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A Review on Economic Applications of Plant Physiology & Their Aims

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Abstract:
Plant physiology is the study of all aspects of a plant's internal operations, including the physical and chemical processes required for life as it appears in a plant. This includes studies that span a variety of time and size scales. The smallest scale interactions include those that occur during molecular-level photosynthesis and during internal diffusion of water, minerals, and nutrients. On the largest scale, activities like plant development, seasonality, dormancy, and reproductive control take place. Phytochemistry, phytopathology, and other related issues are the primary areas of research within the field of plant physiology. We'll discuss the goals and applications of plant physiology in this paper.
Keywords- *PlantPhysiology, Phytochemistry, dormancy etc.*

I. Introduction:

All the dynamic processes of growth, metabolism, reproduction, defence, and communication that give rise to the existence of plants are included in the study of plant function and behaviour, or plant physiology . Francis Bacon provided one of the earliest studies on plant physiology in his work Sylva Sylvarum in 1627. Bacon grew several terrestrial plants, including a rose, in water before realising that soil is simply required to keep a plant in an upright position. Jan Baptist van Helmont presented the results of the first quantitative study on plant physiology in 1648. He spent five years cultivating a willow tree in a pot with 200 pounds of oven-dried dirt. Despite the fact that the soil only lost two ounces of its dry weight, Van Helmont came to the conclusion that plants get all of their weight from water rather than soil. In 1699, John Woodward presented his findings on the development of spearmint in various water sources. He found that infused water with dirt grew plants better than pure water.

Stephen Hales is considered as the father of plant physiology for the numerous experiments in the 1727 book Vegetable Staticks, even though Julius von Sachs unified the diverse components of plant physiology and turned them into a field . At the time, his Lehrbuch der Botanik was the accepted reference work on plant physiology. Scientists originally recognised inorganic ions in water as the form in which plants obtain essential mineral elements in the 1800s. Under natural conditions, soil acts as a reservoir for mineral nutrients, but it is not essential for plant growth in and of itself. When the mineral minerals in the soil are dissolved in water, plant roots quickly absorb nutrients, and dirt is no longer required for the plant to thrive. This discovery led to the creation of hydroponics, a common technique utilised in biological research, laboratory exercises in school, agricultural production, and even as a hobby. In hydroponics, plants are grown in a solution of water rather than in soil.

Aims: It is possible to classify the primary areas of study within the field of plant physiology.

First, the study of phytochemistry, or plant chemistry, is a part of the field of plant physiology. In order to work and survive, plants produce a broad variety of specialised chemicals. For photosynthesis to occur, a number of pigments, enzymes, and other chemicals are required. Because they are immovable, plants must use chemical defence to protect themselves from herbivores, diseases, and competing plants. They achieve this by developing poisonous substances and substances having a poor taste or smell. In addition, some compounds are employed to attract animals or pollinators to disperse mature seeds, protect plants from disease, enable drought survival, or aid in the preparation of plants for dormancy.

Second, a component of plant physiology is the study of the biological and chemical operations of various plant cells. Plant life functions and responds differently from animal life due to a number of traits that distinguish plant cells from animal cells. For instance, the walls of plant cells constrain their shape, which in turn prevents plants from being flexible and moving. Plant cells contain chlorophyll, a chemical that interacts with light to enable plants to manufacture their own food rather than relying on external sources like mammals do.

Thirdly, the main focus of plant physiology is the interactions that occur between cells, tissues, and organs within a plant. To perform a variety of activities, different tissues and cells are chemically and physically specialised. The plant is anchored by rhizomes and its roots absorb minerals from the ground. The light is captured by leaves to make nutrition. For both of these organs to remain alive, nutrients created in the leaves must be carried to the roots and minerals obtained by the roots must be supplied to the leaves. Plant physiologists study how the many transport pathways that plants have developed, such as vascular tissue, function to complete this transfer.

Fourthly, scientists that study plants examine how they manage and direct their internal activities. Plants produce hormone-like chemicals that instruct cells in other areas of the plant to respond in a manner similar to that of animals. Many blooming plants bloom at the right time because of photoperiodism, a process where light-sensitive molecules respond to the length of the night. Fruit ripening and winter leaf loss are both impacted by the plant's production of the gas ethylene.

