut of cremocarp; F,diagrammatic T.S. of mericarp; H,detailed T.S. of mericarp; cp,carpophore; c.s,commisural surface; ct, cotyledons; en & pq,parquetry endocarp; end,endosperm; ep,epicarp; iml,innermost layer of mosocarp; l,lacuna; m,mesocarp; p & p.r. primary ridge;s & sr,secondary ridge; scl.l,longitudinal, sclerenchyma; scl.t, tangential sclerenchyma; st, stylopod; par, lignified innermost layer of mesocarp; r,raphe; v.b., vascular strand; k, sepals of calyx.

of flattened hexagonal pitted lignified cells, usually adhering to the endocarp.

Mesocarp, on the commisural side, shows no sclerenchyma layer, but 2 large elliptical yellowish-brown schizogenous vittae.

Endocarp is formed of very narrow elongated thin-walled cells, in groups variously oriented.

Endosperm consists of thick-walled polygonal cellulosic parenchyma containing much fixed oil and several aleurone grains, about 4 to 12 μ in diameter, each enclosing a micro-rosette crystal, rarely a prism of calcium oxalate, about 3 to 10μ in diameter.

Carpophore, split, passing at the apex of each mericarp into the raphe; traversed by a flattened vascular strand, consisting of fibers surrounded by spiral vessels.

Powder:

Powdered coriander is light brown to brown; having an aromatic odour and an aromatic, spicy, characteristic taste. Microscopically it is characterized by:

1- Numerous irregular fragments of endosperm cells containing globules of fixed oil and aleurone grains containing micro-rosette crystals of calcium oxalate.

2- Fragments of endocarp associated with the hexagonal sclerenchyma of mesocarp.

3- Parenchymatous cells of the mesocarp without reticulate thickening.

4- Very few fragments showing pieces of yellowish-brown vittae, usually crossed polygonal yellowish-brown cells.

5- Fragments of irregularly curved, pitted lignified fusiform sclerenchymatous fibers of mesocarp, in sinuous rows, often crossing at right angle.

6- Abundance of minute oil globules.

7- Hairs and starch granules, absent.

Constituents:

1- 1-1.8% of volatile oil containing linalool (55-74%), α and β pinene, γ-terpenene, p-cymene, limonene, anethole, camphor, geraniol and geranyl acetate.

2- Fats (up to 26%); its main fatty acids are oleic and linolenic acids,

3- Flavonoid glycosides (quercetin, isoquercetin and rutin), coumarins, and phenolic acids.

4- Proteins (11 -17%)

N.S. Trans-tridec-2-en-1-al, is responsible for the bedbug smell of the unripe fruit and of the herb.

