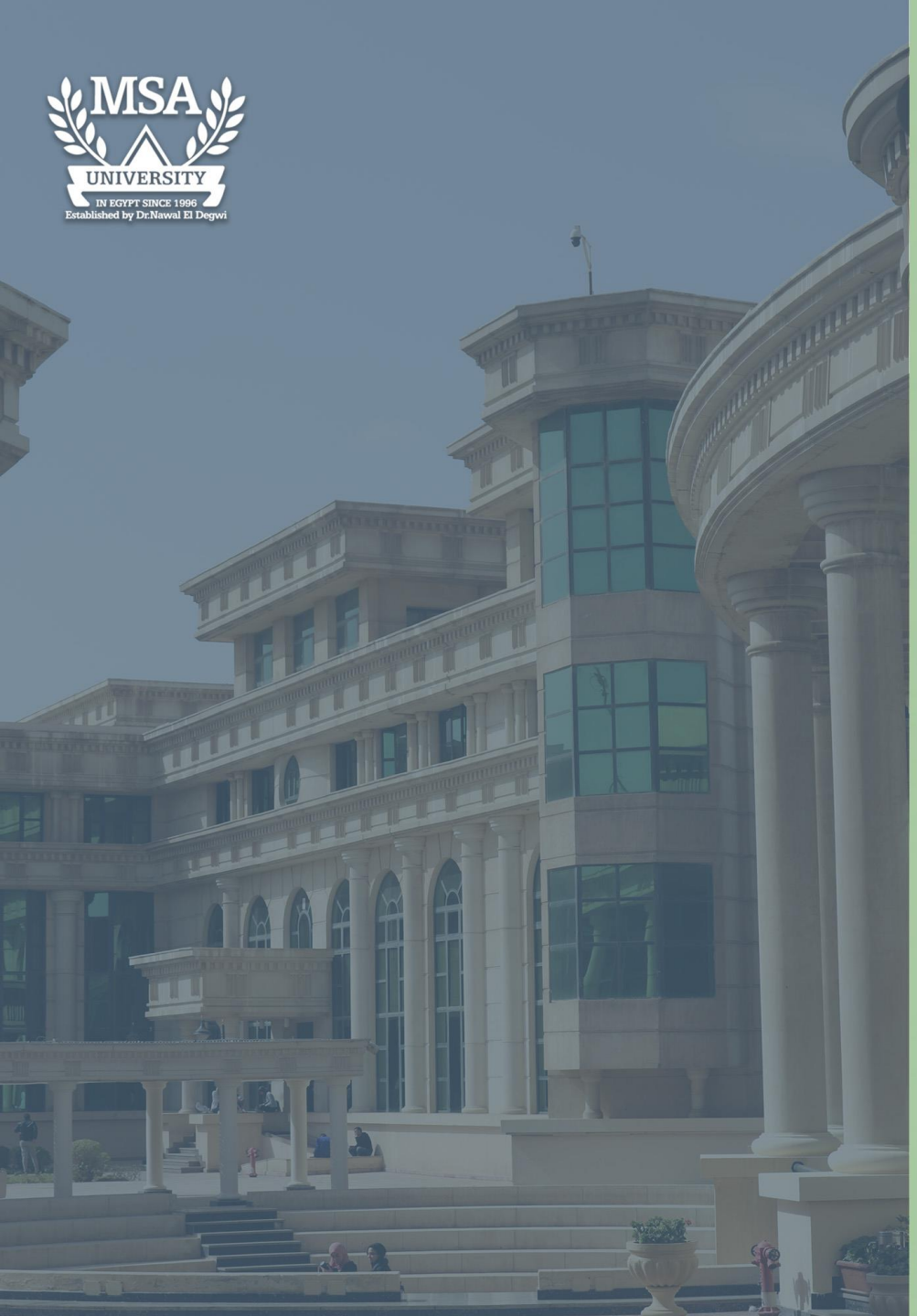

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Pharmacognosy
PHG112





Course Instructors

Assoc. Prof. Dr. Soumaya Saad Zaghloul
Pharmacognosy
szaghloul@ msa.edu.eg

Dr. Passant Mohamed
Lecturer of Pharmacognosy
pabdelbaki@msa.edu.eg

Office: G42

References

Author	Date	Title	Publisher	ISBN
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Biren Shah, Avinash Seth	2012	Textbook of Pharmacognosy and Phytochemistry	Elsevier Health Sciences	8131232603, 9788131232606
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Lecture 10

