Pharmacognosy 1 (PG 112)

Medicinal Barks

(Introduction & Cinchona bark)

By the end of this lecture you will be able to:

- Define the bark.
- Understand the development & the structure of barks.
- Describe the different layers of the bark, and understand their roles.
- Describe the different methods used for collection and drying of barks.
- Describe the main morphological features of cinchona.
- Recognize the main elements in powdered cinchona.
- Enumerate the uses of cinchona.
- Suggest a chemical test for cinchona

The Bark

Definition:

The portion of the trunk, stem, branches or roots of woody plants exterior to the primary cambium (vascular cambium). The place where the separation take place readily because cells are young, very soft and easily ruptured).

Formation of Bark:

- Cambium cells are active cells with thin walls responsible for cell division.
- The primary cambium (vascular cambium) gives **phloem** to **outside** & **xylem (wood)** to **inside**.
- While the cork cambium (phellogen) gives **cork** to **outside** & **phelloderm (secondary cortex)** to **inside.**

Structure of a typical bark

1. Cork (Phellem).
2. Phellogen (cork cambium).
3. Phelloderm (cortex).

Periderm

4. Pericycle.
5. Primary phloem.
6. Secondary phloem.

Inner bark

Structure of a typical bark

1. Cork (phellem)

Protective tissues of secondary origin developed from the phellogen or cork cambium by division.(*c.f.* epidermis)

Cork cells appear dark brown due to **tannins.**

2. Phellogen (2º cambium) cork cambium

✓One row of secondary meristimatic cells in young barks only.

✓It produces cork to the outside and phelloderm to the inside.

3. Phelloderm (cortex)

✓Unsuberised cells, arranged in radial rows (short).

✓Devoid of brown coloring matter.

✓May contain starch or Ca-oxalate.

✓May be parenchymatous, collenchymatous or sclerenchymatous.

4. Pericycle

✓May be:-

✓ **parenchymatous**: Indistinguishable from the cortex e.g. **Cinchona**.

✓**Sclerenchymatous** : formed from

✓Interrupted band of sclereid. e.g. **Cassia**.

✓Continuous band of sclereid. e.g. **Cinnamon**.

✓**N.B**. Sclereids are accompanied with patches of pericyclic fibres.