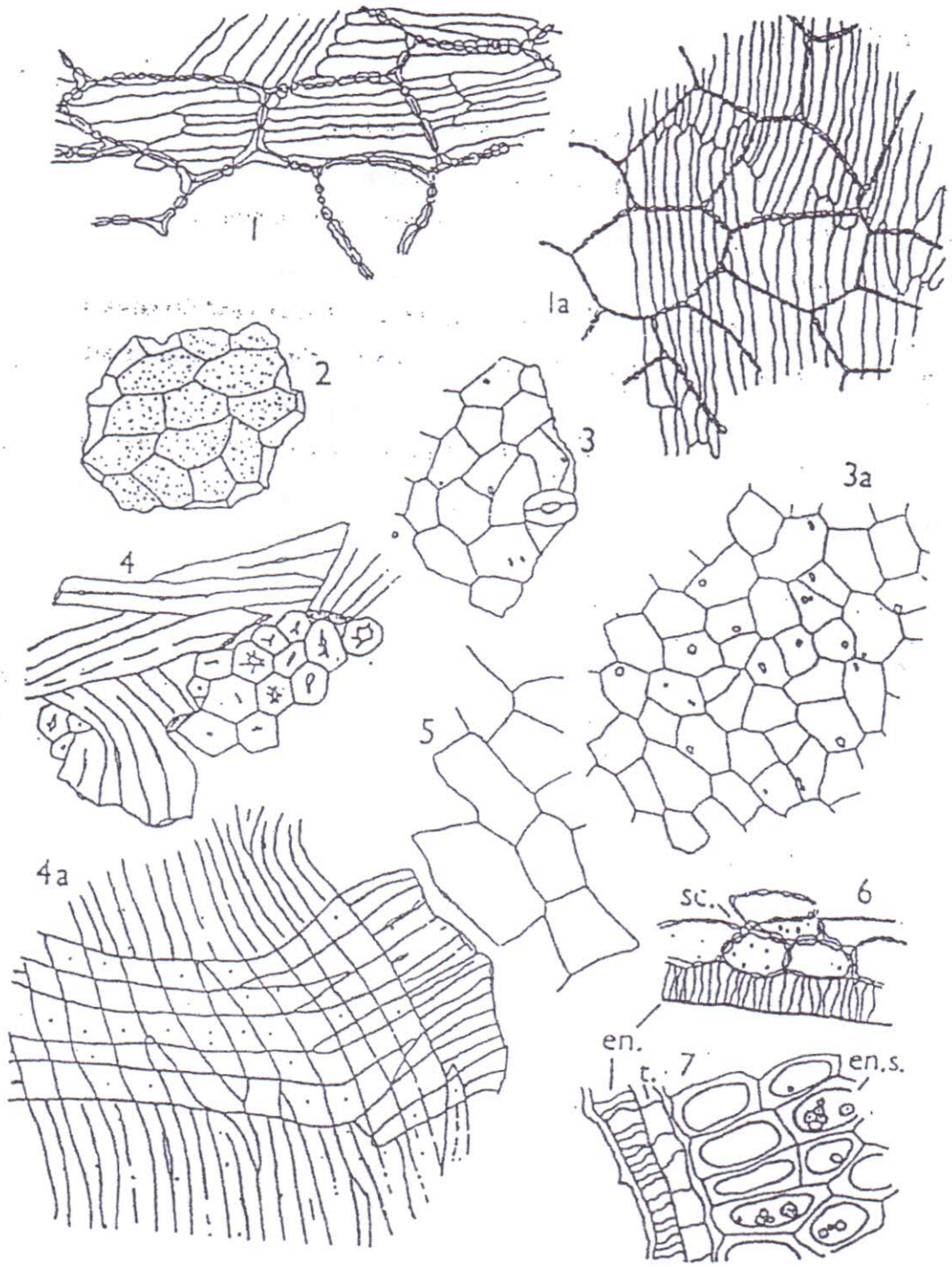

Fig. 24 : Powdered Coriander. 1,endocarp with innermost layer of mesocarp; 2,fragment of vitta; 3,epicarp; 4;sclerenchymatous cells; 5,testa in surface view; 6,endocarp and innermost layer of mesocarp in sectional view; 7,endosperm cells.

Uses and Actions:

1- Spice

2- Stomachic, spasmolytic, carminative and flavouring agent.

3- It has bactericidal and fungicidal properties.

4- It is useful for sub-acid gastritis, diarrhea and dyspepsia of various origins.

5- It has strong lipolytic activity.

6- It is added to purgative preparations of: Rhubarb, Frangula, Cascara and Senna as it is supposed to prevent the gripping effect that occurs when anthraquinone drugs are used.

7- The high percent of fats and protein makes distillation residues suitable for animal feed.

Carawy Fruit

Thamarul Karawya

Names: Fructus Carvi. Carum

Origin: Caraway is the dried ripe fruit of *Carum carvi* Linne (Fam. Apiaceae). It contains not more than 3 % of foreign organic matter, and yields not less than 3.5 % v/w of volatile oil

Description

A- Morphology

. The Fruit is cremocarp, elongated, usually separated into its two mericarps

Mericarp: narrow, curved or crescent shaped, tapering towards both ends, almost equally 5-sided, 3 to 7 mm. Mostly 5 mm. long and up to 3 mm. broad; grayish-brown to dark brown, externally: glabrous, marked with 5 yellowish filiform longitudinal primary ridges and sometimes a secondary ridge may be seen between each pair of the primary ones; internally: the mericarp shows a thin pericarp traversed longitudinally by 6 vittae, 4 in the dorsal side and 2 in the commissural one, a large oil orthospermous endosperm, and a small narrow apical embryo.

Caraway fruits have an aromatic and characteristic odour and taste

B- Histology:

Epicarp: It consists of rectangular to polygonal tangentially elongated cells with rather thick walls and striated cuticle, occasional stomata, but no hairs.

Mesocarp: is parenchymatous without reticulate thickening and showing in each primary ridge, a vascular strand, with small vessels, fibres and two bicollateral phloem strands and accompanied by pitted parenchyma, and a very small secretory duct above, and longitudinally traversed by 6 large, schizogenous vittae, appearing elliptical in transverse section, and possessing brown epithelial cells.

Endocarp: It is composed of very narrow, thin-walled cells, usually regularly arranged longitudinally in rows, occasionally at an angle, but not in groups variously oriented.

Seed coat: consists of a single layer of polygonal brown cells.