Introduction to Subterranean Organs (Underground Organs) and Some Examples

Interactive teaching methods and activities





Learning Outcomes

By the end of this lecture, students should be able to:

1. Knowledge / Remembering

- **Define** subterranean (underground) organs and their importance in pharmacognosy.
- **List** different types of subterranean organs: roots, rhizomes, tubers, bulbs, and corms.
- **Identify** examples of medicinal subterranean drugs such as liquorice, ginger, turmeric, and rauwolfia.
- **Recall** the main active constituents of these drugs (e.g., glycyrrhizin, gingerol, curcumin, reserpine).

2. Comprehension / Understanding

- **Explain** the differences between root-origin and stem-origin underground organs.
- **Describe** the morphological differences between roots and rhizomes (presence of nodes, buds, root cap, etc.).
- **Discuss** the pharmacological uses of subterranean drugs such as liquorice (demulcent), ginger (antiemetic), turmeric (anti-inflammatory), and rauwolfia (antihypertensive).
- **Summarize** the nutraceutical and cosmeceutical applications of liquorice and other subterranean

Learning Outcomes

By the end of this lecture, students should be able to:

3. Application

- **Apply** morphological characteristics to distinguish between different underground organs.
- **Use** microscopic and powder characteristics (e.g., starch granules, vessels, fibers) to identify drugs like liquorice and ginger.
- **Perform** basic chemical tests (e.g., froth test for saponins) for identification of active constituents.

4. Analysis

- **Differentiate** between Spanish and Russian liquorice based on morphology and taste.
- **Analyze** the relationship between chemical constituents (e.g., saponins, volatile oils, alkaloids) and pharmacological effects.
- **Compare** rhizomes such as ginger and turmeric in terms of constituents, structure, and uses.

Learning Outcomes

By the end of this lecture, students should be able to:

5. Synthesis / Creating

- **Construct** a comparative table summarizing source, type of organ, active constituents, and uses of subterranean drugs.
- **Design** a simple identification scheme using morphological, microscopic, and chemical features.

6. Evaluation

- **Evaluate** the therapeutic importance of subterranean drugs in pharmacy practice.
- **Assess** the benefits and potential side effects of compounds such as glycyrrhizin (e.g., hypertension risk).
- **Judge** the importance of pharmacognostic identification in ensuring quality and preventing adulteration.



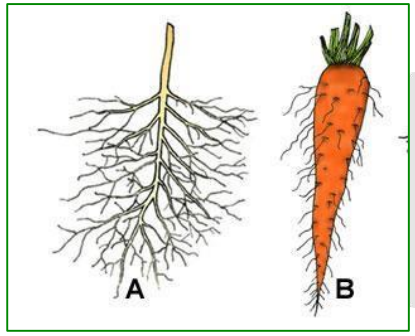
Subterranean Organs (Underground Organs)

