

### 3.3. Axially and radially oriented elements

Secondary xylem has two systems of tissues which show different orientation in the longitudinal axis of the plant.

#### 1. Axial System:

It consists of vertical files of tracheary elements, fibres and wood parenchyma. The elements of this system can be studied in transverse and radial longitudinal sections (R.L.S). This system is also known as vertical or longitudinal system.

#### 2. Radial System:

It consists of rows of parenchymatous cells oriented at right angles to the longitudinal axis of the plant and forms xylem rays or wood rays. The height and thickness of xylem rays is revealed best in radial and tangential longitudinal sections respectively.

#### Rays and Axial Parenchyma:

The parenchyma associated with the secondary xylem can be differentiated into

- (i) axial parenchyma, initiating from the fusiform initials, and
- (ii) ray parenchyma, which initiates from the ray initials.

The cells of the axial parenchyma are usually as long as the fusiform initials from which they are derived. But sometimes the fusiform initials may divide transversely and then shorter axial parenchyma cells are differentiated. The Ray parenchyma cells which are usually shorter than the axial parenchyma cells may sometimes develop secondary thickenings in their walls.

#### Distribution of the Axial Parenchyma

The amount and distribution of axial parenchyma shows considerable variation in different woods and much taxonomic importance is attached to the type of distribution. Kariba (1937), who described the phylogenetic distribution of axial parenchyma, considers the absence of axial parenchyma as primitive feature and the presence of terminal parenchyma as advanced feature. With the increased specialization of the secondary xylem, the parenchyma cells become shorter and broader. The axial parenchyma may be categorized into two groups:

- i) **Apotracheal:** when the distribution of parenchyma independent of the vessels,
- ii) **Paratracheal:** when distribution of parenchyma is associated with vessels.

In addition to the above two types, a third type of parenchyma distribution, called boundary parenchyma, has been recognized (Jane, 1962). In this type, the parenchyma occurs as a fine continuous line or a narrow band either at the beginning or end of the growth rings. Such initial or terminal bands of parenchyma sharply delimit the growth rings. Apotracheal parenchyma may be divided into following types:

(1) **Diffuse or scattered**- When the apotracheal parenchyma occurs as isolated cells or short tangential aggregates, the distribution is described as diffuse or scattered. e.g., *Adina cordifolia*, *Dillenia*

(2) **Diffuse-in-aggregates**- Here, the apotracheal parenchyma occurs in the form of fine and evenly spaced broken or tangential lines. This type of distribution is also referred to as fine line distribution. e.g., *Dipterocarpus*, *Hopea parviflora*

(3) **Banded**- In this type the parenchyma forms relatively conspicuous tangential bands, occurring at frequent intervals throughout the growth rings. When the band is broad and conspicuous, it is termed as banded-broad (e.g., *Pterygota*) and when fine and narrow, it is called banded-narrow. (e.g., *Lophopetalum*)

The Paratracheal parenchyma shows following variations:

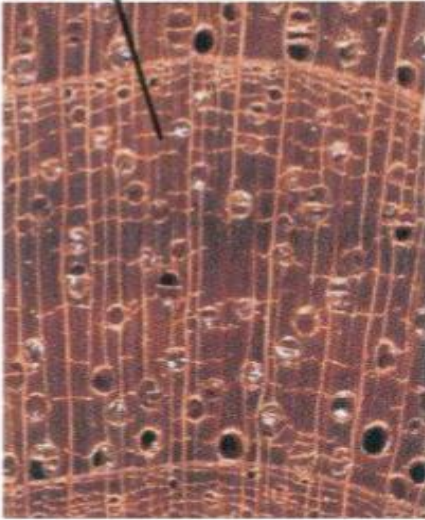
**1. Vasicentric** - When parenchyma is closely associated with the pores, forming a fairly uniform light coloured sheath around the vessels, it is known as vasicentric. (e.g., *Acacia catechu*)

**2. Aliform** - In this type of parenchyma surrounds the vessels in such a way that wing like lateral projections are formed. It is also known as eyelet type. (e.g., *Albizia lebbek*, *Holoptelea integrifolia*).