Structure of a typical bark

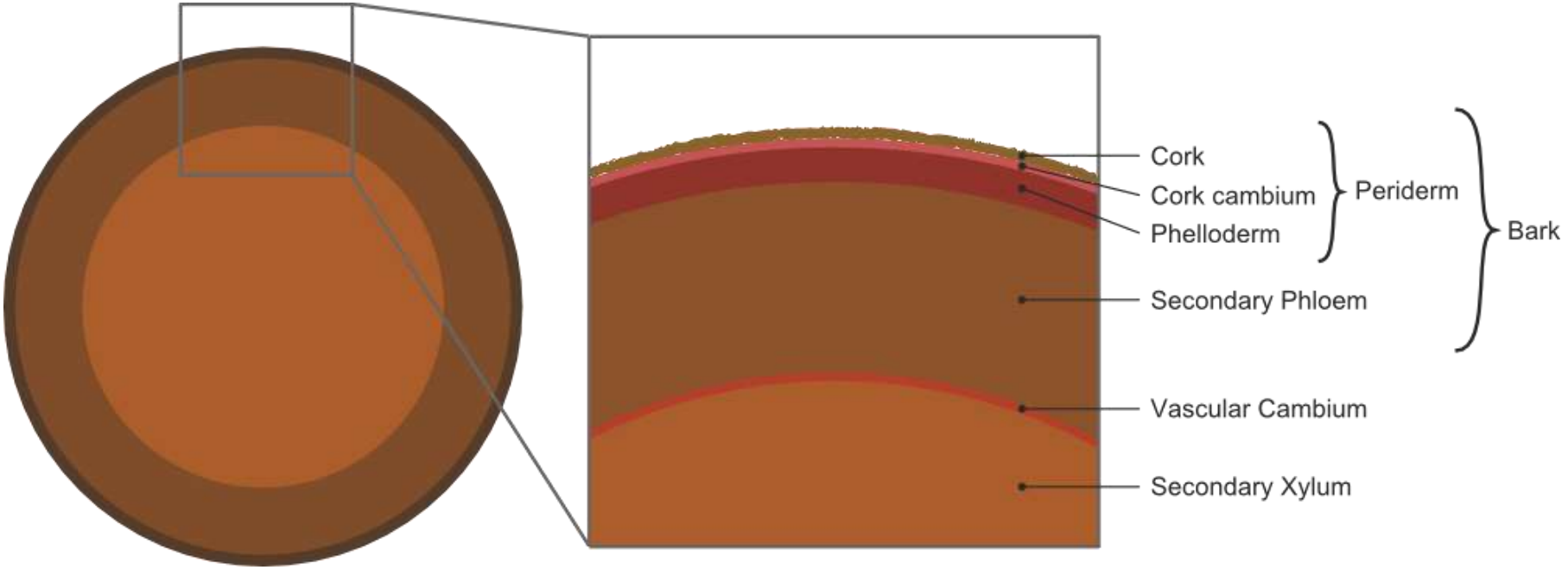
5.Primary phloem

Usually collapsed and even becoming indistinguishable. The phloem composed practically from the secondary phloem which constitute the inner bark.

6.Secondary phloem

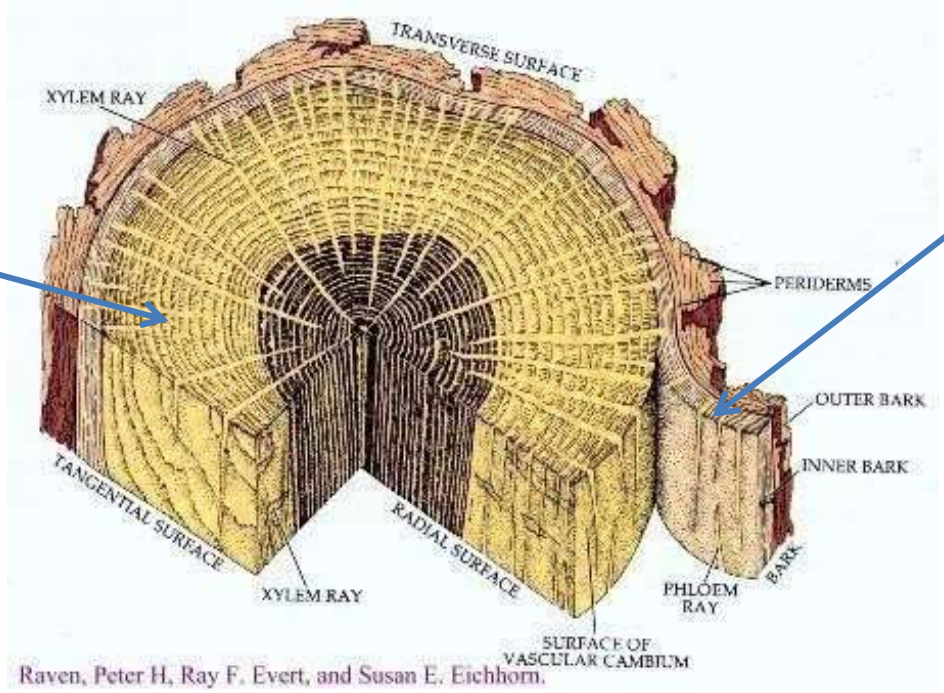
2ry Phloem consists of:

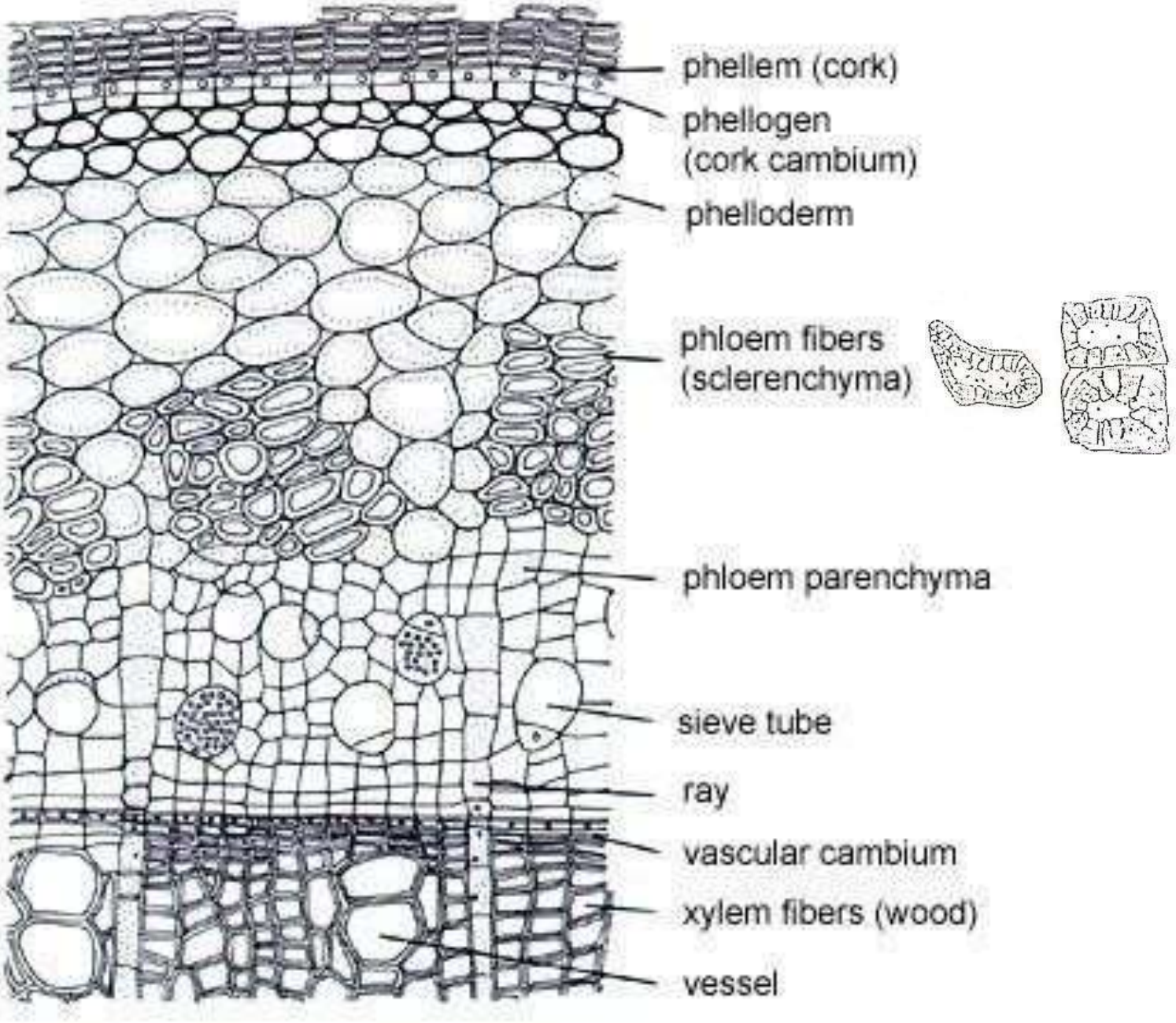
a. **Sieve tubes**
b. **Companion cells**
c. **Phloem parenchyma**
d. **Medullary rays**
e. **Bast fibres**



Woo d

Bark (Pherolderm + 2ry phloem)




phellem (cork)
phellogen
(cork cambium)
phelloderm
phloem fibers
(sclerenchyma)
phloem parenchyma
sieve tube
ray
vascular cambium
xylem fibers (wood)
vessel

Collection of Bark

✓ Barks are generally collected in **spring or early summer,** when cambium cells are active & so can regenerate the removed bark, to keep the plant alive.

✓ Cambium is the weakest cells in the plant & so the bark is easily removed & plant is easily hurt if no new bark is formed).

Drying of Bark

- In sun, shade, in open air, artificial methods.
- All of them cause the shapes or the barks to curve.
- The outer side is hard and dry (cork cells), while the inner side
- is soft parenchymal tissue, so the drying leads to curvature
- towards the **inner** side.

N.B. Decortication

Removal of parts or whole of the tissues outside the secondary phloem (cork + periderm) during the preparation of commercial barks.