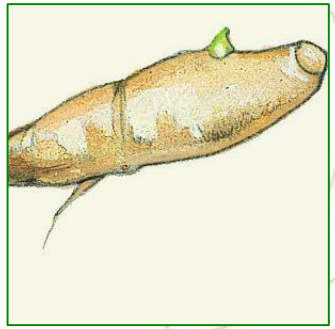
THE SUBTERRANEAN ORGANS

1- Stem origin

Rhizome
Corms Bulbs
Tubers

2- Root origin





Roots Tubers
roots

1- Stem origin

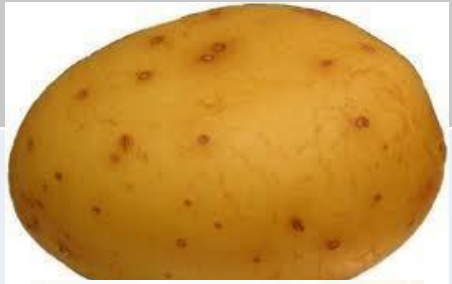
Rhizome	Bulb	Corm	Tuber
Underground horizontal stem with stored foods	Short stem with fleshy leaves	Short, vertical, swollen underground plant stem that serves as a storage organ	Tubers are various types of modified plant structures that are enlarged to store nutrients

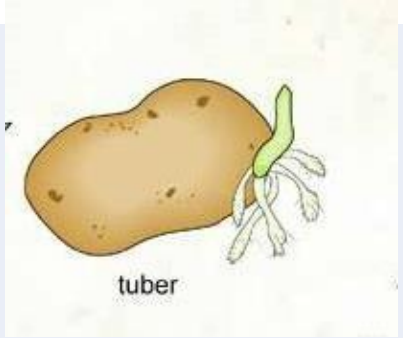






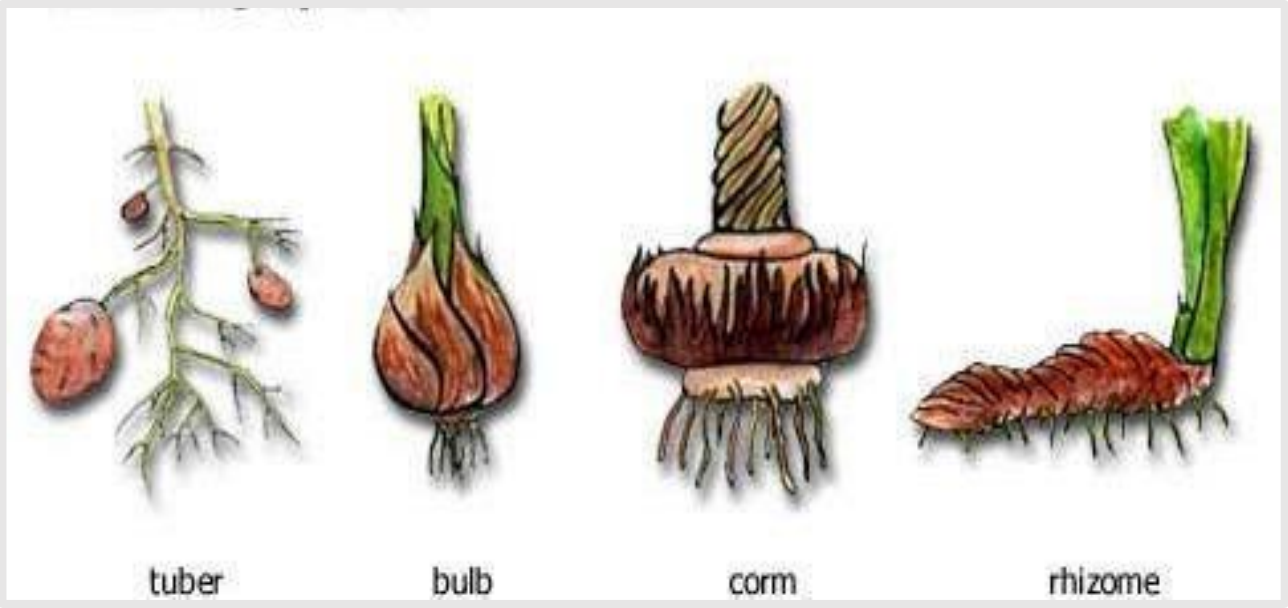






Subterranean stem differs from the aerial stem in the following

1 It bears scale leaves (not foliage)
2 Bears adventitious roots arise from the nodes.



What is the difference between root and rhizome?

