# Plant Physiology

## Topic 2: Influence of Heredity and Environment on Plant Behaviour

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# Topic outline

- Influences of Heredity and Environment on Plant Behaviour
  - Light
  - Moisture and Humidity
  - Chemical in Soil and Atmosphere
  - Temperature
  - Physical Forces

# Influence of Heredity and Environment on Plant Behaviour

- **Heredity** and **environment** are two factors that regulate the internal processes and conditions of a plant

- Interaction between genetic composition and environment in which a plant grew influenced
  - shape, size, form, and degree of complexity of the plant

- For example, genetic composition of rice seeds ensure that rice plants are produced, and not corn or blady grass (*Imperata cylindrica*)

## Influence of Heredity and Environment on Plant Behaviour cont.

- For example, environmental factors determine whether the rice plants are;
  - grwoth: vigorous or stunted
  - colour: bright green or yellowish
  - plant cell: turgid or wilted

- Modifications caused by the variations in environmental factors normally are not inherited

## Influence of Heredity and Environment on Plant Behaviour cont.

- Heredity information directs a plant how to behave
  - determined by the nucleic acids present in the cells of the plant

- Deoxyribonucleic acid (DNA) - primary genetic substance that conveys heredity information from generation to generation
  - e.g. dictates how the genetic blueprint is transmitted

## Influence of Heredity and Environment on Plant Behaviour cont.

- Plant responses to the physical environment

- Some of the major factors of physical environment influence on physiological processes are:
  - light, moisture and humidity, chemicals in soil and atmosphere, temperature and physical forces

# Light

- The quality, intensity, and duration of light/radiation that impinges on plants have profound effects on many physiological processes

- Light affects:
  - chlorophyll formation
  - photosynthesis
  - photorespiration

- Cylindrical plant organs (e.g. stems, petioles, coleoptiles) are induced to grow at unequal rates
  - when they are differentially illuminated on the two sides (phototropism)

- Alternations in light and dark periods from day and night (photoperiodism)
  - Control many aspects of plant growth and development

- Red and blue lights have the greatest impact on plant growth
- Green light is least effective (the reflection of green light gives the green colour to plants)
- Blue light is primarily responsible vegetative leaf growth
- Red light, when combined with blue light, encourages flowering

- **Light Duration:**
  - The amount of time that a plant is exposed to sunlight
  - Plants require 12 to 14 hours of light per day, but intolerant to continuous light for 24 hours

- **Light Intensity:**
  - the more sunlight a plant receives; the photosynthetic rate will be higher
  - Plants require 8,000 to 12,000 lux of light

# Moisture and Humidity

- The important of soil moisture supply and atmospheric humidity on plant growth and development is critical

- When a plant does not receive sufficient water or when transpiration rates are excessive;
  - leaves wilt, growth slows down, ceases altogether, or die

- Moderates water deficits, whether initiated by low soil moisture or desiccated atmospheric conditions;
  - may impair the plant's ability to carry on one or another physiological process at a normal rate

# Chemical in Soil and Atmosphere

- Plant growth and development is also affected by a host of chemicals naturally present in the soil and atmosphere

- Mineral ions are supplied by the soil to roots, and some of these substances are excreted by the plants;
  - inhibited the germination of seeds of other plants

# Temperature

- Temperature of the soil and air not only affects the rates of physiological processes;
  - but also determine the course of development

- Seeds of some species will not germinate unless exposed to low temperature for several weeks or months;
  - certain biochemical changes occur that result in the breaking of dormancy

# Physical Forces

- In response to the **natural field gravity** on earth;
  - roots grow down toward the center of the earth
  - stems grow up, away from the center of the earth

- Other physical forces that fall into this category would be:
  - electrical and magnetic fields of force artificially applied to plants, and winds of extreme velocity

# Thought question

**Can you name the factors that influenced the plant behaviour?**

# Further reading

Fitter, A.H. and Hay, R.K.M. (2002). Environmental Physiology of Plants. Academic Press.

Taiz, L. and Zeiger, E. (2010) Plant physiology 5th ed. Sunderland, MA : Sinauer Associates.

# End of Topic 2

**Thank you**