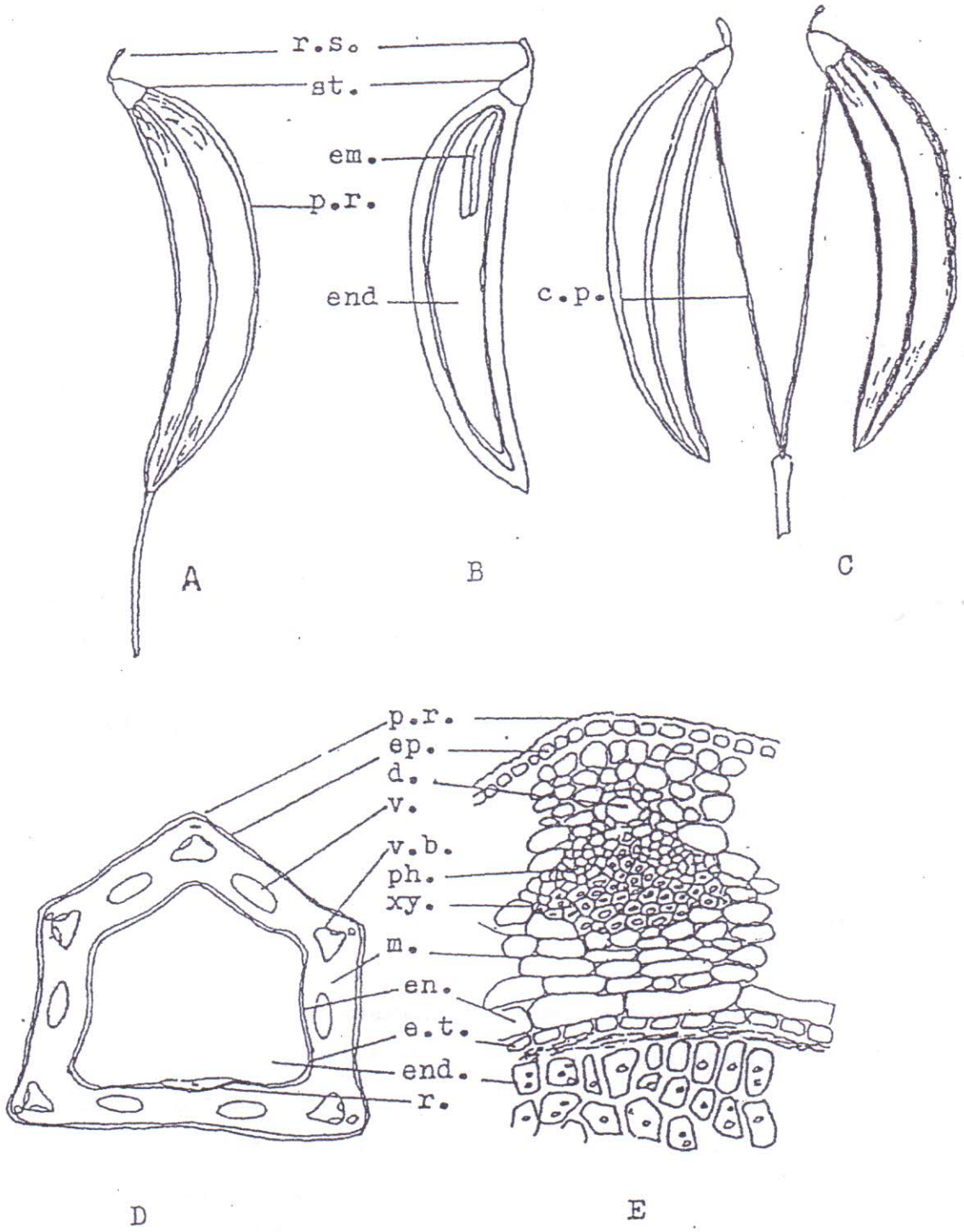

Fig. 25: Caraway. A,entire fruit; B,L.S. in afruit; C,cremocarp showing splitted carpophore; D, T.S. in mericarp; E,detailed. T.S. in mericarp; c.p, carpophore; e.t.,epidermis of testa; em,embryo; en., endocarp; end., endosperm; ep., epicarp; d.,duct; m.,mesocarp; p.r., primary ridge; ph., phloem; r.,raphe; r.s., remain of stigma; st.;stylopod; v.,vitta; v.b.,vascular bundle.

Endosperm: It is formed of somewhat thick-walled cellulosic parenchyma containing much fixed oil and numerous aleurone grains, each with an almost rounded micro rosette crystal of calcium oxalate.

Carpophore: when present, split, passing at the apex into the raphe of each mericarp, and with a small strand of sclerenchyma, the sclereids of which continue into the stylopod.

Powder:

Powdered caraway is yellowish-brown or brownish-gray, having an aromatic characteristic odour and taste. Microscopically, it is characterized by:

1- Fragments of epicarp with striated cuticle showing small prisms of calcium oxalate.

2- Brown fragments showing pieces of vittae generally crossed by cells of the endocarp.

3- Few fragments of seed coat.

4- Numerous fragments of endosperm with thick-walled polygonal parenchymatous. cells containing globules of fixed oil and numerous aleurone grains, up to 10 μ in diameter and containing micro-rosette crystals of calcium oxalate

5- Few fragments of fibers and spiral vessels

6- Hairs, starch granules and parquetry layer, are absent

Constituents:

1- Essential oil (3 – 7containing carvone, limonene, *a*- pinene, and carveol

2- Fixed oil (10-18%), protein (3- 20%), carbohydrates and flavonoids.

Uses and Actions:

1- Caraway is used as stomachic since the essential oil promotes gastric secretions and stimulates the appetite.

2- It relieves colic and cramps as well as flatulence.

3- Caraway oil has marked fungicidal activity. The diluted essential oil is a useful remedy for scabies. The essential oil is included in mouth washes

4- In folk medicine, caraway is also employed as lactagauge.

5- The bulk of caraway is used as spice and taste enhancer as well as to improve tolerance to food causing flatulence e.g. cabbage