The root:

*It is derived from the radical and grows towards the soil and water

*It has no leaves

*No nodes and internodes

*No buds

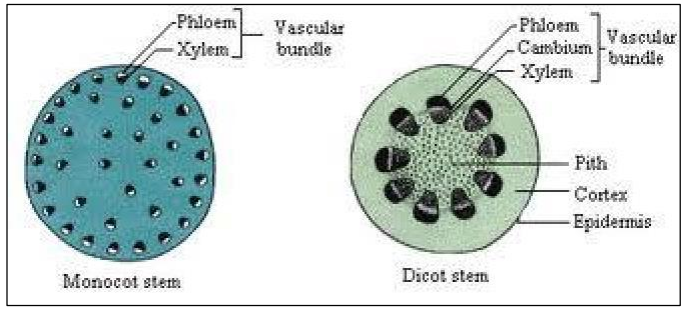
*No chlorophyll

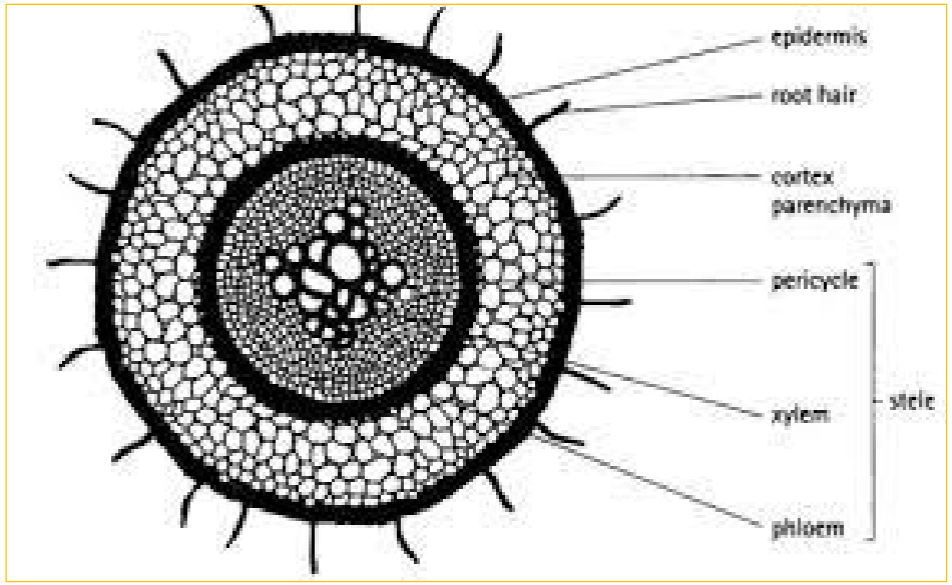
*Apical growing point called root-cap.

The rhizome:

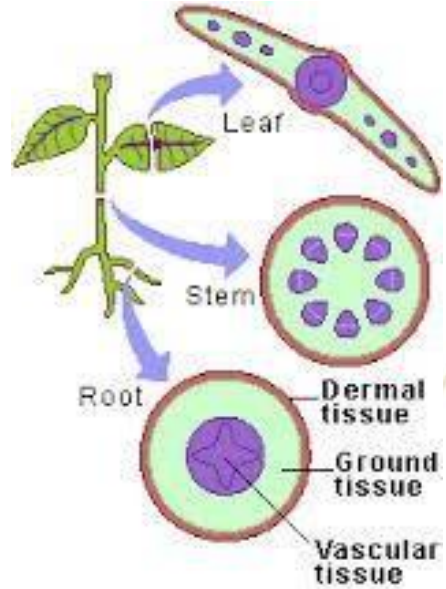
-It has nodes and internodes

-The growing point covered with scaly leaves and not root cap.