Decortication is done for the following reasons:

- They contain low percentage or no active constituent.
- They contain undesirable amounts of tannins, coloring matters or other undesirable constituents.

e.g. **Cinnamon.**

Shapes (Forms) of Bark

- **Flat**: when the bark is very thick.

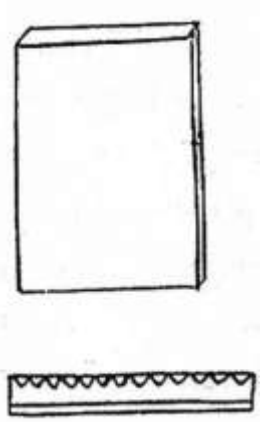
  e.g. ***Quillaia***.
- **Curved**: slightly concave to the inner side.

  e.g. ***Wild Cherry.***
- **Recurved**: of rare occurrence, when the concave side is on the outer side. It has a hard thickening of fibres on the inner sides such that the inner side become harder than the outer, so it curves towards outside.

  e.g. ***Pomegranate bark***
- **Channeled:** when the curvature is so great on the inner side.

  e.g. ***Hamamelis and Cassia***.
- **Single quill**: When deeply concave on the inner side, that the edges of the bark nearly or quit overlap. **e.g. *Cascara and Cinchona***.
- **Double quill**: when both edges are separately in rolled. **e.g. *Frangula.***
- **Compound quill**: when single or double quills are packed inside one another.

  e.g. *Cinnamon.*



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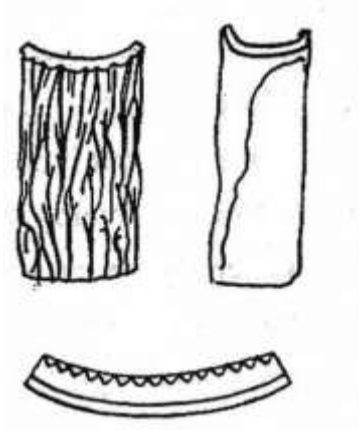

Curve
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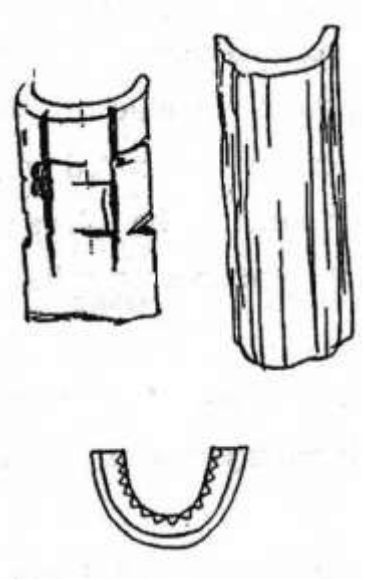

Channel
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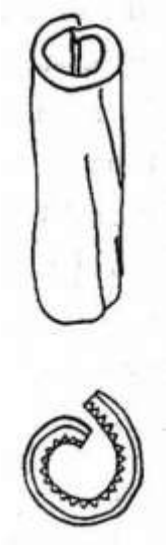
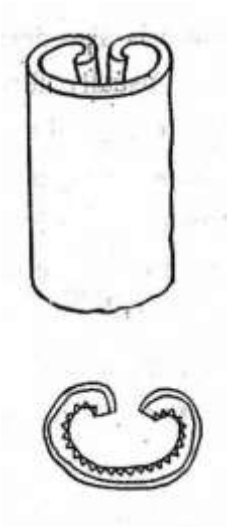


Single
quill



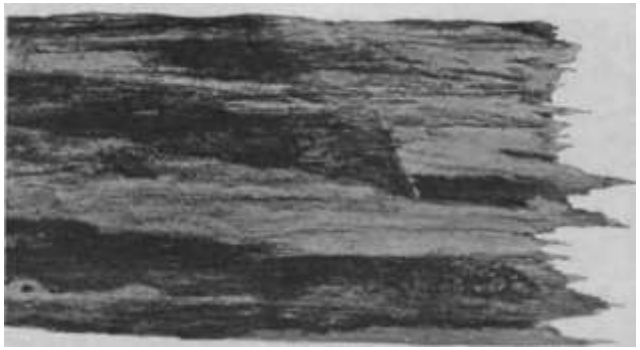
Double
quill

Compound
single
quill

Shape / Form of Bark

Cassia: channeled

Wild cherry: curved



Quillaia: flat

Cascara: single quill

Frangula: double quill

Cinnamon: compound quill

Outer Surface of Bark

- It usually contains:

1. **Epiphytes - (thallus plants).**

- Usually on **stem barks** identifying them from root barks – they are of 3 kinds:-

- **Lichens**
- **Mosses**
- **Liverworts**

2.Cracks and fissures

Formed due to increase in growth and lack of elasticity.

