

Secretory structures

• Secretory structures could be:

1. External Secretory Structures (found on surface of plant)

A - Trichomes and Glands

B - Nectaries

C - Hydathodes (water stomata)

2. Internal Secretory Structure (embedded in various tissues)

A -Secretory cells

B -Secretory cavities and canals

C - Laticifers

Special or Secretory Tissues

Secretory tissues occur in **most** vascular plants. Some of these tissues, such as hydathodes (water pores), salt glands and nectaries. The cells of secretory tissues usually contain numerous **mitochondria**. The secretory tissues may consist of single cells or small to very large groups of cells. Hydathodes, salt-secreting glands, nectaries, stinging hairs and the secretory glands of **carnivorous** plants lie on the plant surface. Tissues secreting lipophilic substances, gums and mucilages may be present either on the plant **surface**, mostly in the form of trichomes, or **inside** the plant body.

Secretory tissues are usually classified according to the **substances** they produce. The various kinds are: hydathodes; salt glands; nectaries; mucilage-secreting cells, trichomes, ducts and cavities; gum ducts; enzyme-secreting glands of carnivorous plants; stinging trichomes; oil cells; oil-secreting trichomes; osmophores; oil cavities; resin ducts and laticifers. The **same** tissue often secretes a number of **different** substances.

• **Secretion**: Complex phenomena of separation of substances from the protoplast,

- The secreted substances may be:

1. Excess of ions removed in a form of salts,
2. Excess of products as sugars or cell wall substances
3. End products of metabolism
4. Products that will not be used physiologically as alkaloids, tannins, terpenes, resins, crystals
5. Products with special physiological function as enzymes, hormones
6. some secretory substances are waste products

The exact role of many secreted substances is not known.

• No exact distinction between **excretion** and **secretion** although excretion may refer to removal of substances that are not used in metabolism.

1. External Secretory Structures

A) Trichomes:

- **Oil** secreting trichomes (mint, geranium)
- **Stinging** hairs in *Urtica* (nettle plant): These hairs are present in epidermal layers of leaves and are of various kinds. Contents of hair are poisonous and are secreted by a gland at the base of hair.
- **Trichomes** in leaves of **insectivorous** secrete mucopolysaccharides (Complex polysaccharides containing an amino group) to **trap** insects and proteolytic **enzymes** to digest the insects and the secretion is trapped by nitrogenous material trapped on the surface.



B) Nectaries

Both xylem and phloem **participate** in secretion by nectaries.

Vascular tissue occurs more or less **close** to the secretory tissue, some nectaries have their **own** vascular bundles, **often** consisting of **phloem** only.



Specialized epidermal cells & structures

Nectary : a gland that secretes nectar. •

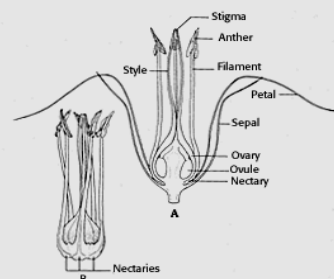


Figure 113. - Flax flower, x3. A, Longitudinal section; B, flower with perianth removed to show nectaries.



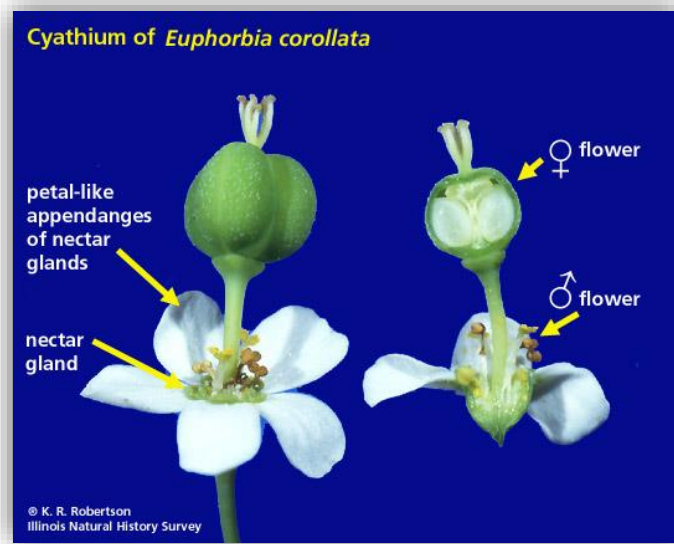
- Nectaries secrete sugar-containing liquid (**nectar**), the sugar is not as derived from phloem but modified by enzymes of nectaries.

• Nectaries could be:

1-Floral nectaries: occur on flower, found on sepals or petals, stamens, ovaries or the receptacles

2-Extra floral nectaries: occur on vegetative parts of the plant, on stems, leaves, stipules and pedicle of flower

- The secretory **cells** of nectaries have **dense** cytoplasm and **small** vacuoles often containing **tannins**, numerous of **mitochondria** and Endoplasmic **Reticulum**.