T.S of young root





Subterraneans Having Nutraceutical and Cosmeceutical Applications

Liquorice

Origin: Is the dried peeled or unpeeled root and rhizome (stolon) of *Glycyrrhiza glabra* var. *typica* (Spanish liquorice) or *Glycyrrhiza glabra var. glandulifera* (Russian liquorice)
Family Leguminosae



Spanish liquorice

-It is mainly peeled stolon (rhizome) and few root.

-The stolon bears scale leaves, buds and root scars and microscopically has central pith.

-It has a sweet taste free from any bitterness.

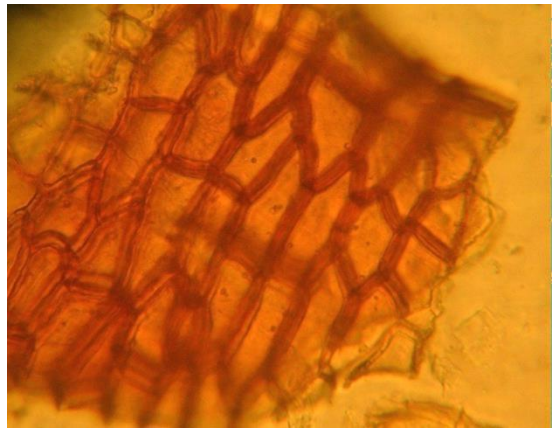
Russian liquorice

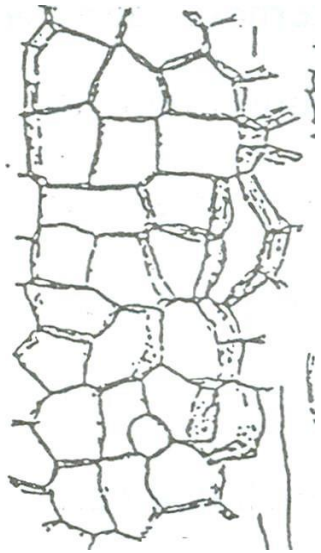
-Mainly unpeeled roots

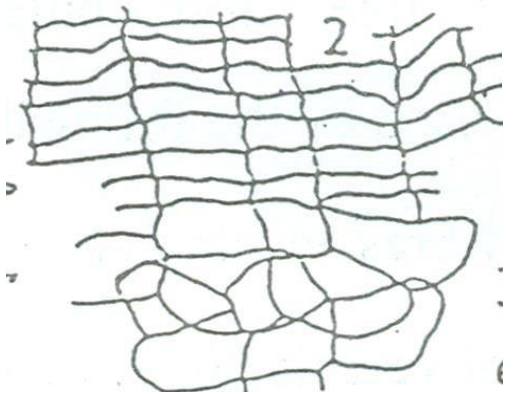
-It has sweet taste but with bitterness

Powdered Liquorice

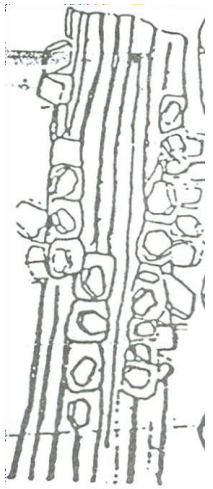
1- Cork cells







2- Crystal sheath

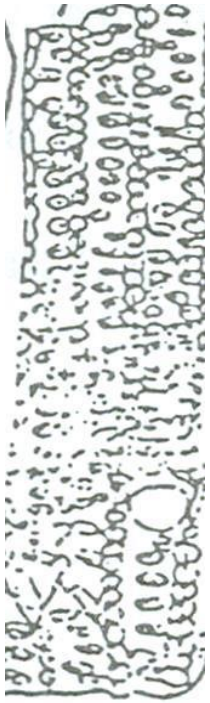




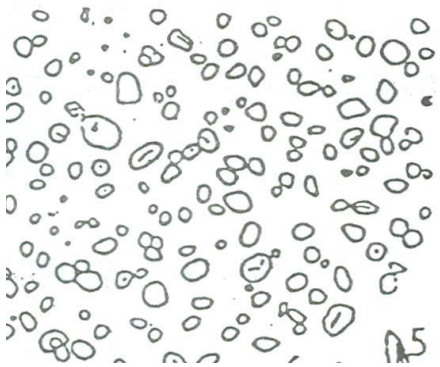
3- Xylem vessels lignified, showing bordered pits