Lichens, mosses and liver worts

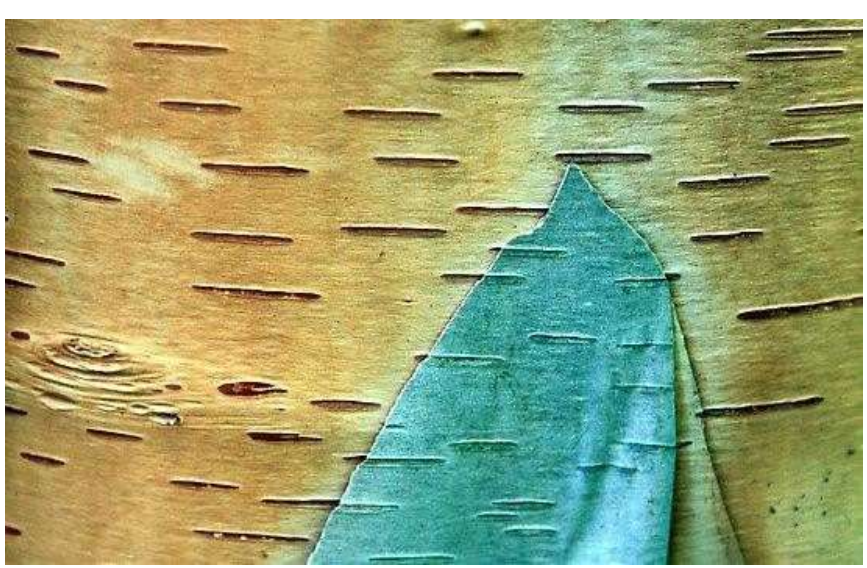
Outer Surface of Bark

3.Exfoliations:

- The cork cells layer is removed due to any mechanical or natural factor (completely different from decortication) i.e. (Only cork cells are removed, while in decortication, cork, cambium & cortex (periderm) are removed).

4. Lenticels:

- Holes in the cork layer for exchange of gases between cortex cells & outer atmosphere. But no transpiration.

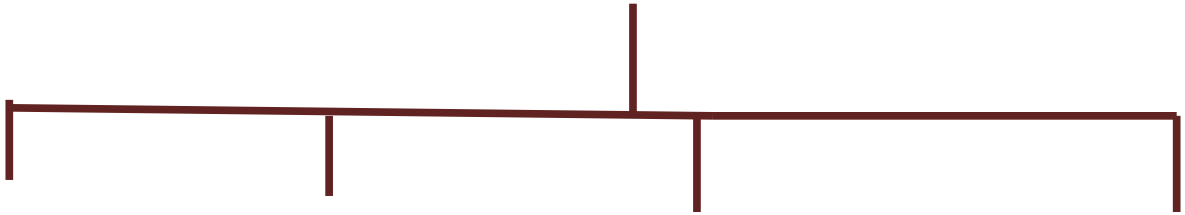


Lenticels

Exfoliation

Decortication

Classification of Bark acc. To A.C.



1-Alkaloids

- Cinchona
- Pomegranate

2-V.O.

- Cinnamon
- Cassia
- Canella
- Cascarilla
- Sassafras
- Euonymus
- Elm

3-Tannins

- Hammamils
- Pomegranate

4-Glycosides

Anthraquinone

- Cascara
- Frangula

Cyanogenic Gly.

- Wild cherry

Saponin Gly.