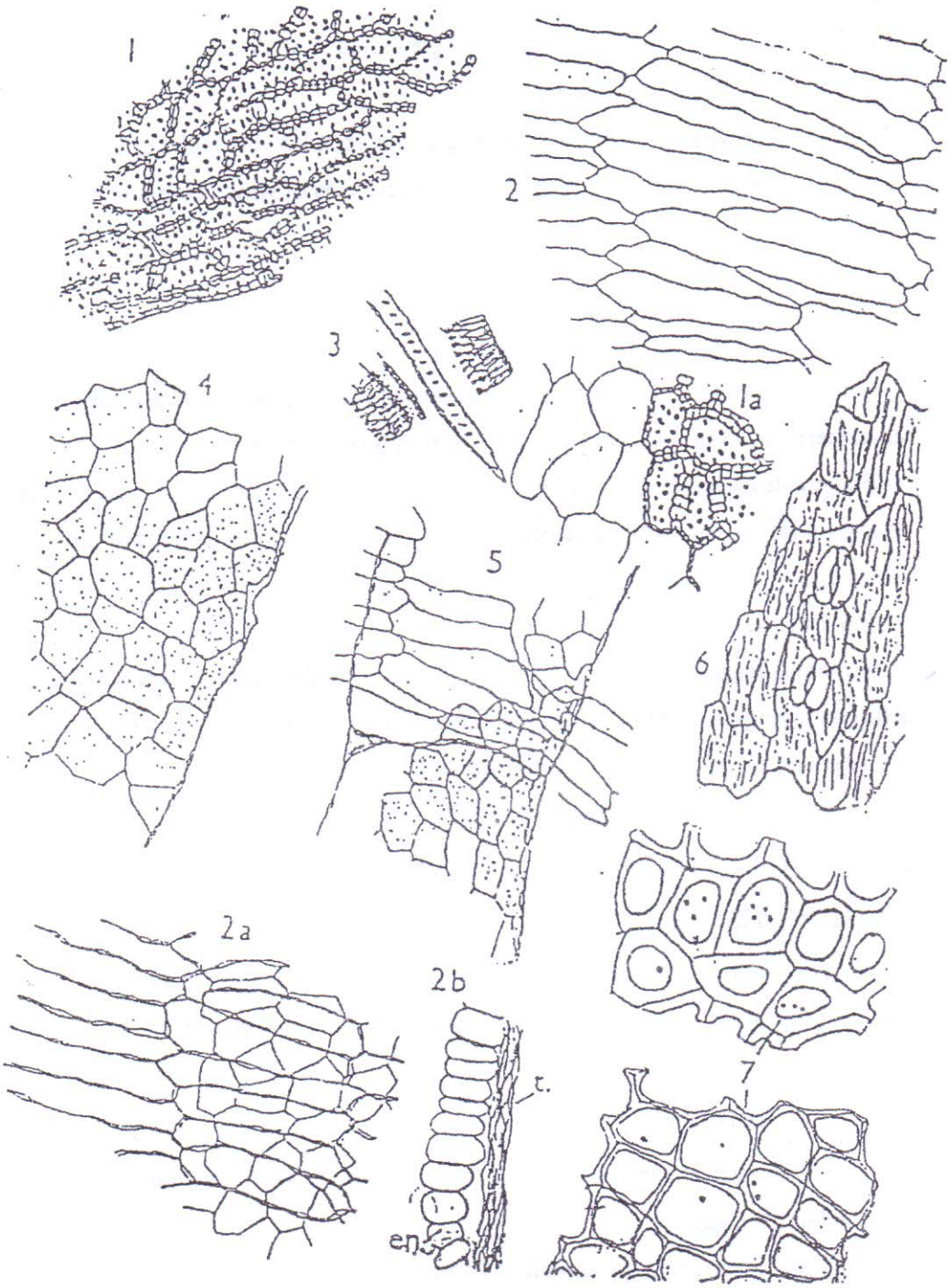

Fig. 26. Powdered Caraway. 1, pitted parenchyma from mesocarp; 2, endocarp cells with parallel arrangement; 3, elements of V.B.; 4 & 5, fragments of vittae; 6, epicarp cells; 7, fragment of endosperm.

– Other Fruits –

1- Capsicum Fruit

Thamarul Shatta

Names: Fructus Capsici, Chillies, Cayenne pepper

Origin: Capsicum is the dried ripe fruits of *Capsicum minimum* Roxb. (Fam. Solanaceae). It should contains not more than 3 per cent of calyces and pedicels, and not more than 1 per cent of foreign organic matter.

Description

A- Morphology:

Capsicum fruits have a characteristic odour and an extremely pungent taste.

-The fruit: is berry, oblong conical, obtuse, somewhat flattened, bilocular about 10 to 25mm long and up to 7 mm. in greatest width, dull orange red to brownish red; superior and sometimes remains attached to a small, inconspicuous, 5 toothed calyx and a slender straight pedicel, about 1 mm. Thick, which is as long as or rather longer than the fruit itself. The pericarp is glabrous, shining, leathery and more or less translucent.

-The Seed: 10 to 20 in each fruit. brownish-yellow, flat subreniform. albuminous, with curved embryo; about 3 to 4 mm. long either loose or attached to a thin reddish, membranous dissepiment.

B- Histology

The pericarp consists of

-Epicarp: It consists of thick, straight-walled, rectangular cells. 25 to 60 microns wide, often arranged in groups of 5 to 7 in a row, and showing a uniformly striated cuticle

-Mesocarp: It formed of several rows of thin-walled, cellulosic parenchyma containing numerous reddish oil globules, occasional idioblasts containing microsphenoidal or prismatic crystals of calcium oxalate and traversed by small vascular bundles. The innermost layer is formed of thin walled giant cells.

-Endocarp: It is composed of islets of isodiametric sclereids with thick, pitted, lignified, sinuous walls, one islet ove. . : cavity of each giant cell, and separated by thin-walled small parenchymatous cells.