4- Starch granules



5- Prisms of Ca oxalate



ACTIVE CONSTITUENTS

1- Sweet principle glycyrrhizin (triterpenoid saponin)

2- Flavonoids, liquiritin, isoliquirtin

3- Coumarins (liqcoumarin) & bitter principle (glycyramarin)

4- Volatile oils

5- Starch, sugar , ß- sitosterol and protein

6- Asparagine (amide of aspartic acid)

USES AND ACTIONS:

1- Anti-inflammatory for gastric and duodenal ulcer and rheumatoid arthritis (due to presence of cortisone like compounds)

2- Demulcent and mild expectorant

3- Sweetening agent

4- Mild laxative

5- Mouth wash for mouth ulcer.

Cosmeceutical applications

Skin whitening, brightening, clears hyperpigmentation, anti-aging, sun protection and acne management.







It also promote hair growth but also leave your hair feeling soft and silky.



- **Strengthens hair roots preventing hair breakage and promoting overall hair health.**
- **Promotes hair growth, stimulates the scalp and encourages hair growth.**

The glycyrrhizic acid helps in the proliferation of hair follicles, leading to thicker and fuller hair over time.

- **Prevents Hair Loss**
- **Reduces Dandruff and Scalp Issues: has anti-inflammatory and anti-microbial properties, making it effective in reducing dandruff and soothing various scalp issues.**

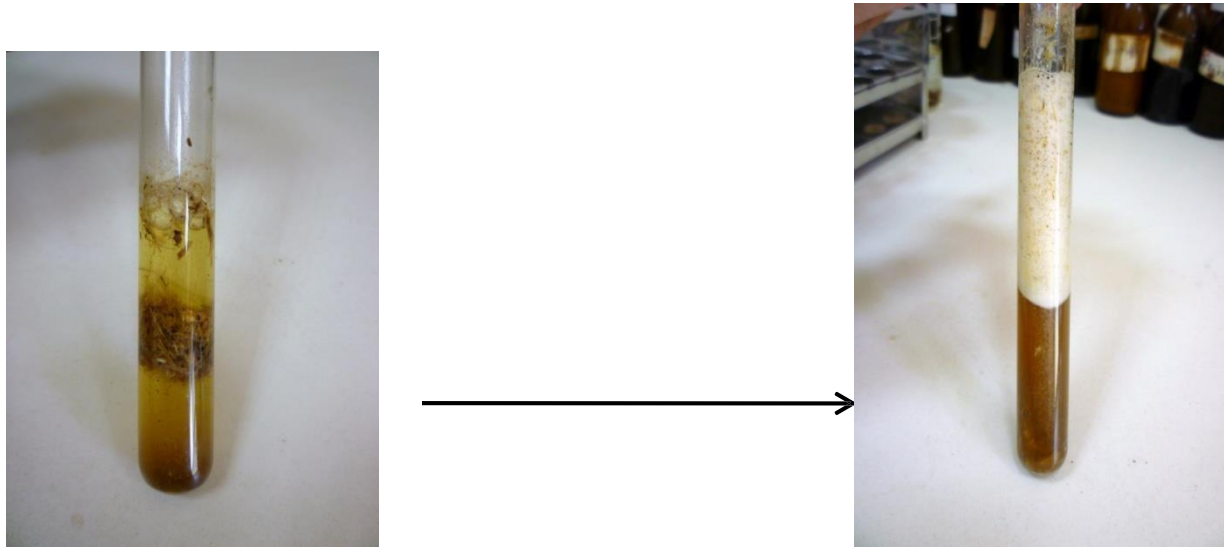
It helps maintain a healthy scalp environment for hair growth.