- **Quillaia**

Cinchona قشر الكينا

Syn.	Countess bark, Peruvian bark, Quishrul Kiena.
Origin	Dried stem & root barks of ***Cinchona succirubra*** *known as* Red Cinchona , ***C. ledgeriana*** and ***C. calisaya*** *known as* Yellow Cinchona and ***C. officinalis*** *, known as* Pale Cinchona **F. Rubiaceae**
G.O.	Peru
Shape	Channeled, quills and double quils.
Outer surface	Grey or greyish-brown to reddish brown, usually bearing whitish or grey lichens and mosses with longitudinal ridges.
A.C.	1 About 30 **alkaloids of quinoline alkaloids**, the most important are:- **Quinine, Quinidine, Cinchonine, Cinchonidine**. 2 In combination with quinic acid or tannins → Cinchotannic acids **3 Colouring matter** (cinchona red) □ in red cinchona only

Uses	1 Bitter tonic – Stomachic (not for anemic patients). 2 Cinchona infusion in form of gargle in case of Tonsillitis as the Tannins ppt. proteins of bacteria. **3 Quinine** is used as **antimalarial** & **hair tonic.** 4 **Quinidine** is used in cardiac arrhythmia (**atrial fibrillation**)- 5 **Cinchonine, cinchonidine** have antipyretic effect **anti-rheumatic**
Caution	▪ Pregnancy (cause abortion due to quinine).

Tests	▪ **Test for red *Cinchona* "*Dry heat test*"** Powder in dry test tube –Δ purplish red fumes, condensed on a slide ----50% alcohol **Blue fluorescence.** ▪ **General test for alkaloid "*Mayer's test*"** Powder + dil. HCl----Filter F +Mayer's reagent (Potassium- mercuric iodide) yellowish white ppt. ▪ **Test for Quinine:** Powder + dil. H_2SO_4 ----Filter F –U.V. blue fluorescence. ▪ **Test for Tannins (catechol tannins):** It give greenish black color with $FeCl_3$
Pharmaceutical preparation	▪ Quinine SO_4 (antimalarial), quinidine SO_4 (antiarrhythmic). ▪ Tonoscalpine (Hair tonic).

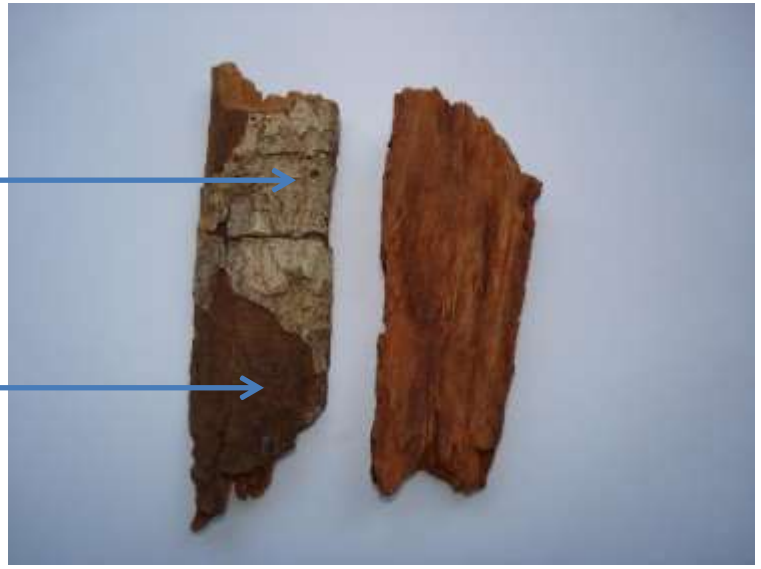
Differences between stem & root of Cinchona

	Stem bark	Root bark
Morphology	Single or double quills	Curved –Channeled
Outer surface epiphytes	with lichens	No Lichens
Inner surface	Differ from outer.	Same as outer.
A.C.	Low %	High %