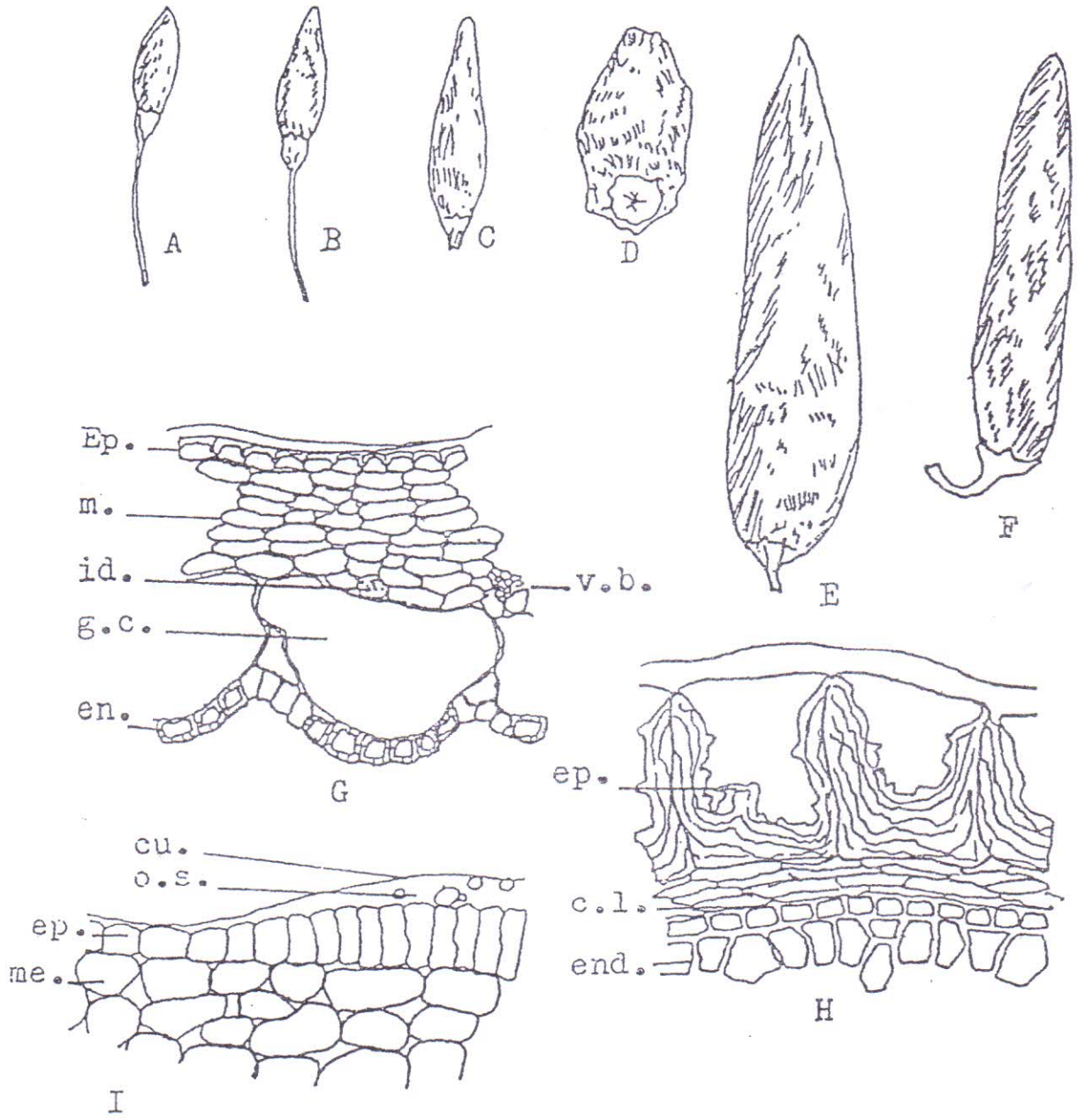

Fig. 27: Capsicum. A, Zanzibar; B, Sierra Leone; C, Japanese; D, Bombay; E, Natal; F, Capsicum annuum; G, datailed T.S. in the pericarp; H,T.S. in the seed ; I. T.S. in dissipiment;. c.l, collapsed layer; cu,cuticle; en, endocarp; ep.epidermis; end,endosperm; g.c, giant cell; id, idioblast; hp, hypodermis; m. mosocarp; me. mesophyll; o.s, oily secretion; v.b, vascular bundle.

-Dissepiment: It shows an epidermis, formed of thin-walled polygonal cells, the cuticle of which being raised by secretion of reddish oily drops, containing, sometimes, crystals of capsaicin, the remainder parenchyma, containing occasional idioblasts of microphenoidal crystals of calcium oxalate, and traversed by vascular bundles.

The seed consists of:

-Seed-coat: consists of an epidermis composed of yellowish, very large sinuous walled cells, with characteristic lignified thickening on the inner tangential and radial walls, and a nutritive layer of collapsed parenchymatous cells.

-Endosperm: It is formed of polygonal cellulosic parenchymatous cells with highly refractive colourless walls and containing fixed oil and aleurone grains.

Powder:

It is yellowish-brown to brownish-red in colour; having a characteristic but not powerful odour and an extremely pungent taste; the pungency is not destroyed by solutions of caustic alkalies (1 in 50), but is destroyed by potassium permanganate (T.S.). Microscopically, it is characterised by:

1-Fragments of the outer epidermis of the seed coat, consisting of lignified cells, with yellowish thick and sinuous walls.

2-Fragments of the endosperm with polyhedral cells containing globules of fixed oil and aleurone grains, 3 to 6 microns in diameter.

3-Scattered reddish oily droplets.

4-Fragments of the outer epidermis of the pericarp.

5-Scattered idioblasts of microsphenoidal crystals of calcium oxalate.

6-Fragments of sclerenchymatous islets from the inner epidermis of the pericarp.

7- Few small vessels, and fibres but no starch granules.

Constituents:

1- Pungent principles named Capsaicinoids (up to 1.5%), including capsaicin (0.1 - 1 %), 6,7 -dihydrocapsaicin, nordihydrocapsaicin, homodihydrocapsaicin, andihomocapsaicin.