CHEMICAL TESTS:

1-Froth test:

Powder + Water in a test tube and shake well, Persistent froth stable for more than 1 min. (saponin)



2- Powder +66% H_2SO_4 orange red colour

Deglycyrrhizinated licorice

Deglycyrrhizinated licorice, or **DGL**, is an herbal supplement typically used in the treatment of gastric and duodenal ulcers.

It is made from licorice from which the glycyrrhizin has been removed.

Glycyrrhizin is known to cause negative side effects, such as hypertension and edema; removing the glycyrrhizin is meant to avoid these symptoms





Subterraneans Having Nutraceutical Applications

Ginger

Origin: **Is the fresh or dried rhizomes of *Zingiber officinale* F. Zingiberaceae.**

<u>To avoid insect attack ginger undergoes:</u>

Decorticated, peeled (unbleached)

Limed ginger (with calcium carbonate)





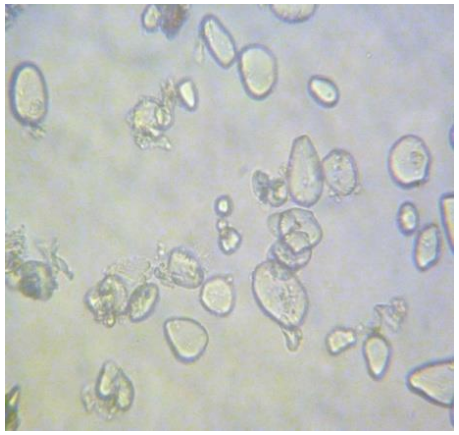
Ginger is an example for monocot rhizome

It has aromatic odour and pungent aromatic taste.

Its pungency is destroyed by boiling with KOH solution (c.f. capsicum).

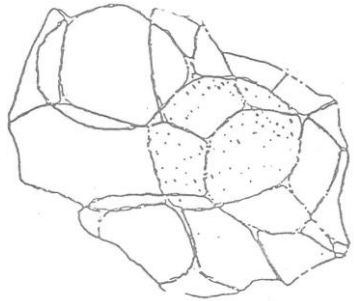
Powder

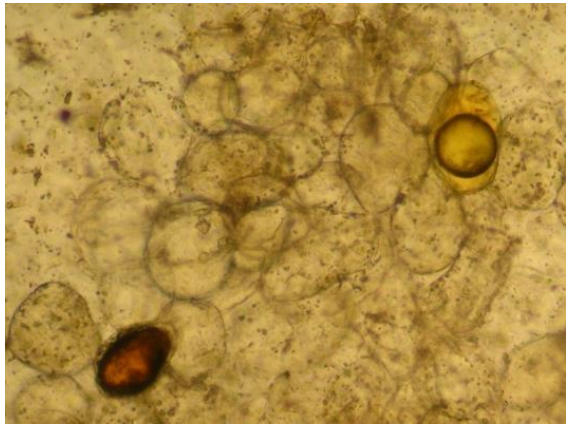
1- Large scitaminaceous starch granules





2- Parenchyma containing oleo-resin cells.

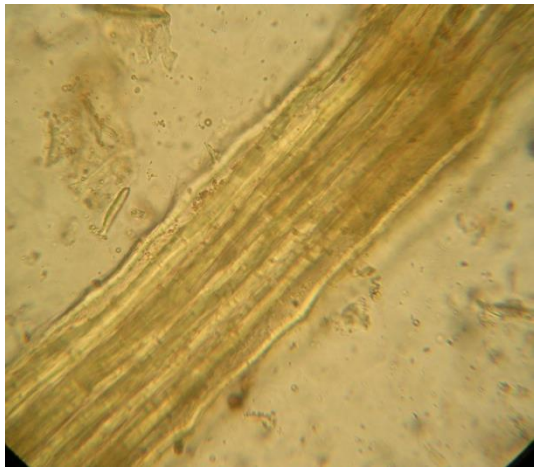




3- Non lignified xylem vessels.