**3. Aliform confluent** - It is a modification of aliform type. Here the wing like extensions of adjacent pores becomes connected laterally. Such distribution may either be found independently or in association with aliform type. (e.g., *Ongelnia cojeinensis*). When adjacent connecting pores are thin and narrow, it is called confluent narrow and when relatively broad then confluent broad.

## Anatomy of Hardwood (cont'd)

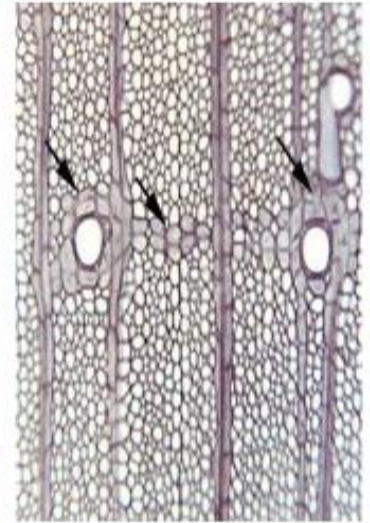
### Parenchyma types



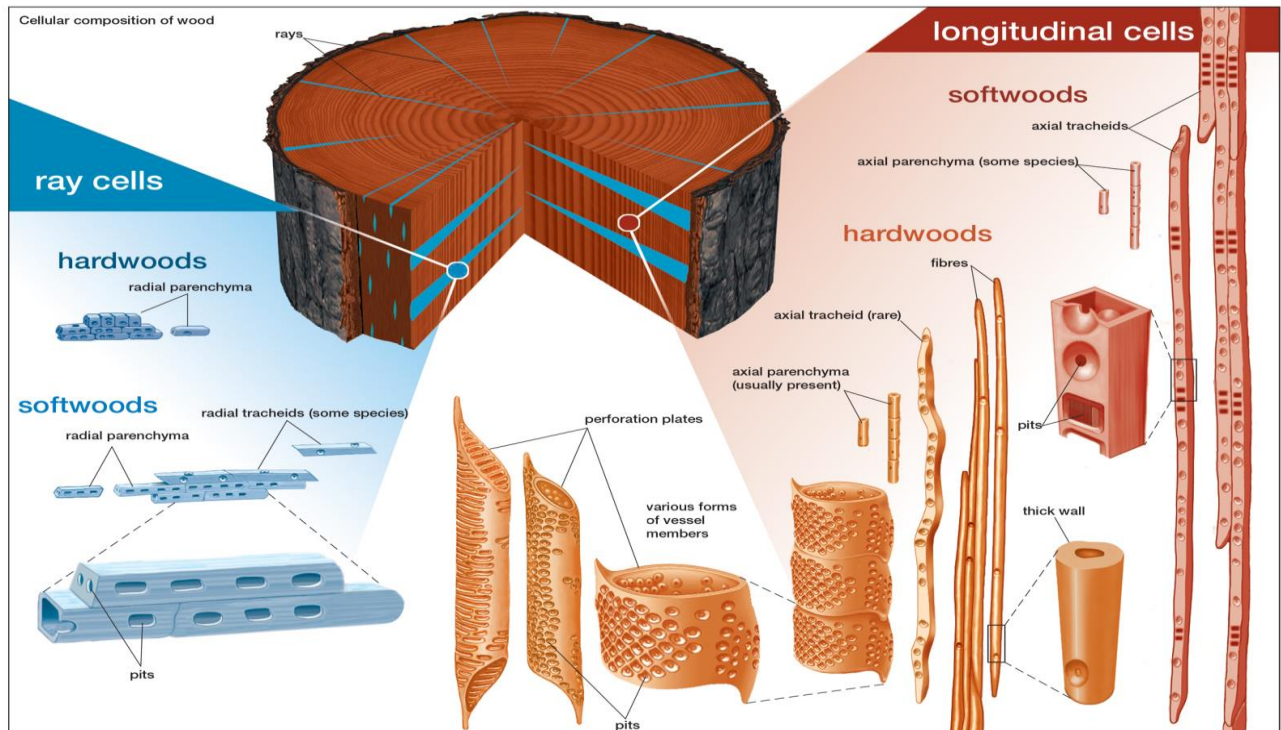
Apotracheal parenchyma

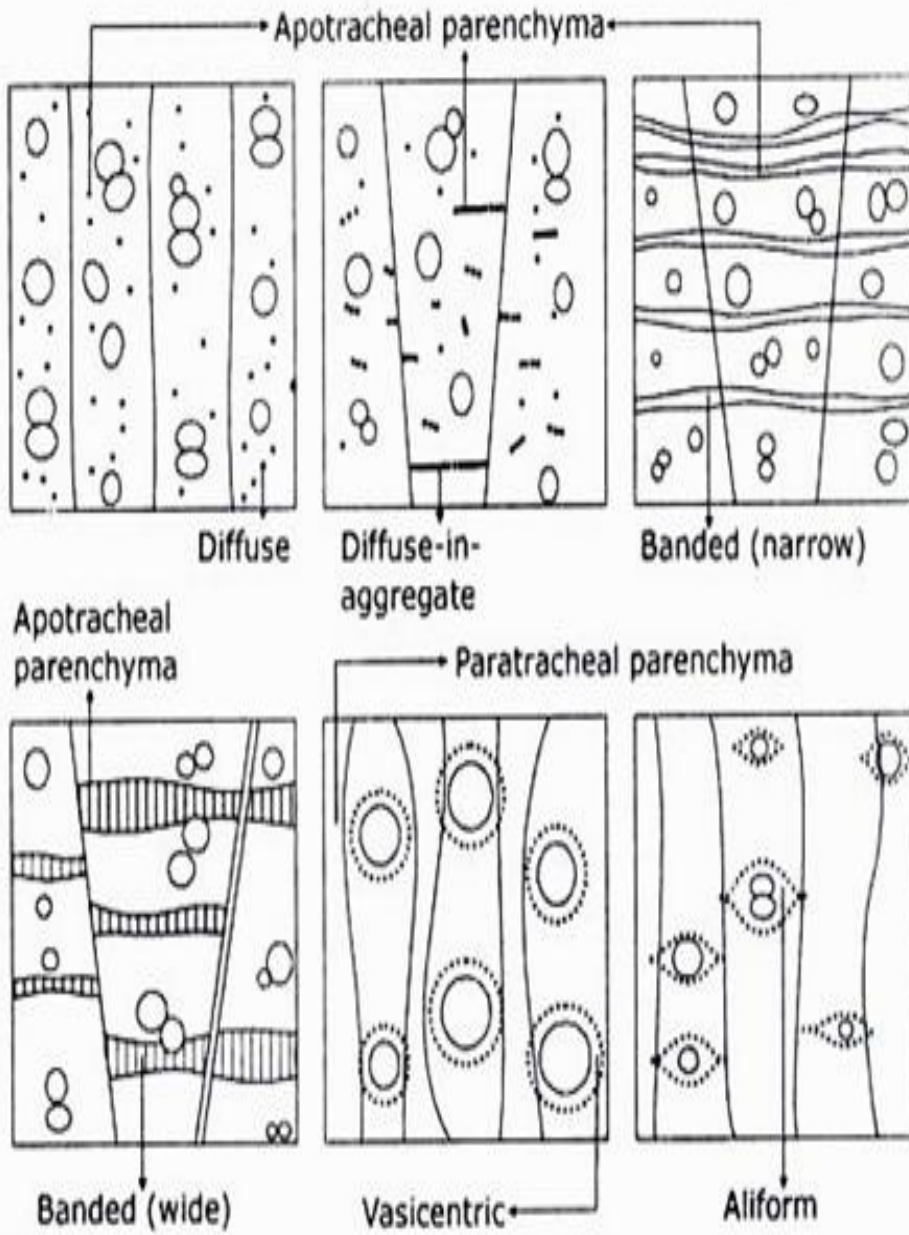


Paratracheal parenchyma



Banded parenchyma





*Prepared by: Dr. Sagarika Parida*