The capsaicin content of fruits varies in a range up to 1.55 and is much influenced by environmental conditions and age of the fruit. It occurs principally in the dissepiment

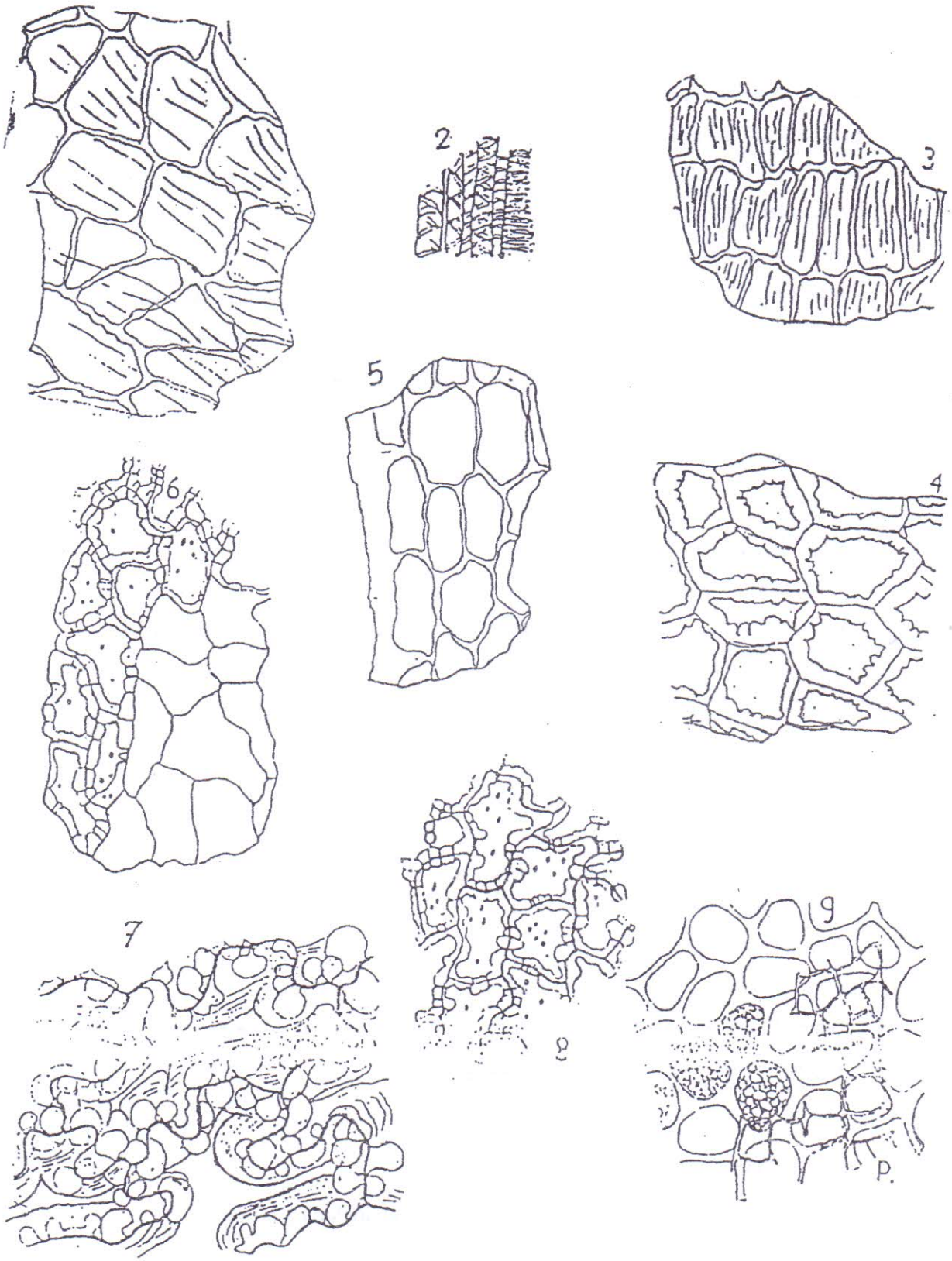

Fig. 28: Powdered Capsicum. 1 & 3, epicarp in s.v.; 2,a group of vessels; 4,epicarp near base of fruit; 5,outer part of pericarp in sectional view; 6,endocarp sclereids with adjacent parenchyma; 7, epidermis of the testa; 8,sclereids of endocarp in s.v.; 9,endosperm.

of the fruits. The pungency of capsicum is not destroyed by treatment with alkalis (distinction from gingerol, the phenolic pungent principle of Ginger) but destroyed by oxidation with potassium dichromate or permenganate.

2- Fixed oils.

3- Carotenoid pigments (including capsanthin, capsorubin, alpha- and beta carotene).

4- Steroid glycosides (including capsicosides A, B, C, and D).

5- Fats (9 -17%), proteins (12 -15%), vitamins A and C, and trace of volatile oil.

Uses and actions:

1- Condiment

2- Internally, the drug is given in atonic dyspepsia and flatulence.

3- Externally, It is used in different formulations (e.g. ointments and plasters) as a pain controller for the relief of rheumatism, lumbago, and after Herpes Zoster infections. Moreover, it provides counter irritant activity without rubificient.

Topical application of capsaicin relieves pain and itching by acting on sensory nerves. for a range of conditions, including nerve pain in diabetes (diabetic neuropathy), post-surgical pain, muscle and nerve pain, osteoarthritis pain, and rheumatoid arthritis.

Contraindications:

Application on injured skin, allergies to cayenne preparations.

Side effects:

- Some people may have an allergic reaction to the cream, so the first application should be to a very small area of skin.

-Oral intake can cause burning in the mouth and throat, and can cause the nose to run and eyes to water.

-People with ulcers, heartburn, or gastritis should use any cayenne-containing product cautiously as it may worsen their condition.

Chemical tests:

1- Capsaicin gives a bluish-green colour on addition of few drops of $FeCl_3$.

2- When capsaicin dissolved in H_2SO_4 and small piece of sucrose sugar is added, a violet colour is developed after few hours.

