**Dr. Rima Kumari: Date: 14/08/2020**

Online class and e- content for BSc IIIrd year students

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| Date and Time | Online class medium | E. content topic |
| 14/08/2020  02:30 p.m to 3.30 p.m | Via Google meet  Link: Meeting URL: https://meet.google.com/ssp-nqqj-djg | **Photoperiodism** |

**Photoperiodism:**

**Photoperiodism** is the physiological response of organisms to the time duration of light or a dark period. It occurs in plants and animals. Photoperiodism can also be defined as the developmental and physiological responses of plants to the relative lengths of light and dark periods. The plants in order to flower require a certain day length i.e., the relative length of day and night which is called as photoperiod. The response of plants to the photoperiod expressed in the form of flowering is called as photoperiodism.

The phenomenon of photoperiodism was first discovered by Garner and Allard (1920, 22) who observed that the Biloxi variety of Soybeans (Glycine max) and ‘Maryland Mammoth’ variety of tobacco (*Nicotiana tabacum*) could be made to flower only when the daily exposure to the light was reduced below a certain critical duration and after many complex experiments concluded that ‘the relative length of the day is a factor of the first importance in the growth and development of plants’. Depending upon the duration of the photoperiod, they classified plants into three major categories: short-day plants, long-day plants, and day-neutral plants.

**(1) Short Day Plants (SDP):**

These plants require a relatively short day light period (usually 8-10 hours) and a continuous dark period of about 14-16 hours for subsequent flowering. Some examples of these plants which are also known as long-night-plants are Maryland Mammoth variety of tobacco (Nicotiana tabacum) Soybeans (Glycine max), Cocklebur (Xanthium pennsylvanicum).

i. In short day plants the dark period is critical and must be continuous. If this dark period is interrupted even with a brief exposure of red light (660-665 mµ wavelength), the short day plant will not flower.

Effect of a brief exposure of red light

ii. Maximum inhibition of flowering with red light occurs at about the middle of critical dark period.

iii. However, the inhibitory effect of red light can be overcome by a subsequent exposure with far-red light (730-735 mu wavelengths).

iv. Interruption of the light period by dark does not have inhibitory effect on flowering in short day plants (Fig. 18.1 C).

v. Prolongation of the continuous dark period initiates early flowering in short day plants.

Short-day facultative plants are:

* [Marijuana](https://en.wikipedia.org/wiki/Marijuana) (*Cannabis*)
* [Cotton](https://en.wikipedia.org/wiki/Cotton) (*Gossypium*)
* [Rice](https://en.wikipedia.org/wiki/Rice) (*Oryza*)
* [Jowar](https://en.wikipedia.org/wiki/Jowar) (*Sorghum bicolor*)
* [Green Gram](https://en.wikipedia.org/wiki/Green_Gram) (Mung bean, *Vigna radiata*)
* [Soybeans](https://en.wikipedia.org/wiki/Soybean)[[17]](https://en.wikipedia.org/wiki/Photoperiodism#cite_note-17) (*Glycine max*)

Short-day obligate plants are

*Dolichos lablab (***Indian bean)**

**(2) Long Day Plants (LDP):**

Long-day plants flower when the night length falls below their critical photoperiod.[[13]](https://en.wikipedia.org/wiki/Photoperiodism#cite_note-13) These plants typically flower during late spring or early summer as days are getting longer. These plants require a longer day light period (usually 14-16 hours) in a 24 hours cycle for subsequent flowering. Some examples of these plants which are also called as short night plants are Hyoscyamus niger (Henbane) Spinacea (spinach) Beta vulgaris (Sugar beet).

i. In long day plants the light period is critical.

ii. A brief exposure in the dark period or the prolongation of the light period stimulates flowering in long day plants.

Some long-day obligate plants are:

Henbane (Hyoscyamus)

Oat (Avena)

Some long-day facultative plants are:

Pea (Pisum sativum)

Barley (Hordeum vulgare)

Lettuce (Lactuca sativa)

Wheat (Triticum aestivum)

**(3) Day Neutral Plants:**

These plants flower in all photoperiods ranging from 5 hours to 24 hours continuous ex­posure. Some of the examples of these plants are tomato, cotton, sunflower, cucumber and certain varieties of peas and tobacco.

During recent years certain intermediate categories of plants have also been recognised. They are,

**Long- Short Day Plants:**

These are short day plants but must be exposed to long days during early periods of growth for subsequent flowering. Some of the examples of these plants are certain species of Bryophyllum.

**Short-Long Day Plants:**

These are long day plants but must be exposed to short days during early periods of growth for subsequent flowering. Some of the examples of these plants are certain varieties of wheat (Triticum) and rye (Secale).

**Photoperiodic Induction:**

Plants may require one or more inductive cycles for flowering. An appropriate photo­period in 24 hours cycle constitutes one inductive cycle. If a plant which has received suf­ficient inductive cycles is subsequently placed under un-favourable photoperiods, it will still flower. Flowering will also occur if a plant receives inductive cycles after intervals of un-favourable photoperiods (i.e., discontinuous inductive cycles). This persistence of photo­periodic after effect is called as photoperiodic induction.

i. An increase in the number of inductive cycles results in early flowering of the plant. For instance Xanthium (a short day plant) requires only one inductive cycle and normally flowers after about 64 days. It can be made to flower even after 13 days if it has received 4-8 inductive cycles. In such cases the number of flowers is also increased.

ii. Continuous inductive cycles promote early flowering than discontinuous inductive cycles.

Some of the example of plants which require more than one inductive cycles for sub­sequent flowering are Biloxi soybean (SDP) —2 inductive cycles; Salvia occidentalis (SDP) — 17 inductive cycles; Plantago lanceolata (LDP)—25 inductive cycles.

**Perception of the Photoperiodic Stimulus and Presence of a Floral Hormone:**

It is now well established that the photoperiodic stimulus is perceived by the leaves. As a result, a floral hormone **florigen** is produced in the leaves which is then translocated to the apical tip, subsequently causing the initiation of floral primordia.

#### Nature of the Floral Hormone:

Although there are firm evidences for the existence of a floral hormone but it has not yet been isolated. Therefore, the nature of this hormone which has been named as **florigen** is not very clear. But it is quite evident that this hormone is a material substance which can be trans located from leaves to the apical tips situated at other parts of the plant resulting in flowering.

Recent researches are indicative of ‘florigen’ to be a macromolecule unlike other plant growth hormones which are rather small molecules. This macromolecule may possibly be a RNA or protein molecule which is trans located from the leaf to the apical tips (or meristems) via phloem in photo-induced plants (Corbesier and Coupland, 2005).