S.Y.B.SC Botany

Sem IV

Paper II , Unit II

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Photoperiodism

Photoperiodism: The response of plant towards the relative length of day and night is called photoperiodism.

Phytochrome:

- Phytochrome is a blue proteinaceous plant pigment acting as photoreceptor in photo morphogenetic processes.
- It is present in the plasma membrane of the cells of leaves and shoot apex.
- The discovery of phytochrome is closely associated with studies on flowering but many other light controlled processes in higher plants other than photosynthesis are outcome of phytochrome response. **E.g:** Leaf expansion, stem elongation, seed germination, hook opening, pigment biosynthesis and membrane permeability are some to mention.
- It was discovered by Butler in 1959.
- Structurally, Phytochrome exists in the form of a dimmer with molecular mass of about 250 kDa.
- Each subunit consists of a light-absorbing pigment molecule called the chromophore and a polypeptide chain called the apoprotein (125kDA). The apoprotein and the chromophore together make up the Holochrome.
- Phytochrome exists in two forms one form absorbs red light of wavelength 650-680nm, so that it is designated as **Pr** form; and theother form which absorbs far red light of wavelength 710-740nm, so that it is designated as **Pfr** form.
- The **Pr** form is blue in colour while **Pfr** form is blue-green in colour.
- Butler *etal* (1959) found that these two forms of phytochrome are photochemically interconvertible.

Pr-Pfr Interconversion

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- Butler *et al* (1959) found that these two forms of phytochrome are photochemically interconvertible.
- When plants are exposed to light, the **Pr** form absorbs red light and becomes **Pfr** form and at the same time the **Pfr** form absorbs far red and gets converted into **Pr** form. This interconversion does not occur in a single step and it needs to produce many intermediates.
- The chromatophore of **Pr** form undergoes a cis-trans isomerization of the double bond between 15 and 16. There is a rotation of the C14-C15 single bond to form chromatophore of **Pfr**. The apoprotein also undergoes some conformational changes during this conversion.
- Not all molecules of **Pr** form are converted into **Pfr** form when plants are exposed to light.
- In the presence of light, most molecules of **Pr** form absorb red light and become **Pfr** form. At the same time, some of the **Pfr**, thus converted, absorb the far-red light and are converted back to **Pr** form.
- Therefore, the total amount of **Pfr** formed after exposure to saturating red light is only about 85%.
- Likewise, only a small amount of **Pr**, formed after exposure to far-red, is converted back to **Pfr** form.