2- Colocynth Fruit

Thamarul Handthal

Names: Fructus Colocynthidis. Colocynth Pulp. Bitter apple

Origin: Colocynth is the dried unripe, but fully grown fruits of *Citrullus colocynthis* (Linne) Schrader (Fam Cucurbitaceae), deprived of its seeds and outer hard pericarp. It contains not more than 5 per cent of its seeds. and not more than 2 per cent of the outer sclerenchymatous part of the pericarp

Description:

A- Morphology: Colocynth has a slight or no odour and an intensely bitter, persistent taste.

Colocynth occurs in light spongy, easily breakable, globular masses or in pieces of variable sizes up to about 6 cm. long and 2 cm. thick; white or pale yellowish white, with occasional small patches of the darker epicarp and consisting of narrow mesocarp and three wide bifid placentas;

B- Histology:

Spongy tissue: It is composed of large, more or less rounded parenchymatous cells known as pithy parenchyma almost devoid of contents, with large intercellular spaces and having thin, cellulosic occasionally lignified walls with oval or circular pitted areas at the junction of contiguous cells, traversed by bicollateral vascular bundles, having spiral and annular vessels and accompanied in the phloem by irregularly tubular laticiferous vessels, the contents of which give red colour with sulfuric acid.

Powder:

Powdered Colocynth is yellowish white or buff, having a slight or no odour and an intensely bitter, persistent taste. Microscopically, it is characterised by:

1- Fragments of pithy parenchyma with few small spiral and annular vessels.

2- Very small amount of polygonal sclerenchymatous cells of epicarp.

3- Occasional isodiametric sclerenchymatous cells and parenchymatous cells from the

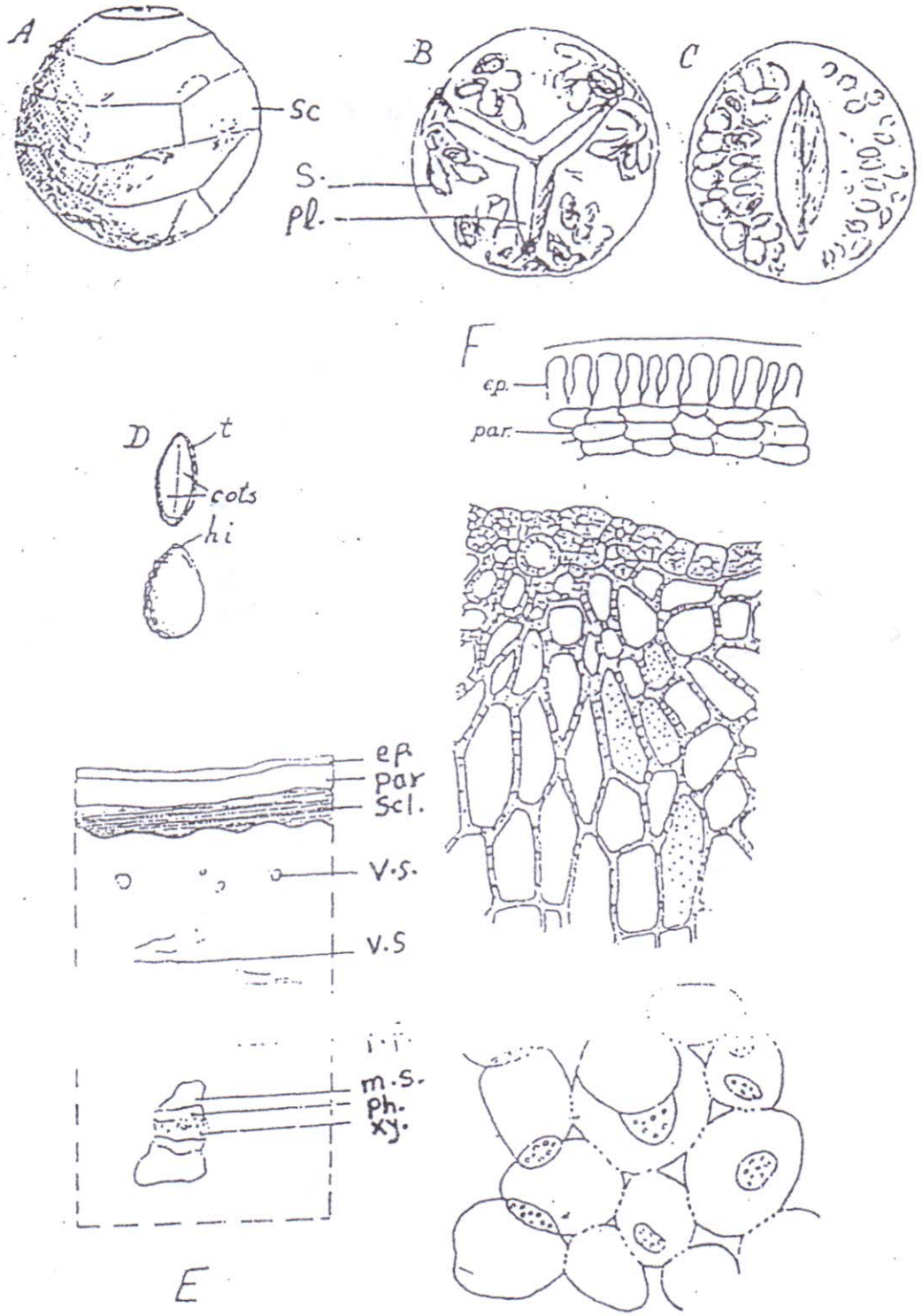

Fig. 29: Colocynth. A,peeled fruit; B,T.cut fruit; C,L.cut fruit; D,entire and L.cut seed; E;diagrammatic T.S.of pericarp; F,detailed T.S. of pericarp; ep,epidermis; cot,cotyledon; m.s,meristele sheath; p.p,pitted parenchyma; par,parenchymatous hypodermis; pl,placenta; ph,phloem; s,seed; sc, scar of peeling; scl, sclerenchyma; v.s, vascular strand; xy,xylem.