4- Non lignified septate fibers with dentate margin and transverse pectosic septa









ACTIVE CONSTITUENTS

1- Volatile oil mainly Zingeberene, bisabolene and farnesene

2- Gingerol and shogaols (responsible for pungent taste)

3- Resin and starch

ACTIONS AND USES



1- Powerful anti-emetic in motion sickness.
2- Carminative & flavouring agent
3- Reduce high cholesterol level in blood
4- Improve circulation and antihypertensive
5- Anti-inflammatory and in rheumatic pain.
6- Antioxidant
7- Cough mixtures



Some important subterranean drugs

Black ginger

-Origin : the rhizomes of ***Kampferia parviflora*** Known as “Thai ginseng,” F. Zingiberaceae.

Used as food and a folk medicine for more than 1000 years in Thailand



Active constituents:

- Polymethoxyflavones:
- Essential oils: Sesquiterpenoid compounds, such as germacene D, β-elemene, α-copaene, and (E)-caryophyllene

Biological activity:

- Antiallergic
- Anti-inflammatory
- Antidepressive
- Antimicrobial, anticancer.
- Anti-peptic ulcer, cardioprotective, antiobesity .

Black ginger in skin care



- **Antiacne**
- **Improve skin aging**: by restoring expression of essential components of the extracellular matrix, including collagen type I, fibrillin-1, and hyaluronic acid.
- Regular consumption of black ginger may help reduce the appearance of fine lines and wrinkles, promote skin elasticity, and support a healthy complexion.



Normal Ginger Vs. Black Ginger

Normal Ginger	Black Ginger/Kaempferia Parviflora
It has a pungent and zesty aroma, accompanied by a **slightly spicy and tangy flavor.**	It emits an intense & exotic fragrance with hints of earthiness. **Its flavor is described as milder & less pungent than normal ginger.**
It is renowned for its anti-inflammatory properties, aiding digestion, **relieving nausea**, and supporting immune health.	It is valued for **its antioxidant** content and its potential to boost energy levels, enhance circulation, & promote overall well-being.
The regular/normal ginger exhibits **a pale yellow to golden color, with a smooth and thin skin.**	It stands out with its deep ebony color, often **appearing darker and more intense than normal ginger. Its skin is rougher and thicker.**
It is a versatile spice used in various cuisines, adding flavor and aroma to dishes, beverages, and desserts	While less commonly used in cooking, it can be infused into teas, herbal remedies, & health supplements for its health benefits.

Turmeric

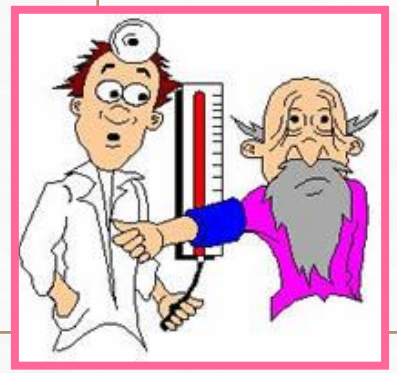
Name	Origin	Active constituents	Uses
Curcuma or Turmeric	Is the dried prepared rhizome of *Curcuma domestica* or *Curcuma longa* F. Zingiberaceae	1- Volatile oils; turmerone, zingiberene 2-Curcumin (a yellow polyphenol) 3- Resin, starch (gelatinzed) and sugar. 	1-Antiinflammatory, antioxidant and antihepatotoxic 2-Colouring agent, and carminative



Another Subterranean Example

Rauwolfia

Name	Origin	Active constituents	Uses
Rauwolfia 	**Is the dried root and rhizome of Rauwolfia serpentina** **F. Apocyanaceae.**	**Mainly <u>alkaloids</u> (<u>Reserpine</u>, rescinnamine, ajmaline, ajmalinine and serpentine.)**	**1-Reserpine used as powerful <u>antihypertensive</u>.** **<u>2-In insomnia and psycatric disorders.</u>**







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