Environmental physiology:

Environmental physiology is one of the oldest and, at the same time, one of the most recent areas of study in plant ecology. Environmental physiology is more commonly referred to as such by plant biologists, but it goes by many other names in the applied sciences. It is comparable to horticulture, crop ecology, agronomy, and ecophysiology. The particular name assigned to the subdiscipline expresses its viewpoint and goals for its research. Whatever term is given to it, ecology is concerned with how plants interact with their surroundings.

Environmental physiologists research how plants respond to a range of environmental factors, such as wind, fire, and radiation (such as light and UV radiation). A pressure bomb can be used to detect water interactions. Drought or flood stress, gas exchange with the atmosphere, and the cycling of nutrients like nitrogen and carbon are also all highly important.

Environmental physiologists also research how plants react to biological factors. This includes both beneficial interactions like mutualism and pollination as well as unfavourable ones like rivalry, herbivory, disease, and parasitism.

a) **Tropisms and Nastic movements**

Plants can react to both directional and non-directional stimuli. Tropism is the term for a reaction to focused stimuli, like gravity or sunshine. A nastic movement is a response to nondirectional stimuli, like humidity or temperature.

Differential cell growth, in which cells on one side of the plant lengthen more than those on the other, causes plant trophisms, causing a portion of the plant to bend in the direction of the side with less development. One of the commonly seen plant tropisms is phototropism, or the bending of a plant toward a light source. When a plant need more light for photosynthesis, phototropism allows it to either increase or decrease light exposure in conditions of intense light and heat. Geotropism describes how a plant's roots may detect the direction of gravity and grow downward. Tropisms frequently result from environmental influences on the synthesis of one or more plant hormones.

Nastic movements are brought on by abrupt changes in turgor pressure in plant tissues or variations in cell development (such as epinasty and hiponasty) (such as nyctinasty). The thigmonasty (response to contact) in the carnivorous Venus fly trap is a well-known example. The traps are constructed from modified leaf blades that have fine trigger hairs. When an animal, such as an insect, contacts the hairs on the leaf, it folds inward. With the help of this system, the plant can seize and consume microscopic insects for additional nutrients. The trap closes fast when internal cell pressures change, but the leaf must grow slowly to reset for another chance to catch insects.

(a) Plant illness

Phytopathology, one of the most commercially relevant subfields of environmental physiology, is the study of plant diseases and how plants combat infection. Plants are susceptible to the same pathogens that cause disease in animals, such as viruses, bacteria, and fungus, as well as physical invasion by insects and roundworms.

The biology of plants differs from that of animals, and as a result, their symptoms and responses are significantly different. Sometimes a plant will simply remove the diseased leaves or blooms, a process known as abscission, to stop the disease from spreading. The majority of animals cannot use this form of illness management. Plant illnesses organisms differ from those causing disease in animals because plants normally cannot spread illness through casual physical contact. Plant diseases are mainly spread through animal vectors or spores.

One of the most important advancements in the treatment of plant disease was the discovery of Bordeaux mixture in the nineteenth century. The first known fungicide is made of copper sulphate and lime. Application of the mixture assisted in halting the growth of downy mildew, which posed a serious threat to the French wine industry .

Economic applications:

Food production

Plant physiology is a key area of study in horticulture, agriculture, and food science as it relates to fruits, vegetables, and other consumable plant components. Climate needs, fruit drop, nutrition, ripening, and fruit set are some of the subjects covered. The study of plant physiology, which addresses issues like ideal planting and harvesting periods, post-harvest storage of plant products for human consumption, and the creation of secondary goods like pharmaceuticals and cosmetics, is essential for the production of food crops.

II. Result and Conclusions:

Crop physiology evaluates an entire field of plants as opposed to focusing on a single plant at a time. Crop physiology studies the interactions between plants and how to increase results, such food production, by determining things like the appropriate planting density.

A branch of plant physiology called environmental physiology investigates how plants respond differently to their environment. Stress from water loss, changes in the air's chemistry, or plant crowding can all affect a plant's ability to function. These changes are influenced by genetic, chemical, and physical factors.

Plant responses to external factors like wind, heat, fire, and radiation are the subject of environmental physiology research. Important factors include water linkages, stresses from drought or flooding, interactions between gases and the atmosphere, and the cycling of nutrients like nitrogen and carbon. They also study the responses of plants to biological factors. This includes both beneficial interactions like mutualism and pollination as well as unfavourable ones like rivalry, herbivory, disease, and parasitism.

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