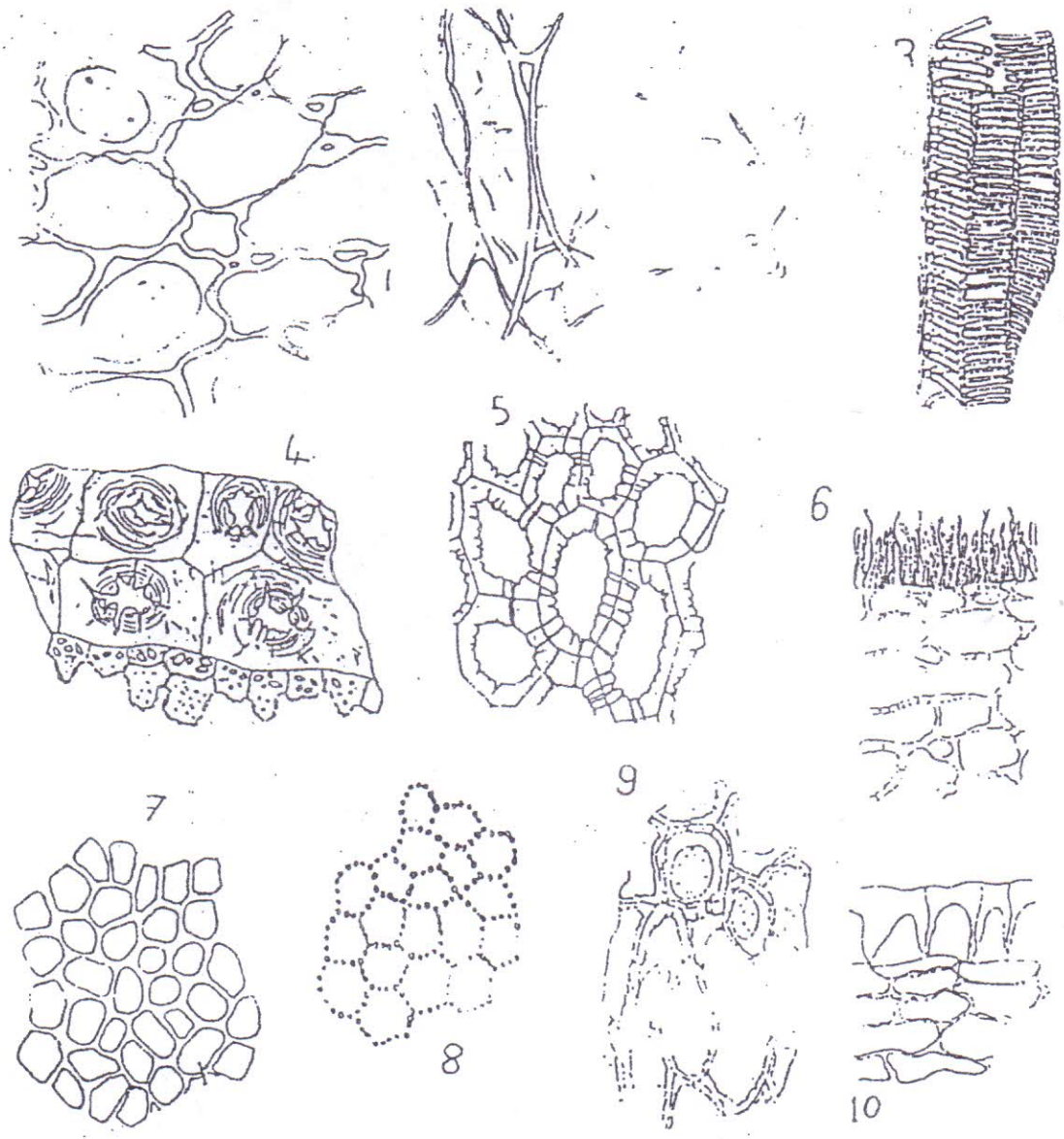

Fig. 30: Powdered Colocynth 1,outer part of pulp. 2,parenchyma of the pulp;3,agroup of vessels; 4. innermost layers of sclerenchyma of testa; 5,sclerenchyma of testa, 6,outer part of testa in sectional view, 7,epicarp; 8,epidermis of testa in s.v . 9,inner layers of sclerenchyma of pericarp; 10,outer layers of pericarp in sectional view.

seed containing aleurone grains up to 7 microns in diameter and oil globules

4- Starch granules and calcium oxalate, absent

Constituents

1- Resin soluble in ether and chloroform which is a powerful purgative

2- A crystalline alcohol, citrullol

3- Cucubitacins: cucurbitacin E, cucurbitacin-B, cucurbitacin glucoside, cucurbitacin-L, and cucurbitacin-L-glucoside

4- Flavonoids as vitexin, isovitexin, acacetin and acacetin 7-0-glycoside

Uses and Actions

1- Colocynth is agastro-intestinal stimulant or irritant and one of the most powerful purgatives, acting as a hydragogue cathartic

2- The cucurbitacin, have been shown to have necrosing activity, indicating that the antitumour activity is attributed to it. The drug as well as the cucurbitacins are reported as potent cytotoxic

3- In folk medicine it is used as antirheumatic

4- The flavonoidal content found to have moderate antimicrobial activity.