C) Hydathodes:

- Secretory structure that discharge **water** from the interior of the leaf to the **surface** (process called **guttation**)
- **Structurally** are modified parts of leaves (modified **mesophyll** epithem), located at **margins** or tips, so water released from **xylem** can reach the surface and released through openings in the epidermis (**stomata**)
- **Epithem** is chlorophyll-free parenchyma, may be compact or with intercellular spaces, may be differentiate as **transfer** cells with **thick** cell wall.
- Hydathodes xylem consists of **tracheids**.

2. Internal secretory structures:

A) Secretory cells

Specialized cells (**Idioblasts**) may be **elongate** so called **sacs** or **tubes**. Could be **branched**. Secretory cells are classified based on their **contents**, but many secretory cells contains **mixtures** of substances Used in **taxonomic** purposes of plants. Some plant families for example have secretory cells containing **oil** Rutaceae.

- The secretions (**oil**) are formed in the **thylakoids** of plastids, then it appears in the cytoplasm as **droplets**, then all cell components **degenerate**.
- **Tannin** cells are **parenchyma** cells and often connected to **vascular** bundles.
- It occur in many families in **leaves** and in **pith** and **phloem** of stems.
- **Crystal**- containing cells are **parenchyma** cells too.
- **Raphide** crystals are found in **long** sac like cells filled with mucilage, it may be separated from the **living** part of protoplast by cellulosic cell wall.



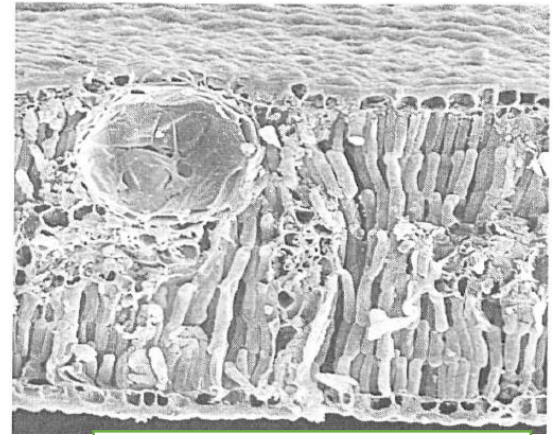
B) Secretory cavities and canals: are spaces that result from:

1. Dissolution of cells (lysigenous spaces):

- * Partly **disintegrated** cells occur along the periphery of the **cavity**
- * Example **oil** cavities in *Citrus* plants and **mucilage** canals in bud scales of *Tilia*.

2. Separation of cells from one another (schizogenous spaces)

- * Usually lined with **intact** cells
- Example **Resin** ducts in Conifers similar to **gum** ducts in dicots
- Resin ducts are **long** spaces surrounded by resin secreting **cells** and occur in **vascular** tissues of all plant organ,
- The contents of secretory cavities and canals are often **oily**
- Secretory cavities and canals occur **naturally** in plants **cannot** be distinguished from canals and cavities arising under the stimulus of **injury**.

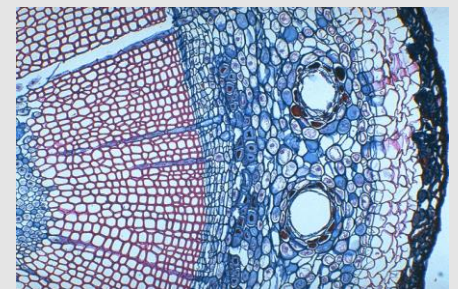


Oil gland in *Eucalyptus* leaf

C) Laticifers:

- Are series of **connected** cells that contain **latex** (fluid of **complex** composition)
- Laticifers may be simple or compound by **origin**:
 - Simple** laticifers: **single** cells (**Latex cells**) (nonarticulated laticifers), **may** become **multinucleated** if they elongate and their nuclei divide **repeatedly**.
 - Compound** laticifers (**Latex vessels**): derived from **series** of cells by **dissolution** of intervening walls so called (**articulated** laticifers), are **multinucleated**.
- Occur in **various** tissues and organs but may be **restricted** to phloem.
- Laticifers have **primary** non-lignified cell walls variable in thickness.
- Laticifers have **living** protoplast when the latex is formed but some undergo **autolysis** during this process.
- Occur in **some** families as and certain genera of families of dicots and monocots:
 - **Euphorbiaceae** (Have a source of **rubber**)
 - **Asteraceae** (dandelion)

Resin canals is a portion of a pine (*Pinus*) stem



Latex:

- Secreted by **laticifers** varies in appearance and composition
 - Frequently **milky** but may be **clear** and **colourless** or **brown** or **orange**
 - of the components of latex **terpenoids** (as rubber), **alkaloids** (morphine, codeine and papaverine in the **opium poppy**), sugars, waxes, proteins, enzymes, crystals, tannins and starch.

