

## **Climatic Factors:**

### **A. Light:**

Light plays an important role in the species composition and development of vegetation. Light is abundantly received on the surface of the earth. And, on an average approximately only 2-3 per cent of this solar energy is used in Primary Productivity.

Light intensity shows special variations due to the factors like atmospheric water layer, particles dispersed in the air, etc. Further, the vegetation of an area may also affect the light intensity. In deep shade under trees, or under water, light becomes limiting below which photo-synthesis is not sufficient for effective growth.

#### **(a) Effect of Light on Plants:**

Light plays a vital role directly or indirectly in regulating the growth (structure, form, size), metabolism, development and distribution of plants.

The plants are influenced by light in the following ways:

##### 1. Effect on Chlorophyll synthesis:

The synthesis of chlorophyll in green plants can take place only in the presence of light. It is seen that if a coprophilous plant is kept in pro-longed darkness, the chlorophyll amount practically disappears.

##### 2. Effect on number and Position of Chloroplasts:

Light has marked effect on the number and position of chloroplasts, the chlorophyll bearing organell. The upper surface of leaves which receive maximum sunlight has the largest number of chloroplasts arranged in line with the direction of light. On the other hand, the leaves of the plants which shade chloroplasts are very few in number and arranged at right angles to the light rays, thus increasing the surface of absorption.

##### 3. Effect on Photosynthesis:

Photosynthesis is a process of conversion of solar energy (light) into chemical energy (in presence of chlorophyll) which is subsequently used for the preparation of carbohydrate from carbon dioxide and water.

### Photosynthesis Process

From the above statement, it is clear that light is highly essential for photosynthesis. The rate of photosynthesis is slower at lower intensity and it increases linearly with increasing light intensity upto a particular point, known as "Saturation point," and after attaining this point, it remains constant. The intensity of light at which the plants no longer carry on photosynthesis or when the photosynthesis balances respiration is called compensation intensity.

#### 4. Effect on Respiration:

In plants, respiration is a process of the oxidation of carbohydrate (produced in the photosynthesis) into carbon dioxide and water. According to Calvin (1958), the rate of respiration increases at higher light intensity and it decreases at lower light intensity.

#### 5. Effect on Transpiration:

The rise in atmospheric temperature which may be due to the conversion of solar radiation into heat increases the rate of transpiration. The process of opening of stomata (which depends upon light) leading to loss of water from the aerial surface of plants is known as transpiration.

#### 6. Effect on Production of Hormone:

Light inhibits the synthesis of auxins or growth hormones in plants as a result of which the shape and size of the plants gets modified.

#### 7. Effect on development of Flowers, Fruits and Vegetative parts:

The intensity of light largely influences the growth and development of flowers, fruits and vegetative parts of plants. Light of higher intensity favours development of flowers,

fruits and seeds but light of lower intensity promotes the development of vegetative parts and causes delicacy.

8. Effect on Formation of Anthocyanin Pigment:

Intense light helps in the formation of anthocyanin pigments in plants. The plants in Alpine regions have beautiful flowers contain-ing this pigment.

9. Effect on Movement:

The effect on sunlight in modulating the movement of plants is called phototropism or heliotropism. The elongation on stem towards light is known as posi-tive photo-tropism and the movement of roots away from light is known as negative photo-tropism. The leaves grow transversely to light.

10. Effect on Photoperiodism:

The response of plants to the relative length of the day (known as photo-period) is known as photoperiodism. According to the response of the plants to the length of the photo-period, the plants have been clas-sified into three groups:

(i) Long Day Plants (L.D.P.):

The plants which bloom when the light duration is more than 12 hours per day e.g. radish, potato, spinach, etc.

(ii) Short Day Plants (S.D.P.):

The plants which bloom when the light duration is lesser than 12 hours per day e.g. cereals, tobacco, cosmos, dahlia etc.

(iii) Day neutral Plants (D.KP.):

The plants which show little response to the length of the day light e.g. cotton, bal-sam, tomato, etc.

11. Effect on Seed Germination:

The germination of seeds is largely influenced by light. In most of the plants, the red light induces seed germination and in some plants blue light promotes the process. In some cases, far-red light is seen to inhibit seed germination.

12. Effect on Distribution of Plants:

The duration and intensity of light plays an important role in determining the distribution of plants. Hence the vegetation of different geographical regions are different from one another (Kebs 1972).

### 13. Effect on Photo-morphogenesis:

The development of plants in seedling stage is controlled by light. The seedlings present in dark condition are non-green and highly elongated with poorly developed root system and no-foilage. However, an exposure of the dark grown seedling to light makes it normal.

### **(b) Effect of Light on Animals:**

Besides the multifarious influence of light over plants, it has far reaching effects on the various biological activities of animals such as growth, development, reproduction, locomotion, pigmentation, metabolism etc. Some major effects of light on animals are described below:

#### 1. Effect on Metabolism:

The rate of metabolism in animals is largely influenced by light intensity through enzyme activity. Higher the intensity of light higher will be enzyme activity and higher will be the general metabolic rate. However, the cave-dwelling animals are not influenced much by light intensity.

#### 2. Effect on Reproduction:

In case of some animals and birds, the breeding activities are induced by light through its inoculating action over the gonads. In addition, there exists a definite relationship between the length of the day (i.e. the amount of light) and egg laying by the birds.

#### 3. Effect on Development:

Light has differential action over development. In case of some animals, light accelerates the development and in some other cases, it retards the same. For example, Salmon larvae grows larger in darkness.

#### 4. Effect on Pigmentation:

Light induces the formation of pigments in animals. It is seen that higher the intensity of light, higher will be pigmentation. For example, the human inhabitants of tropical region

have higher concentration of mela-nin in their skin. Hence comparatively darker than their coun-terparts in temperate regions.

#### 5. Effect on Locomotion:

In some lower animals, light con-trols the speed of locomotion and such a process is known as photo kinesis. They are of two types:

##### (a) Phototaxis:

It is a process of the movement of animals in response to the light stimulus. When an animal moves towards the light source, it is said to be positively photoactic and when moves away from the light source, it is said to be negatively photoactic.

##### (b) Phototropism:

When only a part of organism shows re-sponsive movement to light stimulus, it is called as pho-totropism. It is seen in case of sessile animals.

#### 6. Photoperiodism:

The response of animals to the length of the day or the rhythms of light and darkness is called photophase. And, portion of darkness is called scotophase.

#### 7. Effect on Eyes:

The degree of development of eyes depend on the intensity of light available in the environment. For example, in case of the cave dwelling animals and deep sea fishes, the eyes are absent or rudimentary as these animals live in total darkness.

Thus, from the above discussion, it is clear that light is most important environmental abiotic factor which produces diverse ecological effects. Besides, the preparation of food by photo-syn-thesis, it has direct effects on morphology, growth, development, metabolism, reproductive behaviour, and survival of most of the plants and animals.