Morphology

Outer surface
Epiphytes, greyish white patches
Lichens

Exfoliated part

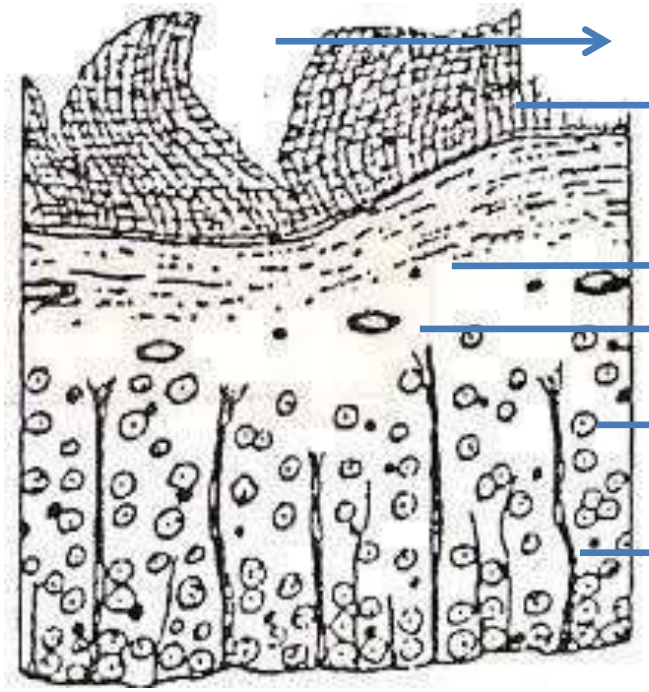


Transverse cracks

Inner surface
Pale yellowish brown
Longitudinally striated


Channeled
Single quill
Double quill

T.S. in Stem Cinchona bark, complete bark



Lenticels

Cork

Idioblasts

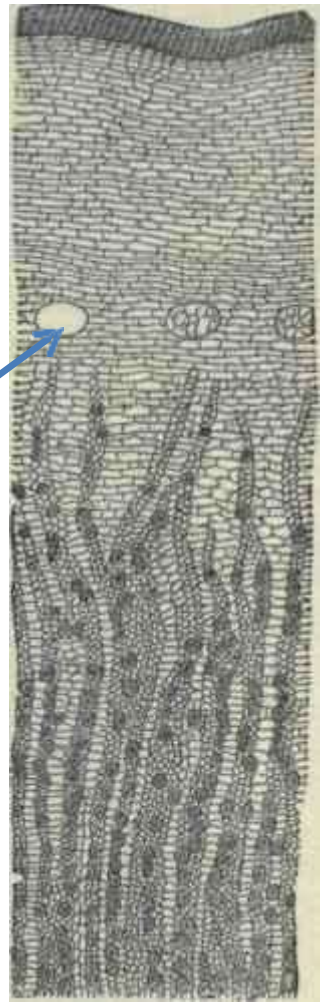
Secretion duct

Phloem rays

Medullary fibres

Cortex

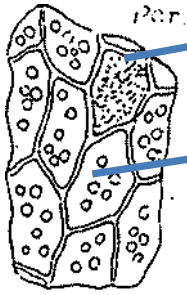
phloem



N.B. parenchymatous pericycle

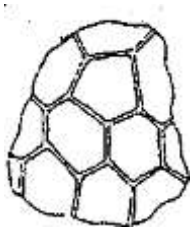
Powder

- Reddish brown colour.
- Faint characteristic odor.
- Bitter astringent taste.



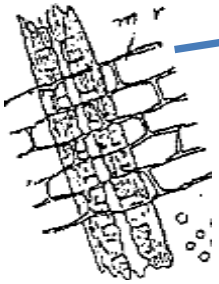
Idioblast (**Microprisms of Ca-oxalate)**

Starch granules



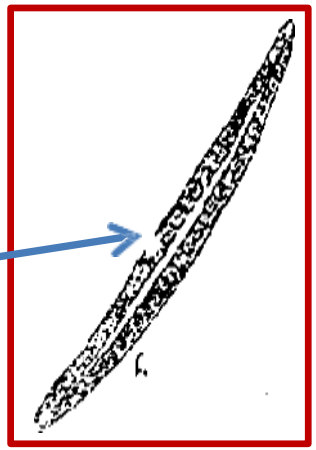
Cork cells

Parenchyma cells

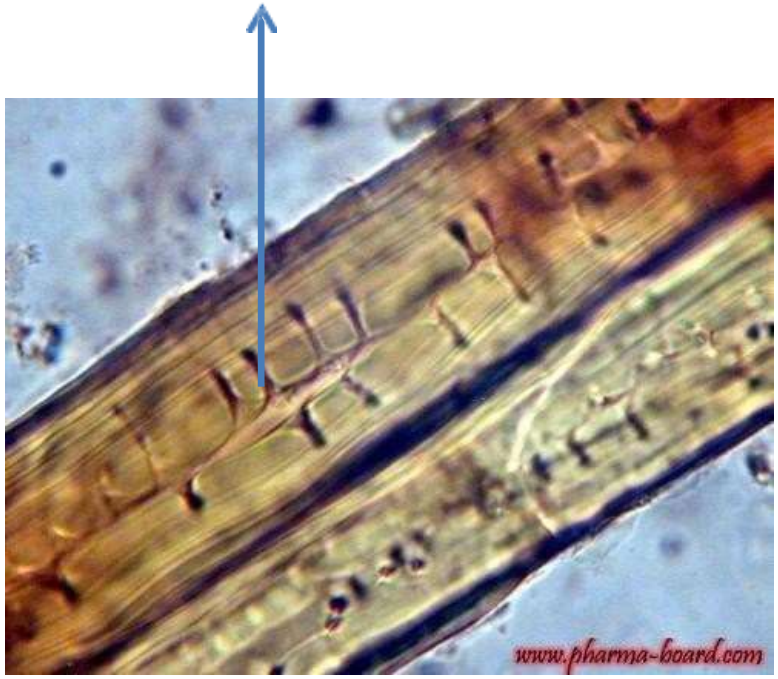


Medullary rays

Bast (Phloerm) fibre

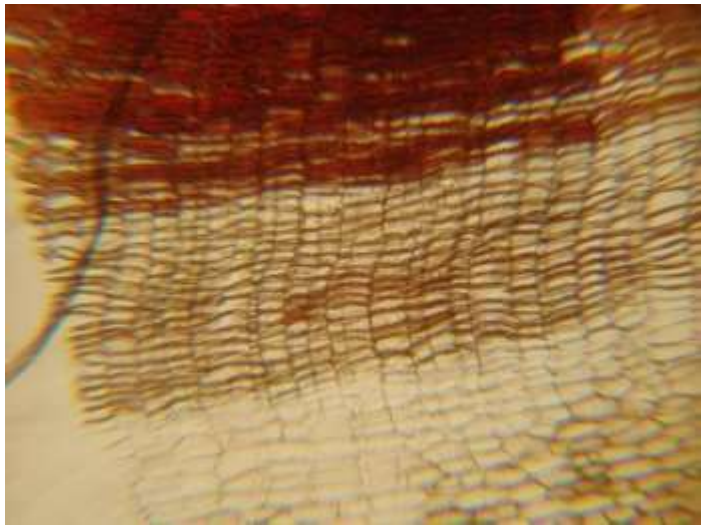


Funnel-shaped pits



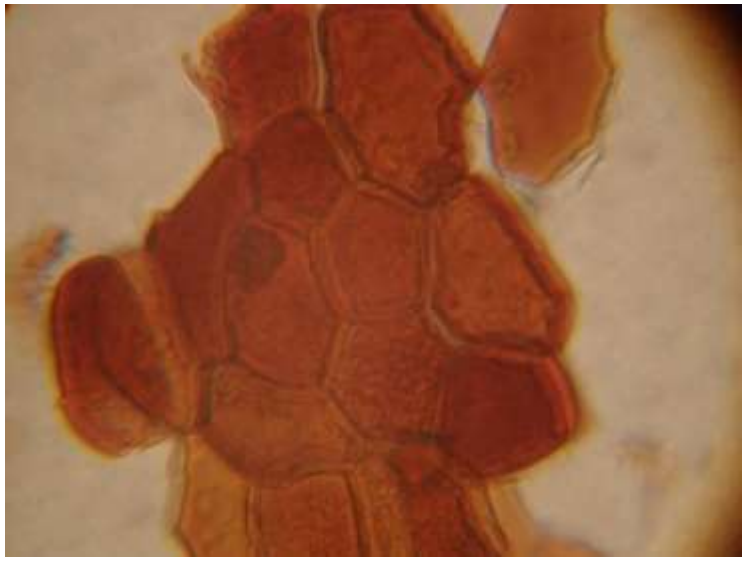
Phloem fibre of cinchona

Large, fusiform, lignified having striated walls, blunt apex Lumen with funnel-shaped pits



Cork cells S.V.

Thin layer, flat, radially arranged



Cork cells, T.V.

Polygonal, isodiametric cell with reddish Brown content